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U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

C. 2

UNITED STATES COAST PILOT

ATLANTIC COAST

SECTION B

CAPE COD TO SANDY HOOK

SECOND EDITION

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DEPARTMENT OF COMMERCE,
UNITED STATES COAST AND GEODETIC SURVEY,
Washington, May 21, 1926.

This publication covers the Atlantic coast from Race Point, Cape Cod, to Sandy Hook, including Nantucket, Vineyard, and Long Island Sounds, New York Harbor, Hudson River, and tributaries. It is based mainly upon the work of the United States Coast and Geodetic Survey, including the results of a special examination in 1925.

This volume covers a part of the territory formerly included in Atlantic Coast Pilot, Part III, Cape Ann to Point Judith, and all of the territory formerly included in Atlantic Coast Pilot, Part IV, Point Judith to New York. Three editions of the former and six of the latter were published. This volume is the second edition of United States Coast Pilot, Atlantic Coast, Section B, the first edition having been published in 1918.

The present volume has been prepared by Lieut. William D. Patterson, United States Coast and Geodetic Survey. The compilation was supervised by Lieut. Commander J. H. Hawley, chief, coast pilot section.

Great courtesy has been shown by the United States Engineers, the Lighthouse Service, and local authorities in furnishing information for use in this publication.

The aids to navigation are corrected to May 21, 1926.

Navigators and others are requested to notify the director United States Coast and Geodetic Survey of any errors or omissions that they may find in this publication, or of any additional matter which they think should be inserted for the information of mariners.

E. LESTER JONES, *Director.*

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NOTE

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 359°, and are followed by the corresponding *magnetic* course in points, in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

Distances are in *nautical miles* and may be converted approximately to statute miles by adding 15 per cent to the distances given.

Currents are expressed in knots, which are nautical miles per hour.

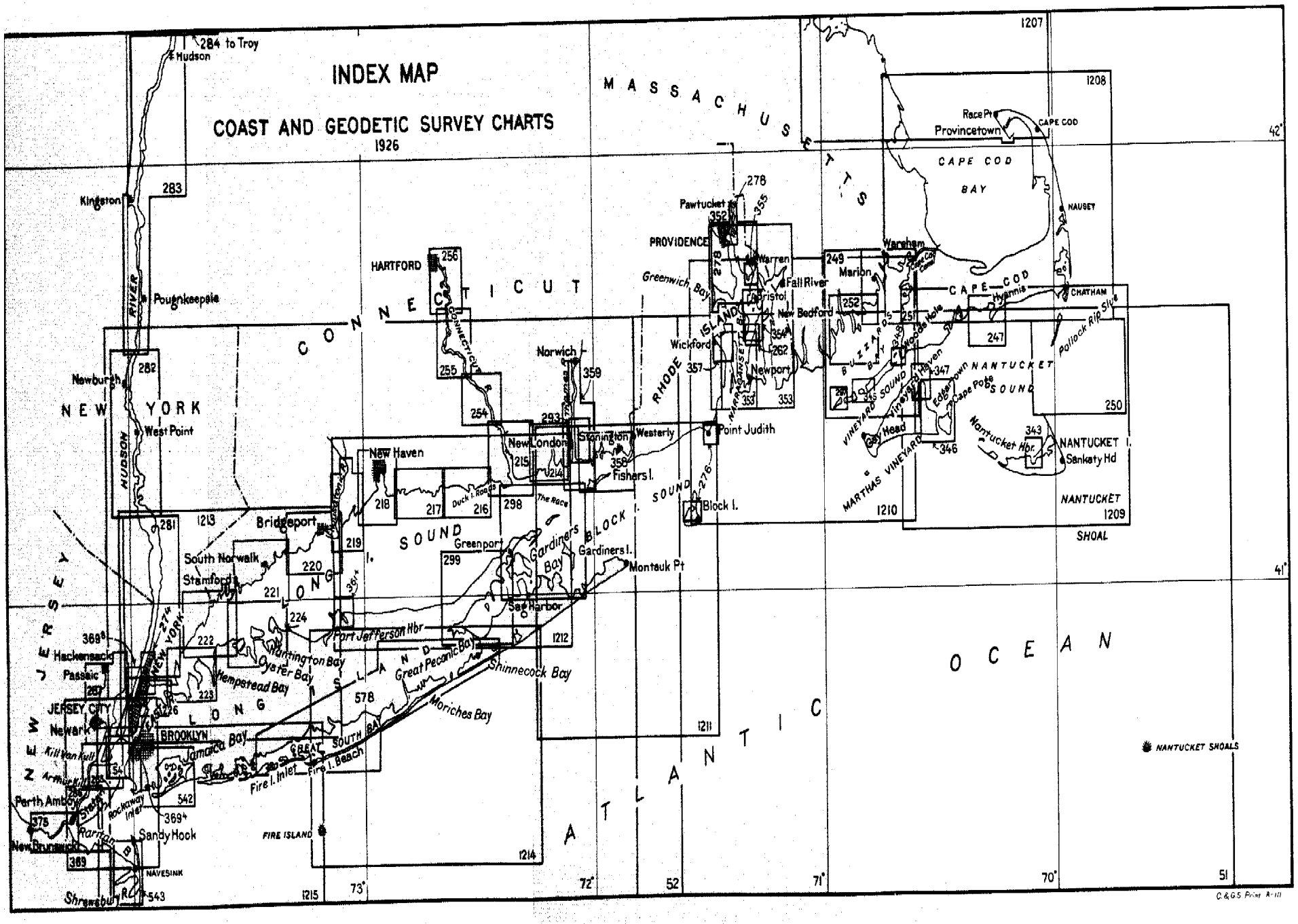
Except where otherwise stated, all depths are at *mean low water*.

In accordance with the desire of the International Hydrographic Conference, each depth is followed, in parentheses, by its equivalent in meters.

Heights are given in feet with metric equivalent in parentheses.

Changes and other corrections affecting all coast-pilot volumes are included in the Notice to Mariners published weekly by the United States Department of Commerce. About one year after a Coast Pilot is published, and at approximately yearly intervals thereafter until a new edition is brought out, a supplement, giving the more important corrections and additions to its text since the date of its publication, is issued. The date of the latest supplement to each Coast Pilot, for which a supplement has been issued, is shown in the list of Coast Pilots published each week in the Notice to Mariners. Any supplement may be obtained, free of charge, upon application to the Coast and Geodetic Survey, Washington, D. C., or any of its field stations. Each supplement is complete in itself and cancels all previous supplements.

Do not use this Coast Pilot except with reference to the latest supplement that may have been published and Notices to Mariners issued after the date of the supplement.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UNITED STATES COAST PILOT

ATLANTIC COAST—SECTION B—CAPE COD TO SANDY HOOK

GENERAL INFORMATION

The information contained in this volume relates to the coast and inland waters from Race Point, Cape Cod, to Sandy Hook, and includes Nantucket and Vineyard Sounds, Buzzards Bay, Narragansett Bay, Long Island Sound and tributaries, New York Harbor and tributaries, and embraces part of the coast of Massachusetts and all of the coasts of Rhode Island, Connecticut, and New York.

Character of the bottom.—THE EASTERN AND SOUTHERN SHORES OF CAPE COD AND NANTUCKET ISLAND are generally sandy, with extensive sand shoals extending well from the shore in many places; this is notably the case eastward and southeastward of Monomoy Point and Nantucket Island, where the shoals are shifting in character, being subject to changes in position and depth. IN NANTUCKET AND VINEYARD SOUNDS rocky ledges and bowlders occur along the north shore from Bishop and Clerks Lighthouse to Elizabeth Islands; elsewhere the shores and shoals in Nantucket Sound are generally sandy and more stable than those eastward.

THE COAST OF MARTHAS VINEYARD is generally sandy, with bowlders scattered along the shore in many places. The shores of the ELIZABETH ISLANDS, BUZZARDS BAY, AND THE COAST FROM BUZZARDS BAY TO POINT JUDITH, INCLUDING NARRAGANSETT BAY, are bold and generally rocky, with stretches of sand beach, but off the shore numerous rocky ledges and bowlders are found; there is little natural change in the shore or shoals.

LONG ISLAND SOUND, BLOCK ISLAND SOUND, AND FISHERS ISLAND SOUND are regions of bowlders, and all broken ground is liable to be of this character; in these waters there is little or no natural change in the shore, shoals, or other features. THE OUTSIDE COAST OF LONG ISLAND is a sand beach, without bowlders, and large changes occur in a few years in the vicinity of the inlets.

Wire drag surveys.—In all areas mentioned above as rocky or regions of bowlders, the ordinary survey with the lead line can not be relied upon to locate all dangers. In such areas a wire drag survey, in which a horizontal wire is suspended at a known depth below the surface and dragged across the area, is the only means of locating all dangers. *Until such surveys are made and the dangers thus located have been charted, vessels should proceed with caution when crossing such areas where the charted depth does not considerably exceed the draft.*

At the end of 1925 the areas examined by means of a wire drag were as follows: The main part of Buzzards Bay to the entrance of Cape Cod Canal, excluding tributaries; the broken ground in the approaches to Buzzards and Narragansett Bays outside of the inshore dangers; the eastern passage of Narragansett Bay between the Dumplings and the south end of Prudence Island, including Newport Outer and Inner Harbor; parts of the western passage of Narragansett Bay; an area about 5 miles wide between Endeavor Shoal and Block Island, including the western part of Southwest Ledge; an area between Constellation Rock and Cerebus Shoal; an area about 3 miles wide northward and westward of Shagwong Reef nearly to Gardiners Island; the main part of Gardiners Bay, including Plum Gut; the western approach to the Race; the western approach and the greater part of Fishers Island Sound; the approach to Port Jefferson Harbor, outside of Mount Misery Shoal; the approaches to Duck Islands Roads; parts of Sixmile Reef; and East River between Whitestone and Lawrence Points, northward of Rikers Island. These limits are general, and are given more in detail under the descriptions of the various bodies of water. The dangers bordering the shores are not ordinarily dragged.

Harbors and ports.—The more important places, either commercially or as harbors of refuge, are Vineyard Haven, New Bedford, Newport, Dutch Island Harbor, Fall River, Providence, Point Judith Harbor, Great Salt Pond, Gardiners Bay, New London, New Haven, Bridgeport, and New York.

Anchorages in Nantucket and Vineyard Sounds, Buzzards Bay, Narragansett Bay, and Long Island Sound and tributaries are given under the general information for these regions. Anchorage areas in New York Harbor are given in the Appendix.

System of buoyage.—In conformity with section 4678 of the Revised Statutes of the United States, the following order is observed in coloring and numbering buoys in United States waters, viz:

In approaching the channel, etc., from seaward, red buoys, with even numbers, will be found on the starboard side.

In approaching the channel, etc., from seaward, black buoys, with odd numbers, will be found on the port side.

Buoys painted with red and black horizontal stripes will be found on obstructions with channel ways on either side of them and may be left on either hand in passing in.

Buoys painted with white and black perpendicular stripes will be found in midchannel and must be passed close to to avoid danger.

All other distinguishing marks to buoys will be in addition to the foregoing and may be employed to mark particular spots.

Perches, with balls, cages, etc., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

Nun buoys, properly colored and numbered, are usually placed on the starboard side and can buoys on the port side of channels.

Day beacons (except such as are on the sides of channels, which will be colored like buoys) are constructed and distinguished with special reference to each locality, and particularly in regard to the background upon which they are projected.

Buoys maintained by the United States Army Engineers for dredging purposes will hereafter be painted white, with the top for a distance of 2 feet painted dark green.

Aids to navigation.—The lighthouses and other aids to navigation are the principal guides, and mark the approach and channels to the important ports. The buoyage accords with the system adopted in United States waters. The principal coast lights are described in the text of this volume. For a complete description of all lighted aids see the Light List, Atlantic and Gulf Coasts of the United States, and for a brief description of lights, buoys, and beacons, see Buoy List, Second District, Coast of Massachusetts, and Buoy List, Third District, Narragansett Bay to Cape May. These lists are published by the Lighthouse Service and can be obtained at a cost of 30 cents for the Light List and 20 cents each for the Buoy Lists.

Bridge regulations.—Regulations for lighting bridges over navigable waters, also for lights on sheer booms, piers, dams, and similar obstructions to navigation are prescribed by the Department of Commerce. A copy of these regulations will be sent free of charge to any shipmaster, pilot, or bridge owner on application to the Division of Publications, Department of Commerce, Washington, D. C. The lighthouse inspectors have immediate authority over lighting of structures in their respective districts and are charged with the enforcement of the regulations. Regulations for the operation of drawbridges are prescribed by the Secretary of War, and extracts from these regulations are given in the description of the waters affected under the heading "Bridge regulations."

Fish weirs.—Regulations prescribe that fishing structures and appliances in navigable waters of the United States shall be lighted for the safety of navigation, as follows:

> The lights shall be displayed between sunset and sunrise. They shall be placed at each end of the structure excepting where the inner end terminates in such situation that there is no practicable navigation between it and the high-water line of the adjacent coast, in which case no inner light shall be displayed. The outer light shall be white and the inner light shall be red. The size, capacity, and manner of maintenance of the lights shall be such as may be specified in the War Department permit authorizing the erection of the structure or appliance. When several structures or appliances are placed on one line with no navigable passage between them, they will be considered, for lighting purposes, as one structure.

Regulations for passing dredges are prescribed by the Secretary of War for many channels and are given under the descriptions of the channels.

Lighthouse tenders, when working on buoys in channels or other frequented waters, may display a red flag (international signal-code letter B) and a black ball at the fore, as a warning to other vessels to slow down in passing.

Regulations for avoiding survey boats, prescribed by the Secretary of War, direct that all vessels navigating the tidal waters of the harbor of New York and its adjacent and tributary waters within a radius of 150 miles (statute) of the Battery, New York, on approaching or passing within 600 feet of floating plant of any character employed by the United States on hydrographic work within the limits named, and which display a black drum and a red

flag, shall slow down in passing to a speed of 6 miles (statute) per hour and shall give the craft displaying the said signals as wide a berth as practicable and not less than 100 feet.

The following **special signals for surveying vessels** of the United States employed in hydrographic surveying have been prescribed:

A surveying vessel of the United States, under way or at anchor in a fairway and employed in hydrographic surveying, may carry where they can best be seen, but in any case well above the running lights prescribed by law for preventing collisions, three lights in a vertical line one over the other and not less than 6 feet apart. The highest and lowest of these lights shall be green, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least 2 miles. In the case of a small vessel the distance between the lights of such private code may be reduced to 3 feet if necessary.

By day such surveying vessel may carry in a vertical line, not less than 6 feet apart, where they can best be seen, three shapes of not less than 2 feet in diameter, of which the highest and lowest shall be globular in shape and green in color, and the middle one diamond in shape and white.

The wire drags, some of which are over 2 miles long, used by the Coast and Geodetic Survey in sweeping for dangers to navigation, may be crossed by vessels without danger of fouling at any point except between the towing launches and the large buoys near them, where the towline approaches the surface of the water. Steamers passing over the drag are requested to change course so as to cross it approximately at right angles, as a diagonal course may cause the propeller to foul the supporting buoys and attached wires.

Supplies.—Coal, gasoline, water, and supplies of all kinds are obtainable at New Bedford, Newport, Fall River, Providence, New London, New Haven, Bridgeport, and at various points on East River, New York Harbor and tributaries, and Arthur Kill. Limited quantities of such supplies are also obtainable at Nantucket, Edgartown, Vineyard Haven, Wareham, Greenport, Sag Harbor, Stonington, Noank, Mystic, Saybrook Point, South Norwalk, Stamford, Greenwich, Port Chester, New Rochelle, City Island, Port Jefferson, Northport, Oyster Bay, and the principal cities and towns on the Hudson River.

Repairs.—New York Harbor and the adjacent localities of Arthur Kill, Kill van Kull, and Hoboken are the principal places where extensive repairs to hulls and machinery of large vessels can be made. Repairs to smaller vessels can be made at the other places named in the following table. Small vessels and motor boats can be hauled out, and minor repairs to machinery can be made at many other places as mentioned under the descriptions of the different ports.

Largest dry docks and marine railways

Port	Name	Length over blocks	Depth on sill at high water	Capacity
		Feet	*Feet*	*Tons*
Narragansett Bay:				
Newport	Railway	180	6½, 13½	700
Fall River	do	325	15, 18	2, 500
East Providence	Floating dock	200	13	700
Connecticut:				
Noank	Railway	250	14	1, 500
West Mystic	do	100	10, 15	200
New London	do	310	17, 21	2, 500
New Haven	do	100	6, 12	350
Bridgeport	do	150	8, 16	500
Greenwich	do	83	5, 8	200
Long Island, N. Y.:				
Greenport	do	180	8, 20	1, 200
Port Jefferson	do	210	12, 21	1, 200
Northport	do			200
Babylon	do	75	5	
East River, N. Y.:				
City Island	do	165	21	1, 000
College Point	Dry dock	300	14	1, 000
Astoria	Railway	175	8	600
Long Island City	do	200	12	2, 000
Newtown Creek	Floating dock	140	12	400
Brooklyn (navy yard)	Dry dock	625	30	
East Seventh Street	Floating dock	260	20	3, 000
New York Harbor:				
Gravesend Bay	Railway	135	15	400
Bay Ridge Channel	Floating dock	531	24	15, 000
Gowanus Bay	do	450	30	12, 000
Erie Basin	do	560	28	24, 000
Greenwich Piers	Railway	130	8, 11	800
Arthur Kill and Raritan Bay:				
Keyport	do	160	5, 8	
Perth Amboy	Floating dock	440	24	10, 000
Tottenville	Railway	175	9, 12	1, 000
Kill Van Kull:				
Holland Hook	do	130	4, 6	800
Elizabethport	do	258	9, 14	2, 000
Mariners Harbor	Floating dock	440	26	10, 000
Bayonne	do	110	6	
Port Richmond	do	294	23	3, 500
Factoryville	do	185	23	1, 600
West New Brighton	do	209	19	2, 000
New Brighton	do			600
Hudson River:				
Jersey City	do	143	19	2, 000
Hoboken	do	525	22	10, 000
Weehawken	do	240	21	2, 000
Nyack	Railway	110	5, 9	500
Grassy Point	do	100	5, 6	225
Newburgh	do	185	6	1, 000
Roundout (South)	Floating dock	182	9	1, 100
Athens	Railway	170	8, 11	1, 000
New Baltimore	do	148	4, 12	400

PILOTS AND PILOTAGE

Pilots.—In the States covered by this volume pilotage, with a few unimportant exceptions, which seldom occur, is compulsory, for all

vessels, both domestic and foreign, engaged in the foreign trade, but not for any class of vessel in the domestic trade. Rates and other information for the more important ports are given in the description of the localities.

Pilots cruise off the entrance of New York Harbor and are always available here and also at points on East River. Local pilots can be obtained on inquiry at most of the larger ports covered by this volume. The masters of towboats are usually licensed pilots.

Towboats are stationed at Vineyard Haven, New Bedford, Cape Cod Canal, Newport, Fall River, Providence, Westerly, New London, Connecticut River, New Haven, Bridgeport, South Norwalk, City Island, New York Harbor and tributaries, and the more important ports on the Hudson River.

Harbor masters are appointed for the principal ports, and they have charge of the anchorage and berthing of vessels in their respective harbors. The anchorage regulations for the port of New York are given in the appendix. The laws prohibit the dumping of ashes or other materials in the channels.

Navigation laws of the United States are published by the Bureau of Navigation, Department of Commerce, at intervals of four years, the present edition being that of 1923. A supplement is issued after every session of Congress. The volume and supplements can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., price $1 for the volume and 5 cents each for the supplements.

Rules of the road.—International and inland "Rules to prevent collisions of vessels," lines within which the inland rules apply, and "Regulation of motor boats" are published by the Bureau of Navigation, Department of Commerce, and are included in the appendix of this volume.

Pilot rules for certain inland waters of the Atlantic and Pacific coasts and of the coast of the Gulf of Mexico are published by the Steamboat Inspection Service in Form 804.

Copies of these pamphlets are furnished by the officers of the Steamboat Inspection Service, and can also be had from the Division of Publications, Department of Commerce, Washington, D. C.

QUARANTINE

Quarantine for all ports in the States of Massachusetts and Rhode Island is enforced in accordance with the requirements of the United States Public Health Service. There are quarantine officers at Boston, Providence, and Newport.

The quarantine laws of Connecticut govern the ports in that State and local boards of health have the power to make sanitary regulations for the ports under their control. The laws of the State of New York govern the ports of that State, including those on the shore of Long Island. The quarantine laws for the city of New York control vessels westward of Execution Rocks.

Ordinarily there is no special boarding station for vessels coming through the Sound bound to New York. During periods when the necessity for such course has been felt, health officers have been detailed and temporary boarding stations established at or near the Sound entrance of East River. The health officer of the port of

New York has his headquarters just above Fort Wadsworth, Staten Island.

In general, where State quarantine is in force, the minimum requirements of quarantine are in accordance with the regulations of the United States Public Health Service. National quarantine regulations will be found at the stations of the service and at American consulates, and will be furnished to vessels upon application, either by officers of the service or by the bureau in Washington, D. C. Every vessel should be provided with the quarantine regulations. There is a national quarantine station at Perth Amboy, N. J.

Medical relief.—American merchant seamen are entitled to free medical relief at the expense of the Government, through the United States Public Health Service at its established relief stations. A list of such stations in the region covered by this volume is given below. An American merchant seaman is one "engaged on board in the care, preservation, or navigation of any registered, enrolled, or licensed vessel of the United States, or in the service, on board, of those engaged in such care, preservation, or navigation."

Bridgeport, Conn. (deputy collector of customs).
Ellis Island, N. Y., Marine Hospital No. 43.
Fall, River, Mass. (1244 Pleasant Street).
Hartford, Conn. (deputy collector of customs).
New York, N. Y., Marine Hospital No. 70 (67 Hudson Street).
New York, N. Y., out-patient office (barge office).
Nantucket, Mass. (31 Center Street).
New Bedford, Mass. (11 North Orchard Street).
New Haven, Conn. (1187 Chapel Street).
New London, Conn. (205 William Street).
Newport, R. I. (98 Mill Street).
Perth Amboy, N. J. (Customhouse).
Providence, R. I. (403 Federal Building).
Provincetown, Mass. (234 Commercial Street).
Stapleton, N. Y., Marine Hospital No. 21 (Bay Street).
Vineyard Haven, Mass., Marine Hospital No. 22.

WEATHER

Winds.—On Nantucket Shoals and through Nantucket and Vineyard Sounds the prevailing winds are westerly and northwesterly in winter and southwesterly in summer. From Vineyard Sound westward the prevailing winds are northwesterly and northerly in winter and southwesterly and southerly in summer, but subject to many variations at all seasons. (See also the meteorological tables in the appendix.)

Fogs are liable to occur at any season, but are more prevalent from April to October than during the rest of the year. They come most frequently with easterly and southeasterly winds, often with southerly winds, and occasionally with the wind westward of south. Off Montauk Point and Point Judith, winds between south and southwest are nearly as apt to bring fog as those from southeastward. Westerly and northerly winds clear away fog, this holding good for all parts of the Atlantic coast. (For fog conditions in Long Island Sound, see p. 118.)

The following table shows the average number of hours per month, from a record of six years or more, that the fog signals were operated at the stated light stations of the United States:

Hours of operation of fog signals

Light station	January	February	March	April	May	June	July	August	September	October	November	December	Total
Race Point	90	87	81	69	68	58	66	47	67	53	31	34	751
Cape Cod	92	83	91	78	94	78	96	68	77	72	34	29	892
Pollock Rip Slue Lightship	88	102	84	70	118	116	212	145	126	73	37	44	1, 215
Great Round Shoal Lightship	105	109	90	92	99	124	181	111	94	70	33	50	1, 158
Nantucket Shoals Lightship	50	59	63	83	141	168	184	80	71	63	11	10	983
Bishop and Clerks	79	58	59	41	50	44	53	28	36	31	24	22	525
Nobska Point	64	37	34	33	30	41	66	35	31	26	17	17	431
Vineyard Sound Lightship	108	80	82	88	98	98	111	82	73	30	38	36	924
Dumpling Rock	102	68	66	71	78	68	104	59	54	24	35	35	764
Wings Neck	31	22	30	22	23	33	30	15	21	19	17	14	277
Brenton Reef Lightship	69	38	56	58	79	61	74	48	45	22	18	29	597
Newport Harbor	47	25	43	40	59	44	54	33	33	15	13	21	427
Prudence Island	57	30	43	38	47	33	42	25	28	23	15	26	407
Borden Flats	16	12	15	9	7	5	7	12	14	17	9	11	134
Plum Beach	63	31	42	45	65	35	46	28	33	22	18	28	456
Conimicut	72	48	52	36	39	18	25	17	38	35	30	34	444
Pomham Rocks	40	20	22	23	22	9	10	10	18	18	13	26	231
Point Judith	90	53	84	79	105	87	109	69	61	35	32	44	848
Block Island Southeast	93	56	89	86	126	99	126	79	72	35	21	41	923
Watch Hill	76	44	70	73	107	82	82	35	46	28	20	45	708
Montauk Point	89	62	100	82	129	99	110	70	66	33	34	54	928
New London Ledge	80	49	85	64	99	66	78	40	48	38	18	56	721
Little Gull Island	97	61	99	81	111	87	89	50	55	33	40	55	858
Orient Point	66	48	67	56	75	51	45	21	27	17	19	35	527
Saybrook Breakwater	49	23	52	49	67	46	44	23	29	20	17	27	446
Cornfield Point Lightship	99	68	97	61	96	75	72	41	52	29	39	63	792
Falkner Island	102	74	96	67	83	54	40	20	40	24	37	71	708
Stratford Point	80	40	67	53	59	36	25	13	21	18	25	49	486
Stratford Shoal	109	82	107	77	92	53	43	24	33	28	36	71	755
Eatons Neck	101	56	79	51	58	38	30	17	23	17	32	61	563
Greens Ledge	96	49	76	53	58	31	28	14	26	17	36	61	545
Great Captain Island	121	90	84	60	73	51	48	37	41	30	51	100	786
Execution Rocks	99	55	83	58	56	44	37	24	30	31	46	73	636
Throgs Neck	78	41	57	33	36	27	28	18	30	26	32	56	462
Fire Island Lightship	72	50	76	70	95	65	41	21	42	33	23	38	626
Ambrose Channel Lightship	123	86	116	86	113	89	69	43	70	57	55	76	983
Romer Shoal	100	61	79	56	58	52	38	18	44	35	41	43	625
Robbins Reef	104	52	71	42	46	29	17	7	32	32	35	61	528
Great Beds	75	35	43	29	37	18	12	14	34	36	37	46	416
Stony Point lower	73	27	45	37	39	17	11	11	27	29	45	78	439
Hudson City	4	1	10	5	2	3	2	7	13	23	16	23	109
Northeast End Lightship	124	84	154	121	133	70	35	18	59	64	34	97	993

Ice.—In severe winters some of the harbors are closed to navigation by ice, but the principal harbors are usually kept open by the steamers and towboats. There is usually some drift ice on Monomoy and Nantucket Shoals and in Nantucket and Vineyard Sounds, Buzzards and Narragansett Bays, and Long Island Sound. For ice in Long Island Sound see page 118. Additional information concerning ice conditions is given under the descriptions of the tributaries.

STORM WARNINGS

Storm warnings are displayed by the United States Weather Bureau at numerous places on the coasts of the United States and the Great Lakes.

Small-craft warning.—A red pennant indicates that moderately strong winds that will interfere with the safe operation of small craft are expected. No night display of small-craft warnings is made.

Northeast storm warning.—A red pennant above a square red flag with black center displayed by day, or two red lanterns, one above the other, displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northeast.

Southeast storm warning.—A red pennant below a square red flag with black center displayed by day, or one red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southeast.

Southwest storm warning.—A white pennant below a square red flag with black center displayed by day, or a white lantern below a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southwest.

Northwest storm warning.—A white pennant above a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the northwest.

Hurricane, or whole gale warning.—Two square flags, red with black centers, one above the other, displayed by day, or two red lanterns, with a white lantern between, displayed by night, indicate the approach of a tropical hurricane, or one of the extremely severe and dangerous storms which occasionally move across the Great Lakes and Atlantic coast.

These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Turks Island, Bermuda, Haiti, Curaçao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Barbados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

The following are the storm warning display stations within the limits covered by this volume:

MASSACHUSETTS:
- Race Point.
- Cape Cod Light.
- Chatham.
- Monomoy.
- Nantucket Shoals Light Vessel.
- Nantucket.
- Cross Rip Light Vessel.
- Hyannis.
- East Chop.
- Nobska Point Light.
- Tarpaulin Cove.
- Cuttyhunk.
- Wings Neck Light (Pocasset).
- New Bedford.
- New Bedford Yacht Club.
- Fall River.

RHODE ISLAND:
- Newport.
- Saunderstown.
- Providence.
- Providence Yacht Club.
- Point Judith.
- Block Island.

CONNECTICUT:
- Bridgeport.
- New Haven.
- New Haven old light.
- New London.
- Saybrook Point.
- Stonington.

NEW YORK:
- Brooklyn (navy yard).
- Center Island.
- Fort H. G. Wright (Fishers Island).
- Fort Schuyler (Throgs Neck).
- New Rochelle.
- New York (Whitehall Building).
- New York (Maritime Exchange).
- New York, One hundred and thirty-eighth Street, Hudson River.

NEW JERSEY:
- Long Branch.
- Sandy Hook.

RADIO SERVICE

The supervision of radio communication in the United States, including the Hawaiian Islands, is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States are published by the bureau. Either of the first two publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., price, 15 cents each; the last one, 25 cents. Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international list shows geographical locations, normal ranges in nautical miles, radio systems, and rates. Supplements to the international list will be issued monthly and will contain new stations and tables of alterations. Inquiries as to the subscription prices of these lists should be made direct to the Berne bureau at the address given above. Remittances to Berne should be made by international postal money orders.

Time signals.—Radio time signals are sent daily from United States naval radio stations as follows: From the station at Arlington (call letters NAA) signals are sent out at noon and 10 p. m., standard seventy-fifth meridian time, on a wave length of 2,677 meters, continuous wave. They are repeated automatically from the station at Annapolis (NSS) on a wave length of 17,130 meters, continuous wave, and from the station at Key West (VAR) on a wave length of 2,939 meters, spark. Lag constants have been determined for these stations, as follows: Arlington, 0.09 second; Annapolis, 0.08 second; and Key West, 0.28 second. Should the Arlington station not be working, time signals will be sent at noon daily, Sundays and holidays excepted, from the stations at Boston, Newport, New York, Norfolk, and Charleston.

The signals begin at five minutes before the hour and continue for five minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The time signal is the beginning of the dash after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

Radiocompass bearings.—The increasing use of radio directional bearings for locations of ships' positions at sea, especially during foggy weather, has made it particularly desirable to be able to apply these radio bearings sent out by the shore stations directly to the nautical chart. The radio bearings sent out by radiocompass stations are the bearings of the great circles passing through those

stations and the ship, and unless in the plane of the Equator or of a meridian, would be represented on a Mercator chart as curved lines. Obviously it is impracticable for a navigator to plot such lines on his chart, so it is necessary to apply a correction to a radiocompass bearing to convert it into a Mercator bearing; that is, the bearing of a straight line on a Mercator chart laid off from the sending station and passing through the receiving station.

On page 13 is given a table of corrections for the conversion of a radio bearing into a Mercator bearing. It is sufficiently accurate for practical purposes for distances up to 1,000 miles.

The only data required are the latitudes and longitudes of the radiocompass stations and of the ship by dead reckoning. The latter is scaled from the chart and the former either scaled from the chart or taken from the list of radiocompass stations printed in the Coast Pilots or in the publication, Radio Aids to Navigation (H. O. No. 205), issued by the Hydrographic Office, United States Navy. The largest scale chart available should be used for this purpose.

The table is entered with the difference in longitude in minutes between the ship and shore station (the nearest tabulated value being used), and opposite the middle latitude between the ship and shore station (to the nearest tabulated value) the correction to be applied is read.

The sign of the **correction,** when bearings are read clockwise from north, will be as follows: In **north latitude,** the plus sign is used when the ship is **east** of the compass station; the minus sign is used when the ship is **west** of the compass station; in **south latitude,** the minus sign is used when the ship is **east** of the compass station; the plus sign is used when the ship is **west** of the compass station. If the radio bearings are observed on the ship, the signs will be reversed. The corrected bearing is then the Mercator bearing from ship to the sending station, and to facilitate plotting 180° should be added to it and the result plotted from the sending station.

Should the position by dead reckoning differ greatly from the true position of ship as determined by plotting the corrected radio bearings, a retrial should be made, using the new value as the position of the ship.

Example.—A ship in latitude 37° 20′ N., longitude 69° 20′ W., by dead reckoning receives a radio bearing of 64° from a radiocompass station located in latitude 35° 14′ N., longitude 75° 32′ W. Find the Mercator bearing of the ship from the station—

Radiocompass station latitude	35°	14′ N.,	long.	75°	32′ W.
Dead reckoning position of ship	37	20		69	20
Middle latitude	36	17	Diff.	372′	

Entering table with difference of longitude=360′, which is the nearest tabulated value to 372′ and opposite 36° middle latitude (the nearest tabulated value to 36° 17′) the correction 106′ is read. The ship being east of the station the correction is plus. The Mercator bearing will then be the radio bearing received plus the correction from the table, 64° 00′+106′=64°+1° 46′=65° 46′.

For more accurate determinations the following formula should be used and on which the table of corrections are based.

Formula for the conversion of radio bearings into Mercator bearings.—The Mercator bearing is equal to the radio bearing received, plus or minus one-half the convergence of the meridians in minutes, which expressed as a formula is

$$M = R \pm \frac{D}{2} \sin\left(\frac{B+B'}{2}\right) \text{ in which}$$

M=Mercator bearing required.
R=radio bearing received from the radiocompass station.
D=difference in longitude, in minutes, between the radiocompass station and the ship's position by dead reckoning.
B=latitude of the radiocompass station.
B'=latitude of the ship's position by dead reckoning.

Example.—A ship in latitude 37° 20′ N., longitude 69° 20′ W. by dead reckoning receives a radio bearing of 64° from a radiocompass station located in latitude 35° 14′ N., longitude 75° 32′ W. Find the Mercator bearing of the ship from the station.

By the formula—

$R = 64°$
$D = 75° 32' - 69° 20' = 6° 12' = 372'$
$\frac{D}{2} = 186'$

$B = 37° 20'$
$B' = 35° 14'$
$B + B' = 72° 34'$
$\frac{B+B'}{2} = 36° 17'$

sin 36° 17′ = .59176 (from the table of natural sines, below.

Substituting these values in the formula, and observing that since the ship is in north latitude and east of the radiocompass station, the + sign is used (see p. 11 for determination of signs), we have—

$$M = 64° + 186' \times 0.59176 = 64° + 110' = 64° + 1° 50' = 65° 50'$$

Table of natural sines

Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine
0°	0.00000	11°	0.19081	22°	0.37461	33°	0.54464	44°	0.69466	55°	0.81915
1°	.01745	12°	.20791	23°	.39073	34°	.55919	45°	.70711	56°	.82904
2°	.03490	13°	.22495	24°	.40674	35°	.57358	46°	.71934	57°	.83867
3°	.05234	14°	.24192	25°	.42262	36°	.58779	47°	.73135	58°	.84806
4°	.06976	15°	.25882	26°	.43837	37°	.60182	48°	.74314	59°	.85717
5°	.08716	16°	.27564	37°	.45399	38°	.61566	49°	.75471	60°	.86603
6°	.10453	17°	.29237	28°	.46947	39°	.62932	50°	.76604	61°	.87462
7°	.12187	18°	.30902	29°	.48481	40°	.64279	51°	.77715	62°	.88295
8°	.13917	19°	.32557	30°	.50000	41°	.65606	52°	.78801	63°	.89101
9°	.15643	20°	.34202	31°	.51504	42°	.66913	53°	.79864	64°	.89879
10°	.17365	21°	.35837	32°	.52992	43°	.68200	54°	.80902	65°	.90631

Table of corrections, in minutes

[Difference of longitude in minutes]

Mid. L.	30′	60′	90′	120′	150′	180′	210′	240′	270′	300′	330′	360′	390′	420′	450′	480′	510′	540′	570′	600′
20°	5	10	15	21	26	31	36	41	46	51	56	62	67	72	77	82	87	92	98	103
21°	5	11	16	21	27	32	38	43	48	54	59	64	70	75	81	86	91	97	102	108
22°	6	11	17	22	28	34	39	45	51	56	62	67	73	79	84	90	96	101	107	112
23°	6	12	18	23	29	35	41	47	53	59	64	70	76	82	88	94	100	105	111	117
24°	6	12	18	24	31	37	43	49	55	61	67	73	79	85	92	98	104	110	116	122
25°	6	13	19	25	32	38	44	51	57	63	70	76	82	89	95	101	108	114	120	127
26°	7	13	20	26	33	39	46	53	59	66	72	79	85	92	99	105	112	118	125	131
27°	7	14	20	27	34	41	48	54	61	68	75	82	89	95	102	109	116	123	129	136
28°	7	14	21	28	35	42	49	56	63	70	77	84	92	99	106	113	120	127	134	141
29°	7	15	22	29	36	44	51	58	65	73	80	87	95	102	109	116	124	131	138	145
30°	7	15	22	30	38	45	53	60	68	75	83	90	98	105	113	120	127	135	143	150
31°	8	15	23	31	39	46	54	62	70	77	85	93	100	108	116	124	131	139	147	155
32°	8	16	24	32	40	48	56	64	72	79	87	95	103	111	119	127	135	143	151	159
33°	8	16	25	33	41	49	57	65	74	82	90	98	106	114	123	131	139	147	155	163
34°	8	17	25	34	42	50	59	67	75	84	92	101	109	117	126	134	143	151	159	168
35°	9	17	26	34	43	52	60	69	77	86	95	103	112	120	129	138	146	155	163	172
36°	9	18	26	35	44	53	62	71	79	88	97	106	115	123	132	141	150	159	168	176
37°	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	163	172	181
38°	9	18	28	37	46	55	65	74	83	92	102	111	120	129	139	148	157	166	175	185
39°	9	19	28	38	47	57	66	75	85	94	104	113	123	132	142	151	160	170	179	189
40°	10	19	29	39	48	58	68	77	87	96	106	116	125	135	145	154	164	174	183	193
41°	10	20	30	39	49	59	69	79	89	98	108	118	128	138	148	157	167	177	187	197
42°	10	20	30	40	50	60	70	80	90	100	110	120	130	140	151	161	171	181	191	201
43°	10	20	31	41	51	61	72	82	92	102	113	123	133	143	153	164	174	184	194	205
44°	10	21	31	42	52	63	73	83	94	104	115	125	135	146	156	167	177	188	198	208
45°	11	21	32	42	53	64	74	85	95	106	117	127	138	149	159	170	180	191	201	212
46°	11	22	32	43	54	65	76	86	97	108	119	129	140	151	162	173	183	194	205	216
47°	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	186	197	208	219
48°	11	22	33	45	56	67	78	89	100	111	123	134	145	156	167	178	190	201	212	223
49°	11	23	34	45	57	68	79	91	102	113	125	136	147	158	170	181	192	204	215	226
50°	11	23	34	46	57	69	80	92	103	115	126	138	149	161	172	184	195	207	218	230
51°	12	23	35	47	58	70	82	93	105	117	128	140	152	163	175	186	198	210	221	233
52°	12	24	35	47	59	71	83	95	106	118	130	142	154	165	177	189	201	213	225	236
53°	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
54°	12	24	36	49	61	73	85	97	109	121	133	146	158	170	182	194	206	218	231	243
55°	12	25	37	49	61	74	86	98	111	123	135	147	160	172	184	197	209	221	233	246
56°	12	25	37	50	62	75	87	100	112	124	137	149	162	174	187	199	211	224	236	249
57°	13	25	38	50	63	75	88	101	113	126	138	151	164	176	189	201	214	226	239	252
58°	13	25	38	51	64	76	89	102	115	127	140	153	165	178	191	204	216	229	242	254
59°	13	26	39	51	64	77	90	103	116	129	141	154	167	180	193	206	219	231	244	257
60°	13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260

Accuracy of bearings.—The accuracy with which bearings can be taken depends on various conditions and, while bearings taken by a station can generally be considered accurate to within 2°, the Government can not accept any responsibility for the consequences of a bearing being inaccurate.

When three stations, so situated as to give intersecting bearings, can be used and the three simultaneous bearings cross with a small "triangle of error," considerable reliance can be placed in the position obtained.

In the case of bearings which cut the coast line at an oblique angle, errors of from 4° to 5° have been reported. Bearings obtained between about one-half hour before sunset and one-half hour after sunrise are generally unreliable. It is probable that the accuracy of a bearing is also affected if the ship's transmitting instrument is not adjusted to the correct wave length. Bearings signaled as "approximate" or "second class" should be regarded with suspicion as being subject to considerable error.

United States naval radiocompass stations will furnish radio bearings to mariners of all vessels equipped with radiotelegraph transmitters. While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radiocompass stations are provided, primarily, to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the positions of vessels at sea in radiocompass range, about 150 miles, when for any reason positions can not be obtained by other means. The maximum distance for which bearings from these stations are accurate is 150 miles. (See preceding pages for reduction of observed bearings to Mercator bearings.)

Radiocompass stations are divided into two classes: (*a*) Single stations, operating independently and furnishing a single bearing. (*b*) Harbor-entrance groups. All stations in harbor-entrance groups are connected to and controlled by the master station. All stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station.

Where only one radiocompass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position, or as a danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

Wave lengths.—All independent and group radiocompass stations keep watch on 375 kilocycles (800 meters). Only this wave should be used to call and work with these stations.

Hours of service.—During the first 10 minutes of each hour during clear weather radiocompass stations ordinarily will not be guarding this wave. Ships are requested to confine their requests to bearings during clear weather to the remaining 50 minutes of the hour, as far as is practicable. Should a station chance to hear a request for a bearing during the first 10 minutes of the hour, the required bearing will be given. During the remaining 50 minutes, and at all times during inclement weather, all radiocompass stations will be continuously guarding the 375-kilocycle (800-meter) wave.

Calling a radiocompass station.—To obtain a bearing from independent radiocompass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired. To obtain bearings from the harbor-entrance compass stations, carry out the procedure previously given. The compass-control station only will answer.

Conventional signals.—The following abbreviated signals will be used:

Signal	Meaning
QTE?	What is my true bearing?
QTE	Your true bearing from ..... radio compass station was ..... degrees.

The following radiocompass stations will be of use for vessels navigating within the approximate limits of this volume. In plotting bearings furnished by these stations the *position of receiver* must be used. Vessels equipped with a radiocompass may also use these stations as radio beacons. For this purpose a station will transmit, upon request, its call letter for 45 seconds on 800-meter wave. When the bearing is taken on the vessel, the *position of transmitter* must be used for plotting:

Name of station	Call letters	Position of receiver		Position of transmitter		Arc of calibration
		Latitude (N.)	Longitude (W.)	Latitude (N.)	Longitude (W.)	
		° ′ ″	° ′ ″	° ′ ″	° ′ ″	°
Thatcher Island, Mass	NWM	42 38 10	70 34 45	42 22 32	[1] 71 03 16	322–243
Deer Island, Mass	NWM	42 21 16	70 57 29			15–150
Fourth Cliff, Mass	NWM	42 09 40	70 42 22			330–135
North Truro, Mass	NAE	42 02 23	70 03 37	42 02 27	70 03 43	210–150
Surfside (Nantucket), Mass	NBS	41 14 39	70 05 53	41 14 40	70 05 55	345–275
Prices Neck, R. I. [3]	NGO	41 27 04	71 20 16	41 30 28	71 19 48	80–270
Amagansett, Long Island, N. Y	NBM	40 58 10	72 07 27	40 58 20	72 07 39	70–230
Fire Island, N. Y	NJY	40 38 07	73 12 32	40 37 59	[2] 73 13 00	83–262
Sandy Hook, N. J	NJY	40 27 54	73 59 50			0–170
Manasquan, N. J	NJY	40 07 05	74 01 58			10–190

[1] Boston Bay entrance group—controlled by Boston master station.
[2] New York entrance group—controlled by New York master station.
[3] This station uses alternating continuous wave for transmitting bearings.

NOTE.—The arc of calibration is a sector of the circle of which the compass coil at the radio station is the center. The bearings are from the station (clockwise). Compass bearings are reliable only when they fall within the calibrated arcs.

Procedure in detail.—(*a*) A ship calling the radiocompass station or compass control station should make the abbreviation "QTE?" ("What is my true bearing?"). This request will be answered by the radiocompass station or control station, and when ready to observe the radio bearing it will send the signal "K," indicating to the ship to commence "testing"; that is, repeating its distinguishing signal for a period of 50 seconds. The signal should be made slowly, with the dashes considerably prolonged.

(*b*) The testing should be made on 800 meters, upon the completion of which the ship should await reply from the radiocompass station.

(*c*) The radiocompass station or control station will then reply, repeating the abbreviation "QTE" ("Your true bearing from _____ was _____ degrees"), followed by the bearing in degrees given by a group of three figures 000 to 359, indicating the true bearing in degrees of the ship station from the radiocompass station, and then the time group, giving the time of observations in local standard time. In the case of more than one radiocompass connected by land line, only the station originally called will answer. This station will combine all the bearings taken by itself and associated stations into one message, which gives each bearing observed immediately after the name of the station making the observations. *All compass stations transmit on 800 meters.*

Danger from reciprocal bearings.—Attention is invited to the fact that when a signal bearing is furnished there is a possibility of an

error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radiocompass stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings when furnished vessels may differ by approximately 180°, and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the correction necessary on account of deviation at the compass station. An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radiocompass station if not previously furnished.

Bearings, except in the case of approximate reciprocal bearings, should be accurate within 2° of arc, provided the transmitting equipment on board vessels is tuned sharply to 800 meters. Operators should use sufficiently wide coupling to obtain low decrement. If radio transmitters are not tuned sharply, it is difficult to obtain bearings that are sufficiently accurate for navigational purposes.

When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel. Mariners, until thoroughly familiar with the system, are advised to use radiocompass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed in order to accustom operators to the procedure and to acquaint themselves with the degree of accuracy and dependability of bearings furnished by the radiocompass stations.

Reports.—In order that the operation of shore radiocompass stations may be checked, mariners, obtaining bearings are requested to forward a brief report to the Director Naval Communications, Navy Department, Washington, D. C., containing the following particulars:

1. Name of ship.
2. Name of radiocompass station.
3. Date and local standard time at which radio bearing was taken.
4. Bearings given by radio station.
5. Estimated position of ship at above time and dates by methods other than radio.
6. The probable degree of accuracy of the estimated position.
7. Weather conditions at above time.
8. Remarks, if any.
9. Signature of master or responsible navigating officer.

There is no charge for bearings furnished by the United States naval radiocompass stations.

Radio fog signals.—The following radio fog signals are operated on the Atlantic coast by the United States Lighthouse Service:

Boston Lightship, Mass.:	
Group of 1 dash and 1 dot	55 seconds
Silent	20 seconds

Nantucket Shoals Lightship, Mass. (call letters WWAH):	
Group of 4 dashes	60 seconds
Silent	30 seconds
Fire Island Lightship, N. Y. (call letters WWAN):	
Group of 2 dashes	50 seconds
Silent	15 seconds
Ambrose Channel Lightship, N. J. (call letters WWAT):	
Single dashes	65 seconds
Silent	25 seconds
Seagirt Light Station, N. J.:	
Groups of 3 dashes	30 seconds
Silent	3 minutes
Five Fathom Bank Lightship (call letters WWAR):	
Group of 1 dash and 3 dots	40 seconds
Silent	25 seconds
Cape Henry Light Station, Va.:	
Groups of 2 dots and 1 dash	60 seconds
Silent	120 seconds
Diamond Shoal Lightship, N. C. (call letters WWAZ):	
Group of 2 dashes	30 seconds
Silent	30 seconds

NOTE.—Ships and stations for which no call letters are given do not maintain radio communication.

These radio fog signals are intended for the use of vessels equipped with radiocompass. By reason of this radiocompass (also termed radio direction finder) the bearing of the radio fog-signal station may be determined with an accuracy of approximately 2° and at distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or without knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

It is important to note that the bearing of an incoming radio wave is subject to errors not unlike the deviation of a magnetic compass. Those using radio direction finding on shipboard are cautioned to bear these errors in mind and to keep radiocompasses calibrated at all times. This may be done during clear weather by comparing the bearing obtained with the radiocompass with the bearing as given by other methods in general use. All radiocompasses are subject to what is called "night effect," an indeterminate error sometimes experienced near nightfall and sunrise.

The signals from the light vessels have definite characteristics for identifying the stations, as have the flashing lights and sound fog signals and bearing may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference.

With the exception of *Nantucket Shoals Lightship*, as noted below, the lightships and stations transmit continuously during thick or foggy weather, and sound the signal daily in clear weather from 9 to 9.30 a. m. and from 3 to 3.30 p. m. (seventy-fifth meridian time).

With the exception of *Nantucket Shoals and Boston Lightships*, operators on lightships maintain watch on 600-meter wave length for the first 15 minutes of each hour from 8 a. m. to 9.15 p. m., local standard time, except when radio fog signal is in operation. Requests by radio for special transmission of signals for testing or calibrating should be made during such watch periods, using 600-meter wave length.

In clear weather, *Nantucket Shoals Lightship* (call letters WWAH), transmits signals day and night during the second 15 minutes of each hour, and the operator stands watch during the first 15 minutes of each hour from 8 a. m. to 10.15 p. m. (seventy-fifth meridian time). During fog the radio fog signal will be silent from 10 a. m. to 10.15 a. m. and from 4 p. m. to 4.15 p. m. for listening in.

Nantucket Shoals Lightship sounds radio fog signal and submarine signal at the same time. The submarine signal sounds 2 groups of 6 blasts every 90 seconds, thus, six 1-second blasts, 3½ seconds apart, 12 seconds silence, six 1-second blasts, 3½ seconds apart, 31 seconds of silence. In each repetition the first dash of the radio signal and the first blast of the submarine signal are sounded at the same time. The difference in time in seconds between the reception of the first dash of the radio signal and the first blast of the submarine signal multiplied by 1,600 will give the distance in yards of the observer from the lightship.

Vessels are requested to forward reports to the Commissioner of Lighthouses, Washington, D. C., or Superintendent of Lighthouses, Boston, Mass., as to the effectiveness of this signal.

A general description of this method of navigation and the instruments required may be obtained from the Commissioner of Lighthouses, Washington, D. C., upon request. The Bureau of Standards Scientific Paper, No. 428, the Radio Direction Finder and Its Application to Navigation, may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

Radio telegraphic broadcasts of weather information, issued daily (Sundays and holidays included) by the United States Weather Bureau for the benefit of marine and aviation interests, are sent out in cooperation with the Office of Communications, Navy Department, from naval radio stations on the North Atlantic coast.

Major bulletins.—These bulletins are broadcast from the Arlington (Va.) Naval Radio Station (call letters NAA) twice daily, as follows:

Morning bulletin at 10.30 a. m. (1030) (1530 GCT) on a wave length of 2,677 meters (133 KC/s) CW.

Evening bulletin at 10.30 p. m. (2230) (0330 GCT) on a wave length of 2,677 meters (133 KC/s) CW.

The bulletins are divided into two parts and invariably begin with the words "Weather Bureau bulletin." The first part consists of surface weather conditions based upon observations taken at 8 a. m. and 8 p. m. and upper-air data.

Weather reports from ships in the Atlantic Ocean, and during the hurricane season additional ship reports from the Gulf of Mexico and Caribbean Sea, follow the reports from land stations in the first part of the bulletin, as follows:

In the afternoon bulletin—7 a. m. reports received too late for inclusion in the morning bulletin and 7 p. m. reports, both of current day.

In the morning bulletin—7 p. m. reports of previous day received too late for inclusion in afternoon bulletin and 7 a. m. current day reports.

NOTE.—Ship reports of previous observation included only when conditions are unusual.

The second part of the bulletin consists of a summary of general atmospheric pressure distribution over land and sea, including the locations of "high" and of "low" areas and the barometer readings at their centers; wind and weather forecasts for Atlantic and Gulf of Mexico offshore areas; storm warnings for these areas; and flying weather forecasts for each of six aviation zones.

The weather reports contained in the bulletins and supplemented by others picked up from vessels can be used in the production of weather maps, which will be of much value to navigating officers; and charts prepared for this purpose, which show the reporting station and their key letters, will be forwarded upon application to the United States Weather Bureau.

Complete details relative to the above service, including method of decoding the major bulletins and a list of stations from which localized broadcasts are made, are published in Circular No. 13, issued by the United States Weather Bureau. Copies of this circular and a card descriptive of storm signals may be obtained without charge upon application to any United States Weather Bureau office on the Atlantic coast. A new edition of the Radio Weather Code for Vessel Weather Observers (W. B. 860) was published in 1925.

Free medical advice to seamen by radio.—The Seamen's Church Institute, of New York, announces that, through the cooperation of the Seamen's Church Institute with the United States Public Health Service, free medical advice for ships at sea is now available through the coastal radio stations operated on the Atlantic and Pacific coasts of the United States.

The marine hospitals and relief stations of the United States Public Health Service designated to furnish the service in question are as follows:

Atlantic coast:
- New York, N. Y., United States Marine Hospital No. 70. (Alternate.)
- Stapleton, N. Y., United States Marine Hospital No. 21.
- Key West, Fla., United States Marine Hospital No. 10.

Gulf coast: New Orleans, La., United States Marine Hospital No. 14.

While the Panama Canal was not included in the original scheme, several requests for medical service have been received here from ships at sea and have been given prompt attention.

Ships desiring medical advice can secure prompt service by sending radiograms through any radio station with which communication is established, such radiograms to be signed by the master addressed to the nearest marine hospital or relief station and briefly stating symptoms of the person afflicted. The advice given by the above-mentioned hospitals will be phrased in language (English) intelligible to a layman. This free medical service has been established primarily for the benefit of ships not carrying physicians.

However, should occasion require, consultation may be held by radio by ships' physicians with the hospital staffs.

The United Fruit Co. announces that the free medical-radio service, which it inaugurated on August 1, 1922, from its hospitals in the various countries of Central America and from the passenger ships in its service, is now made available for ships at sea through an additional number of stations. The following is a list of radio stations of the United Fruit Co. and of the Tropical Radio Telegraph Co. through which this service may hereafter be obtained without charge, so far as these companies are concerned, by ships of all nationalities:

Radio station	Call letters	Radio station	Call letters
Boston, Mass	WBF	Tegucigalpa, Honduras	UG
Miami, Fla	WAX	Puerto Barrios, Guatemala	UF
New Orleans, La	WNU	Managua, Nicaragua	UL
Burrwood, La	WBW	Bluefields, Nicaragua	UQ
Fort Morgan, Ala	WIO	Cape Gracias, Nicaragua	UW
Mobile, Ala	WNN	Puerto Limon, Costa Rica	UX
Swan Island, Caribbean Sea	US	Almirante, Panama	UB
Santa Marta, Colombia	UJ		

Free medical radio service is also available through the Tela Railroad Co.'s radio station, call letters UC, Tela, Honduras, and through the Truxillo Railroad Co.'s radio station, call letters UA, Puerto Castilla, Honduras. Both of these stations may be reached through any station of the United Fruit Co. or of the Tropical Radio Telegraph Co. listed above.

The following information is taken from a circular issued by the United Fruit Co.:

Radiograms requesting medical advice should be signed by the captain of the ship and should state briefly but clearly the symptoms of the person afflicted. Such radiograms, if intended for a United Fruit Co. hospital, should be addressed "Unifruitco," followed by the name of the place where the hospital is located. United Fruit Co. hospitals giving this service are located at the following places and also may be reached through any of the above-mentioned radio stations: Santa Maria, Colombia; Puerto Limon, Costa Rica; Almirante, Panama; and Puerto Barrios, Guatemala.

This service may also be obtained at the hospital of the Tela Railroad Co., Tela, Honduras, and at the hospital of the Truxillo Railroad Co., Puerto Castilla, Honduras. Radiograms for these hospitals should be addressed "Telarailco" and "Trurailco," respectively.

All United Fruit Co. passenger steamships carry doctors and free medical advice may be secured by radio from any of them by a radiogram addressed "Ship's Doctor," followed by name of the steamship. This free medical service is established primarily for the benefit of ships not carrying doctors; however, should occasion require, ships' doctors may hold consultation by radio with the United Fruit Co. ships' doctors and hospital staffs.

The physicians and surgeons comprising the medical staff of the United Fruit Co. and its associated companies are thoroughly qualified, but in view of the fact that radio medical advice to ships at sea is given free and without an opportunity for a personal examination of the patients, no responsibility will be assumed by either the company and its associated companies or the physicians or surgeons giving the advice as to its accuracy, or for error or delay in the receipt or transmission of any message sent or received in connection therewith.

It is requested that when sending medical-advice radiograms, radio operators check them "(number of words) DH Medico." "DH Medico" radiograms

will be given preference over all other radiograms, excepting SOS calls, throughout the radio service of the United Fruit Co. and Tropical Radio Telegraph Co.

UNITED STATES COAST GUARD STATIONS

Coast Guard stations are maintained at the places named in the following table. The stations, except where shown "Discontinued as an active unit," are fully manned throughout the year and are supplied with boats, wreck guns, beach apparatus, and all other appliances for affording assistance in case of shipwreck. Instructions to enable mariners to avail themselves fully of the assistance thus afforded will be found in the appendix, page 350.

The Coast Guard stations are provided with the International Code Signals and are prepared to send or receive signals in that code or by means of the Semaphore Code, the Occulting or Flashing-light Code, or the International Morse Wigwag Code. Telephone facilities are available at the stations for the summoning of Coast Guard cutters, tugs, or other assistance, or for communicating with telegraph lines.

Name of station	State	Locality
Race Point	Massachusetts	1⅝ miles northeast of Race Point Light.
Peaked Hill Bar	do	2½ miles northeast of Provincetown.
Highland	do	⅞ mile northwest of Cape Cod Light.
Pamet River	do	3½ miles south of Cape Cod Light.
Cahoons Hollow	do	2½ miles east of Wellfleet.
Nauset	do	1¼ miles south of Nauset Light.
Orleans [1]	do	Abreast of Ponchet Island.
Old Harbor	do	½ mile north of Chatham Inlet.
Chatham	do	1½ miles south-southwest of Chatham Light.
Monomoy [1]	do	2¼ miles north of Monomoy tower.
Monomoy Point	do	¾ mile southwest of Monomoy tower.
Coskata	do	2¼ miles south of Nantucket (Great Point) Light.
Maddaket	do	6 miles west of Surfside.
Muskeget [1]	do	Near west end of Muskeget Island.
Gay Head	do	Near Gay Head Light.
Cuttyhunk	do	Near east end of Cuttyhunk Island.
Brenton Point	Rhode Island	On Prices Neck.
Narragansett	do	Northern part of town.
Point Judith	do	Near light.
Green Hill	do	6 miles west of Point Judith Light.
Quonocontaug	do	7½ miles east of Watch Hill Light.
Watch Hill	do	Near light.
Fishers Island	New York	West shore of East Harbor.
Sandy Point	Rhode Island	Block Island, north side, near light.
New Shoreham	do	Block Island, east side, near landing.
Block Island	do	West side, near Dickens Point.
Ditch Plain	New York	3½ miles southwest of Montauk Light.
Hither Plain	do	½ mile southwest of Fort Pond.
Napeague	do	Abreast of Napeague Harbor.
Amagansett	do	Abreast of the village.
Georgica	do	1 mile south of the village of East Hampton.
Mecox	do	2 miles south of Bridgehampton.
Southampton	do	¾ mile south of the village.
Tiana	do	2 miles southwest of Shinnecock Light.

[1] Discontinued as an active unit.

Name of station	State	Locality
Quogue	New York	½ mile south of the village.
Potunk	do	1½ miles southwest of Potunk village.
Moriches	do	2½ miles southwest of Speonk village.
Forge River	do	3½ miles south of Moriches.
Smiths Point	do	Abreast of the point.
Bellport	do	4 miles south of the village.
Blue Point	do	4½ miles south of Patchogue.
Lone Hill	do	8 miles east of Fire Island Light.
Point of Woods	do	4 miles east of Fire Island Light.
Fire Island	do	½ mile west of Fire Island Light.
Oak Island Beach	do	At east end.
Jones Beach	do	Do.
Zachs Inlet	do	West end of Jones Beach.
Short Beach	do	½ mile east of Jones Inlet.
Point Lookout	do	2 miles west of New Inlet.
Long Beach	do	Near the west end.
Rockaway Point	do	West end of Rockaway Beach.
Eatons Neck [1]	do	East side of entrance to Huntington Bay, Long Island Sound.
Rocky Point [1]	do	Long Island Sound, about 4 miles northward of Greenport.
Sandy Hook	New Jersey	On bay side, ½ mile south of point of Hook.
Spermaceti Cove	do	2½ miles south of Sandy Hook Light.

[1] Discontinued as an active unit.

MASSACHUSETTS HUMANE SOCIETY LIFE-SAVING STATIONS

The following life-saving stations, maintained by the Massachusetts Humane Society, are not manned, but depend on local residents to render assistance with the equipment given under the column headed "Remarks":

Locality	Remarks
Race Point Light	Hunt gun and apparatus.
Nashawena	Do.
Nantucket	Lifeboat; hunt gun and apparatus.
Siasconset, Nantucket	Do.
Forked Ponds, Nantucket	Lifeboat and dory; hunt gun and apparatus.
Hummock Pond, Nantucket	Do.
Tuckernuck, Nantucket	Lifeboat; hunt gun and apparatus.
Cape Poge, Marthas Vineyard	Lifeboat and dory; hunt gun and apparatus.

VARIATION OF THE COMPASS

The magnetic variation for 1927 and annual increase at points mentioned are as follows:

Locality	Variation	Annual increase
	° ′	′
Cape Cod Lighthouse	15 35 W	5
Handkerchief Light Vessel	15 05 W	5
Nantucket Shoals Light Vessel	14 25 W	5
Cape Poge	14 35 W	5
Gay Head	14 15 W	5
Hen and Chickens Light Vessel	14 10 W	5
Conimicut Lighthouse	14 00 W	5
Point Judith	13 40 W	5
Montauk Point	13 00 W	5
Gardiners Bay	12 35 W	5
New London Harbor	12 55 W	5
New Haven Harbor	12 20 W	5
Bridgeport Harbor	12 05 W	5
Greens Ledge Lighthouse	11 45 W	5
Great Captain Island	11 35 W	5
Throgs Neck	11 15 W	5
Shinnecock Lighthouse	12 15 W	5
Fire Island Light Vessel	11 20 W	5
New York Bay entrance	10 45 W	5
Kingston	12 00 W	5
Albany	12 40 W	5

TIDES AND CURRENTS

Tide Tables for the Atlantic Coast of the United States, including Canada and the West Indies, are published annually in advance by the United States Coast and Geodetic Survey. This volume furnishes, at the nominal cost of 15 cents, full tidal data for the Atlantic and Gulf coasts of North America.

It contains a table of full daily predictions of the times and heights of high and low waters for certain standard or principal ports along the coast, with full explanations for the use of this table. The use of Table 2 of the Tide Tables should be known to every navigator. By means of this table the predictions given for the standard ports are extended so as to enable one to obtain the predictions for each day for a large number of other stations and with almost the same accuracy as though full predictions were given for all these points.

The effect of strong winds, in combination with the regular tidal action, may at times cause the water to fall below the plane of reference of the chart, mean low water. The water may also rise about the same amount above mean high water, due to similar causes.

Caution.—In using the Tide Tables, slack water should not be confounded with high or low water. For ocean stations there is usually but little difference between the time of high or low water and the beginning of ebb or flood current; but for places in narrow channels, landlocked harbors, or on tidal rivers the time of slack current may differ by two or three hours from the time of high or low water stand, and local knowledge is required to enable one to make the proper allowance for this delay in the condition of tidal currents. To obtain the times of slack water, reference should be made either to figures given for various places in this volume of the Coast Pilot or to the Current Tables.

Current Tables for the Atlantic Coast of the United States are published in advance annually by the United States Coast and Geodetic Survey. This volume, which sells for 10 cents per copy, includes the daily predicted times of slack water for certain standard stations and a table of current differences and constants by means of which the daily predicted times of slack water may be readily obtained for numerous other places. These tables also include current diagrams for six bodies of water along the coast which show in a graphical form the velocities of the flood and ebb currents and the times of slack and strength over a considerable stretch of the channel of these waterways.

A description of the currents along the coast between Cape Cod and New York is given on page 31 of this volume. Information concerning the tides and currents in the harbors, rivers, and their entrances are usually given after the description of the locality. The results of special tidal and current observations in New York Harbor have been published under the title "Tides and Currents in New York Harbor," and copies of this publication can be obtained from the Coast and Geodetic Survey Field Station, New York City, or from the Superintendent of Documents, Government Printing Office, Washington, D. C., price 30 cents.

INLAND WATERWAYS

The following data about the inland waterways are included for ready reference:

The inland waters extending eastward from New York include Long Island Sound, Narragansett Bay, Buzzards Bay, and Vineyard and Nantucket Sounds. From the head of Buzzards Bay there is an available passage through Cape Cod Canal (see p. 78), from which the passage to the New England coast must be made mostly outside, although there are harbors at short intervals.

Long Island Sound has harbors at short intervals on both sides from its west end to Eaton Neck, and thence on its north side to and including Fishers Island Sound. From Watch Hill boats must go outside to the bays and sounds eastward, but Point Judith Harbor of Refuge is available and shortens the distance between harbors.

On the **south coast of Long Island** there is at present no inside route between Jamaica Bay and the inland waters eastward. Boats must go outside from New York to East Rockaway Inlet, and the latter requires local knowledge because of frequent changes. But from East Rockaway Inlet boats of 5-foot (1.5 m.) draft can be taken inside through Great South Bay, Moriches and Shinnecock Bays, and Shinnecock Canal to Great Peconic Bay. Masted boats are limited to a height of less than 20 feet above the water by the fixed bridges over Shinnecock Canal, and otherwise all bridges have draw openings. This route is described in this volume, under the heading "Inland waters, south coast of Long Island."

By the Hudson River and Erie Canal, or Hudson River, Champlain Canal, and Richelieu River boats can be taken through to the Great Lakes or St. Lawrence River, respectively. (See p. 325.)

The nearest inlet (Barnegat) connecting with the inside waters on the **coast of New Jersey** is nearly 45 miles southward of Sandy Hook, and boats must pass outside between these points, unless tak-

ing the route through the Delaware & Raritan Canal; but from the head of Barnegat Bay to Cape May Harbor there is an inside route for boats of 5-foot (1.5 m.) draft by taking advantage of the tide in places.

There is an inside route, good for small boats, along the **coast of Delaware, Maryland, and Virginia,** from Rehoboth Bay southward to Cape Charles. The nearest inlet connecting with the inside waters is 64 miles southward of Cape Henlopen, but a canal connects Rehoboth Bay with Delaware Bay.

New York to Key West.—Vessels of 7-foot (2.1 m.) draft can pass inside from New York Bay to Delaware River through the Delaware & Raritan Canal. Masted vessels are limited to a height of 50 feet above canal level by a bridge without draw at New Brunswick, N. J.

Vessels of about 9-foot (2.7 m.) draft can pass inside from Delaware River to Beaufort, N. C., through the Chesapeake & Delaware Canal, Chesapeake Bay, Elizabeth River, Dismal Swamp Canal or Albemarle & Chesapeake Canal, Albemarle and Pamlico Sounds, Neuse River, Adams Creek, canal to Core Creek, and Newport River. A draft of 3 feet (0.9 m.) can be taken inside about 40 miles southward from Beaufort, N. C., to New River Inlet. All bridges have draw openings.

There is no inside passage from Beaufort, N. C., to Winyah Bay, a distance of about 160 nautical miles, and vessels must pass outside between these points. Cape Fear River, halfway between them, is available as a harbor.

Vessels of 5-foot (1.5 m.) draft can pass inside from Winyah Bay, S. C., to St. Johns River, Fla. All bridges have draw openings.

Vessels of 4-foot (1.2 m.) draft can pass inside from St. Johns River to Miami, Fla., through Pablo Creek, North, Matanzas, Halifax, and Hillsborough Rivers, Mosquito Lagoon, Indian River, South Jupiter Narrows, Hobe and Jupiter Sounds, Lake Worth, Key Biscayne Bay, and the canals connecting them. All bridges have draw openings.

From Miami to Key West, Fla., there is practically an inside route through the Hawk Channel that can be used by vessels of 10-foot (3 m.) draft. Cuts with a depth of 5 feet (1.5 m.) have been made in places so that vessels of 4-foot (1.2 m.) draft can go from Miami through Key Biscayne Bay, Card Sound, Barnes Sound, railroad drawbridge at Cross Key, Blackwater Sound, Tarpon Basin, Florida Bay along the north side of the keys to Long Key, and thence northwestward into the Gulf of Mexico at Cape Sable or can continue in Florida Bay along the north side of the keys, through Big Spanish Key Channel, and then in the Gulf of Mexico to Key West.

Boats of 3-foot (0.9 m.) draft can be taken across Florida by way of some of the drainage canals, Lake Okeechobee, and Caloosahatchee River.

Gulf of Mexico.—From Key West to New Orleans there are several detached stretches of inside waters, available for a draft of 4 to 5 feet (1.2 to 1.5 m.) and a partially sheltered route with frequent harbors for small craft along the entire coast.

From New Orleans westward through Louisiana there is a network of inside waters affording a through route, for drafts of 3 to 5 feet (0.9 to 1.5 m.), to Sabine Pass. From Sabine Pass to Galveston there is no inside route.

From Galveston southwestward to Corpus Christi there is an inside route for a draft of 4 feet (1.2 m.) by way of several extensive bays and dredged canals connecting them. Beyond Corpus Christi there is no inside route available.

Charts covering the routes along the Atlantic coast and Gulf of Mexico are published by the United States Coast and Geodetic Survey. Charts of the Erie Canal, Champlain Canal, Lake Champlain, and Great Lakes are published by the United States Lake Survey Office, Detroit, Mich.; and sections of the New York State canals by the Superintendent of Public Works, Albany, N. Y.

A catalogue showing the charts of the route along the Atlantic and Gulf coasts can be obtained free of charge on application to the Coast and Geodetic Survey, Washington, D. C., or to any of its agents. A list of agents for the sale of charts and other publications of the Coast and Geodetic Survey is given in the catalogue and in the first notice each month of the Notice to Mariners, published weekly by the Bureau of Lighthouses and the Coast and Geodetic Survey.

The inland waters are covered in the following publications of the Coast and Geodetic Survey:

United States Coast Pilot, Section B (this volume), covering the coast and inland waters from Race Point, Cape Cod, to Sandy Hook, including Long Island Sound and New York Harbor and tributaries.

United States Coast Pilot, Section C, covering the coast and inland waters from Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays, and the inside route from New York to Norfolk.

Inside Route Pilot, coast of New Jersey.

United States Coast Pilot, Section D, covering the coast from Cape Henry to Key West.

Inside Route Pilot, New York to Key West.

United States Coast Pilot, Gulf Coast, covering the coast of the Gulf of Mexico.

Inside Route Pilot, Key West to the Rio Grande.

Tide Tables, Atlantic Coast Ports of the United States.

Current Tables, Atlantic Coast of North America.

Table of distances—Atlantic coast

	Key West	Jacksonville	Savannah	Charleston	Norfolk	Baltimore	Philadelphia	New York (Battery)	Bridgeport	New Haven	New London	Providence	Fall River	Newport	New Bedford	Boston
Portland:																
Via Cape Cod Canal								297	253	241	205	190	174	169	146	95
Via Nantucket Sound					574	697	522	339 / [1]356	295	283	247	233	218	212	[2]196	
Via Nantucket Lightship	1,385	1,070	989	912	599	721	561	420								
Boston:																
Via Cape Cod Canal								233	190	177	141	127	111	104	82	
Via Nantucket Sound					529	642	477	294 / [1]311	250	238	202	188	173	167	[2]151	
Via Nantucket Lightship	1,350	1,034	951	875	561	684	525	383								
New Bedford	1,214	899	816	743	408	528	353	165	121	108	72	56	42	37		
Newport	1,187	872	789	713	378	501	325	138	94	81	45	21	16			
Fall River	1,203	888	805	729	395	517	342	155	111	98	62	20				
Providence	1,207	893	810	734	400	522	346	159	115	102	66					
New London	1,178	863	780	705	370	493	317	104	60	48						
New Haven (via East River)	1,175	860	777	701	354	477	299	67	22							
Bridgeport (via East River)	1,160	845	762	686	339	462	283	52								
New York (Battery)	1,108	793	709	634	287	410	231									
Philadelphia	1,095	761	670	597	251	381										
Baltimore	1,030	713	630	554	171											
Norfolk	906	590	507	431												
Charleston	568	193	97													
Savannah	538	145														
Jacksonville	458															

[1] Via Nantucket Sound and Ambrose Channel.
[2] Via Quicks Hole.

NOTE.—Distances are in nautical miles via the shortest navigable routes.

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DESCRIPTIONS AND SAILING DIRECTIONS

COASTWISE NAVIGATION

A discussion of the conditions affecting navigation in the approaches to New York is given on page 291. The following discussion applies to the section eastward of New York.

Navigation along the coast between Cape Cod and New York, either coasting or approaching from sea, presents to the mariner a problem of unusual difficulty from three causes, the off-lying shoals, which are generally shifting in character, strong and variable currents, and large amount of fog.

A discussion of fog and a table of the hours of operation of fog signals is given on page 7. An inspection of the table shows that the area of greatest frequency of fog is southeastward and eastward of Cape Cod and Nantucket Island, where the other two conditions, of strong and variable currents and dangerous shoals, also prevail.

Monomoy and Nantucket Shoals and Georges Bank comprise the extensive shoals, many of them shifting in character and with little depth, extending southeastward and eastward from Nantucket Island and Cape Cod to a total distance of 150 miles from shore. Monomoy and Nantucket Shoals and the channels between them are described on page 36. Nantucket Shoals Lightship, the leading mark for vessels passing southward of Nantucket Shoals, or passing between Nantucket Shoals and Georges Bank, is moored in a depth of 30 fathoms (55 m.) off the south side of Nantucket Shoals.

When crossing the banks or approaching the coast, navigators should not neglect to take soundings at frequent intervals. Due to the irregular bottom, the soundings are of little value for locating the position, but are essential for safety in preventing too close an approach to danger. Vessels equipped with radio transmitter or radio compass should make frequent use of radiocompass bearings and radio fog signals. (See "Radio service," on p. 10.)

The passage across Georges Bank between the easternmost of the Nantucket Shoals and the westernmost shoal spots of Georges Bank, about 30 miles wide, has been called **Great South Channel.** It is generally used by vessels over 24-foot (7.3 m.) draft.

Georges Bank (chart 1107), for a distance of 75 miles in a west-southwesterly direction and a width of about 40 miles, has depths of less than 20 fathoms (36 m.) and numerous scattered unmarked spots with depths ranging from 2 to 10 fathoms (4 to 18 m.), among which are **Georges Shoal** and **Cultivator Shoal.** This part of Georges Bank, lying between latitude 41° 05′ N. and 42° 00′ N. and longitude 67° 17′ W. and 68° 35′ W., should be avoided; in heavy weather the sea breaks on the spots with 10 fathoms (18 m.) or less, and strong tide rips are encountered, the latter, however, not always indicating shoal water. The tidal currents have a maximum velocity of about 2 knots over the shoaler parts of the bank; the flood sets northward and ebb southward, the times of their turning corresponding very nearly with the time of high and low water at Boston.

Vessels passing south of the dangerous part of Georges Bank should not shoal the water to less than 25 fathoms (46 m.). Approaching this part of the bank from the eastward or southward the water shoals gradually. Approaching from westward the depths are irregular and the water shoals abruptly in places to 20 fathoms (36 m.) or less. On the north side of Georges Bank, between longitude 66° 00′ W. and 68° 00′ W., the 100-fathom (183 m.) and 50-fathom (91 m.) curves are but a few miles apart, and when approaching the dangerous part of the bank from northward, 50 fathoms (91 m.) may be taken as a good depth to avoid the shoals.

From southward.—Large vessels approaching the Gulf of Maine from southward sometimes endeavor to make the 50-fathom (91 m.) curve on the southern edge of Georges Bank in latitude 40° 20′ N. and longitude 68° 50′ W.; then stand 0° true (N. by E. ½ E. mag.) on soundings of over 30 and less than 50 fathoms (55 to 91 m.) for about 50 miles; and then shape a 323° true (NNW. mag.) course, taking care to keep in a greater depth than 20 fathoms (36 m.), until the course is laid to sight Cape Cod Lighthouse. This lighthouse, Nauset Beach Lighthouse, and the Pilgrim Monument at Provincetown are the most prominent marks on Cape Cod.

Vessels of over 24-foot (7.3 m.) **draft,** bound from Cape Hatteras, Chesapeake Bay, Delaware Bay, or New York, usually make Nantucket Shoals Lightship. They can then reverse the directions, following, for Cape Cod to New York.

Coasting vessels of 24-foot (7.3 m.) **or less draft,** bound to points north of Cape Cod, usually go inside of Nantucket Shoals, either through Vineyard and Nantucket Sounds, or, if of lighter draft, through Cape Cod Canal. The latter route is stated by the canal company to be available for vessels of 22 foot (6.7 m.) or less draft.

Approaching Vineyard Sound, Buzzards Bay, or Narragansett Bay from sea.—The approach to the above waters in clear weather requires no special caution, as the land, or at night the lights, will be made and recognized in time to fix the vessel's position so as to avoid danger and set a course for the vessel's destination. Vessels from eastward generally sight No Mans Land and pass southward of it. Cape Poge Light, at the eastern end of Marthas Vineyard, is visible on some bearings from seaward, and care should be taken not to mistake it for Gay Head Light. Vessels from westward generally sight Montauk Point and Block Island, passing south of the latter.

In thick weather the greatest caution is necessary, as soundings can not be depended on for locating the vessel's position, but inside a depth of 30 fathoms (55 m.) the lead must be constantly used to prevent too close an approach to danger. Vessels equipped with radio should obtain bearings from near-by radiocompass stations but should not neglect to take frequent soundings also. Coming from the vicinity of Nantucket Shoals Lightship, the depth should not be shoaled to less than 15 fathoms (27 m.), and it is advisable to remain offshore in a depth of over 20 fathoms (36 m.).

Coming from southward or southwestward, to insure clearing the shoals off Montauk Point and Block Island, the usual route followed by coasting vessels is to stand in for the south shore of Long Island

anywhere between Montauk Point and Shinnecock Lighthouse, sounding frequently until in a depth of 15 to 16 fathoms (27 to 29 m.), when the vessel will be from 3½ to 4½ miles from the beach. A 67° true (E. by N. mag.) course made good, and keeping the lead in use so as not to shoal the water to less than 15 fathoms (27 m.), will then lead along the beach at a distance of about 4½ miles and about 5 miles southward of Montauk Point Lighthouse. Continuing on the 67° true (E. by N. mag.) course, the water will gradually deepen to 24 and 26 fathoms (44 and 48 m.), and then begin to shoal again until a depth of 10 to 12 fathoms (18 to 22 m.) is struck on the bank which extends about 5 miles southeastward from Block Island. The distance the vessel should have made in a greater depth than 15 fathoms (27 m.) should be about 13 miles. When the water deepens to more than 15 fathoms (27 m.), after crossing the bank, and does not again shoal, the vessel will have cleared Block Island.

Approaching Block Island from southward is dangerous in thick weather if the position is uncertain. A depth of less than 10 fathoms (18 m.) indicates less than ¾ mile from the south shore of the island.

The **tidal currents** have a velocity of about 1.2 knots between Montauk Point and Block Island and about 1 knot between Block Island and Gay Head. Their greatest velocity is close to Montauk Point, where it is nearly 2 knots. The flood has a general northwesterly set and the ebb a southeasterly set of about equal duration.

Small coasting vessels and tows, bound into Block Island Sound or Vineyard Sound from southward, usually follow the coast until Barnegat Lighthouse is made, then haul across for Shinnecock Lighthouse, and follow the south shore of Long Island to the entrance.

Many vessels have grounded in fog on the south side of Long Island and on Block Island. Probably many of these could have been avoided if frequent soundings had been taken in approaching the coast and if use had been made of radiocompass bearings.

With southwesterly or northwesterly gales the following route is used to some extent by tows to get smoother water and to avoid the very heavy sea that makes into the westerly entrance of Vineyard Sound to abreast Quicks Hole. Bound westward the same route is used, and if the wind is southwestward of west and the sea is too heavy to proceed, anchorage is made in Buzzards Bay eastward of Penikese Island.

Passing 1¼ miles southward of Montauk Point Lighthouse, steer 55° true (ENE. mag.) for 3 miles. Then make good a 43° true (NE. ⅞ E. mag.) course for 21 miles to Point Judith gas, whistling, and submarine bell buoy, passing 1¼ miles northwestward of Block Island North Lighthouse and about ⅛ mile northwestward of Block Island North Reef gas and bell buoy. From Point Judith gas, whistling, and submarine bell buoy make good a 72° true (E. ½ N. mag.) course for 21½ miles to a position northward of Hen and Chickens Lightship, and then shape the courses to pass through Quicks Hole. On these courses the currents have their greatest velocity between Montauk Point and Block Island, where they set northwestward on the flood and southeastward on the ebb.

CURRENTS, CAPE COD TO NEW YORK

The currents between Race Point and Chatham and through Nantucket and Vineyard Sounds and approaches, including Pollock Rip Slue and Great Round Shoal Channel, are described, beginning on page 44.

Nantucket Shoals.—The tidal current over the shoals is rotary, turning clockwise. The average velocity at strength is from 1.5 to 2 knots, setting northeasterly about ½ hour before the current turns southward at Pollock Rip Slue (approximately 2 hours after low water at Boston) on the northern part of the shoals, and about 1 hour after the current turns southward at Pollock Rip Slue (approximately 3½ hours after low water at Boston) on the southern portion. The strength of the southwesterly current is from 1.5 to 2 knots and comes about 1½ hours before the current turns northward at Pollock Rip Slue (approximately 2 hours after high water at Boston) on the northern part of the shoals, and about the time the current turns northward at Pollock Rip Slue (approximately 3½ hours after high water at Boston) on the southern part. A velocity at strength of 2.5 knots or more is common in places on the shoals. Considerable change in velocity may be experienced by a small change in position relative to the shoals.

Since the current is rotary, there is no true slack. The minimum current is about 0.5 knot, setting southeasterly about 2½ hours after the current turns southward at Pollock Rip Slue (approximately 1 hour before high water at Boston) over the northern portion of the shoals, and about 3 hours before the current turns northward at Pollock Rip Slue (approximately ½ hour after high water at Boston) over the southern portion. Over the northern part of the shoals the northwesterly minimum current of 0.5 knot comes about 2 hours after the current turns northward at Pollock Rip Slue (approximately 1 hour before low water at Boston), while over the southern portion it comes about 2 hours before the current turns southward at Pollock Rip Slue (approximately ½ hour after low water at Boston).

Nantucket Shoals Lightship.—The tidal current here is rotary, turning clockwise. The maximum flood current occurs about 1 hour after the current turns northward in Pollock Rip Slue (approximately 2 hours before low water at Boston) and sets 215° true with a velocity of 0.85 knot. The maximum ebb current comes about 1 hour after the current turns southward in Pollock Rip Slue (approximately 2 hours before high water at Boston) and sets 35° true with a velocity of 0.85 knot. The minimum current before flood sets southeastward with a velocity of 0.65 knot about 2 hours before the current turns northward in Pollock Rip Slue (approximately 1 hour after high water at Boston) and the minimum current before ebb sets northwestward with a velocity of 0.65 knot about 2 hours before the current turns southward in Pollock Rip Slue (approximately 1 hour after low water at Boston). However, this tidal current is affected by winds, which, when going with the current accelerate it and when against the current retard it.

Approaching New York from the vicinity of Nantucket Shoals Lightship, a slight allowance should be made for a southwesterly set of the current. Should the wind be easterly, it is customary to

allow, in order to make the course good, a set of the current with it of at least 12 miles in every 24 hours.

The effect of the winds on the currents should always be considered. With strong gales currents with velocities up to 2.5 knots may be encountered at Nantucket Shoals Lightship, and 1.5 knots at Fire Island, Ambrose Channel, and Northeast End Lightships. Alongshore winds produce the highest velocities at Fire Island and Northeast End Lightships.

At Fire Island Lightship the tidal current is slightly rotary, with a mean velocity at strength of 0.25 knot in a west-northwest and east-southeast direction on the flood and ebb, respectively. The minimum currents before flood and ebb are less than one-tenth of a knot.

The important currents affecting navigation are those due to winds, the maximum velocities of current ranging from 1 to 1.5 knots. A sudden reversal in the direction of the wind produces a corresponding change in the current and augmented velocity. Sustained winds do not maintain the currents at the maximum velocities.

At Ambrose Channel Lightship the velocity at strength of the tidal current is about 0.3 knot. The maximum velocities noted, due to winds, are 1 to 1.5 knots.

DIRECTIONS, CAPE COD TO NEW YORK

General remarks.—The routes followed by vessels along this part of the coast vary greatly according to the draft and the state of the weather. Nantucket and Vineyard Sounds and Block Island and Long Island Sounds form a somewhat sheltered route along the coast, which is used extensively by coasting vessels. Deep-draft vessels pass outside of Nantucket Shoals, between them and Georges Bank; vessels of less than 28-foot (8.5 m.) draft, with good local knowledge, can pass through Nantucket and Vineyard Sounds, thereby avoiding Nantucket Shoals, but 24 feet (7.3 m.) is ordinarily the deepest draft using this route. Cape Cod Canal is available for vessels up to 22-foot (6.7 m.) draft, and avoids rounding Cape Cod.

The route through Long Island Sound and East River is used by vessels up to 20-foot (6.1 m.) draft, although barges drawing 23 feet (7 m.) are towed through East River, which is the most difficult part of the route.

There are numerous **anchorages** where a vessel with good ground tackle can ride out any gale. Of these Provincetown Harbor is the harbor of refuge most frequently used by vessels approaching Massachusetts Bay from seaward. Newport Harbor and Dutch Island Harbor are the best anchorages for vessels approaching the coast from seaward between Gay Head and Block Island. Menemsha Bight and the anchorage in Buzzards Bay eastward of Penikese Island are also used to some extent, the former in southerly and easterly winds and the latter in southerly and westerly winds.

Gardiners Bay and Great Salt Pond, in Block Island Sound, are excellent anchorages. In Long Island Sound there are anchorages at frequent intervals. Along the south shore of Long Island there are no harbors, except for small craft.

Directions for Nantucket and Vineyard Sounds are given on page 47 and for Block Island Sound on page 133.

Deep-draft vessels should not attempt to cross Nantucket Shoals. The following courses, if made good, should lead between Nantucket Shoals and Georges Bank, in a depth of not less than 18 fathoms (33 m.).

From a position 4 miles east-northeastward of Cape Cod Lighthouse, made good a 148° true (S. by E. ½ E. mag.) course for 54 miles to a position 27½ miles, 87° true (E. by S. Mag.) from Sankaty Head Lighthouse. Then make good a 166° true (S. mag.) course for 33 miles, and then a 245° true (W. by S. mag.) course for 22 miles to Nantucket Shoals Lightship.

In general, on the courses across Nantucket Shoals, the greatest easterly set (away from the shoals) may be expected from about three hours before high water to high water at Boston, and the greatest westerly set (toward the shoals) from about three hours before low water to low water at Boston. (See also p. 44.)

The soundings on the sailing lines are very irregular and are of little use in determining the position. Since the courses lead outside the range of visibility of Sankaty Head Lighthouse, radiocompass bearings and soundings are the only method of insuring safety when rounding Nantucket Shoals. In thick weather use should also be made of the radio fog signals from Nantucket Shoals Lightship. Vessels depending on soundings only should haul offshore whenever a sounding less than 25 fathoms (46 m.) is obtained; this, however, will take a vessel a little farther offshore than the directions given above. When bound north in thick weather, keeping in a greater depth than 20 fathoms (36 m.) will insure giving the eastern side of Cape Cod a berth of 2½ miles.

Cape Cod, Nauset Beach, and Chatham Lighthouses, the lightship at Pollock Rip, and Great Round Shoal entrance gas and whistling buoy may be seen in clear weather. Steamers, unless sure of their position by making some of these aids or Nantucket Shoals Lightship, and sailing vessels at all times, should pass outside the shoals, on account of the strong tidal currents, variable both in direction and velocity, for which it is impracticable to make proper allowance.

From Nantucket Shoals Lightship a 267° true (WNW. ⅛ W. mag.) course for 165 miles will lead to Fire Island Lightship. (See "General remarks, approaches to New York," on p. 291, and "Directions, New York Bay and Harbor," on p. 293.)

COAST OF CAPE COD, FROM RACE POINT TO MONOMOY POINT

Cape Cod Bay and the coast northward is described in Atlantic Coast Pilot, Section A, St. Croix River to Cape Cod.

Prominent objects.—In making the northern part of Cape Cod in clear weather the most prominent feature is Pilgrim Monument, a stone structure about 350 feet (107 m.) high above the sea; a tall standpipe and several high church spires in Provincetown will also be seen. It is frequently difficult to recognize natural landmarks on Cape Cod when approaching from seaward owing to a lack of distinctive features. The Coast Guard stations and the lighthouses are about the only well-defined marks in places; of the latter, Cape Cod Lighthouse is the most important, being the chief guide for this part of the coast. Nauset Beach Lighthouse is the most prominent daymark southward of Pilgrim Monument.

Cape Cod is a long peninsula, forming the easterly extremity of Massachusetts. It makes out from the mainland, first in an easterly direction for 31 miles, and then northward for a little over 20 miles—this latter portion forming what is usually termed the Hook of the Cape. It is composed almost entirely of sandy lands, with high, bare sand hills, and low, nearly level plains, and is well settled. Cape Cod Bay is on its northern side, and Nantucket Sound on its southern. The name Cape Cod is also generally applied to the south coast of Massachusetts between Monomoy and Falmouth.

Race Point Lighthouse, at the extreme northwest end of Cape Cod, is a white tower. The light is fixed white, with a white flash of 4 seconds duration every 90 seconds, 41 feet (12.5 m.) above the water, and visible 12 miles. The fog signal is an air whistle (blast 3 seconds, silent 3 seconds, blast 3 seconds, silent 51 seconds).

From Race Point the shore curves northeastward, eastward, and then southeastward to the Highlands, a total distance of about 9 miles, and is composed of bare, sand hillocks of various heights. On approaching the Highlands the sand hills begin to be covered with a brownish-looking growth of grass, and the land is higher. The pitch of the cape at this point shows a high bluff, on which stands Cape Cod Lighthouse and a radio mast. In coasting several Coast Guard stations are seen. At the Highlands the shore may be safely approached as close as ½ mile, but the water shoals somewhat abruptly and care must be taken not to go inside of 5 fathoms (9.1 m.). From Cape Cod Lighthouse to near Chatham entrance the coast should not be approached closer than ½ mile.

Peaked Hill Bar commences about 3 miles northwestward of Cape Cod Lighthouse and extends westward along the shore 2¾ miles, its distance from the beach being about ¾ mile. The depth over the shoal ranges from 14 to 18 feet (4.3 to 5.5 m.) and in heavy weather it is marked by breakers. A gas and whistling buoy with a submarine bell buoy alongside is placed about 2 miles off Peaked Hill Bar and 5½ miles north-northwestward of Cape Cod Lighthouse.

Many vessels bound westward into Cape Cod Bay or Boston Harbor in a fog have grounded on Peaked Hill Bar through a failure to take soundings. Keeping in a depth of 20 fathoms (36 m.) will insure passing 2 to 2½ miles off the eastern side of Cape Cod, and will lead to Peaked Hill Bar gas, whistling, and submarine bell buoys. Vessels equipped with radio transmitters can fix their position by a sounding taken on a bearing from North Truro Radiocompass Station, or by simultaneous bearings from two or more stations.

Cape Cod Lighthouse is a white tower. The light is flashing white (flash 0.2 second, eclipse 4.8 seconds), 183 feet (56 m.) above the water, and visible 20 miles. The fog signal is a reed horn (blast 8 seconds, silent 30 seconds). Just northward of the lighthouse is a *reporting station* with which vessels may communicate with Boston by using the International Code signals. Close to southward of the lighthouse is **North Truro Radiocompass Station.** (See description on p. 15.)

From the Highlands to Nauset Beach Lighthouse, about 12 miles southward, the shore has a slight curve and consists of steep sand bluffs of various heights, with narrow valleys at intervals. The

two Coast Guard stations, located 3 and 6¾ miles southward from Cape Cod Lighthouse, are fairly prominent objects.

Nauset Beach Lighthouse is a white conical tower. The light is group flashing white (flashes 0.2, 0.2, and 0.2 seconds, eclipses 1.4, 1.4, and 6.6 seconds), 114 feet (35 m.) above the water, and visible 17 miles.

Abreast of Nauset Beach Lighthouse, the **tidal currents** divide and run in opposite directions.

Southward of Nauset Beach Lighthouse the coast turns gradually southward to Chatham, a distance of 10½ miles. It gradually becomes lower, less steep, slopes gently back from the beach and is covered with a scanty growth of grass. A few houses appear at long intervals. Nauset, Orleans, and Old Harbor Coast Guard Stations are located 1, 6, and 10 miles, respectively, below Nauset Beach Lighthouse.

About 3¾ miles below Nauset Beach Lighthouse is the entrance to **Nauset Harbor,** which may be recognized by the thickly clustered houses in the villages on the summit of The Ridge, a rising ground somewhat higher than the land northward. The entrance is practically bare at low water and is used only by small local craft at high water. Strangers should never attempt to enter.

From Nauset Harbor to Chatham the coast shows a low, sandy shore covered with small hillocks and backed by higher lands. The two radio towers on **Nickerson Neck,** 3 miles northward from Chatham Lighthouse, are prominent objects from offshore.

Chatham Bar, the northern entrance to Chatham, is about 11 miles southward of Nauset Beach Lighthouse and ¾ mile northward of Chatham Lighthouse. The channel across the bar is marked by a can buoy and there is a nun buoy and a whistling buoy outside the bar. This bar is dangerous in thick weather, and when in its vicinity the depth should not be shoaled to less than 8 fathoms (14.6 m.).

The channel over the bar to the town of **Chatham** had a depth of about 3½ feet (1.1 m.) at low water in 1925, but is subject to frequent changes, and the buoys at the entrance can not be depended on to lead in the best water. The channel is used only by small local craft with a smooth sea and is not safe for strangers. The large shoal bay northward of the entrance is seldom entered. The beach extends about 1 mile southwestward from Old Harbor Coast Guard Station. There are no wharves on the eastern side of Chatham, the approach being from Stage Harbor (described on p. 60), and there is no channel from Stage Harbor to Chatham Bar.

Chatham Lighthouse is a white, conical tower. The light is group flashing white, 4 flashes every 30 seconds (flashes 0.6, 0.6, 0.6, and 0.6 second, eclipses 4.4, 4.4, 4.4, and 14.4 seconds), 80 feet (24.4 m.) high and visible 15 miles. Storm warnings are displayed near the lighthouse.

Monomoy Beach extends 4½ miles in a southwesterly direction from Chatham Bar to Monomoy Island. In passing along this beach the town of Chatham and Chatham Lighthouse can be seen over it.

Monomoy Island is a low, narrow spit covered with sand hillocks, and forms the northern side of the entrance to Nantucket Sound. Its eastern shore is foul, having many sand shoals off it. Vessels

sometimes anchor off this shore in 4 to 6 fathoms (7.3 to 11 m.) and wait for a fair tide to beat through the sounds. As a general rule the shore should not be approached nearer than 1 mile for a distance of 4 miles southward of Chatham Lighthouse. The southern end of Monomoy Island is called **Monomoy Point,** and nearly 1¼ miles above its southerly extremity stands Monomoy Point unused lighthouse, which marks the northern point at the entrance to Nantucket Sound. Storm warnings are displayed on Monomoy Point. Shoals make off nearly 5 miles in a general east-northeast direction from the end of Monomoy Point.

Monomoy Point unusued lighthouse is a red tower with a covered way to a dwelling. Monomoy and Monomoy Point Coast Guard Stations are located 2 miles north and ¾ mile southwest, respectively, from the unused lighthouse.

Storm warnings are displayed at Race Point Cape Cod Light, Monomoy Point, and from near Chatham Lighthouse.

Currents.—See "Currents, Nantucket and Vineyard Sounds and approaches," beginning on page 44.

MONOMOY AND NANTUCKET SHOALS

Eastward and southeastward of the eastern entrance to Nantucket Sound are Monomoy and Nantucket Shoals. Owing to the great extent and distance of some parts of these shoals from the land, and to the strong and baffling tidal currents which set over them, their navigation in thick or foggy weather is hazardous. In clear weather the lighthouses, light vessels, and buoys render the navigation of the two principal channels comparatively easy. The deeper channel leads through these shoals in an easterly direction from Nantucket (Great Point) Lighthouse, and for the purpose of description will be considered as the dividing line between Nantucket and Monomoy Shoals, which are briefly described under separate headings. (For current information, see "Currents, Cape Cod to New York," p. 31, and "Currents, Nantucket and Vineyard Sounds and approaches," beginning on p. 44.)

Monomoy Shoals consist of numerous detached shoals extending about 5½ miles in an easterly and 9½ miles in a southeasterly and south-southeasterly direction from Monomoy Point. Many parts of these shoals, separated from others by narrow slues, have special names and are briefly described below. It should be remembered that the shoals are shifting in character and are subject to change both in location and depth.

Bearse Shoal is the western, and **Pollock Rip** the eastern, part of the shoal extending 3¾ miles eastward of Monomoy Point Lighthouse. These shoals are a series of sand shoals and ridges, with little water in places for a distance of 2 miles eastward of the lighthouse, and 9 to 18 feet (2.7 to 5.5 m.) farther eastward. The channel lying between these two shoals is marked by buoys. (See description of Pollock Rip Channel on p. 39.)

Broken Part of Pollock Rip, with depths of 10 to 18 feet (3 to 5.5 m.) over it lies eastward of Pollock Rip and is separated from it by Pollock Rip Slue. The black can buoy at the northwest end of these shoals marks the entrance to Pollock Rip Slue.

Stonehorse, Little Round, and **Great Round Shoals** are portions of a continuous series of sand shoals and ridges, with depths of 5 to 18 feet (1.5 to 5.5 m.) over them, lying directly eastward of the entrance to Nantucket Sound and between the two main channels. Southward and eastward of these shoals there are numerous shoal spots, including Orion Shoal, with depths of 9 to 18 feet (2.7 to 5.5 m.) over them.

Shovelful Shoal, extending over 1 mile south-southwestward from Monomoy Point, is bare in places and rises abruptly from the deep water of Butler Hole. The shoal is extending south-southwestward, and strangers should not attempt to pass between the buoy at its southwest end and Monomoy Point. The former channel between Shovelful and Handkerchief Shoals has been rendered unsafe by the action of the sea and should not be attempted.

Handkerchief Shoal extends for 4 miles southwestward from Monomoy Point. It has depths of 4 to 18 feet (1.2 to 5.5 m.) and rises abruptly from the deeper water on its southeast side. On the northwest side the water shoals more gradually, and the lead will indicate an approach to danger. The shoal is uneven and shifting in character, and vessels should not attempt to pass to northward of the nun buoy which marks its southern end.

Pollock Rip Lightship is moored in 9½ fathoms (17.4 m.), about 4.3 miles offshore, on the axis of Pollock Rip Channel, about 1.6 miles off the entrance. It has a red hull with "Pollock" on each side, and two masts with circular gratings at each masthead. The light is occulting white every 5 seconds, light 4 seconds, eclipse 1 second, 65 feet (19.8 m.) high, and visible 14 miles. A white riding light is exhibited from the forestay to indicate the heading of the vessel. The fog signal is a steam chime whistle (blast 5 seconds, silent 25 seconds). If the whistle is disabled, a bell will be struck by hand. A submarine bell strikes a group of 3 strokes every 10 seconds. The radio station receives and transmits messages. Call WWAG.

Stonehorse Shoal Lightship is moored in 14 fathoms (25.6 m.), about 0.9 mile 153° from Monomoy Point unused lighthouse. It has a black hull with "Stone Horse" on each side, and two black masts with a black grating at each masthead. The light (on mainmast) is occulting white every 4 seconds, light 2 seconds, eclipse 2 seconds, 60 feet (18.3 m.) high and visible 11 miles. A fixed white light will be shown 28 feet (8.5 m.) above the water if the occulting light is inoperative. A white riding light is exhibited from the forestay to indicate heading of the vessel. The fog signal is a steam chime whistle, blast 3 seconds, silent 12 seconds. A bell will be struck by hand if the whistle is disabled. A submarine bell sounds 1 group of 5 strokes every 12 seconds.

Handkerchief Lightship is moored in 8¼ fathoms (15.2 m.), about 0.6 miles off the southern end of Handkerchief Shoal. It has a red hull with "Handkerchief" on each side, a red gallery and lantern at the foremast head, and a circular grating at mainmast head. The light is flashing white every 3 seconds, 60 feet (18.3 m.) high, and visible for 12 miles. If flashing light is extinguished, a fixed white light will be shown 39 feet (11.9 m.) above the water. A white riding light is exhibited from the forestay to indicate

heading of the vessel. The fog signal is an air siren, blast 4 seconds, silent 26 seconds. A bell will be struck by hand if whistle is disabled.

Great Round Shoal Lightship is moored in 12 fathoms (21.9 m.), off the south end of the shoal. It has a black hull with "Great Round" on each side; two masts with a black gallery at each masthead. The lighting characteristic is two fixed white lights, 50 feet (15.2 m.) high and visible 11 miles. The fog signal is a steam chime whistle, blast 5 seconds, silent 55 seconds. A bell will be struck by hand if the whistle is disabled. A submarine bell strikes a group of 2 strokes every 7 seconds.

Nantucket Shoals is the general name of the numerous different broken shoals which lie southeastward of Nantucket Island and make this one of the most dangerous parts of the coast of the United States for the navigator. These shoals extend 23 miles eastward and 39 miles southeastward from Nantucket Island, are shifting in their nature, and the depths vary from 3 and 4 feet (0.9 and 1.2 m.) on some to 4 and 5 fathoms (7.3 and 9.1 m.) on others, while sloughs with depths of 10 fathoms (18.3 m.) or more lead between those farthest offshore. The easterly edge of the shoals has depths of 4 and 4½ fathoms (7.3 and 8.2 m.) in places, and trends 166° true (S. mag.) from latitude 41° 18′ N., longitude 69° 29′ W., to latitude 40° 57′ N., longitude 69° 22′ W. **Asia Rip,** the southeasternmost danger, has a least depth of 6 fathoms (11 m.) in latitude 40° 48′ N., longitude 69° 22′ W. Deep-draft vessels should pass southward and eastward of Asia Rip, and eastward of the easterly edge of the shoals as defined above. For a distance of 15 miles eastward and southeastward and 18 miles southward from Nantucket Island, the shoals have depths less than 16 feet (4.9 m.), and this area should be avoided by all vessels. The eastern part of this area is marked by Great Rip gas buoy No. 2 and fishing buoy No. 2, a red nun. The tidal currents are strong and variable in direction, forming extensive rips and broken water over the shoals.

Telegraph cable.—A submarine cable of the French Telegraph Cable Co. extends around Nantucket Shoals, as follows: from latitude 40° 28′ N., longitude 70° 00′ W. to latitude 40° 26′ N., longitude 69° 32′ W.; thence to latitude 40° 38′ N., longitude 69° 01′ W.; thence to latitude 41° 13′ N., longitude 69° 11′ W.; thence to a landing near Nauset Harbor, Cape Cod.

The cable company cautions vessels from anchoring near this cable. They are willing to indemnify any vessel for anchor and gear cut away and lost in order to prevent interruption of cable communication. This will be done on presentation of the proper sworn evidence of the facts with the exact position of the vessel at the time.

Nantucket Shoals Lightship (latitude 40° 37′ 02″ N., longitude 69° 37′ 06″ W.), the leading mark for vessels passing southward of Nantucket Shoals, is moored in 30 fathoms (55 m.) 43 miles 158° true (S. ¾ E. mag.) from Sankaty Head Lighthouse. It has a red hull with "Nantucket" on each side, and two masts with a red circular grating and radio yard at each masthead. The light is occulting white (light 12 seconds, eclipse 3 seconds), 65 feet (19.8 m.) above the water and visible 14 miles. If the occulting light is

inoperative, a fixed white light of less intensity will be shown. The fog signal is a steam chime whistle (blast 5 seconds, silent 25 seconds); a bell will be struck by hand if the whistle is inoperative. The submarine oscillator sounds 2 groups of 6 blasts each every 90 seconds, blasts 1 second duration, silence between groups of blasts 12 seconds each, long silence 31 seconds. If oscillator is inoperative, a submarine bell will sound group of 6 strokes every 30 seconds, interval between strokes each 3 seconds, interval between groups of strokes each 15 seconds.

The radio fog signal[1] sounds every 90 seconds, a group of 4 dashes for 60 seconds, silent 30 seconds. The first dash of radio fog signal and first blast of oscillator are sounded simultaneously; vessels having radio and submarine receivers may determine their distance in yards from the lightship by multiplying the number of seconds intervening between the reception of radio dash and oscillator blast by 1,600. (See "Radio service" on p. 10.)

Day **storm warnings** are displayed. A vessel, showing her distinguishing lights at night, or her number with International Code signals by day, will be reported. The radio station receives and transmits messages. Call WWAH.

Channels.—For a discussion of navigation of vessels not passing through Nantucket Sound see "Coastwise navigation" on page 28 and "Directions, Cape Code to New York," on page 32.

There are two principal channels leading from eastward into Nantucket Sound, the northerly one through Pollock Rip Channel and Butler Hole and the southerly one through what is generally called Great Round Shoal Channel.

Pollock Rip Channel is the most direct channel leading from Nantucket Sound to points northward of Cape Cod. The project provides for a channel 30 feet (9.1 m.) deep for a width not to exceed 1 mile. In 1925 a depth of 29 feet (8.8 m.) obtained for a width of 2,000 feet, with greater depths in the center of the channel. The channel is subject to shoaling, but dredging is in progress to maintain the project depth for a width of 2,000 feet. The axis of the channel follows a line between Pollock Rip Lightship and Stonehorse Shoal Lightship. The channel is well marked by lightships, lighted buoys, and fog signals, and is generally used in preference to Great Round Shoal Channel. In winter the gas buoys are removed when in danger of being carried away by ice and their location is marked by spar buoys.

Great Round Shoal Channel is marked by buoys, some of them lighted, and a lightship, but the fog signals are not as numerous as in Pollock Rip Channel. The channel has a depth of about 30 feet (9.1 m.) and is used by vessels of as much as 28-foot (8.5 m.) draft with good local knowledge, but 24 feet (7.3 m.) is about the deepest draft ordinarily using the channel. Directions for these channels are given on page 47.

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[1] Radio operator on this lightship will stand watch on 500 kilocycles (600 m.) for first 15 minutes of every hour from 8 a. m. to 10.15 p. m. (seventy-fifth meridian time) to answer requests from vessels for radio fog signals. Radio fog signal will be operated day and night for second 15 minutes of every hour in clear weather, and during thick weather it will be operated continuously, except during daily listening-in periods from 10 to 10.15 a. m., and from 4 to 4.15 p. m. Vessels are requested to report to Commissioner of Lighthouses, Washington, or Superintendent of Lighthouses, Boston, as to effectiveness of operation of this signal.

NANTUCKET AND VINEYARD SOUNDS

lie between the south coast of Cape Cod and the Elizabeth Islands on the north and Nantucket Island and Marthas Vineyard on the south; their combined length from Monomoy Point to Cuttyhunk is about 43 miles. At the eastern entrance of Nantucket Sound are Monomoy and Nantucket Shoals, and in the sounds are numerous shoals, but well-marked channels lead between them, making the navigation of these waters, in clear weather and with a fair wind, comparatively easy westward of Monomoy Shoals.

The sounds are a thoroughfare for coasting vessels bound to ports east of Cape Cod and returning bound southward, many thousands of vessels passing through both ways each year. This route is more direct for vessels bound along the coast than outside of Nantucket Shoals. The aids are colored and numbered for passing through the sounds from eastward.

The shoals at the eastern entrance are subject to considerable shifting. Those inside are sand shoals, except along the shores, where bowlders occur, but are subject to little change.

Vessels of less than 24-foot (7.3 m.) draft can pass through Nantucket and Vineyard Sounds, thereby avoiding Nantucket Shoals. With good local knowledge a depth of 30 feet (9.1 m.) can be carried through these sounds, but vessels of over 24-foot (7.3 m.) draft would require careful handling, especially through Cross Rip. This route is used principally by coasting steamers. A description of the shores of Nantucket and Vineyard Sounds is given, beginning on page 51.

Halfmoon Shoal, near the center of Nantucket Sound, has a least depth of 14 feet (4.3 m.). Its southern end is marked by Halfmoon Shoal gas and bell buoy. A 24-foot (7.3 m.) shoal is located ¾ mile 256° true from this buoy. The main channel through the sounds passes close to southward of this shoal, and deep-draft vessels should use care to avoid it. A vessel drawing 24 feet (7.3 m.) recently grounded on this shoal.

Cross Rip Shoal has a least depth of 11 feet (3.3 m.). Its northern edge is marked by a black spar buoy and by Cross Rip Lightship. A shoal with a least depth of 24 feet (7.3 m.) extends for 1¼ miles eastward of the lightship, and deep-draft vessels must exercise caution in passing between this shoal and the shoal making out southwestward from Halfmoon Shoal.

Horseshoe Shoal has a length of about 7½ miles and bares in places at low water. Its northwest end is marked by a black spar buoy and its southeast end by a red spar buoy.

Hedge Fence and L'Hommedieu Shoals, lying in the western end of Nantucket Sound, have depths of from 2 to 16 feet (0.6 to 4.9 m.). The ends of these shoals are marked by buoys. The water deepens abruptly off the edges of these shoals, and soundings will give little warning of the approach to danger.

Cross Rip Lightship is moored off the north end of Cross Rip Shoal in 7 fathoms (13 m.). It has a black hull with "Cross Rip" on each side and two masts with a gallery and lantern at the main masthead and a circular grating at fore masthead. The light is flashing white, flash 0.3 second, eclipse 2.7 seconds, 50 feet (15.2 m.) high, and visible 12 miles. If the flashing light is inoperative, a

fixed white light will be shown. A fixed white light is exhibited from the forestay to indicate heading of the vessel. The fog signal is a steam chime whistle, blast 3 seconds, silent 12 seconds. If the whistle is disabled, a bell will be struck by hand. The submarine bell strikes a group of 5 strokes every 12 seconds. **Storm warnings** are displayed from the lightship.

Hedge Fence Lightship has a red hull with "Fence" on each side and two masts with a red circular grating at each masthead. The light is occulting white, light 3 seconds, eclipse 1 second, 55 feet (16.8 m.) high and visible 12 miles. The fog signal is an air siren, group of 2 blasts every 60 seconds (blast 3 seconds, silent 5 seconds, blast 3 seconds, silent 49 seconds). If the siren is disabled, a bell will be struck by hand. The submarine bell strikes group of 2 strokes every 15 seconds.

Vineyard Sound (Sow and Pigs) Lightship is moored at the west entrance to the sound in 102 feet (31 m.) of water. It has a red hull with "Vineyard" on each side and two masts with a red gallery and lantern at main masthead and a circular grating at the fore masthead. The light is flashing white, flash 0.3 second, eclipse 2.7 seconds, 65 feet (19.8 m.) high and visible for 12 miles. A fixed red light will be shown if the flashing light is inoperative. The fog signal is a steam chime whistle, blast 6 seconds, silent 45 seconds. A bell will be struck by hand if the whistle is disabled. The submarine bell strikes a group of 7 strokes every 13 seconds.

Channels.—Pollock Rip Channel and Great Round Shoal Channel, leading into Nantucket Sound from eastward, are described on page 39. Between the numerous shoals in Nantucket Sound there are two well-marked channels leading through Nantucket Sound to the eastern end of Vineyard Sound.

North Channel leads along the north side of Nantucket Sound, on either side of Bishop and Clerks Shoal (marked by a lighthouse), northward of Horseshoe Shoal, between Wreck Shoal and Eldridge Shoal, northward of L'Hommedieu Shoal, and through one of the openings at the western end of this shoal to the main channel of Vineyard Sound. It is used mostly by vessels bound to points on the north shore of Nantucket Sound and by vessels bound through Nantucket Sound during northerly winds or in winter, when the prevailing northerly winds keep the north shore of Nantucket Sound free from drift ice. The least depth in this channel is about 16 feet (4.9 m.), and it is not recommended for a greater draft than 14 feet (4.3 m.) without local knowledge.

Main Channel leads southward of Halfmoon Shoal; through an opening, marked by Cross Rip Light Vessel, in the shoals between the south end of Horseshoe Shoal and the shoals southward; through the fairway, marked by Hedge Fence Light Vessel, between Hedge Fence and Squash Meadow; and northward of Middle Ground and Lucas Shoals in Vineyard Sound. This channel is used by most of the vessels bound through Nantucket Sound. With care a least depth of 30 feet (9.1 m.) may be carried through it, but the draft of vessels using it seldom exceeds 24 feet (7.3 m.).

Anchorages.—Vessels working through the sounds against a head wind usually anchor during the night, or if becalmed and drifting toward the shoals it is best to anchor and wait for a favorable tide or change of wind. There are no anchorages for vessels of over 10

feet (3 m.) draft that afford shelter from all winds, except Nantucket Harbor, Hyannis Harbor, the inner harbor of Edgartown, and Woods Hole. Vineyard Haven, the anchorage most used by coasters, is exposed to northeasterly winds. In northerly winds the best anchorages are off Dennisport, Hyannisport, along the north shore, and in Tarpaulin Cove. The anchorage off Falmouth is used in all winds by vessels with good ground tackle. In easterly winds vessels sometimes anchor in smooth water westward of Handkerchief Shoal or inside Great Point. Good shelter is then also found in Chatham Roads and Edgartown outer harbor. In southerly winds Edgartown Harbor and Vineyard Haven are the best anchorages; Menemsha Bight affords shelter and is sometimes used by vessels in the western end of Vineyard Sound. In westerly winds Edgartown, Vineyard Haven, and Tarpaulin Cove are good anchorages. These harbors can be entered by a stranger assisted by the chart or following the directions under the different headings. Nantucket Harbor can be entered by vessels of about 12 feet (3.7 m.) draft with smooth water on the bar.

Prohibited anchorages.—Regulations prescribed by the Secretary of War prohibit anchorage in a fairway leading through Nantucket and Vineyard Sounds along the main channel. The courses through Pollock Rip Channel and Nantucket and Vineyard Sounds, given on page 47, lead approximately through the middle of the prohibited anchorage. Officers of the Coast Guard are charged with the enforcement of the regulations governing anchorage grounds. Copies of the rules and regulations with descriptions of the anchorage areas for Narragansett Bay, Buzzards Bay, and Vineyard and Nantucket Sounds can be obtained from the United States Engineers, Providence, R. I.

Approaching Pollock Rip Channel from northward, the prohibited anchorage is bounded on the west by a line passing through Chatham Bar buoy No. 2 and Bearses Shoal North End buoy No. 2A, and on the east by a line extending 27° true through Pollock Rip Lightship.

In Pollock Rip Channel the area is bounded on the north by the shoals and on the south by a line extending 70° true from Stonehorse Shoal gas and bell buoy No. 9.

Between Stonehorse Shoal and Handkerchief Lightships the northwest side of the area is bounded by Shovelful and Handkerchief Shoals, and the southeast side by a line extending 215° true from Stonehorse Shoal gas and bell buoy No. 9.

Between Handkerchief Lightship and Halfmoon Shoal the area extends for 1¼ miles south of a line passing through Handkerchief Shoal buoy No. 16 and Halfmoon Shoal gas and bell buoy.

From Nantucket Harbor to the Main Channel the prohibited anchorage has a width of ⅞ mile to Tuckernuck Shoal bell buoy No. 7 and then increases in width to about 2½ miles at the main channel. The west side of this area is bounded by a line extending from Cross Rip Lightship to Tuckernuck Shoal bell buoy No. 7, thence 145½° true to the west jetty.

From Halfmoon Shoal gas and bell buoy to Nobska Point gas and bell buoy the area is bounded on the north by a line extending 277½° true from Halfmoon Shoal gas and bell buoy to meet a line

extending 109° true from Nobska Point Lighthouse. The southern limit is marked by a line extending 266° true from Cross Rip Lightship to Outer Flats bell buoy No. 17, thence 293° true to Lone Rock spar buoy No. 1, thence 343° true to East Chop bell buoy No. 23, thence 293° true to a position 1¼ miles 145° true from Nobska Point Lighthouse. Anchorage is permitted eastward of Squash Meadow in the following limits: Within the area at Squash Meadow Shoal east of a line bearing 163° and ranging through Squash Meadow West End buoy No. 21; north of the lines parallel to and one-half mile northerly from the lines joining Lone Rock buoy No. 1, Outer Flats bell buoy No. 17, and the Cross Rip Lightship; and south of a line bearing 97° and ranging from East Chop Lighthouse toward Cross Rip Lightship.

At the entrance to Woods Hole the prohibited anchorage has a width of 1 mile southwestward of a line extending 109° true from Nobska Point Lighthouse.

From Nobska Point gas and bell buoy to Vineyard Sound Lightship, the prohibited anchorage is bounded on the north by a line extending from Cuttyhunk Lighthouse to Nashawena gas and bell buoy, thence 57½° true to the entrance of Woods Hole; on the south by a line extending 65° true from a point 3¼ miles, 180° true, from Cuttyhunk Lighthouse, and ranging through a point ⅝ mile 180° true from Nashawena gas and bell buoy, and by a line bearing 57½° true passing 600 yards northerly of Middle Ground bell buoy, to a point 1¼ miles 145° true from Nobska Point Lighthouse.

The following **rules and regulations** are prescribed by the War Department:

1. Except in cases of great emergency no vessels shall be anchored in New Bedford Outer Harbor, Buzzards Bay, near the entrance to the approach channel to Cape Cod Canal, or Vineyard and Nantucket Sounds, outside of the anchorage areas hereby defined and established.
2. Anchors must not be placed outside the anchorage areas, nor shall any vessel be so anchored that any portion of the hull or rigging shall at any time extend outside the boundaries of the anchorage area.
3. Any vessel anchoring under the circumstances of great emergency outside any anchorage area must be placed near the edge of the channel and in such position as not to interfere with the free navigation of the channel, nor obstruct the approach to any pier nor impede the movement of any boat, and shall move away immediately after the emergency ceases, or upon notification by the officer of the Coast Guard Service charged with the enforcement of these regulations.
4. A vessel upon being notified to move into the anchorage limits or to shift its position on anchorage grounds must get under way at once or signal for a tug and must change position as directed with reasonable promptness.
5. Whenever the maritime or commercial interests of the United States so require, the officer of the Coast Guard Service enforcing these regulations is hereby empowered to shift the position of any vessel anchored within the anchorage areas, of any vessel anchored outside the anchorage areas, and of any vessel which is so moored or anchored as to impede or obstruct vessel movements in any channel.
6. Nothing in these rules and regulations shall be construed as relieving the owner or person in charge of any vessel from the penalties of the law for obstructing navigation or for obstructing or interfering with range lights or for not complying with the navigation laws in regard to lights, fog signals, or for otherwise violating the law.

Pilots.—State pilotage is not compulsory for vessels passing through the sounds; it is only compulsory for foreign and registered vessels entering or clearing from the ports. Pilots for the sounds

or Monomoy and Nantucket Shoals may sometimes be obtained at Boston or Provincetown by vessels coming from northward, or at Tarpaulin Cove or Vineyard Haven, coming from westward. The rate for pilotage from Nantucket Shoals to Boston is $4 per foot of draft. For Vineyard Haven, Edgartown, Nantucket, or Hyannis Harbors, the rate is $2 per foot of draft.

Towboats.—Vessels towing usually take a towboat from the port of their departure. A towboat may generally be found at Woods Hole or Vineyard Haven to assist vessels that may be aground or in trouble.

Supplies.—Coal in limited quantities, water, gasoline, provisions, and some ship-chandlers supplies can be had at Nantucket, Edgartown, and Vineyard Haven. Gasoline and small quantities of provisions and motor-boat supplies can be had at the smaller towns on the sounds.

Repairs.—There are marine railways for small craft at Nantucket, Edgartown, Vineyard Haven, and Falmouth. The latter is the largest and can haul vessels 70 feet long and 8-foot draft and has a capacity of 30 tons. The nearest place where light repairs to machinery and boilers can be made is New Bedford.

Storm warning displays are made at Chatham, Monomoy, Nantucket, Cross Rip Lightship, Hyannis, East Chop, Nobska Point, Tarpaulin Cove, and Cuttyhunk.

Fogs are liable to occur at any time, but are more frequent from April to October than during the remainder of the year. They come more frequently with easterly and southerly winds; northerly winds clear them away. Southwesterly winds are usually accompanied by haze.

Ice.—In mild winters ice interferes but little with the movements of vessels in Nantucket and Vineyard Sounds. In severe winters drift ice accumulates and renders the movements of sailing vessels hazardous, and sometimes almost completely obstructs their progress for periods of as much as six weeks. During northerly winds which prevail in winter the passage along the north shore through Nantucket Sound will be clear when other parts of the sound are unsafe. Steamers force their way through the ice. Sailing vessels, if caught in a floe while entering by Pollock Rip Channel and Butlers Hole, are almost certain to be carried on the shoals.

It should be borne in mind that the buoys and even lightships are liable to be moved out of their positions by drift ice.

CURRENTS, NANTUCKET AND VINEYARD SOUNDS AND APPROACHES

From Race Point to Chatham lights the tidal currents are comparatively weak, being on the average not more than 0.5 to 1 knot at time of strength, running approximately parallel to the coast, but the time of current changes rapidly. From 1 to 2 miles off Race Point the flood or northwesterly stream attains its maximum strength about 1¼ hours before the current turns westward in Cape Cod Canal (approximately 3 hours after low water at Boston), while ½ mile off Chatham lights the northerly current is at its strength about 2 hours before the current turns southward at Pollock Rip Slue (approximately ½ hour after low water at Boston). Between 4 and 8 miles offshore is the dividing line between the in-

shore and offshore currents. Outside this limit the southward flow of the current greatly exceeds the northward.

Pollock Rip Slue.—Predicted times of slack water, in advance for every day of the year, are given in the Current Tables, Atlantic Coast, published annually by the United States Coast and Geodetic Survey.

Pollock Rip Lightship.—The tidal current is rotary, turning clockwise. The strength of the flood or northwesterly stream occurs about 1½ hours before the current turns southward at Pollock Rip Slue (approximately 1 hour after low water at Boston), and sets 65° true (E. ¾ N. mag.) with a velocity of 1.4 knots. Strength of ebb occurs about 2½ hours before the current turns northward at Pollock Rip Slue (approximately ¾ of an hour after high water at Boston), and sets 200° true (SW. ⅞ S. mag.) with a velocity of 1.5 knots. Since the current is rotary, there is no true slack; minimum currents of about 0.5 knot set northwesterly about 1 hour after the current turns northward at Pollock Rip Slue (approximately 2 hours before low water at Boston) and southeasterly about 1½ hours after the current turns southward at Pollock Rip Slue (approximately 2 hours before high water at Boston). The greatest observed velocity was 1.8 knots.

Stonehorse Shoal Lightship.—The strength of the flood current occurs about 1½ hours before the current turns southward at Pollock Rip Slue (approximately 1 hour after low water at Boston) and sets 60° true (ENE. ¾ E. mag.) with a velocity of about 2½ knots. The strength of ebb occurs about 2½ hours before the current turns northward at Pollock Rip Slue (approximately 1 hour after high water at Boston), and sets 240° true (WSW. ¾ W. mag.) with a velocity of about 2½ knots. Slack waters occur about 1½ hours after the current turns southward and 1 hour after the current turns northward at Pollock Rip Slue (approximately 2 hours before the time of high or low water at Boston). The greatest observed velocity was 3.6 knots.

Great Round Shoals Lightship.—The tidal current is rotary, turning clockwise. The strength of the flood occurs about the time the current turns southward at Pollock Rip Slue (approximately 2½ hours after low water at Boston) and sets 65° true (E. ¾ N. mag.) with a velocity of 1.4 knots. The strength of the ebb occurs about 1 hour before the current turns northward at Pollock Rip Slue (approximately 2 hours after high water at Boston) and sets 245° true (W. ⅞ S. mag.) with a velocity of 1.3 knots. There is no true slack, since the current is rotary. The minimum currents are about 0.4 knot and set 335° true (WSW. ¼ W. mag.) about 2 hours after the current turns northward at Pollock Rip Slue (approximately ¾ hour before low water at Boston) and 155° true (S. ⅞ E. mag.) about 2¾ hours after the current turns southward at Pollock Rip Slue (approximately ¾ hour before high water at Boston). The greatest observed velocity was 2.5 knots in a southwesterly direction, during a gale of 48 to 65 miles an hour.

From the eastern entrance of Nantucket Sound to Hedge Fence Lightship the time of current becomes gradually later; the average velocity at strength varies from 1.2 to 2 knots, the flood setting easterly and the ebb westerly.

From Hedge Fence Lightship westward, through Vineyard Sound to Gay Head, the time of current becomes somewhat earlier. The average velocity at time of strength increases from 1.3 knots at Hedge Fence Lightship to 2.3 knots off West Chop Light, and then gradually diminishes to 1.5 knots off Gay Head Light. See "Current diagram, Nantucket and Vineyard Sounds," in the Current Tables, Atlantic Coast, also large-scale diagram on heavy paper, price 15 cents, published by the Coast and Geodetic Survey.

Handkerchief Lightship.—Slack water before flood occurs about 1 hour after the current turns eastward at Cape Cod Canal (approximately 1¼ hours before low water at Boston). Strength of flood occurs about 2¼ hours before the current turns westward at Cape Cod Canal (approximately 2 hours after low water at Boston) and sets 80° true (E. ½ S. mag.) with a velocity of 1.6 knots. Slack before ebb occurs about 1 hour after the current turns westward at Cape Cod Canal (approximately 1 hour before high water at Boston). Strength of ebb occurs about 2½ hours before the current turns eastward at Cape Cod Canal (approximately 1½ hours after high water at Boston) and sets 260° true (W. ½ N. mag.) with a velocity of 1.6 knots. The greatest observed velocity was 2.3 knots set 101° true (SE. by E. ¾ E. mag.).

Cross Rip Lightship.—Slack water before flood occurs about 2 hours after the current turns eastward at Cape Cod Canal (approximately ¼ hour before low water at Boston). Strength of flood occurs about 1¼ hours before the current turns westward at Cape Cod Canal (approximately 3 hours after low water at Boston) and sets 80° true (E. ½ S. mag.) with a velocity of 1.2 knots. Slack before ebb occurs about 2 hours after the current turns westward at Cape Cod Canal (approximately the time of high water at Boston). Strength of ebb occurs about 1 hour before the current turns eastward at Cape Cod Canal (approximately 3 hours after high water at Boston) and sets 260° true (W. ½ N. mag.) with a velocity of 1 knot. The greatest observed velocity was 2.4 knots, setting southeasterly during a northwesterly wind with a velocity of 28 miles an hour.

Muskeget Channel.—The currents through Muskeget Channel are strong, having a velocity of 3 knots or more at strength.

The strength of flood comes about 1¾ hours before the current turns westward at Cape Cod Canal (approximately 2½ hours after low water at Boston) and sets northeasterly. The strength of ebb comes about 1½ hours before the current turns eastward at Cape Cod Canal (approximately 2½ hours after high water at Boston), and sets southwesterly. Slack water occurs about 1½ hours after the slacks at Cape Cod Canal (approximately ½ hour before time of high or low water at Boston).

Hedge Fence Lightship.—Slack water before flood comes about 2¾ hours after the current turns eastward at Cape Cod Canal (approximately ½ hour after low water at Boston). The strength of flood occurs about ½ hour before the current turns westward at Cape Cod Canal (approximately 2½ hours before high water at Boston) and sets 100° true (SE. by E. ⅞ E. mag.) with a velocity of 1.3 knots. Slack water before ebb occurs about 2¾ hours after the current turns westward at Cape Cod Canal (approximately ¾ hour after high water at Boston). The strength of ebb occurs about

½ hour before the current turns eastward in Cape Cod Canal (approximately 2¾ hours before low water at Boston) and sets 280° true (NW. by W. ⅞ W. mag.) with a velocity of 1.3 knots. The greatest observed velocity was 2.5 knots, setting southeasterly during a northwesterly wind with a velocity of 28 miles an hour.

Vineyard Sound Lightship.—All the tidal current is rotary, turning clockwise. The velocity is small, averaging about 0.5 knot at strength; the average minimum is about 0.2 knot. The strength of flood occurs about 2 hours after the current turns eastward at Cape Cod Canal (approximately the time of low water at Boston) and sets 345° true (N. mag.). The strength of ebb occurs about 2 hours after the current turns westward at Cape Cod Canal (approximately the time of high water at Boston) and sets 165° true (S. mag.).

Since the tidal currents are small, winds greatly affect them, and the current will generally set with the wind. The greatest observed velocity was 1 knot.

DIRECTIONS, NANTUCKET AND VINEYARD SOUNDS

Directions for approaching Vineyard Sound from southward and westward are given on page 29.

General remarks.—The numerous shoals, strong tidal currents, at certain seasons thick fog, and the large number of vessels which are often encountered in the narrow parts of the channels, call for more than the ordinary attention of the navigator. In clear weather, in the daytime or at night, the aids are readily distinguished and sufficiently numerous to enable a stranger to follow the channel without difficulty.

In clear weather sailing vessels with a favorable current, and with some local knowledge, beat through the sounds against a head wind and, when they find they are losing ground, come to anchor on either side of the prohibited anchorage or under the lee of one of the shoals or in one of the harbors until the wind or current changes. The strongest currents will be encountered in Pollock Rip Channel, between Stonehorse Shoal and Handkerchief Lightships, off East and West Chop, and in Vineyard Sound; in some places the current sets directly on the shoals and in a calm sailing vessels are sometimes obliged to anchor to prevent going aground. Most of the shoals rise abruptly from deep water, and the soundings are very irregular in depth and can not everywhere be depended on alone for warning of too close an approach to danger.

In thick weather or fog, when the aids can not be seen, sailing vessels and steamers in the vicinity of Pollock Rip Channel desiring to anchor are cautioned against anchoring in the channel or near the buoys or lightships (see "Prohibited anchorages," p. 42.) The large number of steamers and tows passing through the slue in thick weather, depending entirely on the sound signals of the aids (making it necessary for them to pass close to the latter), increases the probability of collision for vessels at anchor close to them, and as there is seldom a necessity for such action, sailing vessels should avoid doing so; there is no excuse for a steamer anchoring near the aids.

Vessels when in the vicinity of Pollock Rip Lightship, and desiring to anchor (wind and sea permitting), should first be sure of their

position and then stand northwestward and anchor west of a line joining Bearses Shoal North End buoy No. 2A and Chatham Bar nun buoy No. 2. Or, run 1 mile to southward and anchor in 5 to 7 fathoms (9 to 13 m.) northeastward of Broken Part of Pollock Rip.

When in the vicinity of Stonehorse Shoal Lightship, and desiring to anchor, steer 136° true (SSE. ½ E. mag.) for 1½ miles from the lightship and anchor in about 4½ fathoms (8 m.) and about 1¼ miles southward of the sailing line.

Vessels when between Butler Hole and Handkerchief Lightship, or when in the vicinity of the latter can anchor anywhere southwestward of Stonehorse Shoal in 4¼ to 6½ fathoms (7.7 to 11.9 m.), taking care to keep Stonehorse Shoal gas and bell buoy No. 9 bearing westward of 35° true (NE. ⅜ E. mag.), and to be 1 to 1½ miles southeastward of the sailing line, so as to keep outside of the prohibited anchorage. Or they may anchor northwestward of Handkerchief Lightship and on the west side of Handkerchief Shoal. (See also "Anchorages," preceding.)

Great Round Shoal Channel is used mostly by the very deep draft vessels passing through the sounds and sometimes by sailing vessels that are headed by the wind so as to prevent their working through Pollock Rip Channel. In thick weather a vessel may anchor (wind and sea permitting) anywhere in this channel and wait for clear weather; the bottom is generally sand, gravel, pebbles, or a combination of these. The tidal currents are not as strong as in Pollock Rip Channel, nor is the danger from collision as great as in the former. The sound signals are not as numerous as in Pollock Rip Channel. Easterly winds make high tides and strong westerly currents. Westerly winds make low tides and strong easterly currents.

The following directions are good for a depth of 30 feet (9.1 m.) at low water through Pollock Rip Channel and through Great Round Shoal Channel. These channels are subject to change, and vessels drawing over 27 feet (8.2 m.) should wait for a favorable tide.

Cape Cod Lighthouse through Pollock Rip Channel to Cross Rip Lightship.—Give the northerly shore of Cape Cod a berth of over 2 miles and from a position about 3 miles east-northeast of Cape Cod Lighthouse, make good a 157° true (S. ¾ E. mag.) course for nearly 13 miles to a position about 3 miles eastward of Nauset Beach Lighthouse, passing 1½ miles westward of Nauset gas and whistling buoy. Then make good a 176° true (S. by W. mag.) course 11¼ miles, passing 2 miles westward of Chatham gas and whistling buoy, to a position 3½ miles east of Chatham Lighthouse. Then steer 184° true (S. by W. ⅝ W. mag.) for 6¾ miles, heading for Pollock Rip Lightship. Pass to westward of the lightship and bring it astern on a course of 248 ° true (W. ½ S. mag.) with Stonehorse Shoal Lightship ahead.

Enter Pollock Rip Channel marked on each side by buoys, favoring the northern side if near the limiting depth. The distance between Pollock Rip Lightship and Stonehorse Shoal Lightship is 4¾ miles. Pass to southward of the latter (distance off, 300 yards), and steer 225° true (SW. by W. ¼ W. mag.) to a position ¼ mile southward of Handkerchief Lightship; then steer 255° true (W. mag.) for 8 miles to a position ½ mile south of Halfmoon Shoal

gas and bell buoy; then steer 277° true (WNW. mag.) for 2½ miles to a position ½ mile northward of Cross Rip Lightship. On the last course, Hedge Fence Lightship should be seen dead ahead.

Vessels of 24-foot (7.3 m.) draft or over can avoid the shoals making out into the channel from Halfmoon and Cross Rip Shoals by continuing on course 255° true (W. mag.) for about 1 mile past Halfmoon Shoal gas and bell buoy, and then heading for spar buoy, No. 12A on a course of 325° true (N. by W. ¾ W. mag.). When about ¼ mile from this buoy, haul westward to a position ½ mile northward of Cross Rip Lightship.

Great care should be taken here, as several deep-draft vessels have grounded, due to insufficient allowance for set.

Cape Cod Lighthouse through Great Round Shoal Channel to Cross Rip Lightship.—Give the northerly shore of Cape Cod a berth of over 2 miles, and from a position about 3 miles east-northeast of Cape Cod Lighthouse, make good a 157° true (S. ¾ E. mag.) course for nearly 13 miles to a position 3 miles eastward of Nauset Beach Lighthouse. Then make good a 163° true (S. ¼ E. mag.) course for 27 miles, passing about ½ mile eastward of Chatham gas and whistling buoy, to Great Round Shoal Channel entrance gas and whistling buoy.

From this buoy steer 254° true (W. ⅛ S. mag.) for 9 miles to Great Round Shoal Lightship. Pass on either side of the lightship and steer 306° true (NW. ½ N. mag.) for 3½ miles to a position ¼ mile northeastward of Point Rip gas and bell buoy. Then steer 274° true (WNW. ⅛ W. mag.) for 14 miles to a position ½ mile northward of Cross Rip Lightship, passing about ½ mile southward of Halfmoon Shoal gas and bell buoy.

Cross Rip Lightship through Vineyard Sound.—From a position ½ mile northward of Cross Rip Lightship, steer 276° true (W. NW. ⅛ W. mag.) for 8¾ miles to a position ⅛ mile southward of Hedge Fence Lightship, then 285° true (NW. by W. ⅜ W. mag.) for 7½ miles, passing ¾ mile off West Chop Lighthouse, to a position ⅛ mile southward of Nobska Point gas and bell buoy; then steer 238° true (WSW. ½ W. mag.) for 11⅛ miles to Nashawena gas and bell buoy, passing ¾ mile northward of Middle Ground bell buoy and 1 mile southward of Tarpaulin Cove Lighthouse; then steer 258° true (W. ¼ N. mag.) for 6¾ miles to Vineyard Sound Lightship. From the lightship courses can be shaped as follows:

Bound into Buzzards Bay.—Steer 349° true (N. ¼ E. mag.) for Hen and Chickens Lightship and follow the directions for entering Buzzards Bay from westward. Quicks Hole is generally used by vessels between Vineyard Sound and Buzzards Bay, and Woods Hole is available for vessels of 10 feet (3 m.) or less draft. See the directions for these passages.

Bound into Narragansett Bay.—Steer 280° true (WNW. mag.) for 17¼ miles to Brenton Reef Lightship.

Bound to Long Island Sound.—A 259° true (W. ¼ N. mag.) course will lead to The Race, passing 3 miles southward of Point Judith Lighthouse; the distance from Vineyard Sound Lightship to Race Rock Lighthouse is 48 miles.

Or a 262° true (W. ½ N. mag.) course made good for 21½ miles will lead to a position ¼ mile southward of Point Judith gas, whistling, and submarine bell buoy, which lies 1¼ miles southward

of Point Judith Lighthouse. Vessels can then follow the directions given on page 134.

Bound to sea.—A 237° true (WSW. ¼ W. mag.) course for 29 miles from Vineyard Sound Lightship will lead about 2 miles southward of Block Island Southeast Lighthouse.

Or from Nashawena gas and bell buoy a 237° true (WSW. ¼ W. mag.) course for 36 miles will lead about 4 miles southward of Block Island Southeast Lighthouse.

With southerly or westerly gales there is a heavy sea in the westerly entrance of Vineyard Sound, and a heavy, ugly sea occurs at times in Vineyard Sound off the entrance of Quicks Hole. To avoid this sea tows, especially, frequently use Quicks Hole.

DIRECTIONS ALONG THE NORTH SHORE

This passage has broken ground with depths of 16 and 17 feet (4.9 and 5.2 m.) in places, and is not recommended at low water for a greater draft than about 14 feet (4.3 m.). Strangers should not attempt it at night.

To pass southward of Bishop and Clerks.—From a position close westward of Handkerchief Lightship make good a 293° true (NW. ¾ W. mag.) course for 11¾ miles, passing 1½ miles southwestward of Bishop and Clerks Lighthouse and ¾ mile northeastward of Broken Ground black buoy; Hyannis Lighthouse and lighted beacon should then be in range, and Bishop and Clerks Lighthouse should bear 74° true (E. ⅛ N. mag.). Then steer 254° true (W. ⅛ S. mag.) for 6¼ miles, with Bishop and Clerks Lighthouse astern, to close southward of Wreck Shoal spar buoy No. 18.

To pass northward of Bishop and Clerks.—From a position close westward of Handkerchief Lightship make good a 307° true (NW. ⅝ N. mag.) course for 10 miles, and pass northeastward and northward of Bishop and Clerks Lighthouse, rounding it at a distance of ¾ mile. Then steer 262° true (W. ⅝ N. mag.), pass about ⅜ mile southward of Hallets Rock buoy and ½ mile southward of West Southwest Ledge bell buoy. When the bell buoy is in range with Hyannis Lighthouse, steer 239° true (WSW. ½ W. mag.) for 4¾ miles to a position midway between the buoy at the eastern end of Wreck Shoal and the buoy on the northwest end of Horseshoe Shoal. Then steer 256° true (W. mag.) for 2⅛ miles to Wreck Shoal Spar buoy No. 18.

Wreck Shoal to Nobska Point.—Pass close southward of Wreck Shoal spar buoy No. 18, steer 267° true (W. by N. mag.) for 7 miles, passing 300 yards northward of a horizontally striped buoy, about ⅜ mile northward of the eastern end of L'Hommedieu Shoal and about ¼ mile southward of Davis Neck Shoal red buoy. When about 1 mile westward of the latter buoy and West Chop Lighthouse bears 184° true (S. by W. ⅝ W. mag.), steer 235° true (WSW. ¼ W. mag.) for 2½ miles to a position ⅛ mile southward of Nobska Point gas and bell buoys, passing about ¼ mile northward of the black buoy at the western end of New Shoal. For directions through Vineyard Sound from Nobska Point gas and bell buoys, see the preceding directions, "Cross Rip Lightship through Vineyard Sound."

on the south side of Nantucket Sound, is about 13 miles long, hilly, highest (about 100 feet (30 m.)) in the eastern part, and partly wooded, with steep sand bluffs on the eastern and southern sides. The northern shore is fringed with shoals to a distance of about 1 mile. There is a prominent water tank about 1½ miles westward of Nantucket.

Great Point is the northern extremity of a long sand beach, separated from the main part of the island by Nantucket Harbor and is marked by Nantucket (Great Point) Lighthouse.

Point Rip is a shoal that extends 3¾ miles east-northeastward from Great Point, and has little water over it for a distance of 2 miles from the point. Farther eastward the shoal has depths of 12 to 18 feet (3.7 to 5.5 m.) over it, and is marked on its northerly side by two black buoys. A shoal with 19 to 22 feet (5.8 to 6.7 m.) over it extends northward from these buoys, and is marked at its northerly end by Point Rip gas and bell buoy, which lies 3¾ miles 49° true (NE. by E. ⅝ E. mag.) from Nantucket Lighthouse.

Nantucket (Great Point) Lighthouse is a white tower. The light is fixed white with a red sector between 84° true (E. ¾ S. mag.) and 106° true (SE. by E. ¼ E. mag.), 70 feet (21.3 m.) above the water, and visible 14 miles.

Sankaty Head Lighthouse, the most prominent mark on the easterly side of Nantucket Island, is a white tower with a red band in the middle, on top of a bluff about 90 feet (27 m.) high. The light is fixed white with a white flash of 10 seconds' duration every 60 seconds, 166 feet (51 m.) above the water, and visible 19 miles.

Siasconset is a summer resort on the southeast end of the island, 1¼ miles southward of Sankaty Head Lighthouse; it has radio communication, and bus communication with Nantucket.

The south shore of Nantucket Island has no harbors and is frequented only by local fishermen. The only marks are the Coast Guard stations, radiocompass station, and a few scattered houses.

Surfside (Nantucket) Radiocompass Station is located on the south side of the island in latitude 39° 14′ 39″ N., longitude 70° 05′ 53″ W. The arc of calibration is 30° to 270°. The call letters are NBS. (See also "Radio service" on p. 10.)

Maddaket Harbor and the thoroughfare between the western end of Nantucket Island and Tuckernuck Island is full of shifting, unmarked shoals, and seldom used, even by local boats.

Westward of Nantucket Island and separated from each other only by sand bars are **Tuckernuck, Gravel,** and **Muskeget Islands,** all low and sandy. The Coast Guard station on Muskeget Island is prominent in Nantucket Sound.

Nantucket Harbor (chart 343) is near the middle of the northern shore of Nantucket Island. Shoals extend about 1 mile from shore on both sides of the entrance, which is between two jetties extending northward and partially submerged at high water. **Nantucket East Breakwater Light,** flashing white every 3 seconds, is on a pile of rocks at the outer end of the jetty. A fog bell at the light strikes 1 stroke every 10 seconds. A channel 300 feet wide and 15 feet (4.6 m.) deep, marked by a lighted range, has been dredged between the jetties. Shoaling is liable to occur on the bar which forms just outside the jetties. In 1925 the width of the 15-

foot (4.6 m.) channel opposite the light was only 100 feet, but a depth of 13½ feet (4.2 m.) existed for a width of 300 feet.

Brant Point Lighthouse is a white cylindrical tower on the end of Brant Point. The light is fixed white, 26 feet (7.9 m.) high and visible for 10 miles. A fog bell strikes group of 2 strokes 30 seconds, 1 stroke 30 seconds.

On the point westward of the lighthouse is an unused tower attached to a dwelling. Close to eastward of the disused tower is the **Nantucket Harbor Range,** consisting of two fixed white lights on white skeleton towers. This range is somewhat difficult to pick up in daytime. The bearing of the range is 162° true.

Nantucket Harbor proper lies southward of **Brant Point;** secure anchorage, sheltered from all winds, can be selected 200 to 300 yards off the southerly side of Brant Point, or about the same distance off the wharves, in 12 to 17 feet (3.7 to 5.2 m.) sticky bottom.

Extending northeastward from Nantucket Harbor proper is a shallow lagoon about 5 miles long. A draft of 2 feet (0.6 m.) at low water can be taken to **Wauwinet,** a summer resort at the head of the harbor. A draft of 1½ feet (0.5 m.) can be taken to the wharf at low water, the depth at which is 3 feet (0.9 m.). The shoals extending off Third Point and Five Fingered Point and the crossover at the bar off Bass Point are marked by private buoys. A ferry runs to Nantucket in the summer.

Nantucket is a town on the western shore of the harbor. The principal industry is fishing, and occasionally a cargo of coal is brought in barges. The depths at the wharves are 8 to 12 feet (2.4 to 3.7 m.). The first large wharf is the steamboat wharf. Submerged piers extend off the next two wharves, the ends of which are marked by dolphins. The channel leading between the second and third wharves is marked in summer by two barrel buoys. A submerged pier also extends off from the fifth (southernmost) wharf. Vessels proceeding to any of the wharves should exercise caution to avoid these submerged piers.

Coal, gasoline, provisions, and ship chandlery can be obtained here. Water is piped to the principal wharves. There is a marine railway, for boats 56 feet long, 4½-foot draft, with a capacity of 15 tons. Hull and gas engine repairs can be made.

Pilots can be had by making signal off the entrance. Fishing vessels act as towboats in case of necessity. There is communication by cable with the mainland and by steamer with New Bedford and other points on Nantucket Sound. There is bus communication with Siasconset, a summer resort on the easterly end of the island. There is a relief station of the United States Public Health Service here.

Storm warnings are displayed at Nantucket.

Ice.—Except in severe winters, the harbor is seldom closed by local formations of ice, but is frequently closed by drift ice from the sound, which packs and remains across the entrance during northerly winds.

Tides.—The mean rise and fall of the tides is 3.1 feet.

Directions, Nantucket Harbor.—The following directions are good for a draft of 14 feet (4.3 m.) with smooth water on the bar:

From Handkerchief Lightship steer 189° true (SSW. mag.) for a little over 10 miles to the bell buoy at the entrance. Or from Cross Rip Lightship steer 120° true (SE. mag.) for 5 miles to a position

¼ mile northeastward of the bell buoy at the eastern end of Tuckernuck Shoal, and then steer 144° true (SSE. mag.) for 6½ miles to the bell buoy at the entrance.

When close to the bell buoy steer 162° true (S. ⅜ E. mag.) on the Nantucket Harbor range and follow the buoys until about 50 yards past the last black buoy and about 300 yards from the beach; then steer 133° true (SSE. ⅞ E. mag.) and round Brant Point at a distance of 75 yards. Then stand southwestward into the harbor and anchor with Brant Point Lighthouse bearing 9° true (NNE. mag.), or in line with the northern side of the steamboat wharf and with the old tower on Brant Point in range with the rear light of the Nantucket Harbor range.

MARTHAS VINEYARD

and **Chappaquiddick Islands** have a combined length of 18 miles, the islands being separated by Edgartown Harbor, Katama Bay, and the narrow slough connecting them. Marthas Vineyard is well settled, especially along its northern shore, and has cable communication with the mainland. The principal towns are Edgartown, Vineyard Haven, and Oak Bluffs, the last being an important summer resort.

Muskeget Channel is an opening nearly 6 miles wide between Muskeget Island and Chappaquiddick Island. It is full of shifting shoals, the best water being close eastward of Wasque Shoal, and a little eastward of the eastern shore of Chappaquiddick Island. This channel is partly buoyed, but should never be attempted by strangers, as the currents have great velocity and make the navigation of it dangerous (see p. 46). **Wasque Shoal** lies southward of **Wasque Point** (the southeastern point of Chappaquiddick Island) and rises abruptly on its southern and eastern sides from depths of 3 and 8 fathoms (5.5 to 15 m.) to 2 and 4 feet (0.6 to 1.2 m.); on its eastern edge is a small sand island called **Skiff Island,** which almost disappears at times.

Cape Poge Lighthouse is a white conical tower on the northeast point of Chappaquiddick Island. The light is group flashing white and red, 2 white and 1 red flashes every 15 seconds, each flash 0.7 second duration, each eclipse 4.3 seconds duration, 55 feet (16.8 m.) high and visible for 13 miles.

Edgartown Harbor and Katama Bay are described under a separate heading following.

Harts Haven is a small pond 1⅜ miles southward of the entrance to Lake Anthony. The entrance to the pond is through a privately dredged channel about 50 feet wide and 5 feet (1.5 m.) deep leading between two short jetties. The depths in the pond are from 4 to 5 feet (1.2 to 1.5 m.).

Lake Anthony (chart 346 or 347), which is at **Oak Bluffs,** 1 mile southeastward of Vineyard Haven, has depths of 5 to 9 feet (1.5 to 2.7 m.) except its northern end and near the shores, and affords anchorage for small craft. Its entrance is 150 feet wide between two stone jetties, and through it a depth of 8 feet (2.4 m.) at low water could be carried in 1925. The entrance is marked by a light on the end of the north jetty, and lies ¾ mile southward of East Chop Lighthouse.

There are several landings and numerous mooring buoys. Gasoline, provisions, and motor-boat supplies can be obtained. Communication is by steamer with New Bedford and points on Nantucket Sound. The steamer wharf lies 400 yards south of the entrance to Lake Anthony, and has about 10 feet (3.0 m.) at the end and 8 feet (2.4 m.) on the sides near the end.

East and West Chop are prominent points on the east and west sides, respectively, of the entrance to Vineyard Haven. Each point terminates in a high wooded bluff which show prominently from the sounds.

East Chop Lighthouse is a brown tower on the summit of East Chop. The light is flashing red, flash 3 seconds, eclipse 7 seconds, 79 feet (24.1 m.) high and visible for 15 miles.

West Chop Lighthouse is a white conical tower on the summit of West Chop. The light is fixed white with a red sector from 281 to 331°, covering Squash Meadow and Norton Shoal, 84 feet (25.6 m.) high and visible for 15 miles. The fog signal is a steam whistle, blast 3 seconds, silent 27 seconds.

Vineyard Haven is described on page 57.

A narrow, somewhat shifting ridge extends from about ¼ mile northwestward of West Chop, approximately parallel to and 2 miles off the northerly shore of Vineyard Sound, for a distance of about 9 miles. **Middle Ground** is the easterly half of this ridge and has depths of 4 to 8 feet (1.2 to 2.4 m.) over the greater part; and **Lucas Shoal,** with depths of 12 to 16 feet (3.7 to 4.9 m.) over it, is near the westerly end. It is marked by a horizontally striped buoy at each end and a black bell buoy on the northerly side. The generally used channel through Vineyard Sound leads northward of the shoal.

Norton Point and **Cape Higgon** are prominent bluffs on the northwest side of Marthas Vineyard, about 3 and 8 miles southwestward of West Chop Lighthouse.

Menemsha Bight, on the northerly side of the westerly end of Marthas Vineyard 2 to 3 miles eastward of Gay Head Lighthouse, affords shelter from southerly and easterly winds for vessels of any size, in 6 to 10 fathoms (11 to 18 m.), sticky bottom. There are no dangers in the bight if the shore be given a berth of ¼ mile.

Menemsha Inlet, on the southeasterly side of Menemsha Bight, is an opening between two jetties into the northerly end of **Menemsha Pond.** A channel 75 feet wide and 6 feet (1.8 m.) deep has been dredged through the entrance, and an anchorage basin of the same depth just inside. The inlet is used by local fishermen. The entrance is marked by a light on the end of the east jetty. In 1925 a depth of 5 feet (1.5 m.) could be carried in by favoring the east jetty and when abreast the inner end heading northeastward for the dock. The currents have considerable velocity through the entrance. There is a small settlement where gasoline, ice, and some provisions can be obtained.

Gay Head, the westerly end of Marthas Vineyard, is a prominent high bluff, on the summit of which is a lighthouse.

Devils Bridge is a reef making out ¾ mile in a northwest direction from Gay Head; it has 2 feet (0.6 m.) over it about ⅜ mile offshore and 17 feet (5.2 m.) at its end. The reef is marked off its northwest end by a black buoy.

Gay Head Lighthouse is a red tower; the light is group flashing white and red, 3 white flashes and 1 red flash every 40 seconds (each flash 5 seconds, each eclipse 5 seconds), 170 feet (52 m.) above the water, and visible 19 miles. The light is partially obscured by No Mans Land between 342° true (N. ⅜ W. mag.) and 359° true (N. by E. ⅛ E. mag.), being occasionally visible through the notches in the hilltop.

No Mans Land is a prominent, high, rocky island lying 5 miles southward from Gay Head. A private basin in the bight on the northerly side was nearly closed up in 1925. Several sunken ledges lie in the passage between No Mans Land and Marthas Vineyard, through which is a buoyed channel about ¾ mile wide that may be used by small vessels in the daytime.

EDGARTOWN HARBOR

(chart 346) is on the northern side of Marthas Vineyard, just westward of Cape Poge. It is divided into the outer and inner harbors, the former being principally used as a harbor of refuge in southerly and easterly winds and as an anchorage for the night.

Outer harbor.—On the western side of the harbor is a shoal which extends 2¾ miles in a north-northeasterly direction from Edgartown Lighthouse. The northern extremity of this shoal is a spot with 11 feet (3.4 m.) over it, lying 2 miles 296° true (NW. ½ W. mag.) from Cape Poge Lighthouse, marked by a black bell buoy. Vessels entering or leaving the harbor pass eastward of this buoy. The depth on this shoal is very irregular, and there are a number of rocks with from 3 to 5 feet (0.9 to 1.5 m.) over them. The eastern edge of the shoal is marked by red buoys. Light-draft steamers sometimes cross this shoal, but strangers should not do so.

Cape Poge Flats extend 1½ miles northeastward from Cape Poge and are marked near their end by a black buoy. Vessels of over 14 feet (4.3 m.) draft should pass northward of the buoy; those of less draft can pass southward of it, but should give Cape Poge a berth of at least ¾ mile. The southerly edge of the white sector in West Chop Light leads ¾ mile northward of the buoy.

A shoal, with 18 feet (5.5 m.) at its end, extends ⅜ mile northwestward of Cape Poge, and its edge is marked by a black buoy which lies 1 mile west-northwestward of Cape Poge Lighthouse.

Sturgeon Flats, with 3 to 15 feet (0.9 to 4.6 m.) over them, make off about 600 yards from the southeastern shore of the outer harbor southward of the narrow entrance to Cape Poge Bay. The edge of the flats is marked by a black buoy, from which the edge of the flats extends in a general southwesterly direction to the head of the outer harbor. Edgartown Lighthouse, bearing anything southward of 245° true (W. by S. mag.), clears the flats.

Cape Poge Bay, a shallow lagoon in the northern part of Chappaquiddick Island, is entered only by local fishermen in small craft of about 3 feet (0.9 m.) draft.

Edgartown Lighthouse is a white dwelling at the end of a brige ¼ mile long, connecting with the shore. The light is fixed white, 48 feet (14.6 m.) high and visible for 12 miles. The fog signal is a bell, 1 stroke every 15 seconds.

Inner Harbor.—At the head of the outer harbor a narrow arm makes southward into Katama Bay, forming what is known as the inner harbor. This affords good anchorage in 3 to 5½ fathoms (5.5 to 10 m.), but it is narrow and the tidal currents have considerable velocity. The bar south of Edgartown Lighthouse, at the entrance to the inner harbor, has only 16 feet (4.9 m.) over it. Strangers in sailing vessels seldom enter the inner harbor, as a fair wind is necessary to keep in the channel.

Katama Bay is a large, shallow body of water used by local fishermen and small pleasure craft. The southern half of the bay is full of shoals. The head of the bay is subject to frequent changes, and a channel is sometimes cut through the beach into the ocean, but it is uncertain and is seldom used.

Edgartown, on the western shore of the inner harbor, has a little commerce; the chief industry is fishing. The depth is 18 feet (5.5 m.) at the steamer wharf and about 11 feet (3.4 m.) at the wharves southward of it. Coal, water, gasoline, provisions, and some ship supplies can be had. There are two marine railways, the larger for vessels 60 feet long, 8 feet draft, and with a capacity of 15 tons. Gas engine and hull repairs can be made. Communication is by daily steamer from Oak Bluffs to New Bedford and points on Nantucket Sound.

The channel through the outer harbor is free from dangers and has a least width of ⅝ mile and depths of 4 to 6½ fathoms (7 to 12 m.) until nearly up to Edgartown Lighthouse; here it narrows and takes a sharp bend westward, with a depth of 16 feet (4.9 m.), leading to the wharves of the town. Abreast the town the channel is narrow and has a depth of 4 to 6 fathoms (7 to 11 m.); it then curves southward, its eastern edge marked by a black buoy, and a horizontally striped buoy at the northern end of Middle Ground Shoal. About ½ mile above the upper wharf in the town the channel widens and has a depth of 3½ to 5 fathoms (6 to 9 m.). This depth continues for nearly 1 mile to Katama Bay, where it shoals.

Anchorages.—In easterly gales good shelter is found westward of Cape Poge, on the eastern side of the outer harbor. In westerly and southerly gales vessels find shelter in the southern end of the outer harbor, about ⅜ mile eastward or east-southeastward from Edgartown Lighthouse. Vessels should not anchor in the channel abreast the town, where the bottom is hard sand, the channel narrow, and tidal current strong. Above the town anchorage is found in the channel, south of Middle Ground Shoal, in 4 to 5 fathoms (7 to 9 m.), sticky bottom.

In northerly or northeasterly gales vessels usually go to Woods Hole or Tarpaulin Cove for sheltered anchorage.

Towboats are seldom used, but can be obtained from Vineyard Haven by telephone.

Pilots are stationed at Vineyard Haven and can sometimes be obtained by making signal in the outer harbor; local fishermen are usually available also.

Ice.—Drift ice from the sound, driven into the entrance by the wind, obstructs the entrance of sailing vessels during a part of the winter. The strong tidal currents keep the inner harbor open except for a few days at a time during severe winters.

Tides.—The mean rise and fall of the tides is 2 feet.

The **tidal currents** in the narrow part of the channel, inside Edgartown Lighthouse and off the town, have considerable velocity, but as a rule follow the direction of the channel. When the current turns from east to west in the sound off Edgartown the southerly current is nearing the time of strength in the harbor.

DIRECTIONS, EDGARTOWN HARBOR

The following directions are good for vessels of 18-foot (5.5 m.) draft to the anchorage eastward of Edgartown Lighthouse and for vessels of 15 foot (4.6 m.) draft to the town wharves:

From eastward.—Passing 100 to 500 yards northward of Cross Rip Lightship steer 267° true (W. by N. mag.) for the high standpipe (water tower) on Marthas Vineyard southward of Oak Bluffs and pass northward of Cape Poge Flats buoy. When Cape Poge Lighthouse bears about 155° true (S. by E. mag.) steer 209° true (SW. ⅛ S. mag.) for Edgartown Lighthouse. When Cape Poge Lighthouse bears 87° true (E. by S. mag.) steer 197° true (SSW. ¾ W. mag.), which should lead 400 yards eastward of the red buoy marking the eastern edge of the shoals on the western side of the harbor and nearly ½ mile eastward of Edgartown Lighthouse. Anchor eastward or southeastward of the lighthouse, distant ¼ to ½ mile, in 4 to 5 fathoms (7.3 to 9.1 m.).

From westward.—To pass northward of Squash Meadow, steer for Cape Poge on any bearing southward of 136° true (SSE. ¾ E. mag.) and pass eastward of the black buoy on the southeast end of Squash Meadow. Then bring Hedge Fence Lightship astern on a 178° true (S. by W. mag.) course. When Edgartown Lighthouse bears 209° true (SW. ⅛ S. mag.) steer 197° true (SSW. ¾ W. mag.) and proceed as in the preceding paragraph.

In the daytime, to pass southward of Squash Meadow, pass about 200 yards northeastward of the black buoy eastward of East Chop Lighthouse, and steer 124° true (SE. ¼ S. mag.) for Cape Poge Lighthouse, passing about 200 yards southwestward of the black buoy at the northwest end of Squash Meadow and ¼ mile northward and eastward of the bell buoy. Then steer 181° true (S. by W. ⅜ W. mag.) with Hedge Fence Lightship astern for 1¾ miles. When about 400 yards eastward of the second red buoy, steer about 197° true (SSW. ¾ W. mag.) and anchor as directed in the first paragraph.

To go to the wharves.—Pass close southward of the buoy lying southeastward of Edgartown Lighthouse, steer 274° true (WNW. ⅜ W. mag.), pass 150 yards southward of the lighthouse, and as the wharves are approached follow them at a distance of about 50 yards.

VINEYARD HAVEN

(chart 347) is a funnel-shaped bight about 1⅜ miles long in a southwest direction and about 1¼ miles wide at the entrance; it is on the northern side of Marthas Vineyard between East Chop and West Chop, each marked by a lighthouse. The harbor is easy of access and is the most important and generally used harbor of refuge for coasters between Provincetown and Narragansett Bay; it is exposed to northeasterly winds, but vessels with good ground tackle can ride

out any gale. The greatest danger encountered by vessels at anchor in a northeast gale is from vessels with poor ground tackle, which are likely to drift and foul other vessels and then go ashore. The depth is sufficient for the largest vessels passing through Vineyard Sound; it ranges from 35 feet (10.7 m.) or more at the entrance to 15 feet (4.6 m.) near the head of the harbor.

The channel is unobstructed and the lead will be the best guide in selecting an anchorage. When well inside the entrance the water shoals gradually toward the western shore; toward the eastern shore the water shoals abruptly to Canal Flats above the buoy, and the shore should be given a berth of about 300 yards.

East Chop Flats have 8 to 18 feet (2.4 to 5.5 m.) over them, extend a little over ⅜ mile in a northeasterly direction from East Chop, and are marked off their northeastern end by a black bell buoy with a spar marker alongside. The bell buoy is removed when endangered by ice.

Canal Flats, partly bare at low water, make off 300 yards from the eastern shore of the harbor, about 1 mile inside of East Chop Lighthouse; their northwestern edge is marked by a black buoy.

Shoals extend ¼ mile northward and eastward from **West Chop,** and their edges are marked by three buoys. **Alleghany Rock,** with 6 feet (1.8 m.) over it, lies 650 yards northward from West Chop Lighthouse, and is marked on its northern side by a black buoy, which is colored and numbered for the channel through Vineyard Sound. Low Point Flats buoy is placed off the edge of the shoals 650 yards east-northeastward from West Chop Lighthouse. Rocks awash at low water extend nearly ¼ mile off the eastern side of West Chop, and are marked by Great Rock buoy, which lies ½ mile southeastward of the lighthouse.

Vineyard Haven is a town on the west shore near the head of the harbor; coal and lumber are brought occasionally in barges and vessels. A breakwater, showing about 2 feet (0.6 m.) above high water, is on the flats on the western side of the harbor near the head. It is marked by a light on the south end. A dredged channel 16 feet (4.9 m.) deep leads southward of the breakwater to the steamer wharf, which has 19 feet (5.8 m.) at the end. On the south side of the harbor near the head are three wharves with about 10 feet (3 m.) at their ends, and the ruins of another wharf.

Anchorage.—Vessels anchor, according to draft, anywhere from the points at the entrance to the head of the harbor, the light-draft vessels favoring the western shore. Small craft can anchor between the breakwater and the steamboat wharf, in 6 to 9 feet (1.8 to 2.7 m.).

Pilots.—Coasting vessels do not take a pilot to enter the harbor, as the anchorage can be made without difficulty. State pilotage is compulsory for foreign vessels entering to discharge cargo. Pilots for Vineyard and Nantucket Sounds can be obtained at Vineyard Haven. (See p. 43 for rates.)

Towboats.—A towboat will usually be found here.

Supplies.—Coal in limited quantity and fresh water can be obtained alongside the wharf by steamers of 18-foot (5.5 m.) draft or less. Gasoline, ice, provisions, an some ship chandler's stores can be had at Vineyard Haven.

Repairs.—There are several marine railways at Vineyard Haven for small craft up to 50 feet long, 6 feet draft, and 12 tons capacity.

New Bedford is the nearest place at which repairs to the machinery of steamers can be made.

Storm-warning displays are made near East Chop Lighthouse.

Hospital.—There is a United States marine hospital at Vineyard Haven to which seamen entitled to hospital treatment are sent.

Communication is by steamer to New Bedford and points in Nantucket sound.

Currents.—The tidal currents have little velocity in the harbor; care should, however, be taken on the ebb, which sets westward, not to approach too closely to West Chop, as the current there sets on the ledges which make eastward and northward from the point.

Ice.—Both local and drift ice obstruct the movements of vessels in severe winters and at times entirely close the harbor. Strong northerly winds drive drift ice from Vineyard Sound into the harbor and endanger vessels at anchor.

Tides.—The mean rise and fall of the tides is 1.7 feet.

DIRECTIONS, VINEYARD HAVEN

The currents turn about ½ hour earlier inshore across the entrance of the harbor than in the channel through the sound. Vessels entering the harbor, with a head wind or light breeze at the end of a favorable current through the sound, should stand on in the channel until the harbor is well opened before standing in for the anchorage, so as to clear the points at the entrance.

From eastward.—Squash Meadow and East Chop Flats will be avoided by keeping in the white sector of West Chop Light. From Hedge Fence Lightship steer for West Chop Lighthouse on a 276° true (WNW. ⅛ W. mag.) course until East Chop Lighthouse bears 155° true (S. by E. mag.). Then steer 220° true (SW. ¾ W. mag.) into the harbor, giving the eastern shore a berth of about ¼ mile; the course will lead about 150 yards northwestward of Canal Flats buoy, and the red spar buoy off the southeast end of the breakwater should be nearly ahead. There is good anchorage northeastward of the latter buoy in 20 to 23 feet (6.1 to 7 m.), taking care, however, to keep clear of the edge of Canal Flats, which rise abruptly.

From westward.—Steer for East Chop Lighthouse on a 133° true (SSE. ⅞ E. mag.) course until West Chop Lighthouse bears 262° true (W. ½ N. mag.). Then steer 189° true (SSW. mag.) into the harbor to a position 150 yards northwestward of Canal Flats buoy; a 220° true (SW. ¾ W. mag.) course will then lead to the head of the harbor.

MONOMOY POINT TO HYANNIS HARBOR

Monomoy Point and unused lighthouse are described on page 36. The bight formed by Monomoy Island and the north shore of Nantucket Sound, eastward of Hyannis, has extensive shoals, some of them unmarked, bordering the shores, and scattered throughout the bight. It is frequented only by local fishermen and vessels anchoring in Chatham Roads.

Chatham Roads is at the northeast end of Nantucket Sound, between the extensive shoals which extend northwestward from the northern end of Monomoy Island and the shoals extending 1⅝ miles

from the south shore of Cape Cod at Harwich Port, 3 miles westward of Stage Harbor Lighthouse. It is a good anchorage for vessels up to about 18-foot (5.5 m.) draft in 3½ to 5 fathoms (6 to 9 m.), with good holding ground, but is insecure for small craft in heavy southwesterly gales.

Stage Harbor and Chatham Lighthouses are the guides for entering Chatham Roads and to the entrance of the buoyed channel into Stage Harbor. The western edge of **Common Flat,** the shoal on the eastern side of the roads, is marked by a red buoy.

Stage Harbor Lighthouse is a white tower on **Harding Beach,** on the northeast side of Chatham Roads. The light is fixed white, 40 feet (12.2 m.) high and visible for 12 miles.

Chatham Lighthouse and Chatham Bar are described on page 35.

Stage Harbor is a small, well-sheltered anchorage entered from Chatham Roads by a narrow, crooked channel, through which a depth of 5 feet (1.5 m.) at low water can be carried with local knowledge. The channel is buoyed but a stranger should not attempt to enter without a pilot. Local fishermen usually act as pilots.

Chatham, a town on the northeastern side of the harbor, has railroad communication. The eastern wharf has a depth of 7 feet (2.1 m.); the other wharf is shoal. There is a marine railway for boats 60 feet long, 4½ feet draft forward and 6 feet aft; hull and gas engine repairs can be made. Gasoline, provisions, and a small quantity of boat supplies can be had. A draft of 5 feet (1.5 m.) at high water can be carried to the head of the harbor through a drawbridge having an opening 14 feet wide. The harbor is closed by ice for short periods each winter.

Vessels approaching Chatham Roads from southward should pass westward of Handkerchief Shoal and the extensive shoals along the eastern shore. From westward they can pass on either side of Bishop and Clerks and southward of **Kill Pond Bar.** When in the entrance to Chatham Roads, a 63° true (ENE. ⅞ E. mag.) course with Stage Harbor and Chatham lighthouse in range will lead to the perpendicularly striped buoy at the entrance to Stage Harbor; anchorage may be had northward of the buoy in about 4¾ fathoms (8.8 m.) soft bottom.

Buck Creek, lying 1¾ miles northwestward of Stage Harbor Lighthouse, is used only at high water by boats of local fishermen. Its entrance is 100 feet wide between two jetties, and has a depth of about 2 feet (0.6 m.) at low water.

Wichmere Harbor, 3¾ miles westward of Stage Harbor Lighthouse, has an entrance 100 feet wide between jetties. A channel 30 feet wide and 6 feet (1.8 m.) deep has been dredged to a small pond with general depths of 5 or more feet, but due to considerable shoaling and a heavy growth of grass in the channel only 2 feet (0.6 m.) at low water could be carried through in 1925. **Harwich Port** is a village on the pond; gasoline and a small quantity of provisions can be had. A church spire a little west of the entrance is prominent.

Allen Harbor, 1 mile westward of Wichmere Harbor, can not be entered.

Herring River, 6 miles westward of Stage Harbor Lighthouse, has an entrance between two short jetties. A channel 60 feet wide and 5 feet (1.5 m.) deep has been dredged through the bar at the entrance, but had shoaled to about 2 feet (0.6 m.) in 1925. **Dennis**

Port is a village just inside the entrance. A white hotel on the west side of the entrance is prominent.

Bass River has an entrance between jetties. A channel 60 feet wide and 6 feet (1.8 m.) deep has been dredged to the entrance and between the jetties to an anchorage basin of the same depth just inside. The channel is sometimes marked by private buoys and bush stakes, and is subject to shoaling. In 1925 the controlling depth was 4 feet (1.2 m.). The end of the west jetty is marked by a light and there is a prominent spoil bank on the inshore end of the east jetty. The villages of **South Yarmouth** and **West Dennis** are on the river 1¼ miles above the entrance. Gasoline and provisions can be obtained here.

On the easterly end of **Dogfish Bar,** southeastward of Bass River entrance, there is a small breakwater just northward of which is an anchorage for small craft with a depth of 9 feet (2.7 m.). It does not afford much shelter and is seldom used.

Bishop and Clerks is an extensive shoal lying southward of Point Gammon and marked near the center by a lighthouse. There are several rocks awash at low water on an arm of the shoal extending nearly ⅞ mile southward from the lighthouse, marked at its end by a red buoy. The remainder of the shoal has depths of 12 to 18 feet (3.7 to 5.5 m.).

Bishop and Clerks Lighthouse is a gray granite tower. The light is flashing white flash 2 seconds, eclipse 8 seconds, 56 feet (17.1 m.) high and visible for 12 miles.

Point Gammon, at the eastern entrance to Hyannis Harbor, is a prominent wooded point marked by an unused lighthouse tower. A reef, partly bare at low water, extends ½ mile southward from the point, and is marked at the end by a red buoy. Extensive flats, with rocks bare at low water, extend 1 mile northwestward from Point Gammon. **Great Rock,** a bare rock marked by a spindle and cage, is on the western edge of the flats. A red buoy lies 300 yards westward of Great Rock.

Hyannis Harbor (chart 247).—This harbor is used considerably as a harbor of refuge by coasting vessels of less than 14-foot (4.3 m.) draft, which anchor behind the breakwater, where an area nearly ⅜ mile in diameter has been dredged to a depth of 15½ feet (4.8 m.). The depth in the channel up to the breakwater is 15 to 16 feet (4.6 to 5 m.), but the approach is somewhat obstructed by the flats extending westward from Point Gammon and an extensive shoal with numerous rocks on the west side of the channel. Ice seldom interferes with the movements of vessels, the prevailing northerly winds keeping the harbor clear. Bishop and Clerks lighthouse and Hyannis Lighthouse and beacon, the latter two forming a lighted range, are the guides for the entrance. Pilots for the harbor are located at Vineyard Haven (see p. 43), or local fishermen will come out on signal.

Hyannisport is a village on the northerly side of Hyannis Harbor. The railroad wharf is out of repair and is no longer used. There is a dredged basin 6 feet (1.8 m.) deep leading to the south side of the yacht landing on the west side of the harbor. Gasoline, fresh water, and some provisions can be obtained here.

Lewis Bay, large and shallow, extends northeastward from Hyannis Harbor. A channel 60 feet wide and 9 feet (2.7 m.) deep has

been dredged through the bar at the entrance and is marked by bush stakes in summer. This channel is subject to shoaling and in 1925 had a controlling depth of 6 feet (1.8 m.). The channel leading from Lewis Bay to Hyannis also had a controlling depth of 6 feet (1.8 m.). The deepest draft taken to Hyannis is about 8 feet (2.4 m.) at high water. Lewis Bay is closed by ice for about two months each winter.

Hyannis has railroad communication and is quite an important summer resort. Gasoline, ice, provisions, and some yacht supplies can be obtained here. **Storm warnings** are displayed where they may be seen from the bay.

Directions, Hyannis Harbor—From eastward.—Pass about ¾ mile northeastward of Bishop and Clerks lighthouse and 200 yards southward of Hallets Rock buoy (horizontally striped), then bring Bishop and Clerks lighthouse astern on a 318° true (NNW. ½ W. mag.) course until Hyannis Lighthouse and beacon (on railroad wharf) are in range. Steer this range, course 11° true (NNE. ¼ E. mag.), passing 60 or more yards eastward of the end of the breakwater, and anchor about 300 yards northeastward of the eastern end of the breakwater in 15 to 20 feet (4.6 to 6.1 m.), soft bottom. Small craft can anchor farther northward toward the railroad wharf in 6 to 12 feet (1.8 to 3.7 m.).

From westward.—Pass close southward of Wreck Shoal spar buoy No. 18 and steer 74° true (E. ⅛ N. mag.) for 2¼ miles, heading for Bishop and Clerks Lighthouse, and pass southward of Wreck Shoal buoy (at eastern end of shoal) and well northward of the buoys marking Eldridge Shoal and the northwest end of Horseshoe Shoal. Then steer 59° true (ENE. ½ E. mag.) for 4½ miles to a position about ⅜ mile southeastward of a red bell buoy. When Hyannis Lighthouse and beacon are on range, steer this range, course 11° true (NNE. ¼ E. mag.), passing eastward of a black buoy, and proceed as in the preceding paragraph.

Vessels going to Lewis Bay or Hyannis must be guided by the bush stakes marking the dredged channel and by the color of the water deepest where it is darkest.

HYANNIS HARBOR TO WOODS HOLE

Centerville Harbor (chart 247) is a bight 2 miles wide in the north shore of Nantucket Sound, westward of Hyannis Harbor. The approach to the anchorage is obstructed by rocks and shoals, through which a buoyed channel, with a depth of 10 feet (3 m.) at low water, leads to the anchorage, which has a depth of 15 to 21 feet (4.6 to 6.4 m.) and good holding ground. Vessels seldom anchor here for shelter, as the harbor is exposed to southerly winds; the shoals off the entrance somewhat break the force of the seas from southward, but not sufficiently to make it a safe anchorage. The deepest draft entering is about 12 feet (3.7 m.). Ice closes the harbor in winter.

The shoals in and off the entrance of Centerville Harbor, which are bare at low water, are **Collier Ledge** and **Southwest Rock** (both marked by beacons), **Gannet Rocks** (unmarked), **Spindle Rock** (near the head of the harbor and marked by a red buoy), and

numerous rocks southward of Hyannis Point. There are numerous unmarked rocks with 1 to 6 feet (0.3 to 1.8 m.) over them.

Centerville is a village inland from the head of the harbor; a church spire in the village is prominent and is used as a guide for entering the harbor.

East Bay, on the west side of Centerville Harbor, has depths of 2 to 4 feet (0.6 to 1.2 m.). Its entrance is 250 feet wide between jetties, through which a channel has been dredged 100 feet wide and 6 feet (1.8 m.) deep, but it is subject to shoaling. With local knowledge a draft of 3 feet (0.9 m.) could be carried to the landing on the southwest side of the bay in 1925. Two private buoys mark the entrance to the channel in summer. This bay is used principally by oyster boats, but local launches often pass through the bay into Centerville River. The river is shoal and is crossed by a drawbridge near its mouth. Small boats anchor in the river off the village of Centerville.

Directions, Centerville Harbor.—A 330° true (N. by W. ¼ W. mag.) course, passing eastward of Gallatin Rock buoy, midway between Bearse and Channel Rock buoys, and westward of Gannet Ledge buoy, leads over a least found depth of 10 feet (3 m.). Anchor about ½ mile from shore in 15 to 21 feet (4.6 to 6.4 m.) soft bottom. Strangers should not enter except in the daytime with clear weather.

Cotuit Anchorage is an anchorage for small craft between the shoals making off from the shore about 6½ miles westward of Point Gammon. It is exposed to southerly winds and is seldom used except by local craft. The channel is marked by buoys, and vessels of less than 6 feet (1.8 m.) draft should experience no difficulty in keeping in the best water. Anchorage can be had close northward of buoy No. 4, in a depth of 10 feet (3 m.); or from buoy No. 4, steer 346° true (N. mag.) and anchor in 7 to 12 feet (2.1 to 3.7 m.) ½ to ¼ mile from shore. Approaching from westward the channel between Succonesset Shoal and Wreck Shoal is frequently used.

West Bay, on the northerly side of Cotuit Anchorage, has an entrance 200 feet wide between jetties, and a depth of about 4 feet (1.2 m.) at low water can be taken through the entrance and the narrow channel leading to the northern half of the bay. The channel is usually marked by private buoys during the summer. There are numerous oyster stakes in the bay. A depth of about 4 feet (1.2 m.) can be taken through a narrow channel from West Bay to Great Bay. It is crossed by a drawbridge with an opening about 14 feet wide. There are several oyster wharves in the vicinity of the bridge. **Ice** closes the bay for two months each winter.

Cotuit Bay, northwestward of Cotuit Anchorage, is entered through a dredged channel 100 feet wide and 8 feet (2.4 m.) deep, and there is a greater depth in the bay except at its southern end. The channel is usually marked by bush stakes. A depth of about 4 feet (1.2 m.) can be taken through the narrows from Cotuit Bay to **Great Bay;** the latter has depths of 6 to 18 feet (1.8 to 5.5 m.). Local knowledge is necessary for the navigation of these bays. The bays is closed by ice about two months of each winter.

Cotuit is a village on the western side of Cotuit Bay, and **Osterville** is a village on the eastern side of Great Bay. Gasoline, fresh water, and provisions can be obtained at these villages. There is

a depth of 4 feet (1.2 m.) at the wharves at Oysterville. There are facilities for repairing small boats at Oysterville and Cotuit. The nearest marine railway is located at Falmouth.

Poponesset Bay is used only by local oyster boats. The entrance is narrow and unmarked, dredged to 60 feet wide and 6 feet (1.8 m.) deep, and extends southwestward from the inner end of the entrance channel of Cotuit Bay. The entrance channel is subject to shoaling, and in 1925 was good for a draft of only 3 feet (0.9 m.). The greater part of the pond has depths of 2 to 4 feet (0.6 to 1.2 m.).

Waquoit Bay has general depths of 2 to 8 feet (0.6 to 2.4 m.), and an entrance about 250 feet wide. There is a short jetty on the eastern side of the entrance. The channel into the bay is crooked and difficult and is subject to change. In 1925 a draft of 4 feet (1.2 m.) could be carried across the bar into the bay. The channel across the bay is marked by bush stakes, but is little used. Local knowledge is necessary to enter the bay.

Menauhant is a summer colony 1 mile westward of the entrance to Waquoit Bay.

The outlets of the ponds between Waquoit Bay and Falmouth Inner Harbor are closed and not used.

Falmouth Heights is a prominent yellow bluff on the summit of which are numerous houses and a large hotel; it lies just eastward of the village of **Falmouth** and about 3 miles east-northeastward of Nobska Point Lighthouse (chart 249).

Falmouth Inner Harbor, westward of Falmouth Heights, is entered by a dredged channel 100 feet wide and 7 feet (2.1 m.) deep between jetties; the outer end of the west jetty is marked by a flashing white light. An anchorage basin 1,300 feet long, 100 to 350 feet wide, and 8 feet (2.4 m.) deep has been dredged inside the entrance. The greater part of the pond has depths of 2 to 3 feet (0.6 to 0.9 m.). There is a marine railway for boats 70 feet long and 8 feet draft; it has a capacity of 30 tons. Gas engine and hull repairs can be made. The depth at the power-house wharf is 8 feet (2.4 m.) and at the other wharf 7 feet (2.1 m.). Gasoline and provisions can be obtained.

Falmouth Harbor is the open roadstead on the north shore of the sound from 1 to 3 miles eastward of Nobska Point Lighthouse. It is frequently used by vessels with good ground tackle, who prefer the anchorage here to the one in Vineyard Haven on account of the crowded condition of the latter in bad weather. It affords a lee in northerly winds, and in southerly winds the sea is somewhat broken by L'Hommedieu Shoal, so that vessels with good ground tackle can ride out a gale in comparative safety.

The **anchorage** in Falmouth Harbor is about ¾ mile from shore in 4 to 6 fathoms (7 to 11 m.), and small vessels can anchor closer to shore in 15 to 18 feet (4.6 to 5.5 m.); the bottom is generally sticky and good holding ground, shoaling gradually toward the shore. At night, if less than 2 miles eastward of Nobska Point, with West Chop Light bearing eastward of 167° true (S. mag.), vessels should anchor just before Nobska Point Light comes in range with Tarpaulin Cove Light; if farther eastward, vessels should keep well southward of this range. Vessels can enter from southward on a 344° true (N. ¼ W. mag.) course, with West Chop Light astern, and

pass about ¼ mile westward of black buoy No. 19. Or, pass ⅜ to ½ mile eastward of Nobska Point Light on a north-northeasterly course, and when Tarpaulin Cove Light is nearly in range with Nobska Point Light, stand eastward to an anchorage.

WOODS HOLE

(chart 348) is a narrow passage leading between numerous ledges and shoals from Vineyard Sound to Buzzards Bay, between the mainland and **Nonamesset Island.** It is well marked by buoys and beacons, but the tidal currents are so strong that the passage is dangerous without some local knowledge. The buoys in the narrowest part of the channel are frequently towed under by the currents. A stranger should not attempt to pass through except near slack water. Woods Hole is little used as an anchorage on account of the strong tidal currents and the narrow channel. Great and Little Harbors are on the northern side.

The northerly channel in Woods Hole from Great Harbor to Buzzards Bay has a narrow but straight reach and was dredged 300 feet wide and 13 feet (4 m.) deep, but there are numerous spots with 10 to 12 feet (3 to 3.7 m.) over them. Another channel, **Broadway,** was dredged 300 feet wide and 11 feet (3.4 m.) deep, but it necessitates a sharp turn; the straight reach should be given the preference on account of the difficulty in making the turn in the strong currents. The deepest draft using the passage are local steamers of 11 feet (3.4 m.) draft.

Nobska Point, on the eastern side of the approach to Woods Hole, is a low bluff marked by a lighthouse. Ledges, partly bare at low water, extend 150 yards southwestward from the point.

Nobska Point Lighthouse is a white tower with a covered way to a dwelling on a bluff at the end of Nobska Point. The light is fixed white with a red sector from 263° to 289° covering Hedge Fence and L'Hommedieu Shoals, 87 feet (26.5 m.) high and visible for 15 miles. The fog signal is a reed horn, group of 3 blasts every 30 seconds, blasts each 2 seconds duration, silent 22 seconds. **Storm warnings** are displayed near the lighthouse.

Little Harbor is the easternmost of the two coves in the north shore of the passage. A channel 150 feet wide and 15 feet (4.6 m.) deep has been dredged to the wharf of the lighthouse depot, which is on the western side of the cove, and a turning basin 400 feet wide and 12 to 15 feet (3.7 to 4.6 m.) deep in front of the wharf. Small craft can anchor off or above the wharf, favoring the western side, in 7 to 15 feet (2.1 to 4.6 m.) The dredged channel is marked by buoys, the course into the harbor through it is 351° true (N. ½ E. mag.).

Great Ledge is an extensive rocky shoal, awash at extreme low water, between the entrances to Little and Great Harbors. A red spar buoy marks its southwest side.

Nonamesset Shoal is partly bare at low water, has depths of 10 to 13 feet (3 to 4 m.) near its edge, and extends 400 to 500 yards eastward from the island on the western side of the entrance to Great Harbor. The shoal is marked at its southeasterly end by a black bell buoy, and on its easterly side by a black spar buoy.

Great Harbor has an anchorage at the head about ¼ mile long and nearly ¼ mile wide; its depth is irregular, ranging from 3½ to 12 fathoms (6 to 22 m.) in the channel, and the holding ground is mostly poor. On the eastern side of the harbor is the wharf and depot of the New York, New Haven & Hartford Railroad; and above this is the wharf, basin, and large buildings of the United States Bureau of Fisheries, which are prominent when entering from southward. Shoals with 5 to 9 feet (1.5 to 2.7 m.) over them extend 400 yards from the northwesterly end of the harbor. There is good anchorage 200 yards northwestward of the Bureau of Fisheries wharf, in 5 to 8 fathoms (9 to 15 m.). A rock with 5 feet (1.5 m.) over it and marked by a red buoy lies close to the southern end of this wharf.

Red Ledge (awash at low water) and **Grassy Island** lie on the western side of Great Harbor opposite Parker Flats. The straight channel through Woods Hole leads between these dangers, and is marked by two buoys and on its northerly side by Grassy Island Ledge Light. The northeasterly end of the ledges surrounding Grassy Island is marked by a black buoy. The channel to the anchorage in Great Harbor leads between this buoy and the end of the Bureau of Fisheries wharf.

Great Harbor range lights, fixed red on white posts, on the Bureau of Fisheries wharf, lead into Great Harbor from Vineyard Sound in a depth of over 18 feet (5.5 m.). The course on the range is 345° true (N. mag.), and the range should be held until past Parker Flats buoy. Then steer north-northwestward and pass eastward of the black buoy lying northeastward of Grassy Island, and pass about 75 yards westward of the Bureau of Fisheries wharf. When entering on the range, attention should be paid to the currents through Woods Hole; the current from Buzzards Bay has a tendency to set vessels eastward. (See also the directions for Woods Hole following.)

Hadley Harbor is at the northwest end of Nonamesset Island, between it and **Uncatena** and **Naushon Islands.** Owing to its size and narrow, crooked channel, it is suitable only for small craft, for which it forms a well-sheltered anchorage. The entrance is from northeastward, is 60 yards off the south shore, and leads between ledges on both sides; those on the south side are marked by a private stone beacon and those on the north side by a private buoy. There are two wharves on the western side of the harbor; the northern one has a depth of about 12 feet (3.7 m.) at the end. Chart 348 is the guide.

Middle Ledge, on the south side of the channel in Woods Hole, is partly bare at low water, and is marked at its easterly end by a black can buoy and at its westerly end by Middle Ledge Light; just north of the light is a black spar buoy.

Rocks, with little water over them in places, extend about 250 yards off the westerly side of **Long Neck,** and are marked at the southwest end by a red buoy, which lies 600 yards northwestward of Middle Ledge Light. **Hadley Rock,** lying about ¼ mile west-southwestward of Middle Ledge Light, has a least depth of 5 feet (1.5 m.) over it and is marked by two horizontally striped buoys.

Woods Hole has railroad and bus communication with the interior of the State. It is the location of an important Bureau of

Fisheries station, a lighthouse depot, and is the headquarters of a fleet of Coast Guard vessels. A channel dredged to a depth of 8 feet (2.4 m.), crossed by a drawbridge 36 feet wide, leads from Great Harbor to **Eel Pond.** A marine ways with a capacity of about 30 tons is located on Eel Pond, and light repairs to machinery can be made. Gasoline, fresh water, provisions, and some yacht supplies can be obtained at Woods Hole.

A **time ball** is dropped daily, Sunday excepted, on a staff on the tower of the Bureau of Fisheries buildings, at noon, seventy-fifth meridian time. This time signal can be seen by vessels at anchor in Great Harbor.

Tides.—The mean rise and fall of tides in the passage is about 2 feet. High water occurs at about the strength of the west-flowing current, and low water at about the strength of the east-flowing current. Strong northwesterly winds may lower the water in the passage as much as 2 feet.

Currents.—In the passage through Woods Hole the current turns from east to west about one and one-half hours after the current turns eastward in Cape Cod Canal (approximately one hour before the time of Boston high water), and from west to east about one and one-half hours after the current turns westward in Cape Cod Canal (approximately one hour before the time of Boston low water). In the narrowest part of the passage the velocity at strength is 5½ knots during spring tides and 4½ knots during neap tides. The east-flowing current is somewhat stronger than the west-flowing, owing to the greater depth of water then prevailing. Both the velocity of the current and time of slack water are affected by strong winds. At either entrance to Woods Hole the velocity of the current at strength is nearly 1 knot.

In the upper part of Great Harbor, near the Bureau of Fisheries wharf, the currents are barely perceptible and vessels at anchor lie head to the wind.

Ice.—The strong tidal currents usually keep Great Harbor open. Drift ice is brought through from Buzzards Bay, but seldom interferes with navigation, except in unusually severe winters, when it may close the entrance from that bay.

DIRECTIONS, WOODS HOLE

The following directions are good for vessels of 10-foot (3 m.) draft with slack water in Woods Hole:

Approaching from eastward, pass about ¼ mile southward of Nobska Point and Coffin Rock buoy on a west-southwesterly course; or, from Nobska Point gas and bell buoys, steer 279° true (WNW. mag.) until on the Great Harbor range. From westward give the south side of the Elizabeth Islands a berth of about ½ mile, and steer for Nobska Point Lighthouse on any bearing northward of 51° true (NE. by E. ¾ E. mag.) until about ¾ mile from it and on the Great Harbor range.

Steer 345° true (N. mag.) on the Great Harbor range (two red lights on the Bureau of Fisheries wharf), and pass about 150 yards eastward of Nonamesset Shoal bell buoy, about 50 yards westward of the red spar buoy marking Great Ledge, and about 50 yards eastward of the black spar buoy off the eastern side of Nonamesset Shoal.

When nearly up with Parker Flats buoy, a red buoy and a black buoy will be seen close westward, the red buoy lying just southward of Grassy Island Ledge Light (a spindle with lantern). Turn sharply westward, pass midway between these buoys on a 257° true (W. ⅛ N. mag.) course, and pass about 200 feet northward of a black can buoy and about 100 feet northward of a black spar buoy (lying close northward of Middle Ledge Light). When past the latter buoy bring Middle Ledge Light astern on a 284° true (NW. by W. ½ W. mag.) course, heading for the north end of Uncatena Island, until the red buoy off Long Neck is about 100 yards distant and in range with the western side of Long Neck, bearing 14° true (NNE. ½ E. mag.). Then steer 330° true (N. by W. ⅜ W. mag.), which will lead into Buzzards Bay about 300 yards eastward of the black bell buoy off Naushon Point Shoal.

Vessels of 7-foot (2.1 m.) or less draft can pass 300 yards southwestward of Nobska Point and steer 290° true (NW. by W. mag.) so as to pass about 200 yards southward of Parker Point, leaving Coffin Rock buoy well to the southward and the red buoy off Parker Point about 100 yards to the eastward. Then steer 333° true (N. by W. ⅛ W. mag.) for the end of the Bureau of Fisheries wharf until nearly up to Parker Flats buoy, and if going through into Buzzards Bay, follow the directions in the preceding paragraph.

WOODS HOLE TO CUTTYHUNK

Elizabeth Islands, extending 14 miles west-southwestward from the mainland at Woods Hole, separate Vineyard Sound from Buzzards Bay. They are hilly, partly wooded, and the shores are, in general, low bluffs. Several buoyed channels lead between the islands, but Quicks Hole is the only one fit for a stranger.

Tarpaulin Cove is a bight about ½ mile in diameter in the south shore of Naushon Island, about 5 miles west-southwestward of Nobska Point Lighthouse; it affords shelter from northerly and westerly winds and is frequently used. The western point at the entrance is marked by Tarpaulin Cove Lighthouse, and two buoys are placed to guide clear of rocks near the western shore of the cove. Good anchorage in 16 to 18 feet (4.9 to 5.5 m.), good holding ground, will be found in the cove, with Tarpaulin Cove Lighthouse bearing between 212° true (SW. mag.) and 189° true (SSW. mag.); deep-draft vessels should anchor farther out in 6 fathoms (11 m.) or more. The shore of the cove should be given a berth of 200 yards, and the western end over 300 yards. **Storm-warning** displays are made at the cove.

Tarpaulin Cove Lighthouse is a white tower on the southwest side of Tarpaulin Cove. The light is flashing white, flash 0.4 second, eclipse 4.6 seconds, 78 feet (23.8 m.) high and visible 15 miles. The fog signal is a bell, 1 stroke every 15 seconds.

Robinson Hole (chart 345) is a narrow passage from Vineyard Sound to Buzzards Bay, leading between Naushon Island and **Pasque Island**; the southern entrance lies 2½ miles westward of Tarpaulin Cove. This passage is buoyed, but is narrow, full of rocks and ledges, has strong tidal currents. The buoys often tow under with the currents and the passage should never be attempted by a stranger; local fishermen sometimes pass through it.

Quicks Hole (chart 345) leading between Pasque Island on the east and Nashawena Island on the west, is the only passage from Vineyard Sound into Buzzards Bay eastward of Cuttyhunk available for vesels of over 10-foot (3 m.) draft. It is much used by tows, especially with westerly or southerly winds, to avoid the very heavy sea in the entrance of Vineyard Sound, and also because a secure anchorage from these winds can be had if necessary on the north side of Nashawena Island. The passage is considered unsafe for a long tow at night, but otherwise it may be used by steamers either night or day.

Quicks Hole lies about 4 miles westward of Tarpaulin Cove and is about 5/8 mile wide, with a clearly defined entrance which bears 355° true (N. 3/4 E. mag.) from Gay Head Lighthouse. The channel is nearly straight, has a width of 700 yards, and is marked by buoys. The general depth is over 5 fathoms (9 m.), but there are several spots with 16 to 18 feet (4.9 to 5.5 m.) over them and a number with depths of 24 to 27 feet (7.3 to 8.2 m.). The eastern side is foul from Pasque Island out to the gas buoy. The passage has been examined by means of a wire drag and the dangers charted, but on account of the broken nature of the bottom the passage is not recommended for a greater draft than 21 feet (6.4 m.) in the absence of local knowledge.

The tidal currents have considerable velocity, and a sailing vessel should not attempt to pass through unless with a strong favorable wind or a favorable current. Deep-draft vessels should be careful not to be set off their courses. When the current is setting westward through Vineyard Sound it is setting northward through Quicks Hole, and vice versa. Strong winds affect the regularity of the currents.

Directions, Quicks Hole.—Enter Quicks Hole about midway between Pasque and Nashawena Islands, or pass 1/4 mile eastward of the black buoys on the southwest side of the entrance and steer 330° true (N. by W. 1/2 W. mag.) with Quicks Hole Ledge gas buoy a very little on the starboard bow; at night Dumpling Rock Lighthouse should be ahead on this course, showing just westward of the gas buoy. Continue the course to a position about 200 yards westward of the gas buoy. Then steer 355° true (N. 3/4 E. mag.) with Gay Head Lighthouse astern, which will lead into Buzzards Bay 1/4 mile eastward of Lone Rock buoy. The course can then be shaped up or down Buzzards Bay as desired.

Cuttyhunk Lighthouse is a white conical tower with a covered way to a dwelling, on a bluff at the west end of Cuttyhunk Island. The light is fixed white, 61 feet (18.6 m.) high and visible for 13 miles.

Sow and Pigs Reef, Cuttyhunk Harbor, and Canapitsit Channel are described with Buzzards Bay.

BUZZARDS BAY

(chart 249) indents the south shore of Massachusetts in a northeasterly direction north of the Elizabeth Island, the latter separating the bay from Vineyard Sound. It is the approach to New Bedford Harbor and many smaller towns and villages and to the entrance of Cape Cod Canal, through which a draft of 22 feet (6.7 m.) can be carried to Cape Cod Bay.

The shores are irregular, being broken by many bays and rivers, and in general are rocky in character. Large bowlders are a prominent feature and in places extend some distance from shore, rendering close approach to the shore dangerous.

The main part of Buzzards Bay and its approach have been surveyed by means of a wire drag. The bottom in this locality is very broken, with bowlder reefs in places, and vessels should proceed with caution when crossing shoal areas in the tributaries of the bay where the depths are not more than about 6 feet (1.8 m.) greater than the draft. The bay has deep water as far as Wings Neck, above which it is full of shoals.

About 1 mile northward of the town of Marion is a group of prominent radio masts.

Channels.—There are three entrances to the bay, two of which, the main entrance and Quicks Hole, are used by sailing vessels. Woods Hole and Quicks Hole, the entrances from Vineyard Sound, are described under separate headings preceding.

The western and main entrance is northward of Cuttyhunk Island and has a clear width of 4¼ miles between Sow and Pigs and Hen and Chickens Reefs. The bottom in this entrance is irregular and rocky, and there are spots with 2¾ to 5¾ fathoms (5.1 to 10.4 m.) (on which the sea breaks in heavy southwest gales), surrounded by deeper water, so that extra caution is necessary for vessels of 16 feet (4.9 m.) or more draft when entering the bay. Cuttyhunk Lighthouse, Vineyard Sound Lightship, and Hen and Chickens Lightship are the guides for entering, and Gay Head Lighthouse is a guide for vessels approaching from southward.

Hen and Chickens is the ledge making off nearly 1½ miles southward from Gooseberry Neck, on the northern side of the entrance to Buzzards Bay. It has a number of spots with 4 to 9 feet (1.2 to 2.7 m.) over them, and near the southern end are several rocks bare at half tide. **Old Cock,** one of these rocks, is 3 feet (0.9 m.) out at low water and marked by a black spindle with cage. The south end of the ledge is marked by a black buoy, which lies ¾ mile north-northwestward from Hen and Chickens Lightship. Rocks with 22 feet (6.7 m.) over them lie 1 to 1¼ miles, and another rock with 17 feet (5.2 m.) over it lies 1¾ miles 189° true (SSW. mag.) from Old Cock spindle. A horizontally striped whistling buoy marks the southern side of the 17-foot (5.2 m.) spot.

Sow and Pigs Reef extends 1⅜ miles in a west-southwest direction from Cuttyhunk. It is in part dry or awash at low water and has an average width of about 400 yards; at its westerly end it has a depth of 15 feet (4.6 m.), and is marked by a red bell buoy, which lies about 1½ miles northeastward from Vineyard Sound Lightship.

Ribbon Reef is a small detached ledge with 18 feet (5.5 m.) over it lying 1½ miles northwestward of Cuttyhunk Lighthouse. It is surrounded by deep water and marked off its northern side by a horizontally striped buoy. About 1¼ miles northward of Ribbon Reef is a ledge with 23 feet (7.0 m.) over it, on which the sea breaks in heavy southwest gales; it lies about 1⅝ miles 88° true (E. by S. mag.) from Hen and Chickens Lightship.

Mishaum Ledge is a number of shoal, rocky spots, one of which has a depth of 8 feet (2.4 m.) over it. The ledge extends 1¾ miles off the northern shore, about 3 miles eastward of Gooseberry Neck;

it is marked by a red sector in Dumpling Rock Lighthouse, and off its southeastern end by a black gas and bell buoy. Strangers should pass southward of this buoy.

A rock with 22 feet (6.7 m.) over it lies nearly 1 mile north-northwestward of the northern end of Penikese Island, and another rocky spot with 18 feet (5.5 m.) over it lies ½ mile northward of the northern end of the island. The channel between the northernmost of these rocks and Mishaum Ledge is about 1½ miles wide.

Hen and Chickens Lightship has a black hull with "Hen & Chickens" on both sides and two masts with a black circular grating at each masthead. The light is fixed white, 45 feet (13.7 m.) above the water and visible for 12 miles. The fog signal is an air whistle blowing groups of 2 blasts every 60 seconds, blast 3 seconds, silent 4 seconds, blast 3 seconds, silent 50 seconds. If the whistle is disabled, a bell will be struck by hand.

Anchorage.—New Bedford Harbor affords anchorage for vessels of 23-foot (7 m.) draft and is described on page 85. Cuttyhunk Harbor, described on page 73, affords anchorage in 12 to 24 feet (3.7 to 7.3 m), but is exposed to northeasterly winds. There is a good anchorage, sheltered from all southerly winds, on the northerly side of Nashawena Island eastward of Penikese and Gull Islands, in 7 to 8 fathoms (13 to 15 m.). This anchorage is frequently used by tows, and is available for vessels of any draft.

Prohibited anchorages.—Regulations prescribed by the Secretary of War prohibit anchorage in the fairway leading to Cape Cod Canal or the fairway leading through New Bedford Outer Harbor. Officers of the Coast Guard are charged with the enforcement of the regulations governing anchorage grounds. Copies of the rules and regulations with descriptions of the anchorage areas for Narragansett Bay, New Bedford Outer Harbor, Buzzards Bay (in the approach to Cape Cod Canal), and Vineyard and Nantucket Sounds can be obtained from the United States Engineers, Providence, R. I. Rules and regulations governing these anchorages are given on page 43 of this volume.

Anchorage areas prescribed for New Bedford Outer Harbor are described on page 88. Anchorage areas near the entrance to the approach channel to Cape Cod Canal are defined as follows:

Mercantile anchorage.—Within the triangular area west of the line parallel to and 220 yards northwesterly from a line bearing 39° and ranging from Buzzards Bay gas and bell buoy through the central point between Canal Channel gas buoy No. 1 and Canal Channel gas and bell buoy No. 2; south of a line bearing 270° and ranging from Canal Channel gas buoy No. 4 through a point which is 1,070 yards distant from Wings Neck Lighthouse on a line bearing 309° and ranging toward Dry Ledge buoy No. 12; and east of a line bearing 0° and ranging from Cleveland Ledge buoy No. 7, toward a point 200 yards east of Dry Ledge buoy No. 12.

Naval anchorage.—Within the rectangular area 2,000 yards long and 1,000 yards wide east of a line parallel to and 200 yards southeasterly from the line bearing 39° and ranging from Buzzards Bay gas and bell buoy through the central point between Canal Channel gas buoy No. 1 and Canal Channel gas and bell buoy No. 2. the north end of the area being 333 yards southwesterly from Wings Neck Lighthouse.

Pilots.—State pilotage is compulsory for all vessels over 7 feet (2.1 m.) draft, except fishing vessels other than whalers, vessels regularly employed in the coasting trade, and steam vessels carrying United States licensed pilots. Pilots for Buzzards Bay and

for many of its harbors can be had at Cuttyhunk or off the entrance of the harbor to which the vessel is bound. Vessels bound through Cape Cod Canal make signal for a pilot off Wings Neck Lighthouse.

Towboats can be had at New Bedford. Towboats for Cape Cod Canal can be had by making signal off Wings Neck Lighthouse.

Storm-warning displays are made at Cuttyhunk, New Bedford, and Wings Neck Lighthouse.

Tides.—The mean rise and fall of the tides is about 4 feet throughout the bay.

Currents.—In the passages from Buzzards Bay to Vineyard Sound the currents have great velocity, and require special attention. At Hen and Chickens Lightship, from observations during one autumn, the following results have been obtained:

The tidal current is rotary, turning clockwise. The strength of flood occurs about 3 hours after the current turns eastward in Cape Cod Canal (approximately ¾ hour after low water at Boston) and sets 50° true (NE. by E. ¾ E. mag.), with an average velocity of 0.7 knot. The strength of ebb occurs about 2½ hours after the current turns westward in Cape Cod Canal (approximately ½ hour after high water at Boston) and sets 230° true (SW. by W. ¾ W. mag.), with an average velocity of 0.7 knot. Since the current is rotary, there is no true slack; the average minimum velocity is about 0.2 knot, and sets northwesterly about ½ hour before the current turns eastward at Cape Cod Canal (approximately 2½ hours before low water at Boston) and southeasterly about ½ hour before the current turns westward at Cape Cod Canal (approximately 2½ hours before high water at Boston).

The greatest observed velocity was 1.6 knots, setting southwesterly, during a northeasterly wind with a velocity of 34 miles an hour.

Ice.—The head of the bay and the harbors in its vicinity are generally closed to navigation during the winter months; the approaches to the harbors on the eastern shore are rendered dangerous by drift ice, which in exceptionally severe winters extends across the bay and joins the local formations on the western shore, thus forming an impassable barrier for short periods. It forms more rapidly in the bay with the wind from north to west. Under ordinary circumstances a northeast wind, if continued for 48 hours, will clear the bay of ice. Southerly winds, especially southeasters, diminish the extent and weaken the strength of the pack. The ice does not usually affect the positions of the spar buoys in the bay, but the light vessels, and even the buoys, are sometimes carried away by unusually heavy floes.

In New Bedford Harbor steamers can generally make their way in and out during the winter, but sailing vessels require the assistance of a towboat to break the ice. During very severe winters, however, the harbor is at times entirely closed to all navigation. Ice forms rapidly in calms or light winds from north to west, and strong winds from north to northeast break it up and carry it off.

DIRECTIONS, BUZZARDS BAY

Keeping in mind the broken character of the bottom, vessels should proceed with caution when crossing areas where the charted depth is

not more than 6 feet (1.8 m.) greater than the draft. Vessels of over 16-foot (4.9 m.) draft should avoid the broken ground in the entrance of Buzzards Bay.

From Point Judith gas, whistling, and submarine bell buoy a 72° true (E. ½ N. mag.) course for 21½ miles leads to a position ⅜ mile northward of Hen and Chickens Lightship. Then steer 66° true (E. by N. mag.) to a position ½ mile south-southeastward of Mishaum Ledge gas and bell buoy; or, **from a position 2½ miles southeastward of Block Island southeast lighthouse,** a 50° true (NE. by E. ¾ E. mag.) course for 33¾ miles will lead to a position ½ mile south-southeastward of Mishaum Ledge gas and bell buoy, passing ⅜ mile southeastward of the 17-foot (5.2 m.) rock lying 1⅜ miles 223° true (SW. by W. mag.) from Hen and Chickens Lightship, and nearly ⅝ mile southeastward of the lightship.

From the position ½ mile south-southeastward of Mishaum Ledge gas and bell buoy, a 66° true (E. ⅞ N. mag.) course for 5½ miles will lead to a position ¾ mile south-southeastward of Negro Ledge gas and bell buoy; then a 42° true (NE. by E. mag.) course for 9⅛ miles will lead to a position midway between Cleveland Ledge buoy and the red buoy eastward of it. From here a 20° true (NE. by N. mag.) course for 3⅛ miles will lead to the gas buoys at the entrance of the dredged channel leading to the Cape Cod Canal. The least depth crossed on these courses is about 28 feet (8.6 m.). For directions, Cape Cod Canal, see page 79.

CUTTYHUNK HARBOR

(chart 297) is on the south side near the western entrance of Buzzards Bay, and is formed by a bight between the eastern end of Cuttyhunk and western end of Nashawena Islands. It is about ¾ mile wide, and affords anchorage in 12 to 24 feet (3.7 to 7.3 m.), but is exposed to northeasterly winds. Northward of the harbor are Penikese and Gull Islands and a number of ledges, which shelter it from that direction. The shores on both sides of the harbor are foul, and the anchorage is in the middle; it is sometimes used by weather-bound coasting vessels and fishermen. The principal dangers are marked by buoys, and the approach from westward is marked by Cuttyhunk Lighthouse, which is near the western end of the island. There is a prominent lookout tower on the highest part of the island.

Penikese Island is bare and hilly and is occupied by the cottages of a leper colony. Shoal water extends from Penikese to **Gull Island** and no attempt should be made to pass between them. Rocky ledges extend southward and westward from Gull Island and are marked by black buoys. The eastern point at the entrance and the eastern shore of the harbor should be given a berth of over 300 yards.

Shoals extend out about ½ mile northeastward from Cuttyhunk Island, **Whale Rock** and **Pease Ledge** being the names given to the parts which show at low water. A detailed description of the dangers would be of but little use; vessels must be guided mainly by the buoys and the chart.

Cuttyhunk Pond, on the southwest side of the harbor, has an entrance between jetties. The northern jetty is marked at the outer

end by a light. Between the jetties a channel with a least width of 60 feet and depth 12 feet (3.7 m.) has been dredged to the town landing of **Gosnold** (Cuttyhunk post office) on the south side just inside the entrance of the pond. A turning basin of the same depth 300 feet long and 150 feet wide has been dredged at the wharf, and an anchorage basin 600 feet long, 150 feet wide, and 8 feet (2.4 m.) deep has been dredged just northwestward of the turning basin. The entrance channel is subject to shoaling and in 1925 had a controlling depth of only 10 feet (3 m.). The pond is partly dry at low water and has depths up to 4 feet (1.2 m.), but has considerable grass in the summer. Gasoline and a small quantity of provisions can be had. Communication is by daily launch with New Bedford.

Canapitsit Channel, the dredged cut between Nashawena and Cuttyhunk Islands, forming a connection between Cuttyhunk Harbor and Vineyard Sound, has a depth of 6 feet (1.8 m.) and is marked by several buoys. It is used by local craft of 5-foot (1.5 m.) draft. The **currents** are strong, and in southerly winds a heavy sea breaks across the entrance.

Storm-warning displays are made at the Coast Guard station on the south side of the harbor.

Ice.—Drift ice is carried into the harbor with northerly winds and closes the harbor for short periods during severe winters.

Directions, Cuttyhunk Harbor.—Strangers should not enter except in the daytime with clear weather. If entering from westward, a greater draft than 15 feet (4.6 m.) should not be taken in.

From eastward.—Care should be taken to avoid **Lone Rock,** which lies about ¾ mile northward of the northeastern end of Nashawena Island. When westward of Quicks Hole and Lone Rock, steer 246° true (W. ⅞ S. mag.) for the northern end of Cuttyhunk Island, giving the northern shore of Nashawena Island a berth of about ½ mile and passing ¼ mile southward of the bell buoy. When 100 yards southward of the black spar buoy southward of Gull Island, steer 223° true (SW. by W. mag.), heading for the red buoy northeastward of Pease Ledge. When this buoy is ¼ mile distant and Gay Head is just open westward of Nashawena Island, anchor in the middle of the harbor eastward of the buoy. Or, if less than 9-foot (2.7 m.) draft, steer 184° true (S. by W. ⅝ W. mag.) for the Coast Guard station on the south side of the harbor, and anchor a little over ¼ mile from the shore, in 16 to 18 feet (4.9 to 5.5 m.).

From westward.—Steer for Cuttyhunk Lighthouse on any bearing between 68° true (E. ¾ N. mag.) and 122° true (SE. mag.), which leads between Sow and Pigs Reef and Ribbon Reef. Pass ½ mile northward of the lighthouse and steer 49° true (NE. by E. ⅝ E. mag.) for the black buoy marking Middle Ground. Pass about 30 yards southward of this buoy, steer 82° true (E. ½ S. mag.), and pass about 100 yards northward of the horizontally striped buoy marking Middle Ledge. Pass about midway between Middle Ledge buoy and the black buoy westward of Gull Island and steer 122° true (SE. mag.) for about ¼ mile. Then steer 184° true (S. by W. ⅝ W. mag.) for the Coast Guard station on the south side of the harbor. Anchor near midharbor, eastward of the southernmost red buoy, in 3 to 4 fathoms (5.5 to 7.3 m.).

Gay Head Lighthouse, open a little westward of Nashawena Island, clears the rock westward of the southern end of Penikese

Island, and the light just shut in leads between the shoals making off Gull and Cuttyhunk Islands.

To enter Cuttyhunk Pond from the anchorage, steer 237° true (WSW, ¼ W. mag.) to a mid-channel position southward of the light on the end of the breakwater, then steer 250° true (W. ½ S. mag.) for 200 yards until 100 feet off the south shore; then follow the shore at this distance to the wharf.

BUZZARDS BAY, EASTERN SIDE

The Elizabeth Islands, Quicks Hole, and Robinson Hole are described, beginning on page 68.

Weepecket Island and the two islets northeastward of it are bare and rocky. **Weepecket Rock,** 1¼ miles northeastward of Weepecket Island, has 10 feet (3 m.) over it and is marked by a buoy. These, with **Lone Rock,** off the north entrance to Quicks Hole, are the principal off-lying dangers between Cuttyhunk Harbor and Woods Hole.

Woods Hole is described on page 65.

The easterly shore of Buzzards Bay northward of Woods Hole has shoals, many of them rocky, making out a greatest distance of about 1 mile, the ends of which are marked by red buoys. The harbors are shoal and are frequented only by small local craft. Gasoline, provisions, ice, and a small quantity of motor-boat supplies can be obtained at the villages. A railroad extends southward to Woods Hole, affording communication to the towns and villages on the eastern shore.

Quamquisset Harbor (chart 249), a small harbor lying 1½ miles northeastward of the northern entrance of Woods Hole, has a narrow, buoyed entrance with a depth of about 9 feet (2.7 m.). Small craft, closely following the buoys and passing southward of the horizontally striped inner buoy, can anchor in the middle of the harbor southeastward of this buoy, in 16 to 18 feet (4.9 to 5.5 m.), sticky bottom, width of anchorage 250 yards. Local boats anchor in the northeastern part of the harbor. To go to this anchorage, pass midway between the small, grassy islet and the point northward of it, and anchor in the middle in 15 to 18 feet (4.6 to 5.5 m.). The shoal extending about 75 yards off the point on the west side northward of the islet was marked by a bush stake in 1925. There are several landings on the southeastern shore and a small wharf near the head of the harbor. The residences on the southeastern shore are prominent when off the entrance; the northern point of the entrance is a small, prominent knoll. There is a prominent water tank about 1 mile east-northeastward of the entrance.

Hamlin Point is marked by a prominent hotel. A shoal with 12 feet (3.7 m.) near its end extends ⅞ mile northwestward from Hamlin Point and **Gunning Point,** and is marked at its end by a red buoy.

Gifford Ledge, with 10 feet (3 m.) near its end, extends ⅞ mile from the shore 1¼ miles northward of Hamlin Point; the ledge is marked at its end by a red buoy. Westward and northward of this buoy was a dumping ground for material from Cape Cod Canal.

West Falmouth Harbor (chart 249), 2¼ miles northward of Hamlin Point, has depths of 1 to 4 feet (0.3 to 1.2 m.) and bares in places at low water. A narrow channel with depths of 5 to 7 feet (1.5 to 2.1 m.) leads along the south shore to an anchorage basin 6 feet (1.8 m.) deep and 300 feet wide off the town of West Falmouth. The channel is not marked, but the shoals are visible and in the inner harbor are marked by a heavy growth of grass. The currents have an estimated velocity of 1½ knots. A rock with 4 feet (1.2 m.) over it lies 500 yards 256° true (W. mag.) from the outer end of the small breakwater extending northward from the southern point at the entrance. A bowlder reef extends about 400 yards westward and northwestward from the northern point of the entrance and is marked at the western side by a black buoy. **Chappaquoit Point,** on the south side of the entrance, has numerous summer cottages and a prominent lookout tower.

To enter, steer southeastward for the end of the breakwater and round it closely; then steer east-southeastward and pass 100 feet off the rounding point on the south side, marked by a number of boat sheds, and 200 feet off the next point, marked by a dolphin; then steer south-southeastward and round the point extending from the north shore at a distance of 80 yards; a reef extends 70 yards southward from this point and is sometimes marked by bush stakes. Anchor about midway between this point and the town wharf, which has a depth of about 1 foot (0.3 m.) at low water.

Wild Harbor (chart 251), a small cove on the south side of **Nye Neck,** 1¾ miles northward of West Falmouth Harbor, affords anchorage during northerly or easterly winds just inside the entrance, in 12 to 18 feet (3.7 to 5.5 m.). The shores of the harbor are foul, and its easterly part shoal. The entrance is clear in midchannel. A channel 50 feet wide and 5 feet (1.5 m.) deep has been dredged to a small basin, with the same depth in the northeastern part of the harbor. The channel is subject to shoaling and is not marked.

Cataumet Harbor (chart 251), between Nye Neck and Scraggy Neck, has its entrance 1¾ miles southward of Wings Neck Lighthouse. The harbor has extensive shoals and ledges, but the channel is buoyed, and a draft of 9 feet (2.7 m.) can be taken well inside to an anchorage in 18 to 22 feet (5.5 to 6.7 m.) between the black buoys. **Halftide Rock,** bare at low water, lies 625 yards 246° true (W. ⅞ S. mag.) from the end of the wharf at **Megansett,** and was marked by a bush stake in 1925. A depth of 6 feet (1.8 m.) can be taken to the wharf at Megansett by passing northward and 150 yards eastward of the red buoy and then steering for the wharf. A crooked channel, dredged 60 feet wide and 6 feet (1.8 m.) deep, leads to **Squeteague Harbor,** which has depths of 5 to 6 feet (1.5 to 1.8 m.) in the northern part. The channel is not marked, but the shoals are visible. The village of **Cataumet** lies near the northern part of Squeteague Harbor.

Seal Rocks, partly bare at half tide, extend ⅜ mile southwestward from **Scraggy Neck,** on the north side at the entrance of Cataumet Harbor, and are marked at the southwest end by a black buoy. The narrow channel between the ledge and Scraggy Neck has a depth of about 6 feet (1.8 m.).

Southwest Ledge is two patches with little water in places, lying ¾ mile southwestward and ⅜ to ⅝ mile westward from the west-

erly end of Scraggy Neck; the two patches are marked at their westerly ends by red buoys. There are depths of 12 to 16 feet (3.7 to 4.9 m.), rocky bottom, between the patches and Seal Rocks.

Pocasset Harbor (chart 251) lies between Wenaumet Neck and Scraggy Neck, and its inner part is separated from Red Brook Harbor by **Bassett Island.** Broken ground, with depths of 17 to 18 feet (5.2 to 5.5 m.) in places, extends across the entrance. Entering between Wings Neck Lighthouse and Southwest Ledge north part buoy and giving Scraggy Neck and Wenaumet Neck a berth of 400 yards, vessels of about 14-foot (4.3 m.) draft can anchor westward of Eustis Rock buoy (horizontally striped) in about 5 fathoms (9 m.); this anchorage is exposed to westerly winds. Eastward of **Eustis Rock** the entire eastern part of the harbor between Scraggy Neck and Bassett Island is shoal.

The inner part of Pocasset Harbor is frequented only by small craft of about 6-foot (1.8 m.) or less draft. Its entrance is through a narrow buoyed passage northward of the western end of Bassett Island. Following a careful mid-channel course, anchorage can be selected below buoy No. 1, in 14 to 18 feet (4.3 to 5.5 m.). Above this point the navigation is not difficult in the daytime for vessels of 6-foot (1.8 m.) or less draft, with the aid of the chart and the buoys. The village of **North Pocasset** lies near the eastern end of Pocasset Harbor. The wharf is nearly bare at low water.

A narrow channel with a depth of about 7 feet (2.1 m.) leads between Scraggy Neck and Bassett Island to a small anchorage with depths of 8 to 15 feet (2.4 to 4.6 m.) south-southeastward of the southern end of Bassett Island. The channel is well marked by private buoys, which are at times almost towed under by the current. The bowlder reef extending northeastward from Scraggy Neck westward of the southern point of Bassett Island, was marked by a spindle and can in 1925. There are several landings with depths of 5 to 8 feet (1.5 to 2.4 m.). A draft of 4 feet (1.2 m.) can be taken northward to Red Brook Harbor. A rock, bare at half tide and marked by a spindle and keg, lies 250 yards from the eastern shore of Bassett Island, ⅜ mile from the southern point.

Red Brook Harbor lies eastward of Basset Island and is very shallow. A draft of about 6 feet (1.8 m.) can be taken into the harbor around the north end of Basset Island, which is the better entrance. There is a marine railway for small craft under 30 feet in length. The village of **South Pocasset** lies near the southeastern end of Red Brook Harbor.

Wings Neck Lighthouse is a white hexagonal tower with a covered way to a dwelling located at the end of Wenaumet Neck. The light is fixed white, 50 feet (15.2 m.) high, and visible for 10 miles. The fog signal is a reed horn, blast 2 seconds, silent 18 seconds. If the horn is disabled, a bell will sound 1 stroke every 10 seconds. **Storm warnings** are displayed near the lighthouse.

Back River, Onset Bay, Monument River, Cohasset Narrows, and Buttermilk Bay (chart 251) lie at the northeast end of Buzzards Bay; the common entrance is between **Wenaumet Neck,** marked by **Wings Neck Lighthouse** on the south, and **Great Neck,** marked by **Tempe Knob** (a prominent hill), on the north. The indentation, of which these waters are a part, includes a large number of bights, coves, and shallow streams, whose channels are all more or less ob-

structed by shoals and rocks. These waters are important as the western entrance of the Cape Cod Canal.

Phinney Harbor, off the village of **Monument Beach,** has two buoyed entrances; the northern one with a depth of 7 feet (2.1 m.) and the southern one with greater depth. Its size makes it available as an anchorage only for small craft and very small vessels, for which the chart is a sufficient guide. There is a marine railway for boats 75 feet long and 6 feet draft; gas engine and hull repairs can be made.

Back River, emptying into the north side of Phinney Harbor, is obstructed by rocks, and nearly bare at low water, except in its entrance, and is crossed by two fixed bridges having a least headroom of 5 feet at high water. Small craft sometimes anchor in the entrance.

A small breakwater lies about 100 yards off the southern shore of Great Neck southward of Tempe Knob and protects a private landing.

The Widow Cove, westward of **Mashnee Island,** has depths of 3 to 5 feet (0.9 to 1.5 m.); there are several private landings with depths of about 3 feet (0.9 m.). The flats extending ¾ mile south-southeastward from Great Neck can be crossed with a draft of 4 feet (1.2 m.) at low water on the range of the western end of Mashnee Island and the eastern end of **Hog Island.** Elsewhere the flats have little depth.

Onset Bay.—A depth of about 7 feet (2.1 m.) can be carried to an anchorage in Onset Bay through the buoyed channel westward of Mashnee and Hog Island, and 6 feet (1.8 m.) by passing about 200 yards northward of Hog Island, the latter being safer for strangers. **Wicket Island** is high and wooded and is marked by a lookout tower. Westward of Wicket Island a buoyed channel, dredged 100 feet wide and 10 feet (3 m.) deep, leads to the wharf at **Onset,** a small village and summer resort. The wharf has a depth of 6 feet (1.8 m.) at the end.

Small craft anchor about 100 yards off the north shore westward of the wharf, or northeastward of Wicket Island. A depth of 3 feet (0.9 m.) can be carried into **East River** to an anchorage just above the closed bridge, which has an overhead clearance of 11 feet at mean high water.

Eastward of Onset Bay a narrow and crooked buoyed channel leads through **Cohasset Narrows** to **Buttermilk Bay.** Cohasset Narrows is crossed by two drawbridges, having a least width of 25 feet, and overhead clearance when closed of 6 feet at mean high water. The currents in the narrows are strong. Buttermilk Bay has depths of 1 to 7 feet (0.3 to 2.1 m.) and about 4 feet (1.2 m.) in the channel. It is seldom entered.

Butler Cove, on the western side of Cohasset Narrows, southward of the bridges, has depths of 3 to 5 feet (0.9 to 1.5 m.) in the middle; there are several private landings with depths of 2 to 3 feet (0.6 to 0.9 m.).

CAPE COD CANAL

connects the northern part of Buzzards Bay with Cape Cod Bay. It has a length of 11½ miles from Wings Neck Lighthouse, in Buzzards Bay, to a depth of 5 fathoms (9 m.) in Cape Cod Bay. It

shortens the distance between points north of Cape Cod and points west of Buzzards Bay by 53, 67, or 144 miles, according to the different routes considered, and avoids the outside run along the easterly side of Cape Cod and the exposed ocean route outside of Nantucket Shoals. The western approach to the canal is shown on chart 249 or 251 and the eastern approach on chart 1208.

The Cape Cod Canal is stated by the canal company to be open for navigation for vessels of about 22-foot (6.7 m.) draft and less. The general depth in canal and approach channels is 25 feet (7.6 m.). Passage through the canal is made with less difficulty with a fair current, and vessels proceeding with the current are given the right of way over vessels with head current. Vessels are not allowed to enter the canal against the current unless the canal is clear of vessels proceeding with a fair current.

The approach channel from Buzzards Bay to a point 2,000 feet west of the railroad bridge has a bottom width of 250 feet, increased at the turns. The entrance to the canal off Wings Neck Lighthouse, Buzzards Bay, is marked by two pairs of lighted buoys, one with a fog bell, which, in addition to the fog signal on Wings Neck, makes the entrance accessible in thick weather. From the entrance of the dredged channel to the canal proper there are gas buoys and lights, as well as fog signals, at frequent intervals; the lights on the west side are white, and those on the east side red. Two sets of range lights (rear lights fixed white, front lights flashing white) lead through the western approach.

From a point 2,000 feet west of the railroad bridge, to the bridge, the bottom width of the canal is 150 feet; then 100 feet width for a distance of 33,000 feet; then 200 feet width for a distance of 4,000 feet; then 300 feet width for a distance of 5,000 feet to deep water in Cape Cod Bay.

The best track for vessels is 100 feet northward of the mooring dolphins on the south bank of the canal west of the railroad bridge, then through the middle of the canal, then 430 feet south of the north breakwater at the Cape Cod Bay entrance. Fixed white lights on poles are erected at high-water mark on both sides of the canal at intervals of 500 feet between the Buzzards Bay railroad bridge and the breakwater at the east entrance.

The **entrance from Cape Cod Bay** is protected on its north side by a breakwater 3,000 feet long, built out from the shore to a depth of 5 fathoms (9 m.) and a short breakwater which extends from the shore on the south side of the entrance. A light (black skeleton tower) is established on the north breakwater 1,700 feet from the outer end.

There is a red gas buoy off the north breakwater, a black spar buoy off the south breakwater, and a black bell buoy a little farther out. A perpendicularly striped gas and bell buoy lies 2½ miles 30° true (NE. mag.) from the entrance.

In approaching the eastern entrance of the canal in clear weather the jetties and the light at the entrance, a large square building and the Coast Guard station on the east bank of the canal, are the guides. In thick weather the buoys are the guides. Strangers should not confuse the entrance jetties with the smaller ones at Sandwich Harbor, 1 mile southeastward. The fog is said to be always less dense inside the entrance than outside.

Pilotage is not compulsory for vessels carrying a pilot licensed by the United States Steamboat Inspection Service for the canal. Pilots or towboats may be obtained by making a signal upon approaching either end of the canal. The signal for a pilot is 3 long and 1 short blasts of whistle. A telephone office is established at Wings Neck Lighthouse and also on the wharf at the east end of the canal, from which vessels are reported. The following rates were charged for pilotage in 1925:

Commercial vessels

Commercial steamer up to 1,000 gross tons	$15
Commercial steamer over 1,000 gross tons	25
Yachts up to 100 gross tons	10
Yachts 101 to 500 gross tons	15
Yachts over 500 gross tons	20
Tugs up to 200 gross tons	6
Tugs over 200 gross tons	8
Tugs with 1, 2, or 3 barges (light)	10
Minimum charge	6
Tugs with loaded barge	10
Special types	25

Government vessels

Destroyers	20
Monitors	25
Submarines	20
Cruisers, third class	30
Tender of torpedo vessels	30
Gunboats	25
Special types	30
Mine sweepers	15
Converted yachts up to 500 gross tons	15
Converted yachts over 500 gross tons	20
Submarine chasers up to 110 feet in length	10
Submarine chasers over 110 feet in length	15
All light tugs	15
Tugs with tow	20

Supplies.—Coal, water, gasoline, and other supplies can be had at the canal company wharf near the eastern entrance of the canal.

Currents.—Predictions for the times of slack water for every day in the year are given in the Current Tables, Atlantic Coast. Slack water occurs about 2 hours before high and low water at Boston, the east current beginning before Boston low water and the west current before Boston high water. About halfway through the canal the average maximum westerly current occurs about ¾ hour after high water at Boston and the easterly current about ¾ hour after low water at Boston. Under ordinary conditions the currents have an average velocity at strength of 3.6 knots in midstream. The maximum current at spring tides is about 6 knots.

Bridges cross the canal at the villages of Buzzards Bay, Bourne, and Sagamore, at distances of 5, 5.6, and 9.4 miles from Wings Neck Lighthouse. The clearance between the fenders of all bridges is 140 feet. The railroad bridge at Buzzards Bay is a single-lift structure 2½ feet above extreme high water. The others are highway bridges, and are two-leaved lift structures, 30 feet in the clear above extreme high water.

The whistle signals for the bridges are as follows: Railroad bridge, Buzzards Bay, 3 long blasts; highway bridge, Bourne, 1

long and 1 short blast; highway bridge, Sagamore, 2 long and 2 short blasts. Vessels whose height will not permit them to pass under the bridges must give the whistle signal. If passing at night, they will see a red light on the bridge when it is closed and a green light when it is opened.

Storm-warning displays are made near Wings Neck Lighthouse and from a tower near the inner end of the north breakwater at the eastern entrance to the canal.

Signals.—At Wings Neck a red ball is hoisted on a flagpole, attached to a small red house near the lighthouse, if the canal is not clear. If no signal is hoisted, a vessel may enter. At night red and green lights are displayed—red if the canal is not clear and green if it is clear. At the eastern end of the canal there is a day and night signal on the southern bank of the canal at the water's edge. This shows a red light to indicate that the canal is not clear and a green light to indicate that it is clear and that a vessel may enter. These lights are visible by day.

Vessels should get a clearance at all times before proceeding through the canal. Vessels entering from Cape Cod Bay can proceed to the wharf inside the jetties, but can not pass without a clearance. The signal for vessels desiring a clearance is 3 long blasts of the whistle.

Tolls, which are subject to change, are charged all vessels passing through the canal. Vessels are advised to obtain the existing rates from the Boston, Cape Cod & New York Canal Co., 45 Cedar Street, New York, N. Y., in advance of the passage. Toll and patrol boats are stationed at each end of the canal to collect the tolls and issue right-of-way permits, authorizing vessels to proceed.

Ice.—The canal proper has never been closed by ice, but Buzzards Bay is closed at times, so as to prevent navigation through the canal. See "Ice, Buzzards Bay," on page 72.

The following are extracts from **general information** published by the canal company:

All steam vessels will please blow three long blasts for clearance when passing in by Wings Neck Lighthouse and Sandwich Breakwater.

All vessels are requested to stop at entrance to receive toll collector, unless otherwise arranged.

Vessels should proceed through canal at lowest speed that will afford steerageway, taking every precaution to avoid suction damage to moored vessels.

When dredges or lighters are working in canal, it is very essential that approaching vessels signal which side they will pass of same by giving proper whistle signals.

Anchorage is prohibited in the fairway off either entrance.

Advance information of arrival will expedite passage and insure prompt pilot service.

Vessels must not pass in the canal and an overtaking vessel must keep at least 1,000 feet astern of a vessel ahead.

Vessels must blow alarm whistles when approaching bridges and slow or stop engines if bridges are not opened promptly.

Vessels must carefully observe the block signals at either entrance and no violation will be tolerated.

BUZZARDS BAY, WAREHAM RIVER TO NEW BEDFORD

From Wareham River to New Bedford the shore is much indented and rocks and ledges extend offshore nearly 2 miles in places. Communication is by electric road from New Bedford to the towns and

villages as far as Monument Beach, and by railroad to Woods Hole. Gasoline, provisions, and some boat supplies can be had at Wareham, Marion, and Mattapoisett. Coal and water can be obtained at Wareham.

Wareham River (chart 251) empties into the northern end of Buzzards Bay, the entrance lying 3½ miles northward of Bird Island Lighthouse and 3½ miles northwestward of Wings Neck Lighthouse. The river is the approach to the town of Wareham, on the west bank at the head of navigation, nearly 2 miles above its mouth. Off the entrance and in the river are extensive shoals and numerous ledges, through which a dredged channel, marked by buoys, 12 feet (3.7 m.) deep and 100 feet wide, with increased width at the turns, leads to the wharves of the town. There is no anchorage in the river except in the channel, but vessels waiting for a fair wind or tide usually anchor off the mouth of the river northeastward of **Great Hill.** The latter is high and wooded and is marked at its eastern end by a prominent, large stone building.

Dry Ledge, bare at half tide, lies 1 mile from the western shore and east-southeastward of Great Hill. It is sometimes marked by a private spindle. A red buoy lies ¾ mile west-northwestward of the ledge. The depths north of the ledge, to Little Bird Island, range from 4 to 9 feet (1.2 to 2.7 m.).

Great Flats is an extensive shoal extending southward from the eastern side of the entrance to Wareham River. The southern end of the shoal is about 200 yards northeastward of the wharf on the northeastern end of Great Hill, and is marked by a red buoy.

Wareham is a small town on the western bank of the river at the head of navigation, nearly 2 miles above the mouth. The depth at the wharves is about 10 to 12 feet (3 to 3.7 m.). It has some iron manufactories and is the distributing point for coal in upper Buzzards Bay. It has a small marine railway and minor repairs to engines can be made. Coal, gasoline, fresh water, and provisions can be obtained.

Pilots are necessary for strangers, and may be obtained by making signal when off Bird Island Lighthouse or at anchor off Great Hill. State pilotage is not compulsory for coasting vessels.

Towboats are usually employed by the larger vessels, especially in winter. They may be ordered from New Bedford by telegraph or telephone.

Tidal currents.—The velocity of the currents is not great enough to materially interfere with a vessel having a good breeze. During the first half of the ebb the current below the wharves of the town sets across the flats westward of the channel; and during the whole of the ebb it sets across the flats eastward of the channel below Long Beach at the mouth of the river.

Ice.—The river is closed part of each winter by ice.

Directions, Wareham River.—Pass ¾ mile eastward of Bird Island Lighthouse and steer 351° true (N. ⅜ E. mag.), passing about 350 yards eastward of the northeastern end of Great Hill, and anchor about 400 yards eastward of the wharf on its northeastern side in 15 feet (4.6 m.), soft bottom, until a pilot is obtained. Small craft, with the aid of the chart and the buoys, should experience no difficulty in keeping in the channel to Wareham.

Weweantic River, northward of Great Neck, has a narrow, crooked channel, much obstructed by rocks and ledges, and is seldom entered.

Wings Cove, southward of **Great Hill Point,** has depths of 8 to 17 feet (2.4 to 5.2 m.) in the outer part, and is sometimes used by small fishing vessels as an anchorage with westerly winds.

Bird Island Lighthouse is a white tower on the east side of the entrance to Sippican Harbor. The light is fixed white with a flash of 5 seconds duration every 80 seconds; 37 feet (11.3 m.) high and visible for 11 miles. The fog signal is a bell sounding a group of 2 strokes every 12 seconds.

Sippican Harbor (chart 251) makes into the north shore of Buzzards Bay about 2½ miles northeastward of Mattapoisett entrance. The entrance is marked on the eastern side by Bird Island Lighthouse, and on the western side by a prominent large house on **Blake Point (Charles Neck).** The entrance is about 1⅛ miles wide and has few dangers. Above the entrance the width of the harbor gradually lessens, and at Ram Island, 2¼ miles above Bird Island Lighthouse, the width between the island and the western shore is only 300 yards. The harbor is seldom used as an anchorage except by yachts; it is entered by a few vessels each year with cargoes of lumber. The depth of water in the channel to Ram Island is 12 feet (3.7 m.) and to the anchorage off the town 10 feet (3 m.) at low water, but due to the broken character of the bottom vessels should proceed with caution over areas where the charted depths are not more than 6 feet (1.8 m.) greater than the draft. Some local knowledge is necessary to keep in the best water up to the town. The deepest draft entering the harbor is about 10 feet (3 m.)

Butler Point, north-northeastward of **Bird Island,** is marked by a yacht club and by a prominent flagstaff. Bird Island is joined to Butler Point by a bar with little water over it. Small local craft, of less than 4 feet (1.2 m.) draft, cross the bar about 200 yards southward of the point.

Blankenship and **Planting Island Coves** have a common entrance northward of Ram Island, and have general depths of 3 to 5 feet (0.9 to 1.5 m.). A rock, bare at low water, lies in mid-channel northward of Ram Island and is marked by a private spindle.

Ram Island is low and partly wooded and is marked by a large house. It should not be confused with **Little Island,** which lies on the opposite side of the channel about ¼ mile northwestward. The channel is narrow abreast Ram Island and the currents have considerable velocity at times.

Briggs Cove, in the northeastern part of the harbor, has a small marine railway near the head to which a draft of 4 feet (1.2 m.) at high water can be taken with local knowledge. Two rocks, one on each side of the entrance, are marked in summer by private beacons.

Marion is a small town on the western shore about 2½ miles above Bird Island Lighthouse. The depth at the wharf is about 5 feet (1.5 m.). Nye Wharf, abreast Ram Island, is out of repair and is not used. There is a marine railway for boats 30 feet long, 6 feet draft, with a capacity of 8 tons. About 1 mile northward of Marion is a group of prominent radio masts.

Pilots may be had by signaling at the entrance, westward of Bird Island, anchoring there if necessary.

Ice usually closes the harbor about a month or more each winter.

Tides.—The mean rise and fall of the tides is 4.2 feet.

Directions, Sippican Harbor.—Enter midway between the buoys marking the **Bow Bells** and **Centerboard Shoal,** steer 346° true (N. mag.) for 1⅜ miles and pass over 100 yards eastward of the black buoy eastward of the end of Blake Point. When close eastward of the black buoy ⅜ mile beyond, steer 328° true (N. by W. ⅝ W. mag.) for black spar buoy No. 3. When about 200 yards from this buoy, haul northward and pass close to eastward of it, and close to westward of red spar buoy No. 4, the latter lying westward of Ram Island. Then steer 358° true (N. by E. mag.) and pass about 75 yards eastward of Little Island. Anchor about 200 yards eastward of the black buoy southeastward of the wharf at Marion in 10 to 13 feet (3 to 4 m.).

The coves between Sippican Harbor and Mattapoisett Harbor are foul and seldom entered, even by local boats.

Mattapoisett Harbor.—This harbor (chart 251 or 252) lies about 5 miles northeastward of New Bedford Harbor and is marked on its north side by **Ned Point Lighthouse,** which is lighted between April 15 and October 15 only. The entrance, between **Angelica** and **Strawberry Points** on the east and **Mattapoisett Neck** on the west, is about 1½ miles wide, but is much obstructed by shoals and ledges, between which a buoyed channel leads to the anchorage off the village of **Mattapoisett,** which is situated on the north shore about ¾ mile above Ned Point. The harbor is exposed to southeasterly winds, but the ledges at the entrance somewhat break the sea from that direction. It is little frequented except by yachts. The carrying trade of Mattapoisett is comprised in a few cargoes of coal and building material for local use. The least found depth in the channel as far as the anchorage off the village is 14 feet (4.3 m.), but, due to the broken character of the bottom, vessels should proceed with caution over areas where the charted depths are not more than 6 feet (1.8 m.) greater than the draft. The stone wharf has a depth of about 5 feet (1.5 m.) at the end. There is a marine railway for small craft not over 25 feet long. Gas engine and hull repairs for small craft can be made. Strangers should not attempt to enter at night.

Tides.—The mean rise and fall of tides is 4.1 feet.

Directions, Mattapoisett Harbor.—From a position ¼ mile eastward of Nye Ledge bell buoy a 313° true (NW. by N. mag.) course for 2 miles leads through the buoyed channel. When about 200 yards southwestward of the horizontally striped buoy marking Barstow Rock, steer 320° true (NNW. ¼ W. mag.) for the stone wharf with small coal pocket, and anchor ¼ mile from the northeast shore between Ned Point and the wharves, in 13 to 17 feet (4 to 5.2 m.).

Nasketucket Bay (chart 252) has its entrance between West Island on the west and Cormorant Rock on the east, and is sometimes used by sailing vessels as an anchorage in southwesterly winds. Northward and westward of West Island the bay is much obstructed by rocks.

Cormorant Rock, which shows bare at half tide and is marked by a black spindle with cage, lies 1⅜ miles east-northeastward of the easterly point of West Island and ⅞ mile south-southeastward of

Ram Island, the low, grassy island off Mattapoisett Neck. Ledges with little water over them surround the spindle at a distance of 150 yards, and depths of 18 to 21 feet (5.5 to 6.4 m.) extend ¼ mile southward from it; a rock with 14 feet (4.3 m.) over it lies ¼ mile east-northeastward from the spindle. There is a channel with a depth of about 15 feet (4.6 m.) between the rock and Ram Island.

NEW BEDFORD HARBOR AND APPROACHES

New Bedford Harbor (charts 249 or 252), on the northwestern side of Buzzards Bay, is the approach to the city of New Bedford and the towns of Fairhaven and Belleville. The approach from Buzzards Bay and the entrance to the harbor are much obstructed by ledges and shoals, between which several well-marked channels lead to the entrance of the dredged channel. The bottom is very broken, characterized by large bowlders, and as a matter of safety vessels should proceed with caution when crossing areas where the charted depths are not more than 6 to 8 feet (1.8 to 2.4 m.) greater than the draft.

Channels.—There are several channels leading up to Clark Point, between the ledges in the approach. The eastern channel has the deeper water; with the aid of the chart a depth of about 25 feet (7.6 m.) can be taken through this channel to an anchorage eastward or southward of Clark Point. The middle and western channels are good for a depth of about 21 feet (6.4 m.).

The harbor has been improved by dredging a channel 300 feet wide and 25 feet (7.6 m.) deep from Butler Flats Lighthouse to an anchorage basin of the same depth and 1,400 feet wide between New Bedford and Fairhaven. From the northern end of the anchorage basin a channel 25 feet (7.6 m.) deep and 300 feet wide continues through the draw in Fairhaven bridge to the upper wharves of New Bedford, with a turning basin 600 by 900 feet above the bridge. In 1925 the project depth existed except in the anchorage basin which had a depth of 24 feet (7.3 m.) and over, except along its southwestern edge.

Wilkes Ledge is about ⅜ mile in diameter, with depths less than 24 feet (7.3 m.) and has a least depth of 9 feet (2.7 m.) near its northern side. The middle of the ledge lies nearly 1¾ miles 162° true (S. ⅜ E. mag.) from Dumpling Rock Lighthouse, and the ledge is marked on its southern side by a horizontally striped buoy; the buoy should be given a good berth.

Dumpling Rocks is a group of bare and sunken rocks extending ⅜ mile southeastward from Round Hill Point.

Dumpling Rock Lighthouse is a white tower attached to the corner of a dwelling on the outermost bare rock. The light is fixed white with a red sector from 27° to 43° covering Mishaum Ledge (see p. 70); 48 feet (14.6 m.) high and visible for 12 miles. The fog signal is a reed horn, blast 3 seconds, silent 12 seconds.

Round Hill Point is marked by a prominent round hill on which is a white tower. Westward of the point are four prominent radio masts. A famous old sailing ship is set in concrete on the beach on the south side of the point. There is a long wharf on the northeast side of the point, 250 yards from the end.

West Island Shoal extends nearly 1 mile southward from **West Island,** and for half this distance is mostly bare at extreme low water; for the remainder of the distance the depths range from 10 to 18 feet (3 to 5.5 m.). A black gas buoy is placed off the end of the shoal. A small ledge with 13 feet (4 m.) over it lies ⅜ mile westward, and another with 16 feet (4.9 m.) over it lies nearly 1 mile southwestward from the buoy.

A detailed description of the remaining dangers would be of little use; strangers must be guided mainly by the chart and buoys.

Apponaganset Bay is the bight 2 miles northward of Dumpling Rock Lighthouse. The bay is used considerably by small craft as an anchorage during the summer, but is insecure in southeasterly gales. **Nonquitt** and **Bayview** are villages on the south side of the entrance. **South Dartmouth (Padanaram)** is on the east side of the bay. The wharf has a depth of about 12 feet (3.7 m.). The approach to the bay is obstructed by numerous ledges and rocks, and a stranger should not attempt to enter except in the daytime with clear weather.

White Rock and **Ragged Rocks** show above water and lie about ½ mile offshore and about the same distance northward of Dumpling Rock Lighthouse.

A breakwater, marked at the outer end by a light during the summer, extends 700 feet southward from the shoal on the east side of the entrance. An anchorage basin with a least depth of 6 feet (1.8 m.) has been dredged westward of the wharf at South Dartmouth (Padanaram), between it and a line extending 238° true (WSW. ½ W. mag.) from the western end of the draw span of the bridge.

The bridge has openings 30 feet wide and an overhead clearance above mean high water of about 6 feet when closed; above it, numerous small craft find anchorage in a narrow channel near the eastern shore.

To enter, pass ¼ mile eastward of Dumpling Rock Lighthouse and steer 352° true (N. ½ E. mag.), passing about 300 yards eastward of White Rock. When midway between Hussey Rock buoy (black) and Lone Rock buoy (horizontally striped), steer 315° true (NNW. ¾ W. mag.) and enter Apponaganset Bay southward of the breakwater. Anchorage can be selected as far up as 200 yards northwestward of the first red buoy, in 13 to 17 feet (4 to 5.2 m.), sticky bottom.

Clark Cove, between Apponaganset Bay and New Bedford Harbor, affords anchorage in 12 to 22 feet (3.7 to 6.7 m.), but is exposed to southerly weather and is seldom used. There are no dangers in the cove except near the shore.

Clark Point, on the western side of the entrance to New Bedford Harbor, is marked by a granite fort.

New Bedford, a manufacturing city on the western side of the harbor, has considerable trade by water; the deepest draft entering the harbor is about 23 feet (7 m.). The wharves have depths up to 25 feet (7.6 m.); privately dredged channels lead from the anchorage basin to some of the wharves.

Fairhaven is a town on the eastern side of the harbor and is connected with New Bedford by a drawbridge which has openings 100 feet wide eastward of Fish Island. Ferries operate between Fairhaven and New Bedford.

The **Acushnet River** empties into the northern part of New Bedford Harbor. A depth of 23 feet (7 m.) can be carried from the turning basin above the New Bedford and Fairhaven bridge to within 800 feet of the Coggeshall Street Bridge. The eastern side of this channel is marked by red buoys, and a fixed red light is exhibited from a green post off the New England Oil Refining Co. wharf on the west side of the channel at its head. A depth of 7 feet (2.1 m.) can be carried through the draw in the Coggeshall Street Bridge to **Belleville.**

Terminal facilities.—These consist of piers and wharves with a total of about 16,580 feet of docking space, of which 2,050 feet are publicly owned, 2,850 feet privately owned but used by the public upon payment of wharfage, and 11,680 feet privately owned and so used. The wharves on the New Bedford side of the harbor have or can easily secure railroad connection. One on the Fairhaven side is so connected.

The principal items of commerce are coal, petroleum products, lumber, and package freight carried in barges, schooners and steamers, drawing from 8 to 24 feet (2.4 to 7.3 m.).

Bridges.—The New Bedford and Fairhaven bridge has a draw opening, east of Fish Island, 100 feet wide. The Coggeshall Street Bridge has a center pier opening with a least width of 37 feet. **Regulations** have been prescribed by the Secretary of War governing the opening of the New Bedford and Fairhaven bridge, as follows:

1. The signal for opening the draw shall be given by three short blasts of a horn or steam whistle; except that for vessels drawing 15 feet and over desiring to pass through the bridge between the hours of 6.30 and 7.15 a. m., the signal shall be given by three short blasts followed by one long blast of a horn or steam whistle. The signal for opening shall be answered by one long blast of a whistle or horn on the bridge when the operation of opening is commenced, or, if the draw can not be promptly opened, by three long blasts, and in addition a red flag or ball by day and a red light by night shall be conspicuously displayed on the bridge.

2. Except as hereinafter provided the draw shall be immediately opened, upon the prescribed signal, for the passage of foreign vessels and "vessels of the United States," as defined in section 4311 of the Revised Statutes. *Exceptions:* (*a*) Between 6.30 and 7.15 a. m. the draw shall not be opened for any of the above-described vessels drawing at the time less than 15 feet of water. (*b*) Between one hour after sunset and one hour before sunrise (almanac time) the draw shall be opened upon notice given to the draw tender a reasonable time in advance. Arrangements shall be provided whereby the draw tender can be conveniently reached by telephone and notice of such arrangements shall be kept conspicuously posted on the bridge.

3. For all other vessels which can not pass the closed bridge the draw shall, upon the prescribed signal, be opened as soon as practicable, but, subject to the exceptions in paragraph 2 above, in no case shall delay be more than 20 minutes.

4. For every vessel that can not pass the closed bridge the operation of the draw shall afford full horizontal and vertical clearance in the draw opening regardless of the size or requirements of the passing vessel.

Anchorage.—The anchorage known as the outer harbor, westward of Sconticut Neck, has depths of 2 to 4½ fathoms (3.7 to 8.2 m.), but is exposed to southerly winds (see limits as given below). The dredged anchorage basin northward of Palmer Island is 1,400 feet wide and 24 feet (7.3 m.) deep and over except along its southwestern edge, is well sheltered, and has good holding ground. Vessels of less than 8-foot (2.4 m.) draft can anchor southwestward of the dredged anchorage basin, giving the wharves a berth of about 150 yards.

Prohibited anchorages.—Regulations prescribed by the Secretary of War prohibit anchorage in the fairway leading through New Bedford Outer Harbor. (See "Prohibited anchorages" for Buzzards Bay on p. 71, and "Rules and regulations" governing anchorages in Buzzards Bay and Vineyard and Nantucket Sounds on p. 43.)

Anchorage areas in New Bedford Outer Harbor are defined as follows:

Egg Island anchorage.—Within the area west of Sconticut Neck to the eastward of a line bearing 154° and extending from a point 100 yards off the southwest corner of Fort Phoenix, parallel with and 100 yards easterly of the line of spar buoys numbered, respectively, 2, 2A, 4, and 6, to a point from which Egg Island beacon bears 87°; to the northward of a line from Egg Island beacon bearing 267°; to the eastward of a line bearing 156° extending southerly from Egg Island beacon and ranging from Fort Phoenix beacon; and to the northward of a line bearing 87° and ranging from the old tower on Clarks Point to the Sconticut Neck shore.

Butler Flats anchorage.—To the southeastward of a line bearing 222° and ranging from the southwest corner of Fort Phoenix to the New Bedford shore; to the westward of a line from Butler Flats light bearing 334° and ranging toward Palmer Island light; and to the northward of a line bearing 267° and ranging from Butler Flats light to the shore.

Pilots are generally taken by large vessels and may be had by making signal off Cuttyhunk Lighthouse. (See also p. 71.) The pilotage rate for vessels entering New Bedford Harbor is $2.25 per foot of draft, and for vessels leaving the harbor $1.85 per foot of draft. An additional charge of 20 per cent is made during the winter.

Towboats are generally taken by sailing vessels entering the inner harbor and can be had by making signal. A lookout for incoming vessels is kept by the towboat captains when they are not cruising.

The harbor master has control of the anchoring and lightering of vessels in the harbor. His office is located at the foot of City Pier No. 3. **Harbor regulations** have been established and are enforced by the harbor master. Copies of these regulations can be obtained from him.

Hospital.—There is a relief station of the United States Public Health Service at New Bedford.

Supplies.—Coal in unlimited quantities, water, gasoline, provisions, and supplies of all kinds can be obtained.

Repairs.—There is a marine railway at Fairhaven for vessels up to 100 tons. Smaller ways are located at Fairhaven and New Bedford. Boiler and light machinery repairs can be made at New Bedford.

Storm-warning displays are made from a staff on one of the coal pockets of the Philadelphia & Reading Coal & Iron Co., and at New Bedford Yacht Club.

Communication is by railroad and by daily steamer with New York. An electric road runs to Fall River. Daily steamers operate during the entire year to Marthas Vineyard and Nantucket. A mail boat makes daily trips to Cuttyhunk.

Tides.—The mean range of the tide is 4 feet.

Ice.—See page 72.

DIRECTIONS, NEW BEDFORD HARBOR

Keeping in mind the broken character of the bottom, vessels should proceed with caution where the charted depths are not more

than 6 to 8 feet (1.8 to 2.4 m.) greater than the draft. Clear weather, when the aids are visible, is necessary for a stranger. Sailing vessels should not attempt to beat into the harbor unless well acquainted with the dangers. Directions for entering Buzzards Bay are given on page 72.

Eastern Channel.—From a position ½ mile southward of Mishaum Ledge gas and bell buoy, steer 57° true (ENE. ¼ E. mag.) to a position ½ mile southward of Wilkes Ledge buoy; then steer 40° true (NE. ¾ E. mag.) to a position ⅜ mile southeastward of Hursell Rock buoy. Pass 300 yards eastward of the buoy and steer 334° true (N. by W. mag.) with Palmer Island Lighthouse showing just eastward of Butler Flats Lighthouse, and pass about midway between the horizontally striped buoys marking Brooklyn and Henrietta Rocks.

To enter the inner harbor, continue the 334° true (N. by W. mag.) course, and pass 50 yards eastward of the black buoy at the entrance to the dredged channel abreast Butler Flats Lighthouse and through the dredged cut, passing midway between the red and black buoys. Anchorage can be had above Palmer Island, or the course shaped to the wharves or through the bridge as desired.

Or, coming down Buzzards Bay, when Dumpling Rock Lighthouse bears 252° true (W. ⅜ S. mag.), steer for it, passing 400 yards southward of West Island Shoal can buoy and 600 yards southward of Mosher Ledge gas and bell buoy. Round this buoy at this distance and then steer 334° true (N. by W. mag.) and proceed as in the preceding paragraphs.

Middle Channel.—From a position ½ mile southward of Mishaum Ledge gas and bell buoy, steer 57° true (ENE. ¼ E. mag.) to a position ½ mile southward of Wilkes Ledge buoy, when Egg Island beacon and the high standpipe in Fairhaven will be in range, bearing 6° true (N. by E. ¾ E. mag.). Steer this range, passing 400 yards eastward of Wilkes Ledge buoy, and westward of the red buoy off the westerly side of Great Ledge, and to the entrance of the dredged channel eastward of Butler Flats Lighthouse.

West Channel.—Pass ½ mile southward and ¼ mile eastward of Mishaum Ledge gas and bell buoy and steer 26° true (NE. ½ N. mag.) for 5¼ miles, passing 100 yards westward of the horizontally striped buoy ⅝ mile southward of Dumpling Rock Lighthouse and ¼ mile eastward of this lighthouse. When 400 yards westward of Decatur Rock buoy, Egg Island beacon and the high standpipe in Fairhaven will be in range, bearing 6° true (N. by E. ¾ E. mag.). Steer this range and proceed as in the preceding paragraph.

NEW BEDFORD TO SAKONNET RIVER

Apponaganset Bay, Dumpling Rock, and Wilkes Ledge are described with New Bedford Harbor.

The coast between New Bedford Harbor and the entrance of Sakonnet River is fringed with extensive shoals, many of them rocky and some well offshore. The entrances are shoal and of little importance except to local boats.

Mishaum and Hen and Chickens Ledges are described with Buzzards Bay, on page 69.

Paskamanset River, westward of Mishaum Point, has a bar at the entrance nearly bare at low water. The channel inside is narrow and unmarked and seldom used.

Westport Harbor.—This is the name given to the small anchorage just inside the mouth of Westport River, which empties into the northern part of the large bight between Gooseberry Neck and Sakonnet Point.

Westport River has a narrow crooked channel, with a depth of 7 feet (2.1 m.) on the outer bar and 5 feet (1.5 m.) on the inner bar below the village of **Westport Point,** which is about 1½ miles above its mouth, on the point of land between the two branches. The channel is well marked by buoys, but is too narrow and crooked to be followed, except with local knowledge; 8 feet (2.4 m.) is the deepest draft that can be taken to the village at high water. There is a depth of 10 feet (3 m.) alongside some of the wharves. In southerly gales a heavy sea breaks on the bar at the entrance, making it unsafe to enter the harbor. About 1 mile above its mouth Westport River divides into two branches, **East Branch** and **West Branch,** which have narrow and shallow channels and are navigated only by small craft. The drawbridge crossing East Branch at Westport Point has openings 30 feet wide and an overhead clearance of 6 feet at high water when closed.

Vessels should not attempt to enter at night. On the western side of the entrance is a peculiar rounded nubble, about 30 feet (9.1 m.) high, on which a flagstaff is erected, which serves as a guide to the entrance. A flashing white light is maintained on the eastern end of **The Nubble** from March 15 to December 15.

Twomile Rock lies a little over 1 mile south-southeastward of The Nubble, and is marked by a black spindle with cage, and a black buoy, 400 yards southward of the spindle. A black bell buoy is moored ½ mile southeastward of the spindle.

Halfmile Rock is a bare rock lying close southward of the channel into Westport Harbor.

The bight eastward and northeastward of Twomile Rock spindle is free from dangers, and the shore can be approached as close as 400 yards, but the western side of Gooseberry Neck is foul, and should be given a berth of over ½ mile. Close attention should be given the buoys, which are the best guides for a stranger.

Tides.—The mean rise and fall of tides is 3.1 feet.

The **tidal currents** set in and out of the entrance with considerable velocity, and should be allowed for.

Directions, Westport Harbor.—Approach the black bell buoy southeastward of Twomile Rock on any course between 330° true (N. by W. ½ W. mag.) and 63° true (ENE. ¾ E. mag.). Pass eastward of the bell buoy and steer about 347° true (N. mag.) until the flagstaff on The Nubble, on the western side of the entrance, bears 302° true (NW. mag.). Steer for the flagstaff and anchor on this line before reaching the entrance buoys in 4 fathoms (7.3 m.) or more, until a pilot is obtained.

Numerous rocks and ledges extend about 1 mile offshore for a distance of 2½ miles westward of Westport Harbor, and the shore in this vicinity should be given a berth of about 1¼ miles.

(chart 353), on the easterly side of Narragansett Bay, lies between the mainland on the east and Rhode Island on the west, and is marked on the easterly side of its southerly entrance by Sakonnet Lighthouse. The width of the river varies from ¾ mile to 2 miles, except its northern end, where its least width is ¼ mile. The river is little used except by fishing vessels and small local craft. In summer a small steamer runs from Providence to Sakonnet Harbor, stopping at intermediate landings.

The channel of Sakonnet River is good for a depth of 20 feet (6.1 m.) to Mount Hope Bay, a distance of 12 miles. There are many shoals and outlying rocks, but the dangers are well marked by buoys. These buoys are not lighted, and strangers should not attempt to pass through at night. Two drawbridges, described below, cross the river near its upper end.

Sakonnet Point, at the eastern entrance to Sakonnet River, is surrounded by bare and sunken rocks. **Schuyler Ledge,** the southernmost of these ledges, has 8 feet (2.4 m.) over it and lies ¾ mile 156° true (S. by E. mag.) from Sakonnet Lighthouse and is marked by a red bell buoy.

Sakonnet Lighthouse is a white conical tower on a brown cylindrical pier, at the western end of the foul ground off Sakonnet Point. The light is fixed white with a group of 3 red flashes every 60 seconds (fixed white 30 seconds, eclipse 2.6 seconds, red flash 4.8 seconds, eclipse 5.2 seconds, red flash 4.8 seconds, eclipse 5.2 seconds, red flash 4.8 seconds, eclipse 2.6 seconds), 68 feet (20.7 m.) high and visible for 12 miles.

Sakonnet Harbor is a boat harbor ⅞ mile north-northeastward of Sakonnet Lighthouse. A short breakwater marked at its end by a flashing white light, extends northward from its westerly point, and there are depths of 5 to 8 feet (1.5 to 2.4 m.) at the steamer landing just inside the breakwater. Two bare rocks with ledges close to lie 75 to 125 yards eastward of the wharf. The depths in the cove inside the rocks are 4 to 7 feet (1.2 to 2.1 m.) until 100 yards from its head. Gasoline and some provisions can be had in summer.

Cormorant Rock is a bare, dark rock off the western side of the entrance to Sakonnet River, lying about ¾ mile southward of **Sachuest Point,** the southern point of Sachuest Neck. Vessels should not pass between the rock and **Cormorant Reef,** which has 2 feet (0.6 m.) over it, lies about ¼ mile southward of Cormorant Rock, and is marked on its south side by a black bell buoy.

The southern shore of Rhode Island is rocky, with numerous off-lying rocks and ledges. There are several private landings northward of Gooseberry Island, but local knowledge is required. Eastward of Newport is a bathing beach with a prominent pavilion. There are numerous prominent residences on the eastern side of The Neck, the southwestern part of Rhode Island. A large brick residence, with several towers, on the southeastern point of The Neck is conspicuous.

Prices Neck Radiocompass Station is located on the south side of Rhode Island in latitude 41° 27′ 04″ N. longitude 71° 20′ 16″ W.

The arc of calibration is from 80° to 270°. The call letters are NGO. (See also "Radio service" on p. 10.)

Torpedo range buoys have been established off the Rhode Island seacoast in the the following positions: Buoy A, in 14 fathoms (25.6 m.) of water, Sakonnet Lighthouse bears 355° (N. ¾ E. mag.) 4 miles; buoy B, in 15 fathoms (27.4 m.) of water, Sakonnet Lighthouse bears 31½° (NE. mag.) 4 miles; buoy C, in 17 fathoms (31 m.) of water, Coggeshall Ledge Tower, bears 353° (N. ⅝ E. mag.) 3.1 miles; buoy D, in 16 fathoms (29.3 m.) of water, Beavertail Lighthouse bears 323° (WNW. ⅛ W. mag.) 3.2 miles.

The western side of Sakonnet River, from the entrance to Sandy Point, should be given a berth of ⅜ mile to avoid spots with 18 feet (5.5 m.) which make out that distance in places. Rocks extend nearly ¼ mile off the northeast side of **Sachuest Neck;** a ledge with 7½ feet (2.3 m.) over it, lying ½ mile northeastward from the northerly end of Sachuest Neck, is marked by a black buoy. **Black Point** is a rocky bluff on the western side 4½ miles northward of Sakonnet Lighthouse. **Sandy Point** and **McCurry Point** are low and backed by highland, and lie 1⅜ and 2¾ miles northward from Black Point.

The eastern side of the river is bolder than the western side. The principal dangers are a reef, with bare rocks near the end, which extends ½ mile southwestward from **Church Point,** and is marked at its end by a red bell buoy; and **Almy Rock,** bare at low water, lying 350 yards southwestward from Fogland Point, and marked ¼ mile off its southwest side by a red bell buoy. A shoal with 15 feet (4.6 m.) over it lies 150 yards eastward of the bell buoy. Church Point is level and **High Hill Point** is a prominent small hill, and both have bluffs at the water. **Fogland Point** is projecting and prominent; its westerly and northerly sides should be given a berth of over 200 yards.

The western half of the river from McCurry Point to the stone bridge is shoal, with depths of 7 to 14 feet (2.1 to 4.3 m.), and shoals fill the broad bights in the eastern shore northward of Fogland Point. The channel between the shoals is about ¼ mile wide, and leads from the black buoy off McCurry Point toward **Gould Island.** The latter is high and wooded; a shoal with 15 feet (4.6 m.) at its end extends 600 yards southward from it.

Nannaquacket Pond, on the eastern side of the river eastward of Gould Island, has a narrow entrance crossed by a closed bridge having an overhead clearance of about 5 feet (1.5 m.) at mean high water. The deeper water in the entrance is along the north shore, several rocks lying off the southern shore. The currents have considerable velocity. The northern part of the pond has depths up to 30 feet (9.1 m.); elsewhere the general depth is about 3 feet (0.9 m.).

The Cove, on the western side of the river between the bridges, is entered only by small local craft. The general depths are 3 to 4 feet (0.9 to 1.2 m.).

Tiverton, a town on the eastern bank, between the bridges, has railroad communication and steamer communication with Providence in summer. Gasoline, provisions, and other supplies can be obtained.

Bridges.—Two bridges cross the contracted part of the river, just southward of Mount Hope Bay. The southerly one, a stone bridge,

is a double-leaf lift, with an opening 100 feet wide. The railroad bridge is a center pier draw with openings 100 feet wide; the western opening only is used.

Regulations prescribed for the bridges require that they shall be opened for vessels on signal, except in case of the railroad bridge, which may be kept closed for a period not exceeding 4 minutes after the signal is given, provided a train is approaching the bridge. The signal for opening is three short blasts, to be answered by one long blast if bridge can be opened or by three long blasts and conspicuously displaying a red flag or ball by day or a red light by night, if opening is delayed. Small craft which can not pass under the closed bridge shall not be delayed more than 20 minutes.

Anchorages.—There is good anchorage for vessels of 20-foot (6.1 m.) or less draft in midriver about 5 miles above Sakonnet Lighthouse and just below High Hill Point, in 3½ to 4½ fathoms (5.5 to 8.2 m.) Though open southward, a heavy sea seldom reaches as far as the anchorage, and in southeasterly gales the water is comparatively smooth inside the mouth of the river. Fishermen seeking shelter frequently anchor on the flats in the bight northward of Fogland Point, where the depths are 10 to 14 feet (3 to 4.3 m.).

Tides.—The mean rise and fall of tides at Sakonnet Point is 3.3 feet.

Currents.—The two bridges act as dams to maintain the water at different levels on either side of them, and cause dangerous currents through the draws. Vessels usually pass through the draws near the time of slack water, which occurs about 1 hour before the time of high and low water at Newport.

Ice.—The river northward of Fogland Point is usually closed by ice for short periods each winter. Ice packs occur at the railroad bridge.

Directions, Sakonnet River.—Pass ¾ mile westward of Sakonnet Lighthouse and steer 1° true (N. by E. ¼ E. mag.) for 4½ miles, heading for High Hill Point. The course leads near the middle of the river, passing ⅜ mile westward of the red bell buoy southward of Church Point, and to a position ½ mile eastward of Black Point. Then steer 337° true (N. ⅞ W. mag.) to a position 100 yards westward of the Sakonnet River bell buoy No. 6, leaving a black spar buoy No. 5, 100 yards to port. Then steer 15° true (NNE. ½ E. mag.) for 1½ miles to a position midway between a red and a black buoy. Then steer 3° true (N. by E. ½ E. mag.), passing to westward of two red buoys and to eastward of a black buoy and giving Gould Island a berth of about 150 yards. Pass through Stone Bridge draw and keep near the middle of the river until through the second draw (west opening) and then steer 9° true (NNE. mag.), following the eastern bank at a distance of 250 yards until ½ mile northward of the second bridge to avoid a shoal with 11 feet (3.4 m.) making out from Cedar Island. Then follow midchannel courses until in Mount Hope Bay.

NARRAGANSETT BAY

The entrance to this bay (shown on chart 353 and harbor charts) is between Brenton Point, the southwestern point of Rhode Island, on the east and Point Judith Neck on the west. The length of the

bay from the entrance to its northern extremity at the mouth of the Providence River is 16 miles. It is the approach by water to the cities of Newport, Providence, Fall River, and Taunton, and to a number of towns and villages, the most important of which are Bristol, Wickford, and Greenwich. The bay is well marked by lights, making its navigation easy either day or night in clear weather. **Conanicut** and **Prudence Islands** and several smaller ones lie in the bay and divide it into two passages.

The approaches to Narragansett Bay have been examined by means of a wire drag from longitude 71° 25′ W. eastward to the entrance of Buzzards Bay for a width of about 6 miles southward of Brenton Reef Lightship. The eastern passage and parts of the western passage abreast Conanicut Island have also been partly examined.

Brenton Reef Lightship is anchored in 84 feet (25.6 m.) off the entrance to the eastern passage. It has a straw-colored hull with "Brenton" on each side, a black circular day mark on the mast, and a circular gallery on a pyramidal skeleton tower forward. The light is occulting white, light 3 seconds, eclipse 1 second, 57 feet (17.4 m.) high, and visible 12 miles. If the occulting light is inoperative, a fixed white light will be shown from the masthead 38 feet (11.6 m.) above the water. The fog signal is a 10-inch and a 6-inch air whistle; group of 2 blasts every 30 seconds, blast (low tone) 3 seconds, blast (high tone) 3 seconds, silent 24 seconds. A bell will ring 5 strokes every 30 seconds if the whistles are disabled. The submarine bell sounds groups of 3 and 9 every 30 seconds.

Eastern Passage, between Rhode Island on the east and Conanicut and Prudence Islands on the west, is good for a least depth of about 10 fathoms (18.3 m.) in the channel for a distance of 12 miles above the entrance, and a depth of about 5 fathoms (9.1 m.) to the entrance of the dredged channel leading to Providence, which is 600 feet wide and 30 feet (9.1 m.) deep. Eastern Passage is the most direct passage to Newport, Bristol, Mount Hope Bay, and Taunton River.

Western Passage, between Conanicut and Prudence Islands on the east and the mainland on the west, is the approach to Dutch Island Harbor, Wickford, Greenwich, and Providence River. The channel south of Warwick Neck and north of Prudence Island forms a passage through which a depth of 18 feet (5.5 m.) can be taken to Providence. Strangers of over 16 feet (4.9 m.) draft rarely go above Dutch Island Harbor without a pilot, but vessels of 16 feet (4.9 m.) draft should have no difficulty in going to the head of the bay and Providence by following the directions.

Anchorages.—The principal anchorages for vessels seeking shelter are Newport Harbor, in the Eastern Passage, and Dutch Island Harbor, in the Western Passage. These harbors afford anchorage with good holding ground for deep-draft vessels, and are used by coasting vessels on the passage between Vineyard Sound and Long Island Sound. Good anchorage will be found almost anywhere in the bay under the lee of the islands or the shore, and vessels becalmed or at night frequently anchor. Point Judith Harbor of Refuge is just west of the point.

Prohibited anchorages.—Anchorage areas have been established by the Secretary of War in the Eastern and Western Passages and in Bristol Harbor. Vessels are prohibited from anchoring outside these areas, and officers of the Coast Guard Service are charged with the enforcement of the regulations governing these anchorages. A publication defining the anchorage areas, with the rules and regulations relating thereto, can be obtained from the Army Engineers, Providence, R. I. The following are extracts from the **rules and regulations:**

1. Except in cases of great emergency, no vessel shall be anchored in the entrances to Narragansett Bay, in Newport Harbor, or in that portion of Bristol Harbor channelward of the State Harbor line between the westward prolongations of Union and Franklin Streets, outside of the anchorage areas hereby defined and established.
2. Anchors must not be placed outside the anchorage areas, nor shall any vessel be so anchored that any portion of the hull or rigging shall at any time extend outside the boundries of the anchorage area.
3. Any vessel anchoring under the circumstances of great emergency outside the anchorage areas must be placed near the edge of the channel, and in such position as not to interfere with the free navigation of the channel, nor obstruct the approach to any pier, nor impede the movement of any boat, and shall move away immediately after the emergency ceases, or upon notification by the officer of the Coast Guard Service charged with the enforcement of these regulations.
4. A vessel upon being notified to move into the anchorage limits or to shift its position on anchorage grounds must get under way at once, or signal for a tug, and must change position as directed with reasonable promptness.
5. Whenever the maritime or commercial interests of the United States so require, the officer of the Coast Guard Service enforcing these regulations is hereby empowered to shift the position of any vessel anchored within the anchorage areas, of any vessel anchored outside the anchorage areas, and of any vessel which is so moored or anchored as to impede or obstruct vessel movements in any channel.
6. Nothing in these rules and regulations shall be construed as relieving the owner or person in charge of any vessel from the penalties of the law for obstructing navigation or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights, for signals, or for otherwise violating the law.

Torpedo-testing range.—The following information concerning the establishment of a restricted zone in Narragansett Bay for the testing of torpedoes, and the rules and regulations governing the use of this zone by vessels, has been received from the Secretary of War and is published for the information and guidance of mariners:

Under authority of law the following zone in which navigation is likely to be endangered by reason of the operations of the United States Naval Torpedo Station and in which vessels may navigate only subject to rules and regulations is hereby defined and established, and the following rules and regulations relating thereto are hereby prescribed and are in force:

THE DANGER ZONE

Within the area north of Gould Island, west of a line bearing 13° 30′ from the east shore of Gould Island through the spindle on Halfway Rock to the south end of Prudence Island, south of Patience Island and east of a line bearing 353° tangent to the west shore of Gould Island and ranging through the northwest point of Patience Island.

RULES AND REGULATIONS

1. During the period from March 15 to December 31, between the hours of 9 a. m. and 4 p. m. on all days except Saturdays, Sundays, and legal holidays, no vessel shall enter into or pass through the area above defined and established if forbidden to do so by the inspector of ordnance in charge, United States Naval Torpedo Station, or his duly accredited representatives.

2. From March 15 to December 31 all vessels are forbidden to anchor within the area defined except in cases of great emergency. Any vessel anchoring under circumstances of great emergency within the area shall move away immediately after the emergency ceases, or upon notification by the officer or employee charged with the enforcement of these regulations.

3. Any vessel upon being notified to shift its position or course must change position or course as directed with reasonable promptness.

4. During periods when testing is in progress, all vessels in or near the danger zone will be met by representatives of the inspector of ordnance in charge, suitably warned, and given necessary instructions and orders relative to navigating zone. Government vessels, seaplanes, or other equipment patrolling the zone will fly or expose a square red flag.

5. Nothing in these regulations shall prevent the setting of fish traps within the area under permits granted by the War Department, nor shall the passage of fishing vessels to and from authorized traps be unreasonably interfered with or restricted.

Pilots for Fall River and the harbors in Rhode Island will sometimes be found cruising between Point Judith and Cuttyhunk and also off Block Island. A pilot can be obtained by making signal off Block Island, Beavertail Lighthouse, and Brenton Point Coast Guard Station. If a vessel passes into the bay without having been boarded by a pilot, one may be obtained at Newport or Dutch Island Harbor. State pilotage is compulsory for foreign vessels or vessels from a foreign port.

The pilotage rates to all ports in Rhode Island, except Newport, Dutch Island, and Narragansett Pier, are as follows: Vessels of 7½ foot or less draft, $1.75 per foot; 8 to 9½-foot draft, $2 per foot; 10 to 11½-foot draft, $2.25 per foot; increasing 25 cents for each foot to 17½ feet; vessels of 18-foot draft and over, $4 per foot.

The rates to Newport, Dutch Island, and Narragansett Pier are as follows: Vessels of 12-foot or less draft, $1.50 per foot; 12½ to 20-foot draft, $2.50 per foot; 20½-foot draft and over, $3.50 per foot. The inward and outward rates are the same.

Half rate for pilotage is charged under the following conditions:

If bound to Wickford, and past the range of Fox Island and the beacon.

If bound into East Greenwich or Apponaug (so called), and past the range of the beacon and Warwick Neck Lighthouse.

If bound into Mount Hope Bay, and past Sandy Point Lighthouse.

If bound to Providence, and past the line of Warwick Neck Lighthouse and Popasquash Point.

If bound into Warren or Bristol, and past Warwick Neck Lighthouse (Western Passage), and Sandy Point Light (Eastern Passage).

If bound into Narragansett Pier, and past line drawn from buoy on head of reef to Brenton Reef Lightship, from thence to Point Judith Lighthouse.

Pilot rates for Fall River are as follows: Vessels under 500 tons, $3 per foot of draft; 501 to 1,000 tons, $3.50 per foot of draft; 1,001 to 1,500 tons, $4 per foot of draft; 1,501 to 2,000 tons, $4.50 per foot of draft; over 2,000 tons, $5 per foot of draft.

Towboats are frequently used by sailing vessels in the bay, especially those bound to Providence by the Western Passage, and may sometimes be found off the entrance or in Newport Harbor. It is usual for vessels entering by the Western Passage to put into Dutch Island Harbor, and from there telephone to the towboat office at

Providence. A towboat may be had by making signal off Point Judith, Beavertail Lighthouse, or Brenton Point Coast Guard Station.

Quarantine is enforced in accordance with the regulations of the United States Public Health Service. There are quarantine officers at Providence and Newport.

Hospital.—There are relief stations of the United States Public Health Service at Newport and Providence.

Supplies.—Coal, water, gasoline, and ship chandler's stores can be obtained at Newport, Providence, and Fall River, and gasoline and provisions at most of the towns on the bay or its tributaries.

Repairs to the hulls of vessels can be made at Newport, Fall River, and Providence, and to the machinery of steamers at Providence. For further information see the descriptions of the ports, and the table on page 5.

Storm-warning displays are made at Point Judith, Newport, Saunderstown (opposite Dutch Island), Fall River, Providence, and Rhode Island Yacht Club.

Fogs.—In the entrance to the bay and its approach fogs are more prevalent from April to October than during the rest of the year; they are brought in by winds from east through south to southwest, and are cleared off by northerly and westerly winds; their usual duration is 4 to 12 hours, but periods of 4 to 6 days have been known, with but short clear intervals. The head of the bay will sometimes be free from fog when the entrance is completely shut in.

Ice.—Navigation in the bay and its tributaries is sometimes impeded by floating ice, and in severe winters by pack or field ice. The ice breaking up in Providence River and Mount Hope Bay is set by north and northeast winds down the bay through the Eastern Passage, and if there is much ice a gorge is sometimes formed at Fort Adams, but it is of short duration. The passages are rarely closed for any length of time below Gould Island in the Eastern Passage and Dutch Island in the Western Passage. During January and February Mount Hope Bay, Bristol, Providence River, Greenwich, Warren, and Wickford are usually closed to sailing vessels unaided by steam. The inner harbor of Newport is also sometimes closed during the same months, with the exception of a channel kept open by the New York steamers.

Currents.—Observations made at Brenton Reef Lightship give the following results:

The strength of current occurs about ½ hour before the slacks at the Race, Long Island Sound (approximately the time of high or low water at Boston), the flood setting northward with a velocity of 0.5 knot about ½ hour before the current turns westward at the Race (approximately at time of low water at Boston), and the ebb setting southward with a velocity of 0.7 knot about ½ hour before the current turns eastward at the Race (approximately at time of high water at Boston). Slack occurs about 3½ hours before the slacks at the Race (approximately 3 hours after time of high or low water at Boston). The greatest observed velocity was 1.3 knots setting southerly.

Tides.—The mean rise and fall of the tides varies from 3.5 feet at the entrance to 4.6 feet at Providence.

Brenton Reef Lightship, described on page 94, off the entrance to Eastern Passage, forms the principal guide to the entrance of Narragansett Bay.

Brenton Point, the southwestern point of Rhode Island, and the eastern point at the entrance to Eastern Passage is marked by a large residence with cupola. **Brenton Reef,** extending ½ mile south-southwestward from the point, is bare in places at low water and is marked at the southern end by a red buoy. **Seal Rock** is a bare rock near the end of a reef extending ½ mile from the shore just eastward of Brenton Point.

Butterball Rock, a small bare rock about 200 yards from the southern end of **Castle Hill,** is marked off the western side by a red bell buoy.

Beavertail Lighthouse is a square granite tower, upper half white, attached to a white dwelling, on the south point of Conanicut Island. The light is group flashing white, 8 flashes of 0.7 second each, 7 eclipses of 1.2 seconds each and 1 eclipse of 16 seconds, 64 feet (19.5 m.) high and visible for 14 miles. The fog signal is an air siren blowing group of 2 blasts every 68 seconds, first blast 4 seconds, silent 10 seconds, second blast 4 seconds, silent 50 seconds.

Castle Hill Lighthouse is a conical granite tower, upper half white, on the east side of the entrance to Eastern Passage. The light is flashing red, flash 9 seconds, eclipse 21 seconds, 40 feet (12.2 m.) high and visible 10 miles. The fog signal is a bell sounding a group of 2 strokes every 18 seconds.

A private fog bell, maintained by the New England Steamship Co., is located 390 yards 25° from Castle Hill Lighthouse. The bell is rung by hand when the company's vessels pass.

Mackerel Cove, indenting the southern shore of Conanicut Island, is exposed to sea and wind in southerly weather and is seldom entered. **Kettlebottom Rock** is bare and lies about 300 yards southeastward of the eastern entrance to Mackerel Cove.

The Dumplings are a group of bare and sunken rocks off the southeastern point of Conanicut Island. There is a large house on the southern rock. The Dumplings are marked on the eastern side by two black buoys, the southernmost buoy being a bell buoy.

Newport Harbor is described on page 102.

Gould Island is flat and sparsely wooded near the middle. It is marked on the eastern side by a lighthouse, which is a conical tower, upper half white, lower half brown.

Coddington Cove is a good anchorage in southerly or easterly winds.

Cable crossings.—Submarine cables have been laid in Eastern Passage, between Gould Island and Coaster Harbor Island, between southernmost point of Coaster Harbor Island and the mainland opposite the United States Naval Hospital, thence to the northern end of Goat Island, skirting the shore until opposite the light on the northern end of the breakwater, from the southeastern point of Rose Island in a 116° 30′ direction, until in 15 feet (4.6 m.) of water near the northern end of Goat Island, when it turns southward to that island.

Halfway Rock, a small ledge showing bare at its southern end, lies 7/8 mile south-southwestward of the southern end of Prudence Island. A black spindle with cage is on the bare part of the ledge.

Fiske Rock, with 12 feet (3.7 m.) over it, lies 1/4 mile northeastward of the spindle on Halfway Rock, and is marked by a horizontally striped buoy. Strangers should not pass between the buoy and spindle.

Dyer Island is low and brush covered. A reef extending northward of the island, with depths of 10 to 18 feet (3 to 5.5 m.), is marked at its northern end by a red gas and bell buoy. A reef, partly bare at low water, extends 3/8 mile southward and southwestward from the island, and is marked on the western side by a red buoy and at the southern end by a black buoy. A bar with 8 to 17 feet (2.4 to 5.2 m.) over it extends southward from the red buoy to the shore. A lighted range ahead guides across the bar in a depth of about 15 feet (4.6 m.).

Mount Hope Bay and Taunton River are described on page 105.

Bristol Harbor (chart 354a).—This harbor is a cove lying between **Bristol Neck** on the east and **Popasquash Neck** on the west and northward of Hog Island, which lies in the middle of the entrance with a good channel on either side of it. The cove is about 2 miles long and 1 1/4 miles wide at its southern end, narrowing to 3/8 mile at its northern end. The harbor proper (northern part of the cove) is about 1 mile long and nearly 1/2 mile wide, has a depth of 15 to 17 feet (4.6 to 5.2 m.), and excellent anchorage in soft bottom abreast the town. The northern part of the harbor above the railroad wharf is shallow, having a depth of 7 to 12 feet (2.1 to 3.7 m.). The remains of an old pier that is covered at high water lies 50 yards westward of the railroad wharf.

Hog Island is a large island in the entrance. Shoals make out over 3/8 mile southward of the island, and vessels must pass at least 300 yards southeastward of Hog Island Shoal Lighthouse. The eastern shore of Hog Island should be given a berth of at least 350 yards. **Hog Island Rock,** with 4 feet (1.2 m.) over it, is on the eastern edge of the shoal about 1/2 mile northward of the southeastern end of the island and is marked on its eastern side by a black buoy.

The southern and western shores of Bristol Neck should be given a berth of at least 250 yards to avoid the shoals making off that distance. A red buoy marks **Pearce Rock,** about 1/4 mile westward of Bristol Ferry Lighthouse.

Making northward from Hog Island is an extensive shoal with depths of 3 to 12 feet (0.9 to 3.7 m.). For about 1/2 mile northward of the island this shoal has a width of 1/2 mile, thence it narrows to a point at the junction of the eastern and western channels 1 mile northward of the island. The northern end of the shoal, known as the **Middle Ground,** has a depth of only 5 feet (1.5 m.) and is marked by a horizontally striped buoy. Near the western edge of the shoal, about 1/2 mile northward of the northwestern end of the island, is **Castle Island,** a rock bare at low water, marked by a beacon (stone tower).

Usher Rocks, bare at low water, lie on the western side of the channel 3/8 mile north-northwestward of Castle Island beacon. Eastward of the rocks on the edge of the channel is a black buoy.

Usher Cove, lying westward of Usher Rocks, is shoal.

Bristol, a town on the eastern side of the harbor, has but little trade and is of no commercial importance. Near the southern end of the water front of the town is a shipyard where torpedo boats and yachts are built. Provisions, gasoline, and coal can be obtained. At low water 8 to 11 feet (2.4 to 3.4 m.) can be taken to some of the wharves. Bristol has railroad communication with Fall River and Providence. A ferry runs to the wharf on Rhode Island, eastward of Mussel Bed Shoals Lighthouse, from which there is railroad communication with Newport and Fall River.

Tides.—The mean rise and fall of tides is 4.1 feet.

Anchorage regulations for Bristol Harbor require all vessels to anchor at least 400 feet off the ends of the wharves and westward of a line extending northeast by east from Usher Rocks buoy. (See "Prohibited anchorages" on p. 95.)

Directions, Bristol Harbor—Eastern Channel.—Enter about midway between Bristol Neck and the southeast point of Hog Island, steer 340° true (N. ⅝ W. mag.), and pass 150 to 200 yards eastward of Hog Island Rock buoy and the horizontally striped buoy at the north end of the Middle Ground. Anchor in 16 to 17 feet (4.9 to 5.2 m.) at least 400 feet off the wharves, giving the shores a berth of over 200 yards.

Western Channel.—Pass 300 yards southwestward of Popasquash Point bell buoy and steer 29° true (NE. ¼ N. mag.) for the prominent white church spire in Bristol, passing about 250 yards off Castle Island beacon and Usher Rocks buoy and 200 yards northwestward of Middle Ground buoy. Then stand up the middle of the harbor and anchor as in preceding paragraph.

Warren River (chart 355) is a small river emptying into the head of Narragansett Bay, about 2 miles southeastward of Conimicut Lighthouse, at the mouth of Providence River. The channel leading up to the town of **Warren** has a depth of about 10 feet (3 m.) at low water and is narrow and crooked but is well buoyed. A draft of about 14 feet (4.3 m.) can be taken up to the town at high water. Coal can be obtained at the wharves, and gasoline, fresh water, and provisions can be had. The principal wharves have depths of 7 to 12 feet (2.1 to 3.7 m.). Warren has railroad and bus communication with Providence and Fall River.

Rumstick Shoal extends nearly ⅝ mile southward from **Rumstick Neck,** is about ⅜ mile wide, and has depths of 2 to 12 feet (0.6 to 3.7 m.), the ruling depth southward of Rumstick Rock being about 7 feet (2.1 m.). Near its southeastern extremity it is marked by a black gas buoy, and on its eastern edge, nearly ¼ mile southeastward of the southern extremity of Rumstick Neck, is a black spar buoy. **Rumstick Rock,** a bare rock, lies on the western point of the shoal, ¼ mile from Rumstick Neck; and **Rumstick Ledge,** bare at low water, lies 200 yards northwestward of the rock.

Anchorage.—There is excellent anchorage at the mouth of the river about ¼ mile from the eastern shore, southward or just eastward of buoy No. 3, in 14 to 15 feet (4.3 to 4.6 m.), soft bottom. There is not room for anchorage in the river except for small craft. Abreast the lower end of Warren, and 100 to 200 yards above buoy No. 12, the channel is about 450 feet wide with depths of 16 to 18 feet (4.9 to 5.5 m.) in the middle; a very small vessel can anchor temporarily at this point.

The **tidal currents** in some parts of the river run with considerable velocity, especially along the town front.

Directions, Warren River.—Pass about 350 yards eastward of Rumstick Shoal gas buoy, No. 1, and steer about 4° true (N. by E½ E. mag.) with buoy No. 3 on the port bow. Pass 75 yards eastward of buoy No. 3, steer 354° true (N. ⅝ E. mag.) for the western side at the entrance of Smith Cove, and pass 100 yards westward of buoy No. 2. Pass 50 yards westward and northwestward of buoy No. 4, steer 47° true (NE. by E. ⅜ E. mag.) and pass midway between buoy No. 6 and the old pier about 4 feet (1.2 m.) high on Allen Rock. Pass about 100 feet east of buoy No. 5 and steer 354° true (N. ⅝ E. mag.), passing midway between buoy No. 8 and the black buoy opposite. When up with buoy No. 10, steer 13° true (NNE. ⅜ E. mag.) and pass 100 feet westward of it and buoy No. 12. Anchor in midriver, 100 to 200 yards above buoy No. 12.

DIRECTIONS, EASTERN PASSAGE OF NARRAGANSETT BAY

The following directions are good for the deepest-draft vessels to the anchorage off Newport and up the bay to the entrance of Mount Hope Bay, and for a draft of 28 feet (8.5 m.) to the entrance of Providence River and to the city of Providence. Vessels of over 20-foot (6.1 m.) draft bound to Providence or Fall River should take a pilot.

Approaching Brenton Reef Lightship from eastward, care should be taken to keep it bearing northward of 268° true (W. by N. mag.) to give **Seal Ledge** a good berth. In clear weather vessels may pass ⅜ mile eastward of Brenton Reef Lightship; Brenton Reef and other dangers on the easterly side of the entrance will be avoided by keeping Castle Hill Lighthouse bearing eastward of 3° true (N. by E. ½ E. mag.), and passing westward of the bell buoy off Butterball Rock.

In thick weather Brenton Reef Lightship should be made and passed close-to. From the lightship a stranger should be able to make the anchorage in Newport outer harbor by closely following the directions and paying attention to the fog signals. See also the remarks on page 105.

From a position ⅜ mile northward of Hen and Chickens Lightship steer 260° true (W. ¼ N. mag.) for 8 miles to a position 1¼ miles southward of Sakonnet Lighthouse, and then steer 269° true (WNW. ⅞ W. mag.) for 8 miles to Brenton Reef Lightship.

From Vineyard Sound Lightship make good a 280° true (WNW. mag.) course for 17 miles to Brenton Reef Lightship.

From Block Island.—Passing 2½ miles east-southeastward of Block Island Southeast Lighthouse, make good an 18° true (NNE. ¾ E. mag.) course for 18 miles to Brenton Reef Lightship.

From Point Judith gas, whistling, and submarine bell buoy steer 39° true (NE. ⅝ E. mag.) for 7 miles to Brenton Reef Lightship. Or, in clear weather, from Point Judith gas, whistling, and submarine bell buoy a 33° true (NE. ⅛ E. mag.) course made good for 8¾ miles will lead nearly midway between Brenton Reef Lightship and Beavertail Lighthouse and ¼ mile northwestward of Castle Hill Lighthouse.

From Brenton Reef Lightship steer 11° true (NNE. ¼ E. mag.) for 2 miles to a position ¼ mile northwestward of Castle Hill Lighthouse. Then steer 46° true (NE. by E. ¼ E. mag.) for Newport Harbor (Goat Island) Lighthouse, which will lead to the anchorage in Newport outer harbor westward of Goat Island. Or, when southeastward of the Dumplings, and Rose Island Lighthouse bears 10° true (NNE. mag.), steer 358° true (N. by E. mag.), and pass ¼ mile eastward of the Dumplings and 400 yards westward of Rose Island Lighthouse. When Gull Rocks Lighthouse bears 88° true (E. by S. mag.), make good a 19° true (NNE. ⅞ E. mag.) course for 6½ miles, passing nearly ½ mile eastward of Gould Island Lighthouse, in midchannel westward of Dyer Island or slightly favor Prudence Island, passing 200 yards westward of Dyer Island North Point Shoal gas and bell buoy, and to a position ¼ mile eastward of Prudence Island Lighthouse. If bound to Fall River, follow the directions on page 107.

If bound to Providence, steer 1° true (N. by E. ¼ E. mag.) for 1 mile until Hog Island Shoal and Mussel Beds Shoals Lighthouses are in range, bearing 67° true (E. ⅞ N. mag.). Then steer 339° true (N. ⅝ W. mag.) to a position close to eastward of Popasquash gas and bell buoy; then steer 358° true (N. by E. mag.) for nearly 2¼ miles with the red buoy at the eastern side of the dredged channel ahead. When 250 yards southward of this buoy, steer 322° true (NNW. ⅛ W. mag.) in the dredged channel, heading for Bullock Point Lighthouse (square tower on white dwelling on granite pier) until 200 yards northeastward of Conimicut Lighthouse (white conical tower on brown pier). Then follow directions for Providence River on page 117.

NEWPORT HARBOR

(chart 353²) is on the eastern side of the Eastern Passage of Narragansett Bay, about 3½ miles above the entrance. It is divided by Goat Island into an inner and outer harbor and is an important harbor of refuge for coasters, tows, and yachts. The approach is well marked by lighthouses and fog signals, and the harbor is easy of access both day and night.

The Outer Harbor is on the western side of Goat Island, northward of the Dumplings and southward of Gould Island. Its entrance from southward is unobstructed; the entrance from northward, passing either side of Gould Island, is clear, but the passage eastward of Rose Island is obstructed by the rocks and ledges which lie between **Coasters Harbor Island** and Rose Island. The depths range from 6 to 23 fathoms (11 to 42 m.) and the holding ground is good. The anchorage is anywhere westward of Gould Island and westward of a line extending 189° from the east shore of Gould Island at its southern end to the easternmost Dumpling, with the exception of a channel 300 yards wide extending 285° to the ferry landing at Jamestown. An anchorage area is also established westward of Goat Island and eastward of Rose Island, within limits prescribed by the Secretary of War. (See "Prohibited anchorages" on p. 95.)

Rose Island, marked at its southwest end by a lighthouse, is surrounded by a shoal, with little water in places, which extends about

400 yards northeastward and northward from the island, and rises abruptly from deep water. A black buoy is placed on the end of the shoal which extends 225 yards southward from the island. **Mitchell Rock,** 14 feet (4.3 m.), lies 200 yards southeastward, and **Tracey Ledge,** 9 feet (2.7 m.), lies nearly 300 yards eastward from the edge of the shoal surrounding Rose Island. They are marked by black buoys. A red buoy marks a detached rock, 9 feet (2.7 m.), which lies 150 yards northeastward of the edge of the shoal. The north end of the shoal is marked by a red buoy.

Gull Rocks lie about midway between Rose Island and Coasters Harbor Island and are small in extent. Gull Rocks Lighthouse is on the middle of the rocks and may be approached as close as 100 yards on its eastern and western sides, but the shoals and rocks extend over 100 yards northward of it and 300 yards southward. These rocks are surrounded by a depth of 4¼ to 5 fathoms (7.8 to 9.1 m.). North of the lighthouse they are marked by a black buoy and south of the lighthouse by a horizontally striped buoy. A 17-foot (5.2 m.) spot lies 600 yards 336° true (N. by W. mag.) from Gull Rocks Lighthouse.

There is a deep channel between Rose Island and Gull Rocks and also between the latter and Coasters Harbor Island; the latter channel is the safer for strangers.

The Inner Harbor is on the eastern side of Goat Island, and extends along the western front of Newport. It has two entrances, the northern leading northward and eastward of Newport Harbor (Goat Island) Lighthouse and the southern leading around the southern end of Goat Island, between it and Ida Lewis Rock Lighthouse.

A channel 18 feet (5.5 m.) deep and 750 feet wide is maintained along the south and east sides of Goat Island. An anchorage basin, project depth 18 feet (5.5 m.), lies southward and eastward of the dredged channel to a line extending 44° true from Ida Lewis Rock Lighthouse to the wharves. Southeast of this basin is another anchorage area with a project depth of 13 feet (4 m.). In October, 1921, the 18-foot area had a controlling depth of 17½ feet (5.4 m.), and the 13-foot area a controlling depth of 12 feet (3.7 m.). Vessels are prohibited from anchoring within 50 yards of the wharves in these areas. (See "Prohibited anchorages" on p. 95.)

Goat Island and the breakwater extending from its northern end to Newport Harbor Lighthouse should be given a berth of 150 yards. The edge of the shoal at the south end of the island is marked at its southwest end by a black buoy and at its southeast end by Goat Island Shoal Light.

Shoals with little water over them make out nearly 300 yards from the south shore of the harbor to **Ida Lewis Rock Lighthouse** and the granite beacon with spindle and cage on **Little Lime Rock.** Northward of these shoals the project depth in the harbor is 13 feet (4 m.), obtained by dredging, except near the wharves; the southerly edge of the 18-foot (5.5 m.) dredged area in the harbor passes 200 yards northward of the beacon.

Brenton Cove is the bight in the southern part of Newport Harbor between Ida Lewis Rock Lighthouse on the east and Fort Adams on the west. It has good anchorage in 15 to 17 feet (4.6 to 5.2 m.) and is frequently used by yachts. There are no dangers if the

westerly shore of the cove be given a berth of 200 yards. The passage southward of Ida Lewis Rock Lighthouse is blocked by rocks.

Newport, on the eastern shore of the inner harbor, is one of the principal summer resorts on the Atlantic coast. It has considerable trade in coal, lumber, and building material, carried in coasting vessels; few foreign vessels enter the port. The depth at the principal wharves is 18 feet (5.5 m.) and at the railroad wharves 16 to 18 feet (4.9 to 5.5 m.)

Terminal facilities.—These consist of 19 piers and wharves with a total docking space of 13,270 feet, of which one wharf with a frontage of 560 feet is owned by the city of Newport, about 1,900 feet of frontage is privately owned but open to public use on payment of wharfage, and about 9,110 feet of frontage is privately owned and used. On two privately owned piers there are direct railroad connections.

In addition to the above is the Government landing, comprising 2 piers, 3 floats, ferry slips, and wharves with a total docking space of about 1,050 feet.

Prominent objects.—Many prominent objects will be seen, whether the harbor be approached from southward or northward, among which are the following: Fort Adams (stone), the tall buff stack and buildings of the Training Station and Naval War College on Coasters Harbor Island, the radio towers and buildings of the Torpedo Station on Goat Island, and the large hotels and a tall water tank at Jamestown on the eastern shore of Conanicut Island, opposite Rose Island. The lighthouses are the principal guides at all times.

Anchorages are described under the harbors above, and the regulations governing "Prohibited anchorages" are given on page 95.

Cable crossings are defined on page 98.

Quarantine is enforced in accordance with the regulations of the United States Public Health Service. Vessels bound for Newport and subject to quarantine inspection are boarded in the Outer Harbor.

Pilots.—See page 96. A **towboat** can be had at Newport.

Repairs.—At Newport there is a marine railway for vessels 180 feet long, 6½-foot draft forward, and 13½ feet aft; it has a capacity of 700 tons. Hull and small machinery repairs can be made. There are also several smaller railways for small craft.

Harbor regulations have been established and are enforced by a harbor master. Vessels are limited to a speed of 5 miles per hour in the Inner Harbor.

Hospital.—There is a relief station of the United States Public Health Service at Newport.

Storm-warning displays are made on the customhouse.

Supplies.—Coal and water can be had in the stream or at the wharves. Provisions, gasoline, and some ship chandler's stores can be obtained in the city.

Communication.—Newport has railroad communication, and connection by steamers with New York, Providence, and Fall River.

Ice sometimes obstructs navigation in the inner harbor.

Tides.—Daily predictions for high and low waters are given in the Tide Tables, Atlantic Coast.

DIRECTIONS, NEWPORT HARBOR

The following directions are good either day or night for the deepest draft vessels to the Outer Harbor, and for vessels of 18 feet (5.5 m.) draft to the Inner Harbor.

From southwestward.—Enter Narragansett Bay by the Eastern Passage and steer 46° true (NE. by E. ¼ E. mag.) for Newport Harbor Lighthouse, which will lead to the anchorage in the Outer Harbor westward of Goat Island. Or, steer this course until Ida Lewis Rock Lighthouse is opened from the light on the dock northward of Fort Adams, and then round the northern end of the dock, giving it a berth of 150 yards. Then steer 111° true (SE. by E. mag.) and round the south end of Goat Island at a distance of about 250 yards, passing 100 to 200 yards southward of the black buoy and Goat Island Shoal Light. Then stand northeastward to the anchorage. Anchor in 18 feet (5.5 m.), soft bottom, but not close enough to the wharves to interfere with the steamer and ferry traffic, and over 400 yards from Goat Island to avoid the track of the sound steamers.

From northward.—Large vessels generally pass westward of Rose Island and enter the Inner Harbor around the south end of Goat Island. Passing 400 yards westward of Rose Island Lighthouse steer 136° true (SSE. ¾ E. mag.) for Ida Lewis Rock Lighthouse until Goat Island Shoal Light bears 77° true (E. mag.). Then haul eastward and round the south end of Goat Island at a distance of about 250 yards as in the preceding paragraph.

Or, passing eastward of Gould Island give it a berth of over 200 yards. Then bring Gould Island Lighthouse astern on a 164° true (S. ¼ E. mag.) course heading for Newport Harbor Lighthouse. On this course pass about 200 yards westward of Coasters Harbor Island, and 150 to 200 yards eastward of Gull Rocks Lighthouse; then steer so as to pass about 200 yards eastward of Newport Harbor Lighthouse. Then steer 175° true (S. ¾ W. mag.), pass about 100 yards off the railroad wharves and the same distance off the wharf at the Torpedo Station on Goat Island, and then stand over for the wharves of the city to the anchorage as described in the first paragraph.

MOUNT HOPE BAY AND TAUNTON RIVER

Mount Hope Bay (chart 353), in the northeastern part of Narragansett Bay, is the approach to the city of Fall River and to Taunton River. There are two approaches by water to this bay, one through Sakonnet River and the other through the Eastern Passage of Narragansett Bay. The former is little used (see "Sakonnet River," p. 91); the latter is well marked by lighthouses and other aids and has a depth of over 6 fathoms (11 m.) in the channel until in the bay. A channel 300 feet wide and 25 feet (7.6 m.) deep has been dredged to Fall River.

Mount Hope is a prominent hill on the western side of the bay 2 miles northeastward of Bristol Ferry Lighthouse. The eastern and western slopes are wooded, and there is a flagstaff on the summit.

Spar Island is a small, low island near the center of Mount Hope Bay. It is marked by a watch house.

Three shallow streams empty into the northern part of Mount Hope Bay. They are entered only by small local craft. **Kickamuit**

River, the western one, has a narrow entrance through which the currents have considerable velocity. **Coles River,** the middle one, and **Lees River,** the eastern one, are crossed by closed railroad bridges about 1 mile above their entrances; they have an overhead clearance of 6 feet and 13 feet, respectively, at mean high water.

Taunton River empties into the northeastern part of Mount Hope Bay. It has a narrow, crooked channel, originally dredged where necessary to a depth of 12 feet (3.7 m.) in a channel 100 feet wide to Dighton, and 11 feet (3.4 m.) deep and 80 feet wide to Taunton, which is the head of navigation. This channel is subject to change both in width and depth, and its condition has not been determined for several years. The deepest draft taken to Taunton is 9 feet (2.7 m.) at high water. The channel is well marked by buoys. Vessels bound to Taunton usually take a towboat at Fall River, and all towing is done on the tides.

The following **bridges** cross the river: Slades Ferry bridge (railroad), Fall River, is a center-pier draw, with an opening 67.5 feet wide on either side; Brightman Street Bridge, Fall River, is a lift bridge, with an opening 100 feet wide; the railroad bridge at Somerset is a center-pier draw with openings 100 feet wide on either side; the highway bridge at Berkeley, 9 miles above the entrance, is a center-pier draw with openings 51 feet on either side: Plain Street Bridge, Taunton, is a center-pier draw with openings 36 feet wide on either side.

Regulations prescribed for the bridges require that they shall be opened for vessels on signal, except in the case of the railroad bridges, which may be kept closed for a period not exceeding four minutes after the signal is given, provided a train is approaching the bridge. The signal for opening is three short blasts, to be answered by one long blast if bridge can be opened, or by three long blasts and conspicuously displaying a red flag or ball by day or a red light by night, if opening is delayed. Small craft which can not pass under the closed bridges shall not be delayed more than 20 minutes.

Fall River, on the eastern shore at the entrance to Taunton River, has a considerable coasting trade; large cargoes of coal are brought for its factories. At low water a draft of 24 feet (7.3 m.) can be taken up to the city. The depth at the wharves is 10 to 25 feet (3 to 7.6 m.).

Terminal facilities.—These consist of 18 piers having 9,650 feet of docking space, and wharves affording 3,250 feet additional docking space. Three of the piers have direct railroad connection. One pier, belonging to the city of Fall River, is open to general public use.

Somerset, about 5¼ miles, and **Dighton,** about 7½ miles, above Fall River, on the west bank of Taunton River, are two villages to which vessels occasionally bring cargoes. At high water a draft of 18 feet (5.5 m.) can be taken to Somerset and 11 feet (3.4 m.) to Dighton.

Taunton is an important manufacturing city at the head of navigation, 12½ miles above Fall River. It has a large coasting trade in lumber and coal, carried principally in barges. Vessels of 9 feet (2.7 m.) draft are towed to the city at high water.

Anchorage.—There is good anchorage in 3 to 5 fathoms (5.5 to 9 m.) abreast Fall River. An anchorage 25 feet (7.6 m.) deep has been dredged in the eastern half of the harbor from abreast the Old Colony Railroad wharf to deeper water ½ mile farther up. Vessels can anchor anywhere in the bay where the depth and bottom are suitable.

The harbor master controls the anchoring and berthing of vessels. His office is located on the city wharf.

Pilots can be obtained at the entrance to Narragansett Bay. (See p. 96.)

Towboats are used by the larger vessels and those bound into Taunton River; they can be had from Fall River or Newport.

Supplies.—Coal, water, gasoline, provisions, and supplies of all kinds can be had at Fall River.

Repairs.—There is a marine railway at **South Somerset,** opposite Fall River, capable of hauling out vessels of 15-foot draft forward, 18 feet aft, 325 feet long, and with a capacity of 2,500 tons. There are also smaller railways located here, and boiler and machinery repairs can be made.

Storm-warning displays are made at Fall River from a tower on a tall building where they can be seen from the harbor.

Communication.—Fall River has railroad communication. Daily steamers run to New York. There is bus service with Providence and Newport.

Ice generally closes Taunton River from December to March. Mount Hope Bay is occasionally closed to navigation.

Tides.—The mean rise and fall of the tides at Fall River is 4.9 feet and at Taunton 2.8 feet.

DIRECTIONS, MOUNT HOPE BAY

Follow the directions for the eastern passage of Narragansett Bay given on page 101 to a position ¼ mile east-southeastward of Prudence Island Lighthouse. Then steer 40° true (NE. ¾ E. mag.), passing about 200 yards northwestward of Coal Mine buoy and the same distance southeastward of the black buoy southwestward of Hog Island Lighthouse. Pass 200 yards northwestward of Mussel Bed Shoals Lighthouse and 400 yards southeastward of Bristol Ferry Lighthouse. Continue this course for 2½ miles beyond Bristol Ferry Lighthouse to a position ¼ mile southward of the black buoy off Mount Hope Point.

The range for the lower section of the dredged channel is Borden Flats Lighthouse and Mechanics Mill stack; the latter will be identified by a church with twin spires and a belfry which shows just to the right of it when on the range. This range leads in the dredged channel 40 feet from its southerly edge, so that care should be taken to go nothing southward of it to keep in the dredged channel. Steer 45° true (NE. by E. ¼ E. mag.) on this range through the buoyed channel until about ¾ mile from Borden Flats Lighthouse and nearly up with the large coal piers on the southern shore. Then steer 58° true (ENE. ⅜ E. mag.) for the end of the Old Colony Railroad wharf, and pass about 250 yards off the coal piers and 300 yards southward of Borden Flats Lighthouse. Pass the wharf of the Fall River Iron Works (large red-brick factory) at a distance not greater than 200 yards, and anchor above the Old Colony Railroad wharf,

in the eastern half of the harbor, in a depth of 25 feet (7.6 m.). Anchorage can also be selected nearer Borden Flats Lighthouse, where the least depth is 16 feet (4.9 m.).

NARRAGANSETT BAY, WESTERN PASSAGE

This passage is the approach to Dutch Island Harbor, Wickford, and Greenwich. Vessels may also go to Providence by this route, although the route through the Eastern Passage is deeper and generally used.

The shore for a distance of 2¾ miles northeastward of Point Judith is foul, and should be given a berth of ½ mile. Abreast the tall tower it is bold, but abreast Narragansett Pier there are shoals and rocks which extend about 300 yards from the shore. A rock with 14 feet (4.3 m.) over it, lying ¾ mile southwestward from Whale Rock Lighthouse and ⅜ mile from shore, is marked by a black buoy.

Narragansett Pier is a summer resort having railroad communication; the large hotels and a square granite tower are prominent. Storm-warning displays are made.

Pattaquamscott River is a shallow, unimportant stream with a narrow, foul entrance about 1 mile northeastward of Narragansett Pier.

Brenton Reef Lightship is described on page 94.

Beavertail Lighthouse is described on page 98.

Whale Rock Lighthouse is a white conical tower on a red cylindrical pier. The light is fixed red, 71 feet (21.6 m.) high and visible for 12 miles. The fog signal is a bell sounding a group of 2 strokes every 20 seconds.

Newton Rock has 3 feet (0.9 m.) over it and is part of the ledge which extends 400 yards southward from Beavertail Lighthouse. A horizontally striped bell buoy is placed about ¼ mile southwestward of the rock and about 350 yards from the southern end of the ledge.

Whale Rock, on the western side of the entrance to the Western Passage is marked by Whale Rock Lighthouse. There is a 7-foot (2.1 m.) spot about 200 yards northward of Whale Rock Lighthouse. A channel with a depth of about 8 fathoms (14.6 m.) leads between the lighthouse and the western shore, but strangers should not use it.

Austin Hollow, the bight in the eastern shore 1 mile northward of Beavertail, is full of shoals, but the eastern shore above the bight to the entrance of Dutch Island Harbor can be approached as close as 200 yards. The western shore between Bonnet Point and South Ferry should be given a berth of 400 yards.

Saunderstown is on the western shore abreast Dutch Island. A ferry runs to the western side of Conanicut Island at the southern part of Dutch Island Harbor. **Storm-warning signals** are made. **Pilots** for the Western Passage may be had.

Anchorage areas in the Western Passage are defined by the Secretary of War, and vessels are prohibited from anchoring outside these areas. (See "Prohibited anchorages" on p. 95.)

Dutch Island Harbor (charts 353 or 353 *).—This harbor lies in the Western Passage of Narragansett Bay about 3 miles above

Beavertail Lighthouse, and is a semicircular indentation ½ by 1 mile in extent, making into the western side of Conanicut Island. **Dutch Island** is on the western side of the harbor, and vessels may enter by passing either northward or southward of the island. The harbor affords excellent anchorage in 2 to 8 fathoms (3.7 to 14.6 m.), sticky bottom, is easy of access, and is frequently used as a harbor of refuge by coasters. The southern entrance is good for a depth of 28 feet (8.5 m.); the northern entrance has a shoal with 16 to 18 feet (4.9 to 5.5 m.) over it, and should not be used by vessels of over 15 feet (4.6 m.) draft.

Dutch Island Lighthouse is a square white tower attached to a dwelling on the extreme southern end of Dutch Island, and is the guide for vessels coming up the Western Passage and entering Dutch Island Harbor by the southern entrance.

A narrow spit makes out about 150 yards south-southwestward from Dutch Island Lighthouse, and has 6 feet (1.8 m.) near its end, where it is marked by a black buoy. The shoal making out on the northwest side of the island is marked by a red bell buoy.

On the south side of the entrance is a high point known as **Fox Hill,** which terminates in a bluff, rocky face northward, known as **Beaver Head.** From it a shoal makes out 200 yards westward and 350 yards northward. At its northern extremity the shoal rises abruptly from 8½ fathoms to 7 feet (15.5 to 2.1 m.), and is marked by a red buoy.

In the southeastern part of the harbor there is a shallow cove which makes southeastward about ½ mile, and is only separated from Mackerel Cove by a narrow neck of land which joins Beavertail Peninsula to the main body of the island.

Directions, Dutch Island Harbor.—In seeking anchorage, if of over 18-foot (5.5 m.) draft, give the eastern shore of the harbor a berth of at least ⅜ mile; if of less than 14-foot (4.3 m.) draft, the eastern shore may be approached as close as 300 yards and closer in places, the general depth being 15 to 17 feet (4.6 to 5.2 m.). The eastern shore of Dutch Island should be given a berth of 100 yards.

From southward.—Steer 4° true (N. by E. ½ E. mag.) for Dutch Island Lighthouse until ¼ mile or less from it; then steer 43° true (NE. by E. mag.) into the harbor, being guided by the buoys. Select anchorage according to draft, within the anchorage areas prescribed by the Secretary of War.

From northward.—Steer 186° true (S. by W. ¾ W. mag.) for Dutch Island Lighthouse until about ½ mile past Plum Beach Lighthouse, and then steer 157° true (S. ⅞ E. mag.) into the harbor with Plum Beach Lighthouse astern. Give the northeastern end of Dutch Island a berth of over 100 yards, and select anchorage according to draft, within the prescribed anchorage limits.

Plum Beach Shoal has 12 to 16 feet (3.7 to 4.9 m.) over it, and extends ½ mile from the western shore about 1 mile above Dutch Island. The northeastern end of the shoal is marked by Plum Beach Lighthouse, and the south end by a black buoy which lies ½ mile southward of the lighthouse, in line between it and Dutch Island Lighthouse. To insure a depth of more than 18 feet (5.5 m.) vessels should keep over 350 yards eastward of a line joining the buoy and Plum Beach Lighthouse. The lighthouse is a conical

tower, lower half white, upper half brown, on a black cylindrical pier.

Great Ledge stretches along the west shore of Conanicut Island for a distance of 1¾ miles, its southern end lying about ⅞ mile northward of Dutch Island. The distance to which this ledge extends from the shore varies from 175 yards at its southern to 500 yards at its northern end; it comprises a number of bare and sunken rocks and rises abruptly from deep water. **Old Ferry Shoal** has a depth of 23 feet (7 m.) and is marked on its west side by a red spar buoy.

Fox Island, southward of Wickford Harbor, is small and low, with a few trees and a red shed. A shoal, with numerous submerged rocks, extends ¼ mile southward from the island. Bare and sunken rocks extend northeastward and eastward from **Rome Point,** southwestward of Fox Island. A narrow channel, suitable only for small craft, leads between these rocks and Fox Island.

Bissell Cove, west-southwestward of Fox Island, can be entered at high water with a draft of 3 or 4 feet (0.9 or 1.2 m.). There are strong currents through the entrance. The cove is shoal and the channel unmarked.

Wickford Harbor.—This harbor (chart 357), in the west shore of Narragansett Bay, westward of the northern end of Conanicut Island, comprises an outer and inner harbor. The outer harbor is a broad bight between **Quonset Point** on the north and **Wildgoose Point** on the south; between these points it is about 2 miles wide and has good anchorage in 14 to 17 feet (4.3 to 5.2 m.) in the middle and southern parts.

A shoal, with numerous ledges and rocks, extends nearly 1¼ miles southwestward from Quonset Point. A number of these rocks and ledges are buoyed, and 7 feet (2.1 m.) may be taken across the shoal; but strangers should pass southward of **General Rock,** the southernmost, which has 10 feet (3 m.) over it, and is marked by a bell buoy. **James Ledge** has 2 feet (0.6 m.) over it, and is marked by a black buoy. **Brig Ledge,** with 9 feet (2.7 m.) over it, is marked by a horizontally striped buoy. These three are the easternmost of the dangers, and lie from ⅝ to nearly 1¼ miles south-southwestward of Quonset Point.

South White Rock, marked by a granite beacon, is the southwestern most of the rocks southwestward of Quonset Point, and is ⅜ mile north-northwestward of General Rock.

Charles Rock, with 4 feet (1.2 m.) over it, is at the south end of the shoals making out from Sauga Point, and is marked by a red buoy which lies nearly 300 yards north-northwestward of Wickford Harbor Lighthouse.

A shoal extends from Wickford Harbor Lighthouse to the steamboat wharf, on the easterly side at the entrance of the inner harbor, and makes out 200 to 300 feet just eastward of the wharf.

The entrance to the inner harbor is a little more than ¼ mile wide between **Sauga Point** on the north and **Poplar Point** on the south, but the shoals making out from these points leave only a narrow channel, marked by and lying just northward of **Wickford Harbor Lighthouse,** which is on Old Gay Rock, about 300 yards northeastward from the unused light on Poplar Point. The entrance channel between the points leads to the common junction of three coves, **Fish-**

ing Cove making northward, **Mill Cove** making northwestward, and Wickford Cove making southwestward. The first two of these coves are shallow and of no importance.

Wickford Cove has a depth of about 9 feet (2.7 m.) in a narrow dredged channel, which leads between flats that are mostly dry at extreme low water. The western and southern sides of the dredged channel are marked by dolphins. Strangers should not go above the wharves at the entrance without a pilot, who may be had by making signal while eastward of the lighthouse. The town of **Wickford,** on the west side of Wickford Cove, is of little commercial importance; cargoes of coal are brought to it in vessels of 12-foot (3.7 m.) draft, and a steamer runs to Newport, connecting at Wickford with the railroad. The depth at low water at the steamer wharf, on the easterly side of the entrance, is 8 feet (2.4 m.) at the northern end, and at those on the westerly side about 6 to 8 feet (1.8 to 2.4 m.). Gasoline, coal, and some provisions can be had, and there is a small marine railway capable of hauling out vessels up to 6-foot draft. In severe winters the inner harbor is closed by ice, but the outer harbor is usually open, although drift ice is occasionally encountered.

Directions, Wickford Harbor.—From a position ¼ mile eastward of Plum Beach Lighthouse steer 341° true (N. ½ W. mag.) and pass ¼ mile eastward of Fox Island; or from a position ¼ mile northward of Conanicut Island Lighthouse steer 252° true (W. ½ S. mag.) and pass southward of General Rock bell buoy; or, passing ¼ mile or more eastward of Quonset Point and eastward of the black buoy off the point, steer 202° true (SW. ⅞ S. mag.) and pass eastward and southward of General Rock bell buoy. All dangers off the southern shore of the harbor will be cleared by giving Fox Island a berth of over 300 yards when eastward of it, and keeping eastward of a line joining Fox Island and Wickford Harbor Lighthouse. Then steer for Wickford Harbor Lighthouse on any bearing between 313° true (NW. by N. mag.) and 286° true (NW. by W. ⅜ W. mag.) and anchor ¼ mile or more southeastward or eastward of the lighthouse in 14 to 15 feet (4.3 to 4.6 m.), soft bottom.

A depth of 10 feet (3 m.) can be taken to the steamboat wharf, on the easterly side of the entrance to the inner harbor, by passing 200 feet northward of Wickford Harbor Lighthouse, and the same distance southward of Charles Rock buoy, on a 285° true (NW. by W, ½ W. mag.) course. When the entrance to the inner harbor is open, steer 203° true (SW. ¾ S. mag.), heading to favor the wharf on the easterly side. Small craft or a few small vessels can anchor in the channel from Charles Rock buoy to abreast the entrance of the inner harbor. Small craft can enter Wickford Cove by passing 25 feet off the dolphins on the western side of the channel and the same distance northward of the stakes on the south side of the channel, and then rounding gradually to the coal wharf on the western side of the cove near the head.

Shoals fill the bight between Quonset Point and **Calfpasture Point,** the point about 2¼ miles northward. To avoid these a vessel should haul eastward when the water shoals to 18 feet. Abreast Calfpasture Point and for some distance northward of it a shoal extends ½ mile from shore.

Allen Harbor and **Flat Cove** are shallow coves with a common entrance, nearly bare at low water, southward of Calfpasture Point.

Hope Island has a few trees and low grassy hills. Bare and sunken rocks surround the island for a distance of about ¼ mile. **Despair Island** is the outer end of a rocky ledge extending ¼ mile northeastward from Hope Island, and is marked by a black bell buoy.

Shoals make eastward from the entrance to Greenwich Bay, and extend nearly to **Patience Island.** For a distance of nearly 1 mile from shore the shoal has depths of 2 to 12 feet (0.6 to 3.7 m.), and has a number of rocks and ledges, one of which is marked by a black buoy. Hunt Ledge, with 12 feet (3.7 m.) over it, is the easternmost of the rocks surrounding it. From this ledge a shoal with 14 to 17 feet (4.3 to 5.2 m.) over it extends ⅝ mile eastward and 1¾ miles south-southeastward; its southern point is marked by a black buoy. Between this shoal and the shoal making westward and southward from Patience Island there is a channel with a least width of 300 yards and a depth of from 3¼ to 12 fathoms (5.8 to 22 m.), leading up to Warwick Neck. This channel is marked by buoys, leads on a 349° true (N. ¼ E. mag.) bearing for Warwick Lighthouse, and forms the approach through Western Passage to Greenwich Bay and Providence River. The former dredged channel across the shoals bearing 186° true from Warwick Lighthouse has been abandoned.

A shoal with 12 to 15 feet (3.7 to 4.6 m.) over it extends about 600 yards westward of Patience Island, and its edge is marked by a gas and bell buoy, lying ½ mile southward from Warwick Lighthouse.

Potowomut River, on the south side of **Potowomut Neck,** has a bar at the entrance with depths of 2 to 4 feet (0.6 to 1.2 m.). Inside the channel is narrow and crooked.

Greenwich Bay, at the northwestern end of Narragansett Bay, has its entrance between Warwick Neck and Potowomut Neck; the general depth for the greater part is 10 feet (3 m.). At the northwestern end of the bay is a coal wharf to which 8 feet (2.4 m.) can be taken at high water.

Old Warwick Cove, at the northeastern part of the bay, has a depth of 4 feet (1.2 m.) in the entrance, with a narrow channel of greater depth inside. A shoal, bare at low water, extends 200 yards eastward from the western point at the entrance. A drawbridge with openings 30 feet wide crosses the cove just above the entrance.

Brush Neck Cove, westward of Old Warwick Cove, is fronted by a flat with a general depth of about 2 feet (0.6 m.). A closed bridge with an overhead clearance of 5.5 feet at mean high water crosses the entrance.

Oakland Beach, between these coves, is a summer resort with railroad communication. The large hotel and flagstaff are conspicuous.

Apponaug River is a shallow stream emptying into the northwestern part of Greenwich Bay. The general depth is 4 feet (1.2 m.) for about ¼ mile, above which the stream is nearly bare at low water. **Apponaug** is a village nearly 1 mile above the entrance. A depth of 3 feet (0.9 m.) can be carried to the town.

Chippanogset Island is the small island, with yellow bluff facing eastward, in the extreme western part of the bay, and northward of the entrance to Greenwich Cove. From this island shoals, with little water over them, make off 500 yards northward and 250 yards

eastward and southeastward; the southeastern extremity is marked by a red buoy.

Shoals make out northward and northwestward for a distance of about 300 yards from **Long Point,** the northwestern point of Potowomut Neck. The western end of the shoals is marked by a black buoy.

Greenwich Cove, 1¼ miles long, 300 to 600 yards wide, and with a general depth of 8 to 10 feet (2.4 to 3 m.), makes southward from the southwestern end of Greenwich Bay. On the western shore of the cove is the town of **East Greenwich.** The narrow channel into the cove has a depth of 10 feet (3 m.), and there are depths up to 12 feet (3.7 m.) at high water at some of the wharves. A depth of 6 feet (1.8 m.) can be carried to the yacht club landing at low water. There is good anchorage off the wharves in 8 to 11 feet (2.4 to 3.4 m.), the deepest water being found on the eastern side of the cove. Gasoline, fresh water, and provisions can be obtained, and there is a marine railway 120 feet long, 26 feet wide, and capable of hauling out vessels up to 9-foot draft and 100 tons.

Tides.—The mean rise and fall of tide is 4.5 feet.

Directions, Greenwich Bay.—Pass ¼ mile southwestward of Warwick Lighthouse, then steer 302° true (NW. mag.) and pass about 150 yards northward of Sandy Point Shoal buoy. Then steer 280° true (WNW. mag.) to a position 75 yards northward of Sally Rock buoy (black). Then steer 241° true (WSW. ⅝ W. mag.) for the red buoy; pass close southward of it and continue the course, passing 75 yards northward and 50 yards westward of the black buoy off Long Point; then steer about 156° true (S. by E. mag.) into the cove. Keep in the middle of the cove, and anchor not more than ½ mile above the entrance, in 8 to 11 feet (2.4 to 3.4 m.).

Rocky Point, on the eastern side of **Warwick Neck,** about 1½ miles northeastward of the lighthouse, is marked by a prominent amusement park and observation tower. The wharf has a depth of 9 feet (2.7 m.) at the end.

Extensive shoals make off from the eastern side of **Warwick Neck,** and extend out about 2 miles to **Ohio Ledge,** with depths of 15 to 24 feet (4.6 to 7.3 m.). The channel between these shoals and those making northward from Patience and Prudence Islands is about ¼ mile wide, with depths of 4 to 10 fathoms (7 to 18 m.). This channel is now used by vessels of over 12-foot (3.7 m.) draft in preference to the abandoned channel across the shoal eastward of Rocky Point.

DIRECTIONS, WESTERN PASSAGE OF NARRAGANSETT BAY

The least depth on the sailing lines is about 19 feet (5.8 m.) as far as Providence River entrance, but local knowledge is required for a greater draft than 12 feet (3.7 m.).

Pass close to Brenton Reef Lightship and steer 219° true (NW. by W. mag.) for Whale Rock Lighthouse until southwestward of Beavertail Lighthouse. Then pass ⅜ to ½ mile westward of Beavertail Lighthouse and steer 4° true (N. by E. ½ E. mag.) for Dutch Island Lighthouse, with Plum Beach Lighthouse open westward of it. Or, from Point Judith gas, whistling, and submarine bell buoy, steer 24° true (NE. ¾ N. mag.) for 7 miles, and pass midway between

Whale Rock and Beavertail Lighthouses. Then steer 4° true (N. by E. ½ E. mag.) for Dutch Island Lighthouse. At night a careful study of the characteristics of the lights is necessary, as a number of the lights marking the Eastern Passage will be seen on the starboard bow when approaching from Point Judith.

When ½ to ¾ mile from Dutch Island Lighthouse, steer more northward so as to pass ¼ mile west of it. Then steer 7° true (N. by E. ¾ E. mag.) for Plum Beach Lighthouse until abreast the north end of Dutch Island, and then steer northeastward. When Dutch Island Lighthouse bears 186° true (S. by W. ¾ W. mag.), bring it astern and steer 6° true (N. by E. ¾ E. mag.) passing 600 yards eastward of Plum Beach Lighthouse. When Conanicut Island Lighthouse is abeam, steer 18° true (NNE. ¾ E. mag.) for 3⅜ miles, passing about ½ mile westward of Hope Island.

Warwick Lighthouse should then bear 349° true (N. ¼ E. mag.). Head for the lighthouse on this bearing, passing between the red and black spar buoys at the southern end of the shoals. When ⅜ mile from Warwick Lighthouse, and Patience Island gas and bell buoy is abeam, steer 53° true (ENE. mag.) with Ohio Ledge gas buoy No. 9 ahead. Pass 100 yards northward of a horizontally striped buoy, and when Conimicut light bears 1° true (N. by E. ¼ E. mag.) steer 99° true (ESE. mag.) for 1¼ miles, and 3° true (N. by E. ½ E. mag.) for 1 mile. On the last course, Ohio Ledge gas buoy No. 9 will be a little on the port bow. Round this buoy at a distance of 100 yards and steer 324° true (NNW. mag.) and pass 200 yards eastward of Conimicut Lighthouse. Then follow the directions for Providence River.

PROVIDENCE RIVER

(chart 278) empties into the head of Narragansett Bay and is the approach to the city of Providence and to Seekonk (Pawtucket) River. The entrance, between **Nayat Point** (marked by an unused light tower) on the east and **Conimicut Point** on the west, is about ⅞ mile wide but is obstructed by shoals on both sides, which leave an available channel about ¼ mile wide.

Conimicut Lighthouse is a white conical tower on a pier on the eastern end of the shoal making out from Conimicut Point.

Channel.—The channel of Providence River, leading between extensive shoals which make out from both shores, is well marked by lighthouses and other aids and can be readily followed in the daytime with clear weather. The project provides for a channel 600 feet wide and 30 feet (9.1 m.) deep from the deep water in Narragansett Bay opposite North Point up to **Fields Point.** In June, 1925, the project depth obtained in the channel except for several mud lumps of 28 feet (8.5 m.) depth or over. **Providence Harbor** is that section of the river lying northward of Fields Point. The project provides for a depth of 30 feet (9.1 m.) in the harbor for a width of 1,300 to 1,800 feet, reducing to 800 feet at **Fox Point.** In June, 1925, the western portion of the harbor had a ruling depth of 28 feet (8.5 m.) and the eastern part 24 to 30 feet (7.3 to 9.1 m.).

Pawtuxet is a village on the west bank of Providence River westward of Sabine Point Lighthouse. It has no commerce, and can be reached at high water only by vessels up to 7-foot (2.1 m.) draft.

It is frequented by oyster boats and small pleasure craft, for which there is a marine railway. The entrance channel leads between rocks bare at low water. A lighted range ahead guides through the channel. The remains of a stone beacon, covered at high water, is marked by a black buoy.

Providence, about 7 miles above the entrance to the river and at its junction with Seekonk River, is an important commercial port. It has some foreign trade and is being developed as the oil-distributing center for southeastern New England. Groups of prominent oil tanks are located on **Kettle Point** and on the east bank ⅝ mile northward of Kettle Point. The municipal pier, on Fields Point, on the west bank abreast Fuller Rock Lighthouse, is being dredged to 30 feet (9.1 m.). The wharves below the bridges have depths from 10 to 30 feet (3 to 9.1 m.). At high water, a draft of 23 feet (7 m.) can be taken to the coal wharves about Point Street Bridge.

Terminal facilities.—These consist of piers and wharves with a total docking space of 29,250 feet, of which 4,800 feet is publicly owned, about 3,150 feet is open for general public use upon payment of wharfage, and 21,300 feet is privately owned and used. All of these wharves and piers are or can easily be connected with railroad lines which are in operation on all sides of the harbor.

East Providence, a suburb of Providence, is on the east bank and is connected with the city proper by four bridges crossing Seekonk River.

Seekonk (Pawtucket) River (chart 278) has been improved by dredging a channel 150 feet wide and 16 feet (4.9 m.) deep from Red Bridge, Providence, to the lower wharves at Pawtucket; the same depth exists to Division Street Bridge, but ledge rock reduces the width to 60 feet. The lower part of the river has a deep but crooked natural channel. Part of **Green Jacket Shoal,** on the south side at the entrance, has been removed to depths of 21 to 26 feet (6.3 to 7.9 m.). The channel is well marked by buoys, but strangers should have a pilot or towboat. The tidal currents have an estimated velocity of 3 knots at strength in the narrowest part of the river at **India Point.**

Pawtucket is a city at the head of navigation on the Seekonk River about 4½ miles above the mouth. The principal wharves have depths from 9 to 14 feet (2.7 to 4.3 m.), the deepest draft taken to Pawtucket is 17 feet (5.2 m.) at high water.

Terminal facilities.—Including the wharves at **Phillipsdale,** two in number, these cover about 4,540 feet of docking space, of which 700 feet is owned by the State of Rhode Island and 3,840 feet owned and used by private owners. Of the latter some portions are at times used by the public upon payment of wharfage. The two wharves at Phillipsdale have near-by rail connections in the yards of the owners.

Bridges.—Point Street Bridge, crossing Providence River 600 yards above Fox Point, is a center-pier draw with an opening 99 feet wide on either side. Four drawbridges cross Seekonk River within a distance of 1 mile from its mouth; the least headroom at high water when closed is about 5 feet. India Street Bridge is a center-pier draw with an opening 80 feet wide on either side. Washington Street Bridge is a center-pier draw with an opening 80 feet wide on either side. Tunnel Bridge is a single-leaf lift, width of

opening 90 feet. Red Bridge is a center pier draw with an opening 68.5 feet wide on either side.

Regulations prescribed for the bridges require that they shall be opened for vessels on signal, except in the case of the railroad bridges, which may be kept closed for a period not exceeding four minutes after the signal is given, provided a train is approaching the bridge. The signal for opening is three short blasts, to be answered by one long blast if bridge can be opened, or by three long blasts and conspicuously displaying a red flag or ball by day or a red light by night if opening is delayed. Small craft which can not pass under the closed bridges shall not be delayed more than 20 minutes.

Anchorage.—Vessels anchor as directed by the harbor master on the edge of the channel between Fields Point and Fox Point. There is anchorage for a few vessels eastward of Fox Point, where Green Jacket Shoal has been removed. Small craft anchor westward and northward of **Starvegoat Island,** on the western side of the river, southward of Fields Point in 3 to 4 feet (0.9 to 1.2 m.). The southern entrance is better, giving Starvegoat Island a berth of over 100 yards.

Pilots.—Vessels desiring a pilot can get one off the entrance to Narragansett Bay or at Newport or Dutch Island Harbor. (See "Pilots," p. 96.)

Quarantine is enforced in accordance with the regulations of the Public Health Service. Vessels subject to inspection are boarded in the harbor.

Towboats are generally taken by the larger sailing vessels, and may sometimes be found at the entrance of the river when vessels are expected; they may also be obtained from Newport or by telephone from Dutch Island Harbor.

Harbor regulations have been established and are enforced by a harbor master, whose headquarters are at the eastern end of Point Street Bridge. Copies of the "Harbor Regulations" can be obtained from the harbor master.

Hospital.—There is a relief station of the United States Public Health Service at Providence.

Supplies.—Coal, fuel oil, provisions, gasoline, and supplies of all kinds can be obtained at Providence. Water can be had at the principal wharves and from water boats.

Repairs.—There is a floating dock at East Providence with a capacity for vessels 13-foot draft, 200 feet long, and 700 tons; and marine railways for small craft at Sabine Point, Fields Point, and on the Seekonk River. There are large machine shops at Providence with excellent facilities for repairs to the machinery of steamers.

Storm-warning displays are made at Providence and at the Rhode Island Yacht Club.

Communication.—Providence has railroad communication and several lines of steamers to New York.

Tidal currents are not strong and generally follow the direction of the channel.

Ice.—In severe winters the river is closed to navigation, but in ordinary winters the towboats and steamers keep the channel open.

DIRECTIONS, PROVIDENCE RIVER

Having followed the directions for the Eastern Passage or Western Passage of Narragansett Bay, pass 200 yards northeastward of Conimicut Lighthouse and steer 304° true (NW. ¼ N. mag.) for 1⅛ miles; when Sabine Point Lighthouse opens westward of Bullock Point Lighthouse, make the turn with an easy port helm (right rudder) and steer 343° true (N. ¼ W. mag.) for 2⅛ miles, passing 250 yards westward of Bullock Point Lighthouse. When 175 yards westward of Sabine Point Lighthouse, steer 20° true (NE. by N. mag.) for Pomham Rocks Lighthouse until abreast black buoy, *S13;* then steer 8° true (NNE. mag.) with Sabine Point Lighthouse astern until 200 yards northwestward of Pomham Rocks Lighthouse. Then steer 339° true (N. ⅝ W. mag.) for Fuller Rock Lighthouse until ⅜ mile from it and between a red and a black buoy. Then steer 326° true (N. by W. ¾ W. mag.), with the Capitol dome ahead, into the harbor, and anchor on the side of the channel as directed by the harbor master.

LONG ISLAND SOUND AND ADJACENT WATERS

Block Island Sound, Fishers Island Sound, and Long Island Sound are regions of bowlders, and all broken ground is liable to be of this character. In these waters there is generally little or no natural change in the shore, shoals, and other features. These waters are well marked by lighthouses, lightships, and other aids, so that, in clear weather, strangers should experience no difficulty in navigating them. All the more important places are entered by dredged channels, and during fog, vessels are advised to anchor till the weather clears before attempting to enter.

The numerous oyster grounds in this region are usually marked by stakes and flags. These stakes may become broken off and form obstructions, dangerous to small craft, especially at night, so that they should proceed with caution when crossing areas where oyster stakes are found.

Anchorages.—The more important places, either commercially or as harbors of refuge, are Point Judith Harbor and Great Salt Pond, in Block Island Sound; Gardiners Bay and Greenport; and Stonington and Mystic River, in Fishers Island Sound.

New London Harbor is the most important of the anchorages sought for shelter in the eastern part of Long Island Sound. Niantic Bay and the approach between Bartlett Reef and Hatchet Reef are used to some extent by sailing vessels bound foreign, and having unfavorable winds on reaching the eastern part of the sound. Small vessels can select anchorage eastward or westward of Kelsey Point Breakwater, also in Duck Island Roads. Off Madison there is anchorage sheltered from northerly winds. New Haven Harbor is an important harbor of refuge. There is anchorage for large vessels in the bight outside of Bridgeport Harbor Lighthouse and in the harbor. Cockenoe Island Harbor is sometimes used by small vessels; but Sheffield Island Harbor is preferred, and is sometimes used by tows. Westward of Norwalk Islands seagoing vessels can anchor toward the north shore, and with good ground tackle hold on in northerly winds. Captain Harbor affords good shelter, but is

not much used except by local vessels. On the south shore, Huntington Bay and Hempstead Harbor are available for large vessels; Oyster Bay is also used, and Manhassett Bay is available for light-draft vessels. City Island Harbor is a great resort for coasters.

Fog.—In Block Island Sound and in the eastern part of Long Island Sound fogs are generally heaviest with southeast winds. In these waters the usual duration of a fog is from 4 to 12 hours, but periods of from 4 to 6 days have been known with very short clear intervals. In the autumn "land fogs," as they are termed locally, sometimes occur with northerly breezes, but they are generally "burnt off" before midday.

In Long Island Sound the north and south shores are equally subject to fog, except that on spring and summer mornings, when there is little or no wind, fog will often hang along the Connecticut shore when it is clear offshore and to the southward.

In the western end of Long Island Sound, although fogs are liable to occur at any season, they are not encountered so often, nor do they generally last so long as is the case farther eastward. (See also table of "Hours of operation of fog signals," on p. 8.)

Ice.—In ordinary winters the floating and pack ice in Long Island Sound, while impeding navigation, does not render it absolutely unsafe; but in exceptionally severe winters the reverse is the case, none but powerful steamers being able to make their way.

Drift ice (formed principally along the northern shore of the Sound), under the influence of the prevailing northerly winds, drifts across to the southern side and accumulates there, massing into large fields, and remains until removed by southerly winds, when it drifts back to the northerly shore.

In ordinary winters ice generally forms in the western end of the Sound as far as Eatons Neck; in exceptionally severe winters ice may extend to Falkners Island and farther eastward.

Effect of tides and winds on ice.—In Long Island Sound northerly winds drive the ice to the southern shore of the Sound and southerly winds carry it back to the northern shore. Northeasterly winds force the ice westward and cause formations heavy enough to prevent the passage of vessels of every description until the ice is removed by westerly winds. These winds carry the ice eastward, and if of long enough duration drive it through the Race into Block Island Sound, whence it goes to sea and disappears.

The Race may be said to be the only locality where tidal currents have any decided influence on the movements of the ice. Large quantities of "floe" ice usually pass through the Race during the ebb, especially if the wind be westerly, and in severe winters this ice causes some obstruction in Block Island Sound and around Montauk Point. These obstructions are the most extensive about the middle of February.

Navigators must not depend too implicitly upon the lightships and buoys. In severe winters these are liable to be carried away; and, in fact, during every winter it is better to depend on the lighthouses and other permanent objects than on the buoys.

The buoys in New London Harbor are not usually disturbed by ice, but Bartlett Reef and Cornfield Point Lightships are sometimes forced from their stations.

In New Haven Harbor the influence of the northerly winds is to clear the harbor and its approaches unless the local formation is too heavy to be moved. Southerly winds force the drift ice in from the Sound and prevent the local formations from leaving the harbor. Tides have little effect upon the ice.

In Bridgeport Harbor winds from north to northwest clear the harbor of drift ice, and those from southeast through south to southwest force the ice into the harbor from the Sound. The outer buoys are apt to be carried out of position by heavy ice during severe winters.

Additional information concerning ice conditions in the waters adjoining Long Island Sound is given under the local descriptions.

Tides.—Full tidal information, including daily predictions for Newport, New London, Willets Point, and Governors Island, is given in the tide tables.

The effect of strong winds, in combination with the regular tidal action, may at times cause the water to fall below the plane of reference of the chart, mean or low water. The water has been known also to rise about the same amounts above mean high water, due to similar causes. (For additional general information concerning Long Island Sound and adjacent waters, see pp. 1 to 6 and the local descriptions.)

CURRENTS, LONG ISLAND SOUND AND ADJACENT WATERS

Block Island Sound.—In the passage between Point Judith and Block Island slack water before ebb and flood, respectively, occurs about ¾ hour before the current turns eastward and about the time the current turns westward at the Race (about ½ hour before high and ½ hour after low water at Boston). The velocity at strength of the flood or westerly current is about 2 knots and of the ebb or easterly current somewhat greater.

In the passage between Block Island and Montauk Point slack water before the ebb and flood, respectively, occurs about ½ hour before the current turns eastward and westward at the Race (about the time of high and low water at Boston). The velocity at strength of the flood or northwesterly current is about 1.5 knots in the middle of the passage and nearly 2 knots off Montauk Point. The velocity of the ebb or southeasterly current is about 2 knots in the passage.

About 3 miles north-northwestward of Fort Pond Bay the currents have a velocity at strength of about 0.8 knot in a westerly direction and 1 knot in an easterly direction.

About 1½ miles northeastward of Cerberus Shoal the flood or westerly current has a velocity at strength of about 1.2 knots and the ebb or easterly current 1.6 knots.

About 2 miles southeastward of Watch Hill Lighthouse the velocity at strength of the flood and ebb is about 1 knot.

Fishers Island Sound.—In the main channel of Fishers Island Sound, including Watch Hill Passage, the time of slack water before ebb and flood, respectively, occurs about 1 hour before the current turns eastward and westward at the Race (about ½ hour before high and low water at Boston). The strength of the current occurs about 2 hours after the current turns eastward and westward at the Race (about 2½ hours after high and low water at Boston). The flood current sets westward and the ebb eastward.

In Watch Hill Passage the currents have sufficient velocity at times to tow spar buoys under water. The flood current sets nearly in the direction of the channel, but has a tendency northward and the ebb a tendency to southward. The northerly and southerly set is more marked between Napatree Point and Latimer Reef Lighthouse.

In the main channel, northward of Wicopesset, the strength of the flood occurs about 2 hours after the current turns westward at the Race (about 2½ hours after low water at Boston), and sets 295° true (NW. ⅝ W. mag.) with a velocity of about 1.5 knots. The strength of ebb occurs about 2 hours after the current turns eastward at the Race (about 2½ hours after high water at Boston) and sets 110° true (SE. by E. mag.) with a velocity of about 2 knots.

In Catumb and Sugar Reef Passages the tidal currents set obliquely across the axis of the channels.

At Ram Island Reef slack water before ebb and flood, respectively, occurs about 1 hour before the current turns eastward and westward at the Race (about ½ hour before high and low water at Boston). The strength of flood occurs about 2 hours after the current turns westward at the Race (about 2½ hours after low water at Boston) and sets 255° true (W. ¼ S. mag.) with a mean velocity of 1.3 knots. The strength of ebb occurs about 2 hours after the current turns eastward at the Race (about 2½ hours after the high water at Boston) and sets 88° true (E. by S. mag.) with a mean velocity of 1.6 knots. The observed velocity at strength of the flood current ranged from 0.4 knot to 1.9 knots, and of the ebb 1.1 to 2.2 knots. The direction and velocity of the current are affected by strong winds and the period of flood or ebb may be increased or diminished.

The Race.—Predicted times of slack water, in advance, for every day of the year, are given in the Current Tables, Atlantic Coast. In the middle of the Race the current turns from east to west about ¾ hour after low water at Boston and from west to east about ½ hour after high water at Boston. The strength of flood occurs about 3 hours before the current turns eastward at the Race (about 2½ hours before high water at Boston) and sets 300° true (NW. ⅛ mag.). The strength of ebb occurs about 3 hours after the current turns eastward at the Race (about 2¾ hours before low water at Boston) and sets 115° true (SE. ⅝ E. mag.). Near Race Rock and Little Gull Island the current turns about ½ hour earlier than in the middle of the Race.

The mean velocity at strength of the tidal currents through the Race is about 3.5 knots. There are always strong rips and swirls in the wake of all broken ground in the Race, except for about half an hour at slack water. The rips are exceptionally heavy during heavy weather, and especially when a strong wind opposes the current or the current sets through against a heavy sea.

Long Island Sound.—West of Eaton Neck slack water occurs later than at the Race, amounting to about ¼ hour off Great Captain Island, 1 hour just eastward of Execution Rocks, and then increasing rapidly to Throgs Neck.

In the eastern portion of the Sound the currents turn from ½ to 1 hour earlier along the north shore than in mid Sound.

Proceeding westward from the Race in mid Sound the velocity of the currents is 1.7 knots at Cornfield Point Lightship, about 1 knot

off New Haven, 1 knot off Eaton Neck, 0.5 knot between Rye Neck and Matinicock Point, and 0.8 knot eastward of Hart Island.

At Bartlett Reef Lightship slack water before ebb and flood, respectively, occurs about 1 hour before the corresponding slacks at the Race (about 1½ hours after high and low water at New London. The mean velocity at strength of the flood current is 1.2 knots in a 260° true (W. ⅛ N. mag.) direction, and of the ebb 1.5 knots in a 112° true (SE. by E. mag.) direction. The observed velocity at strength of the flood current ranged from 0.6 knot to 1.9 knots, and of the ebb 0.8 knot to 2.2 knots.

At Cornfield Point Lightship slack water before ebb and flood, respectively, occurs about 1 hour before the corresponding slacks at the Race (about 1½ hours after high and low water at New London). The mean velocity at strength of the flood current is 1.8 knots in a 257° true (W. ⅛ S. mag.) direction, and of the ebb 1.6 knots in a 90° true (E. by S. mag.) direction. The observed velocity at strength of the flood current ranged from 0.7 knot to 2.7 knots and of the ebb 0.8 knot to 2.6 knots.

The direction and velocity of the current are affected by strong winds. The period of flood or ebb may be increased or diminished by winds.

About 1 mile north of Stratford Shoal (Middle Ground) Lighthouse the average velocity at strength is 1 knot, the flood setting west and the ebb east about 2¾ hours after the slacks at the Race (about 1 hour before high and low water, respectively, at New London).

About ⅓ mile south of Stratford Point Lighthouse the average velocity at strength is 1.1 knots; the flood sets 235° true (SW. by W. ⅞ W. mag.) about 2 hours after the current turns westward at the Race (about 2 hours before high water at New London), and the ebb 75° true (E. ¼ N. mag.) about 1 hour after the current turns eastward at the Race (about 2½ hours before low water at New London). About ⅓ mile south of the bell buoy the average velocity at strength is 1.2 knots; the flood sets 260° true (W. ⅛ N. mag.) about 3 hours after the current turns westward at the Race (about 1 hour before high water at New London), and the ebb 110° true (SE. by E. ¼ E. mag.) about 2½ hours after the current turns eastward at the Race (about 1 hour before low water at New London).

About ½ mile northward of Eaton Neck Lighthouse the flood and ebb are markedly different. Slack before flood occurs about ½ hour before the current turns westward at the Race (about 2 hours after low water at New London). The strength of the flood has an average velocity of 0.6 knot, sets 310° true (NW. ⅝ N. mag.), and occurs about 2½ hours after the current turns westward at the Race (about 1½ hours before high water at New London). Slack before ebb occurs about 2 hours before the current turns eastward at the Race (about high water at New London). The strength of ebb has an average velocity of 1.4 knots, sets 70° true (E. ¾ N. mag.), and occurs about 1½ hours after the current turns eastward at the Race (about 2 hours before low water at New London).

About ¾ mile north of Lloyd Point the velocity at strength is about 1.4 knots; about ⅜ mile north of Matinicock Point it is about 1 knot.

East River.—Predicted times of slack water for Hell Gate, in advance for every day in the year, are given in the Current Tables, Atlantic Coast. In East River the flood current sets eastward and ebb westward. From Governors Island to Rikers Island, including Hell Gate, the currents turn practically simultaneously, and slack water before the ebb (westerly) and flood (easterly), respectively, occurs about 1 hour and 30 minutes after high and low water at Governors Island.

At Throgs Neck the slack water before the ebb (westerly) and flood (easterly), respectively, occurs about 1 hour earlier than the corresponding slack at Hell Gate (about ½ hour after high and low water at Governors Island), while at City Island the slack occurs about 2¼ hours earlier than the corresponding slack at Hell Gate (about ¾ hour before high and low water at Governors Island).

From Governors Island to Lawrence Point the mean velocity at strength of the currents ranges from 2 to 6 knots, the higher velocities occurring in the narrower parts of the channel eastward of Brooklyn Bridge and abreast Blackwells Island. In Hell Gate a velocity of 8 knots has been observed, but the mean velocity at strength is 6 knots.

The mean velocity at strength of the currents from North Brother Island to Whitestone Point is about 1.6 knots, Throgs Neck 0.9 knot, and City Island and Execution Rocks 0.7 knot.

The currents generally set with the channel, but there are heavy swirls between Negro Point and the north end of Blackwells Island.

A further discussion of currents and a current diagram for East River is given in the Current Tables, Atlantic Coast. (See also Special Publication No. 111, "Tides and Currents in New York Harbor," published by the United States Coast and Geodetic Survey, price 30 cents.)

DIRECTIONS, LONG ISLAND SOUND

Block Island Sound, Fishers Island Sound, and Long Island Sound are regions of bowlders, and all broken ground is liable to be of this character. As a measure of safety, vessels should proceed with caution when in the vicinity of broken areas where the charted depths are not more than 6 to 8 feet (1.8 to 2.4 m.) greater than the draft.

There are only a few places in the open Sound which call for the special attention of the navigator.

Sixmile Reef, 7 miles southwestward of the entrance to Connecticut River, is a critical point, the shoalest part of which should be avoided by vessels of a greater draft than about 12 feet (3.7 m.). Except the shoalest part of the reef, the shoaler places near and southward of Sixmile Reef have been partly examined by means of a wire drag. It is safer to pass southward of the reef. The 3¾-fathom (6.8 m.) rocky patch between Sixmile Reef and the western end of Long Sand Shoal should be avoided by vessels.

The passage northward of Long Sand Shoal and Falkner Island is available for vessels of about 15 feet (4.6 m.) or less draft, and is sometimes used by light tows, especially in northerly winds. The broken ground northward of Falkner Island should be kept in mind.

Most vessels passing through the Sound go southward of Stratford Shoal Lighthouse.

Between Eatons Neck and Norwalk Islands nearly all vessels keep near mid-Sound, passing between the shoal making off from Eatons Neck and the broken ground extending southward from Norwalk Islands.

The following through courses in Block Island Sound and Long Island Sound represent approximately the mean of the tracks of a number of the regular lines of steamers, the deepest draft of which is about 20 feet (6.1 m.):

From Vineyard Sound Lightship, 264° true (W. ⅝ N. mag.) for 21½ miles to a position ¼ mile southward of Point Judith gas, whistling, and submarine bell buoy; then 255° true (W. ¼ S. mag.) for 28½ miles, heading for Little Gull Island Lighthouse until Race Rock Lighthouse bears 33° true (NE. mag.); and then 281° true (WNW. mag.) to a position ¾ mile north-northeastward of Little Gull Island Lighthouse.

Passing ¾ mile north-northeastward of Little Gull Island Lighthouse, 268° true (W. ⅞ N. mag.) for 12¼ miles to Cornfield Point Lightship; then 250° true (W. ¾ S. mag.) for 12 miles, passing about ⅜ mile southward of the shoalest part of Sixmile Reef, to Falkner Island Lighthouse abeam, bearing 340° true (N. ¾ W. mag.) distant 4⅜ miles; and then 255° true (W. ¼ S. mag.) for 22½ miles to a position ¾ mile southward of Stratford Shoal Lighthouse.

Or vessels will give the shoalest part of Sixmile Reef a berth of nearly 1 mile by passing close to Cornfield gas, whistling, and bell buoys, lying 1 mile southward of Cornfield Point Lightship, as follows: Passing ¾ mile north-northeastward of Little Gull Island Lighthouse, steer 263° true (W. ½ N. mag.) for 12 miles to Cornfield gas, whistling, and bell buoys, and then 255° true (W. ¼ S. mag.) for 34½ miles to a position ¾ mile southward of Stratford Shoal Lighthouse.

Passing ¾ mile southward of Stratford Shoal Lighthouse, 259° true (W. mag.) for 14 miles to Eatons Neck Lighthouse abeam, bearing 169° true (S. mag.) distant 3 miles; then 248° true (W. by S. mag.) for 9½ miles to Great Captain Island Lighthouse abeam, bearing 338° true (N. by W. mag.) distant 2½ miles; then 235° true (SW. by W. ⅞ W. mag.) for 7¼ miles to a position 300 to 500 yards southeastward of Execution Rocks Lighthouse; then 215° true (SW. mag.) for 3½ miles to a position 400 to 500 yards northwestward of Stepping Stones Lighthouse; and then 192° true (SSW. mag.) to abreast Throgs Neck.

The following are courses to ports in Long Island Sound from a position 300 to 500 yards southeastward of Execution Rocks Lighthouse unless otherwise stated:

To Bridgeport, 59° true (ENE. ¼ E. mag.) for 27 miles to a position ½ mile southward of Penfield Reef Lighthouse.

To New Haven, 55° true (NE. by E. ⅞ E. mag.) for 8 miles to Great Captain Island Lighthouse abeam, distant 2¼ miles; then 68° true (E. by N. mag.) for 25 miles to Stratford Point Lighthouse abeam, distant 2½ miles; and then 51° true (NE. by E. ½ E. mag.) for 10 miles to a position with Southwest Ledge Lighthouse bearing 0° true (N. by E. mag.), distant 1 mile.

To Connecticut River.—From Cornfield Point Lightship the river steamers of not over 10 feet (3 m.) draft steer 56° true (ENE.

mag.) for about 2 miles, and then cross Long Sand Shoal on a 354° true (N. ½ E. mag.) course, heading for Saybrook Breakwater Lighthouse.

To New London.—From Cornfield Point Lightship 73° true (E. ½ N. mag.) for 11¾ miles to Bartlett Reef Lightship.

With the view of increasing the safety of navigation, several steamship lines operating in Long Island Sound have adopted certain tracks in the eastern part of the Sound, as follows:

Steamers bound east through the Race to shape the course to Cornfield gas, whistling, and bell buoys, then to a position ¾ mile north-northeastward of Little Gull Island Lighthouse, then steer 100° true (ESE. mag.) through the Race and run by Little Gull Island Lighthouse far enough so that when they haul down for the buoy off Point Judith, Little Gull Island Lighthouse will bear not less than one-half point on the port quarter.

Steamers of 12-foot (3.7 m.) or less draft bound west through the Race to have Little Gull Island Lighthouse ¼ point on the port bow until Race Rock Lighthouse is abeam, then steer 280° true (WNW. mag.) through the Race and run nearly ½ mile past Little Gull Island Lighthouse, and then shape the course to Cornfield Point Lightship and pass southward of it.

Note.—Valiant Rock should be avoided by all vessels, and the following change in the above track for westbound vessels is suggested in order to pass between Valiant Rock and Race Rock Lighthouse:

Having Little Gull Island Light ¼ point on the port bow on the course from the buoy off Point Judith, when Race Rock Lighthouse bears 302° true (NW. mag.), steer 280° true (WNW. mag.) until Little Gull Island Lighthouse is abeam, and then shape the course for Cornfield Point Lightship.

Connecticut River steamers pass northward of Cornfield Point Lightship both eastbound and westbound.

Eastbound steamers for New London will pass northward of Cornfield Point Lightship. Westbound steamers from New London, after leaving Bartlett Reef Lightship will shape the course to pass southward of Cornfield Point Lightship.

BLOCK ISLAND SOUND

is the eastern approach to Long Island Sound, Fishers Island Sound, and Gardiners Bay. Its eastern and southern limits are defined by Point Judith, Block Island, and the eastern end of Long Island. The available anchorages are Point Judith Harbor of Refuge, Great Salt Pond, and Gardiners Bay. Newport Harbor and anchorages in Long Island Sound are also available and are generally used by large vessels and tows.

Point Judith Lighthouse is an octagonal, pyramidal tower, lower half white, upper half brown, connected with a dwelling. The light is fixed white, 65 feet (19.8 m.) high, and visible for 14 miles. The fog signal is an air siren, blast 5 seconds, silent 40 seconds.

On **Point Judith,** about 100 yards north of the lighthouse, is a Coast Guard station and a storm warning display station. About 1¼ miles southward of the lighthouse is a gas, whistling, and submarine bell buoy, moored in a depth of about 8 fathoms (14.6 m.).

A prominent high radio mast is ¾ mile westward of the lighthouse. Northward of Point Judith, near Narragansett Pier, is a prominent square granite tower over 100 feet (30 m.) high.

The area, with depths less than about 7 fathoms (13 m.) around Point Judith, including the approaches to Point Judith Harbor of Refuge, is irregular, with rocky bottom, and indications of bowlders. As a measure of caution it is advisable to avoid the shoal spots, even with a smooth sea, and to exercise extra care where the depths are not more than 6 feet (1.8 m.) greater than the draft.

Point Judith Harbor of Refuge (chart 276).—This harbor, on the west side of Point Judith, is formed by a main, V-shaped breakwater and two shore-arm breakwaters extending to the shore. The harbor is easy of access for steamers and sailing vessels except with a heavy southerly or southeasterly sea, but is little used by tows; with a comparatively smooth sea the harbor is available for vessels of about 20-foot (6.1 m.) draft by the east entrance and about 16-foot (4.9 m.) draft by the west entrance. The breakwaters are marked by lights as follows:

East Breakwater Light on the seaward end of the east breakwater. Main Breakwater East Light on the easterly end of the V-shaped breakwater. Main Breakwater Center Light on the V-shaped breakwater at its angle. Main Breakwater West Light on the Northwest end of the V-shaped breakwater. West Breakwater light on the south end of the west breakwater.

In Point Judith Harbor of Refuge the only soft bottom is found in its southern part, in the deeper water inclosed by the main breakwater, where the depths are 4 to 5½ fathoms (7 to 10 m.). On its north side the shoaling is gradual, the 18-foot (5.5 m.) curve lying about ¼ mile from shore. The rocky patches in the central and northern parts of the harbor have a least depth of about 13 feet (4 m.), and the southernmost is marked by a buoy. The range of Main Breakwater East Light and East Breakwater Light, bearing 102° true (SE. by E. ¾ E. mag.), leads clear southward of these rocky patches. The angle and western arm of the main breakwater should be given a berth of 200 yards when anchoring to avoid broken and hard bottom. A good berth for a large vessel is on the range of Main Breakwater East Light and East Breakwater Light, bearing 102° true (SE. by E. ¾ E. mag.), with Main Breakwater Center Light bearing 205 true (SW. ⅝ S. mag.), in 5½ fathoms (10 m.). If anchored farther westward, soft bottom in places and ample swinging room will be had by anchoring on the range of the east end of the main breakwater and Point Judith Lighthouse.

The east entrance to Point Judith Harbor of Refuge is 400 yards wide, with depths of 4 to over 5 fathoms (7 to 9 m.), the deeper water lying in the western half of the entrance. Lying ⅝ mile southward of the entrance there is a shoal ridge which extends in a curve from the angle of the main breakwater to Point Judith. Spots with 25 to 28 feet (7.6 to 8.5 m.) have been found on this ridge, and less water for a distance of nearly ⅜ mile off Point Judith Lighthouse and nearly ¼ mile off the angle of the breakwater. On account of the broken bottom 20 feet (6.1 m.) is about the deepest draft that should cross the ridge with a comparatively smooth sea.

Approaching the east entrance from eastward, give Point Judith a berth of about ½ mile and steer for Main Breakwater Center Light on any bearing northward of 270° true (WNW. ⅞ W. mag.) until the entrance bears northward of 314° true (NW. by N. mag.) and then haul up for it. From westward, pass southward of the bell buoy, lying over ¼ mile southward of the angle of the main breakwater, on an east course, and haul up for the entrance when Main Breakwater East Light bears northward of 4° true (N. by E. ½ E. mag.). When passing through the entrance the course should be westward of north to insure making the turn westward in the harbor. Deep-draft vessels should favor the west side of the entrance.

The west entrance to Point Judith Harbor of Refuge is 500 yards wide, with general depths of 18 to 19 feet (5.5 to 5.8 m.) and less depth near the end of the breakwater on the north side of the entrance. The best water, about 19 feet (5.8 m.), is found on the south side of the entrance for a distance of 200 yards from the main breakwater. Depths of 18 to 20 feet (5.5 to 6.1 m.) extend about 150 yards westward of the entrance.

Point Judith Pond, a shallow salt pond, has its entrance between two jetties at the northerly end of Point Judith Harbor of Refuge, and has a length of about 3 miles to the head of the upper pond. Its navigation is difficult, especially at the south end, and is confined to launches and small craft of not over 5 feet (1.5 m.) draft. The channel at the entrance is subject to change and strangers desiring to enter may obtain a pilot or information concerning the condition of the channel from the settlement on the east side at the entrance. Gasoline and provisions in limited quantity can also be obtained here. At the north end of the upper pond there are landings, boat-building plants, and railways, the largest 45 feet long, where repairs can be made to hulls and motors. Motor-boat supplies and provisions can be obtained from **Wakefield.** The latter is a town with railroad communication on a small stream about ½ mile northward of the upper pond; the stream is dry at low water. The **tides** in the pond have a range of about 3 feet, and the **currents** through the narrow entrance have a velocity of 3 to 4 knots at strength. High and low water in the pond and slack water in the entrance occur about one hour later than high and low water outside. The upper pond is usually closed by ice from one to three months, while the main pond is generally open during the winter.

To enter Point Judith Pond pass midway between the jetties and then favor the marshy west bank until through the narrow entrance at the south end of the pond. Then follow closely the marshy bank northwestward for a distance of about 150 yards until this bank trends westward. Then steer about 353° true (N. ½ E. mag.) for the bluff at the inshore end of a prominent knoll, which is about ¼ mile from the south end of the pond and is connected with the west bank by a low neck. When about halfway to the knoll and 150 yards from the west bank, head up to pass 75 yards eastward of the knoll, and when abreast it head up to pass 75 yards off the next point on the west bank 400 yards farther up the pond.

When about 100 yards above this point steer east-northeastward and pass southward of a stake which marks the end of a spit extending about 100 yards southward from an island; from the south end of the pond to this stake the channel is narrow and difficult. Pass

100 yards eastward of the island, the same distance eastward of the next island lying ½ mile above, and then pass midway between the next two islands, taking care to avoid a rock (covered at high water) which lies about 20 yards off the west side of the eastern one. Then head to pass about 100 yards westward of the point on the east bank ½ mile above. Then steer northeastward, and pass this and the next point at a distance of about 50 yards, leaving a marshy islet about 50 yards on the port hand.

Then steer eastward and then northward through the narrow channel into the upper pond, favoring well the south and east banks in making the turn to avoid a shoal which extends about 100 yards southeastward from the turning point. In the upper pond follow the west bank at a distance of about 100 yards to avoid a rocky shoal, bare at low water, which lies in the middle about halfway up the pond, and then steer for the landings at the north end of the pond.

From Point Judith to Watch Hill the projecting points are rocky. With the exception of Point Judith Pond, the outlets of the ponds are generally closed and not used. The coast is fringed by broken ground and bowlders in places, which should be avoided by deep-draft vessels where the depths are less than 6 or 7 fathoms (11 to 13 m.).

Matoonoc is a small summer settlement 3 miles westward of Point Judith.

Green Hill Coast Guard Station is a prominent feature 5¼ miles westward of Point Judith. A patch of bowlders, with 21 feet (6.4 m.) over them and marked by a buoy, lies 1¼ miles 132° true (SE. ⅞ S. mag.) from the Coast Guard station and 4⅜ miles 262° true (W. ½ N. mag.) from Point Judith Lighthouse. This patch is at the south end of broken ground, with depths less than 5 fathoms (9 m.), making off from the coast; the water deepens abruptly around the patch.

Charlestown Beach is a small summer settlement on the beach between Green Hill and Charlestown Ponds.

There is a small summer settlement at the outlet of **Quonochontaug Pond,** and another 1 mile farther eastward.

Noyes Point is marked by a large hotel, and there are two water tanks northward of the point at the western end of Quonochontaug Pond. The settlement, called **Noyes Neck,** has communication by electric road with **Pleasant View** (summer settlement at western end of Brightman Pond) and Westerly.

Watch Hill is a high, bare bluff, with a number of large hotels and summer houses. There is communication by electric road with Westerly and by boat with Stonington. See also page 148.

Watch Hill Lighthouse, on the low point southward of Watch Hill, is a square gray-granite tower attached to a white dwelling. The light is fixed white with an alternating group of two red flashes every 15 seconds; fixed white 10 seconds, eclipse 1.1 seconds, first red flash 0.3 second, eclipse 2.2 seconds, second red flash 0.3 second, eclipse 1.1 seconds; 61 feet (18.6 m.) high and visible 13 miles. The fog signal is a reed horn, blast 5 seconds, silent 25 seconds. A Coast Guard station is located 300 yards northward of the lighthouse.

The reefs between Watch Hill and Fishers Island are described with Fishers Island Sound.

Fishers Island is hilly, 6 miles long, and bare of trees. **Chocomount,** 136 feet (41.5 m.) high, is the highest land in the vicinity. The Coast Guard station on East Harbor, 1⅛ miles from East Point of Fishers Island, is prominent; there are numerous buildings on the western part of Fishers Island, and storm warnings are displayed. The north side of the island is described with Fishers Island Sound. The south side of the island is fringed with foul ground which rises abruptly from depths of 7 to 8 fathoms (13 to 15 m.); but by giving the shore a berth of ½ mile all dangers will be avoided. Rocks with a least depth of 27 feet (8.2 m.) lie in latitude 41° 16′ 28″ N. and longitude 71° 56′ 36″ W.

Coast Artillery buoys off Fishers Island and Little Gull Island.—Mariners are requested to keep clear of the area bounded by a line extending from Race Point, Fishers Island, to Race Rock Lighthouse, thence 116° 0.7 mile, thence 76½° 3.3 miles, thence 0° to the south shore of Fishers Island, to avoid fouling groups of red and white buoys established for experimental purposes by the Coast Artillery Corps, United States Army. Approximate position of Race Rock Lighthouse, latitude 41° 14′ 37″ N., longitude 72° 02′ 51″ W. Mariners are also requested to avoid fouling the three similar groups of buoys spaced at equal intervals in line extending southward from Little Gull Island Lighthouse, the southernmost group being 1.5 miles 192° from the lighthouse. Approximate position of Little Gull Island Lighthouse, latitude 41° 12′ 23″ N., longitude 72° 06′ 26″ W. Other groups in this vicinity may be established from time to time and are noted in the weekly Notices to Mariners.

Race Rock Lighthouse is a granite tower, attached to a dwelling, on a granite pier. The light is flashing alternating white and red every 20 seconds, white flash 0.5 second, eclipse 9.5 seconds, red flash 0.5 second, eclipse 9.5 seconds; 67 feet (20.4 m.) high and visible for 14 miles. The fog signal is an air siren sounding a group of 2 blasts every 30 seconds, first blast 2 seconds, silent 1 second, second blast 2 seconds, silent 25 seconds.

Little Gull Island Lighthouse is a gray granite tower, attached to a red dwelling, on a pier. The light is fixed white, 91 feet (27.7 m.) high and visible 15 miles. The fog signal is an air siren, blast 3 seconds, silent 27 seconds.

The Race is the main entrance from eastward to Long Island Sound. It is marked by Race Rock and Little Gull Island Lighthouses, between which it has a width of 3½ miles. Between these lighthouses the only dangers are Valiant Rock and Little Gull Island Reef, and Cerberus Shoal is the only outlying danger in the southeasterly approach. There is also a narrow passage for small vessels northward of Race Rock Lighthouse.

Vessels should pass from ½ to ¾ mile southwestward of Race Rock Lighthouse in passing north of Valiant Rock. Passing southward of the rock, vessels will keep in the clearest part of the passage on a northwesterly course by passing from ¾ to 1¼ miles northeastward of Little Gull Island Lighthouse, or on a west-northwesterly course by passing about ¾ mile north-northeastward of it. (For currents see p. 120.)

Race Point Ledge, partly bare at low water, extends nearly ¼ mile southwestward from the southwest end of Fishers Island, and is marked at its end by a red buoy, in a depth of 18 feet (5.5 m.).

Inside of the buoy there are bowlders with 3 to 9 feet (0.9 to 2.7 m.) over them at lowest tides. The passage between this buoy and Race Rock Lighthouse has very irregular bottom, although the least depth found is 25 feet (7.6 m.). It is suitable only for small vessels with a comparatively smooth sea.

Race Rock, on the northeast side of the Race, is nearly 200 yards in diameter, with a depth less than 18 feet (5.5 m.), and is marked by Race Rock Lighthouse, which is a granite tower attached to dwelling.

Valiant Rock, nearly in the middle of the Race, has a least found depth of 18 feet (5.5 m.), and is nearly ⅜ mile long in a northeast and southwest direction with depths of 4 to 5 fathoms (7 to 9 m.) The 10-fathom (18 m.) curve surrounding Valiant Rock includes the area that should be avoided by deep-draft vessels, and preferably by all vessels, on account of the heavy swirls and rips. The lighthouses are the guides, as the lead can not be depended on to give sufficient warning. The northeasterly limit of the 10-fathom (18 m.) curve lies 1 miles southwestward of Race Rock Lighthouse, and its southwesterly limit lies 1¾ miles east-northeastward of Little Gull Island Lighthouse.

Little Gull Island Reef, with little depth over it, extends nearly ¼ mile east-northeastward from Little Gull Island Lighthouse, and is marked at its eastern end by a black buoy in a depth of 18 feet (5.5 m.). Depths less than 5 fathoms (9 m.) extend nearly ⅜ mile eastward and northeastward from the lighthouse, which should not be approached closer from these directions. From a position nearly ½ mile northeastward of Little Gull Island Lighthouse, the general 10-fathom (18 m.) curve trends 123° true (SE. mag.) for 1¼ miles, and this is the northeast limit of the broken ground on the southwest side of the Race. Deep-draft vessels should avoid this area. The passage between Little and Great Gull Islands is foul.

Great Gull Island is ⅜ mile long, about 30 feet (9 m.) high, rocky, and has a number of large buildings. There is a wharf with about 15 feet (4.6 m.) at its end on the north side of the island. Except for about one-half hour after the beginning of the flood current in the Race, the current sets eastward at the wharf, and vessels generally land at the wharf heading westward. There are rocks both eastward and westward of the wharf, which extend outside the line of its face, those eastward of the wharf being marked by a spar buoy. Approaching from eastward, keep the outer small house on the west end of the island open from the wharf, and in leaving swing the bow out from the wharf to insure clearing the rocks westward.

The passage between Great Gull Island and Plum Island has a number of known dangers and very irregular bottom with bowlders, and should be avoided by vessels. The part of the passage between Old Silas and **Plum Island** has been examined by means of a wire drag; bowlders with depths of 3 to 10 feet (0.9 to 3 m.) were found as shown on the chart. The maximum observed velocity of the tidal currents is 2½ knots, but it is considerably higher at times. The tide rips are bad in heavy weather. **Old Silas Rock** is awash at high water.

Bedford Reef is broken ground, on which the least depths found are 13 to 16 feet (4 to 4.9 m.), extending about 1½ miles southward

from the broken ground lying between Great Gull and Plum Islands. It should be avoided by vessels. **Constellation Rock** is on the southeasterly extension of this broken ground; it has 17 feet (5.2 m.) over it, is marked by a horizontally striped spar buoy, and lies 1⅞ miles 184° true (S. by W. ½ W. mag.) from Little Gull Island Lighthouse, nearly on the range of it and New London Lighthouse. Depths of 5½ and 5¾ fathoms (10 and 10.6 m.) have been found ⅝ mile southwestward and ½ mile east-southeastward, respectively, of Constellation Rock, and may be regarded as the southerly limit of the broken ground of Bedford Reef.

Cerberus Shoal has a length of about ⅜ mile in a north and south direction, with depths less than 6 fathoms (11 m.), has a least depth of 14 feet (4.3 m.) on a small rocky patch near its north end, and is marked by a whistling buoy and a spar buoy (both horizontally striped); the whistling buoy is ¼ mile eastward of the shoal. Ordinarily there are strong tide rips near the shoal. The shoal lies 6 miles 136° true (SSE. ⅞ E. mag.) from Race Rock Lighthouse.

Plum Island, Gardiners Island, and the passage southward of the latter are described with Gardiners Bay. Shoals extend about 1¼ miles off the eastern side of **Gardiners Island** to the 6-fathom (11 m.) curve, and inside this depth the bottom is generally rocky and irregular, with indications of bowlders.

Fort Pond Bay is a semicircular bay about 1 mile wide on the north side of Long Island, 5½ miles westward of Montauk Point. The bay is free from dangers, but flats with 8 to 12 feet (2.4 to 3.7 m.) over them make out ¼ mile from its eastern shore. The bay affords anchorage for vessels in 7 to 8 fathoms (13 to 15 m.), soft bottom, but is exposed to northerly and northwesterly winds; the shoaling is abrupt on its east and south sides. The flats at the southeast corner of the bay are generally occupied as an anchorage by launches and other small craft during the summer. **Montauk,** a summer resort at the southeast end of the bay, is the terminus of the Long Island Railroad. The railroad pier at Montauk has a depth of 28 feet (8.5 m.) at its end and 20 feet (6.1 m.) about 200 feet westward on the line of its face; the shoaling is abrupt. The northerly wharf at Montauk has a depth of about 13 feet (4 m.) at its end. The smaller wharves have depths of from 5 to 10 feet (1.5 to 3 m.) at their ends. Gasoline, fresh water, and provisions can be obtained at Montauk.

Broken ground with rocky bottom and bowlders extends 2 miles northward and 3½ miles northwestward of **Shagwong Reef.** It has been examined by means of a wire drag and the dangers are shown on the chart. The principal danger outside Shagwong Reef gas and bell buoy is a shoal with a depth of 30 feet (9.1 m.) 1¾ miles northwestward of the buoy. Vessels should avoid this broken ground.

Fish pounds.—Regulations prescribed by the Secretary of War require that an opening for small craft shall be placed about 400 feet offshore in all pounds between Culloden and Shagwong Points, and in those pounds placed off Rocky Point on the west side of Fort Pond Bay. On the offshore side of these openings signboards 3 feet long and 1 foot wide shall be placed at an elevation of 8 feet above high water. They shall be painted black and shall bear the following notice: "Opening for small boats." This notice shall be painted

in white letters 4 inches, high and underneath a white arrow indicating position of opening shall be placed.

Montauk Point Lighthouse is a white tower with a brown band midway of its height, and is connected by a covered way to a white dwelling. The light is flashing white (flash 0.5 second, eclipse 9.5 seconds), 168 feet (51 m.) above the water, and visible 19 miles; a fixed red range lens, on the gallery railing of the tower, covers Shagwong Reef, and is visible only between the bearings 129° true (SE. ½ S. mag.) and 141° true (SSE. ⅜ E. mag.). The fog signal is a siren, blast 3 seconds, silent intervals 3 and 31 seconds.

Montauk Point, the easterly extremity of Long Island, is a high sandy bluff, on the summit of which is the lighthouse. The land is grass-covered and has a greatest elevation of 165 feet (50 m.) at **Prospect Hill,** 2 miles westward of the point. The south side of the point is bold, the 10-fathom (18 m.) curve lying about ½ mile from shore; depths of 4 fathoms (7.3 m.) and less extend ⅞ mile off the northeast side of the point.

Surrounding Montauk Point to a distance of about 4 miles is an area which includes Montauk Shoal, Great Eastern Rock, Phelps Ledge, and Endeavor Shoals. This area has been closely developed, but the bottom is very broken and extra caution should be observed where the depths are less than about 10 feet (3 m.) greater than the draft. In general, the shoals are a series of long, narrow ridges, in places only a few yards wide, and their positions are clearly indicated by the rips over them at the strength of the tidal currents.

By giving Montauk Point a berth of over 1 mile and avoiding Great Eastern Rock and the shoalest part of Endeavor Shoals, the dangers eastward and northeastward of Montauk Point would not in smooth weather interfere with vessels of 20 feet (6 m.) or less draft. From longitude 71° 46.5′ W. (3¾ miles eastward of Montauk Point Lighthouse) to within ½ mile of Block Island, the area with depths less than 10 fathoms (18 m.) has been examined by means of a wire drag, and the least depths are shown on the chart.

Montauk Shoal, with depths of 5 to 6 fathoms (9 to 11 m.), lies between 2 and 3 miles southward and south-southeastward of Montauk Point Lighthouse. The shoal is 1½ miles long in a west-northwest direction. It has been examined by means of a wire drag, and the least depth found is 5 fathoms (9 m.). The shoaling is abrupt from 11 fathoms (20 m.) on the south side of the shoal. Detached shoals, on which the least depth found is 5½ fathoms (10 m.) lie about 1½ miles south-southeastward of Montauk Point. A gas and whistling buoy is moored 1¼ miles east-southeastward of Montauk Shoal and 4 miles southeastward of Montauk Point Lighthouse.

Great Eastern Rock, as shown by a careful examination, has a least depth of 3½ fathoms (6.4 m.) and lies a little over 1½ miles 74° true (E. ⅜ N. mag.) from Montauk Point Lighthouse. The rock is marked by a black buoy. **Phelps Ledge** has a least found depth of 4¼ fathoms (7.7 m.).

The least depths found on **Endeavor Shoals** are 3½ to 4 fathoms (6.4 to 7.3 m.) on a narrow ridge about ⅜ mile long, which lies 2¼ miles 28° true (NE. ⅜ N. mag.) from Montauk Point Lighthouse.

Southwest Ledge lies 3½ miles west-southwestward of the southwest end of Block Island, and has a least depth of 25 feet (7.6 m.). It is marked at its southwest end by a spar buoy and a bell buoy

(both horizontally striped). Rocky patches, with least depths of 4½ and 4¾ fathoms (8.2 and 8.7 m.) extend 1½ miles northeastward from Southwest Ledge. The sea breaks on the shoaler places in heavy weather. Between the inner patch and the shoals which extend ⅞ mile from Block Island, there is a channel 1¼ miles wide, with a depth of about 6 fathoms (11 m.). The deepest passage in this entrance to Block Island Sound is just westward of Southwest Ledge, and has a width of 2 miles.

Block Island is 5 miles long, hilly, with elevations up to 211 feet (64 m.), and is bare of trees. The shore of the island is fringed in most places by bowlders, and should be given a berth of over ¼ mile even by small craft; the shoaling is generally abrupt in approaching the island.

Block Island Southeast Lighthouse is a red brick, octagonal, pyramidal tower, attached to dwelling. The light is fixed white, 201 feet (61 m.) above the water, and visible 21 miles. The fog signal is a siren, blast 4 seconds, silent 30 seconds. Near the lighthouse are a radio station, and a seacoast telegraph station, with which vessels may communicate by the use of International Code Signals.

Block Island North Lighthouse is a brown tower on gray granite dwelling.

Block Island North Reef is a sand shoal which extends 1½ miles north-northeastward from Block Island North Lighthouse to the 6-fathom (11 m.) curve. Depths less than 18 feet (5.5 m.) are found for a distance of over 1 mile north-northeastward of the lighthouse, and the shoal should be avoided by all vessels. The depths on the shoal change frequently and its position is also subject to a slow change. It is practically steep to on all sides, so that the lead alone can not be depended upon to clear it. A gas and bell buoy is moored in a depth of about 16 fathoms (29 m.) ⅜ mile northward of the 6-fathom (11 m.) curve at the end of the shoal, and 1¾ miles 3° true (N. by E. ⅜ E. mag.) from Block Island North Lighthouse.

New Shoreham (Block Island post office) is a village and summer resort near Block Island Harbor. The island has steamboat communication with Newport and Providence. Storm warnings are displayed near Block Island Southeast Lighthouse and from a skeleton tower northward of the Hygeia Hotel, about ¼ mile from the south end of Great Salt Pond. There are stores, and gasoline can be obtained at Block Island Harbor and Great Salt Pond. Water and limited quantities of anthracite coal can be obtained at Block Island Harbor. The mean rise and fall of tides is 3 feet.

Great Salt Pond (chart 276) is the best harbor in Block Island Sound for vessels of 18-foot (5.5m.) or less draft. In easterly gales, when the sea is too heavy to enter Block Island Harbor, a landing can be made at Great Salt Pond. The entrance is on the west side of Block Island, 2 miles southwestward of Block Island North Lighthouse. It is a dredged cut from 500 to 600 feet wide through the narrow strip of beach which separates the pond from Block Island Sound, and has a central depth of 23 feet (7 m.) or more for a width of 150 feet; the width of the cut between the 12-foot (3.7 m.) curves is 250 feet. The southwest side of the entrance is

formed by a jetty which extends to a depth of about 18 feet (5.5 m.) in the sound. On the jetty are two lights, and at the inner light is a fog signal. The currents in the entrance are small, the average velocity at strength being about ½ knot.

To enter Great Salt Pond pass 50 yards eastward of the red bell buoy which lies nearly ¼ mile north-northwestward of the end of the jetty, and steer 143° true (SSE., ¼ E. mag.) through the middle of the entrance, heading for the steamboat wharf at the head of the pond, passing 300 feet off the southwest jetty and midway between the buoys marking the inner end of the entrance channel. This course leads to the usual anchorage, which is in 3 to 8 fathoms (5.5 to 14.6 m.) off the steamboat wharf, taking care to leave a clear track for the steamers going to the wharf. The shoal on the southeast side of the pond is marked by a black buoy. A shoal extends about ¼ mile from the north side of the pond. The 18-foot (5.5 m.) curve lies 150 to 200 yards from the west side of the pond, except off Cormorant Point, where it makes off 250 yards. There is a depth of about 12 feet (3.7 m.) at the steamboat wharf.

Between the steamboat wharf and a row of piles about 250 feet eastward there is a dredged channel with a depth of about 12 feet (3.7 m.) leading to the western end of a pond where local fishing craft are moored.

Block Island Harbor (chart 276) is an artificial harbor formed by breakwaters, and lies on the east side of Block Island 1⅜ miles northward of Block Island Southeast Lighthouse; the entrance is a dredged channel 100 feet wide and 14½ feet (4.5 m.) deep. The inner harbor has depths of 14 to 15 feet (4.3 to 4.6 m.), is about 600 by 800 feet in the clear, and is occupied by pleasure craft during the summer. The breakwater on its north side should be given a berth of 100 feet, the one on its western side 150 feet, and the southwestern shore 250 feet. The eastern part of the inner harbor is left clear for the passage of the steamer to the dock. The basin at the south end of the inner harbor is 250 feet square and 13 feet (4 m.) deep, and is usually occupied by fishing and other local craft which moor to piles on the sides of the basin and to the bulkhead on its south side. The deepest draft using Block Island Harbor is about 12 feet (3.7 m.).

The east breakwater extends about 850 feet northward of the entrance of the inner harbor, and is marked at its end by a flashing white light; there is a black buoy close northward of the end of the breakwater, and a black bell buoy ½ mile northeastward. There is a flashing red light on the end of the breakwater on the west side at the entrance of the inner harbor.

The center line of the entrance channel is on a 185° true (S. by W. ½ W. mag.) course, passing 250 feet westward of the light at the end of the east breakwater, about 140 feet eastward of the light on the west side of the inner harbor, and continuing for the middle of the entrance of the basin. An 11-foot (3.4 m.) spot is located on the west side of the channel opposite the east breakwater light and is marked by a red buoy.

DIRECTIONS, BLOCK ISLAND SOUND

The tidal currents throughout Block Island Sound have considerable velocity; the greatest velocities occur in the vicinity of the Race

and in the entrances between Montauk Point, Block Island, and Point Judith. Soundings alone can not be depended upon to locate the position; approaching the shores or dangers the shoaling is generally abrupt.

Entering between Point Judith and Block Island.—This entrance is used by all coasting vessels from the bays and sounds eastward to Long Island Sound. The generally used route is through the Race. Tows of light barges and steamers of 14 feet (4.3 m.) or less draft sometimes go through Fishers Island Sound, especially during daylight with a smooth sea. This entrance is clear with the exception of Block Island North Reef. The coast from Point Judith nearly to Watch Hill should be given a berth of over 1 mile, avoiding the broken ground with depths less than 6 or 7 fathoms (11 to 13 m.).

The following are courses and distances from a position ¼ *mile southward of Point Judith gas, whistling, and submarine bell buoy:*

To Fishers Island Sound: 263° true (W. ½ N. mag.) for 17½ miles to Gangway Rock gas buoy.

To the Race: 257° true (W. mag.) for 26¾ miles to a position ½ mile southward of Race Rock Lighthouse. Or a 255° true (W. ¼ S. mag.) course will lead for Little Gull Island Lighthouse; heading for Little Gull Island Lighthouse on this course, when Race Rock Lighthouse bears 33° true (NE. mag.) the course can be changed to 281° true (WNW. mag.) and pass about ¾ mile north-northeastward of Little Gull Island Lighthouse.

To Gardiners Bay: 250° true (W. ¾ S. mag.) for 32¾ miles to a position ½ mile northward of Gardiners Island gas and bell buoys.

The following are courses and distances from a position ¼ *mile northward of Block Island North Reef gas and bell buoy:*

To Fishers Island Sound: 280° true (WNW. mag) for 13 miles to Gangway Rock gas buoy.

To the Race: 266° true (W. ¾ N. mag.) for 21½ miles to a position ½ mile southward of Race Rock Lighthouse. Or a 262° true (W. ⅜ N. mag.) course will lead for Little Gull Island Lighthouse; heading for Little Gull Island Lighthouse on this course, when Race Rock Lighthouse bears 11° true (NNE. mag.) the course can be changed to 281° true (WNW. mag.) and pass about ¾ mile north-northeastward of Little Gull Island Lighthouse.

To Gardiners Bay: 256° true (W. ⅛ S. mag.) for 27 miles, passing 1 mile northward of Cerberus Shoal whistling buoy and to a position ½ mile northward of Gardiners Island gas and bell buoys.

Entering between Block Island and Montauk Point.—In thick weather vessels approaching Block Island Sound from the sea and not being sure of the position are advised to remain offshore until the weather clears. Vessels equipped with radio transmitters should make use of radiocompass bearings from Prices Neck and Amagansett Radiocompass Stations. Approaching Block Island from southward, a depth of less than 10 fathoms (18 m.) indicates less than ¾ mile from shore; and a depth of 10 fathoms (18 m.) is found close to some of the broken ground between Montauk Point and Block Island.

Coming from southward or southwestward, to insure clearing the shoals off Montauk Point and Block Island, the usual route followed by coasting vessels is to stand in for the south shore of Long Island

anywhere between Montauk Point and Shinnecock Lighthouse, sounding frequently, until in a depth of 15 to 16 fathoms (27 to 29 m.), when the vessel will be from 3½ to 4½ miles from the beach. The course can be then shaped along the coast of Long Island or to clear Block Island, as desired.

Small coasting vessels and tows, bound into Block Island Sound or Vineyard Sound from southward, usually follow the coast until Barnegat Lighthouse is made and then haul across for Shinnecock Lighthouse, and follow the south shore of Long Island.

Many vessels have grounded in fog on the south sides of Block Island and Long Island. Undoubtedly many of these could have been avoided if frequent soundings had been taken when approaching the coast or if use had been made of radiocompass bearings.

From ½ mile off Block Island westward to longitude 71° 46.5′ W. this entrance of Block Island Sound has been examined by means of a wire drag. The deepest passage in this entrance is just westward of Southwest Ledge and has a width of over 2 miles; this is the best passage for deep-draft vessels. Rounding the southwest end of Block Island at a distance of 1½ miles leads through the middle of a passage about 1½ miles wide with a depth of 6 fathoms (11 m.). The following are courses and distances from a position 1½ *miles off the southwest end of Block Island*, with Block Island Southeast Lighthouse bearing 78° true (E. mag.):

To Fishers Island Sound: 314° true (NW. by N. mag.) for 14 miles to Gangway Rock gas buoy.

To the Race: 287° true (NW. by W. ⅜ W. mag.) for 20 miles to a position ½ mile south-southwestward of Race Rock Lighthouse. Or 282° true (NW. by W. ⅞ W. mag.) for 21¾ miles to a position ¾ mile north-northeastward of Little Gull Island Lighthouse.

To Gardiners Bay: 272° true (WNW. ¾ W. mag.) for 23 miles to a position ½ mile northward of Gardiners Island gas and bell buoys. By giving Montauk Point a berth of over 1 mile and avoiding Great Eastern Rock and the shoalest part of Endeavor Shoals, the dangers eastward and northeastward of Montauk Point would not, in smooth weather, interfere with vessels of 20 feet (6 m.) draft.

To Fishers Island Sound: Passing ¼ *mile eastward of Great Eastern Rock buoy* a 352° true (N. ⅜ E. mag.) course for 13½ miles will lead to Gangway Rock gas buoy. Passing 1¼ *miles eastward of Montauk Point Lighthouse* and ⅜ mile westward of Great Eastern Rock buoy, steer 337° true (N. by W. mag.) for 1 mile until Montauk Point Lighthouse bears 213° true (SW. mag.). From this position the following course can be steered:

To the Race: 319° true (NNW. ⅝ W. mag.) for 7 miles to a position ½ mile northeastward of Cerberus Shoal whistling buoy. Then a 303° (NW. mag.) course for 6 miles will lead ½ mile southwestward of Race Rock Lighthouse, or a 286° true (NW. by W. ½ W. mag.) course for 7½ miles will lead ¾ mile north-northeastward of Little Gull Island Lighthouse.

To Gardiners Bay: 309° true (NW. ½ N. mag.) for 3½ miles to a position 1 mile east-northeastward of Shagwong Reef gas and bell buoy, and then 278° true (WNW. ¼ W. mag.) for 11½ miles to a position ½ mile northward of Gardiners Island gas and bell buoys.

(chart 298) is at the western end of Rock Island Sound, from which it is separated by Gardiners Island. It is an excellent anchorage and easily entered either day or night. It is the approach to Shelter Island Sound and the Peconic Bays, localities frequented by numerous yachts and motor boats during the summer. The main part of the bay has been examined by means of a wire drag. In addition to the lighthouses, the white church spires at Orient and Sag Harbor are prominent and can be used as aids to navigation. The principal entrance is from eastward, northward of Gardiners Point, and is available for vessels of any draft. The entrance from Long Island Sound is through Plum Gut, and there is an entrance southward of Gardiners Island (Promised Land Channel), that is used by fishing vessels (see the description following). The nearest marine railways are at Greenport, New London, and Fishers Island Sound.

Plum Island is 2½ miles long, hilly, bare of trees except near the southwest end, has a number of large buildings, and is marked at its westerly end by Plum Island Lighthouse. The wharf on the north side of the island, ⅞ mile from the eastern end, has a depth of about 15 feet (4.6 m.) at its end. The bight in the southeast side of Plum Island is foul out to **Plum Island Rock,** which lies ½ mile from shore abreast the middle of the island, has 1 foot (0.3 m.) over it, and is marked by a red buoy.

Plum Gut Harbor, on the southwest side of Plum Island, has an entrance between jetties and a depth of 14 feet (4.3 m.) in the entrance and harbor. Pile dolphins mark the channel between the jetties, and it is necessary only to stand in midway between them on a 25° true (NE. ¾ N. mag.) course and go to the wharf. Two red lights, one above the other, mark the end of the jetty on the north side of the entrance.

Plum Island Lighthouse is a white tower on granite dwelling.

Plum Gut, the entrance to Gardiners Bay from Long Island Sound, is nearly ¾ mile wide and has sufficient water for vessels of the deepest draft; in the passage there are several rocks, with depths of 17 to 19 feet (5.2 to 5.8 m.) over them, and the tidal currents set through with great velocity; but steamers, or sailing vessels with a strong favorable wind, should have no difficulty in passing through. Slack water occurs about ½ hour earlier than in the Race (see p. 120). The strength of flood and ebb occur about 1½ hours after the current turns westward and eastward at the Race (about 2½ hours before high and low water at New London, respectively), and have an average velocity of 3.7 knots. The flood sets northwest and ebb southeast.

Plum Island Lighthouse is on the eastern side of the passage, and Orient Point Lighthouse is near the end of Oyster Pond Reef, on the western side of the passage.

A wire drag set to 16 or 17 feet (4.9 or 5.2 m.) has been passed over the broken ground in Plum Gut between (but not over) Midway Shoal and the end of Oyster Pond Reef, passing 350 yards east-northeastward of Orient Point Lighthouse; and over the Middle Ground, passing 250 yards westward of Plum Island Lighthouse. This insures a clear channel for vessels of about 15 feet (4.6 m.) draft at low water by avoiding Midway Shoal; it is well to give

Plum Island and Orient Point Lighthouses and the shore of Plum Island, just southward of Plum Gut Harbor, a berth of ¼ mile. The best water in the passage will be found on a 295° true (NW. ¾ W. mag.) course, passing Pine Point and Midway Shoal buoy at a distance of 350 yards and passing midway between Orient Point and Plum Island Lighthouses.

Orient Point Lighthouse is a brown, conical tower on a black pier near the eastern end of the shoalest part of Oyster Pond Reef. There are numerous bowlders and little depth between the lighthouse and Orient Point. The lighthouse should be given a berth of over 350 yards when northward and east-northeastward of it.

The wharf on the south side of **Orient Point,** 1 mile westward of the lighthouse, has a depth of 8 feet (2.4 m.) at its end.

Ram Head is a prominent yellow bluff on the western shore of Gardiners Bay. There is a lower bluff nearly 1½ miles westward of Ram Head. A shoal with 7 to 12 feet (2.1 to 3.7 m.) over it extends 1½ miles southeastward from Ram Head.

A bowlder with 1 foot (0.3 m.) over it and marked by a bush stake, lies 230 yards from shore about 650 yards northeastward of the northern point of the entrance to Coecles Harbor. There are other bowlders with little depth between this bowlder and Ram Island.

Coecles Harbor has its entrance at the south end of Ram Head; it is little used. A depth of 4 feet (1.2 m.) can be taken across the bar on a 248° true (W. by S. mag.) course for the north point at the entrance; the latter should be passed close to, not over 100 feet off. Inside this point the chart is the guide. This course leads close southward of the bowlder mentioned above.

Threemile Harbor, on the south side of Gardiners Bay, usually has a depth of 3½ feet (1.1 m.) over a shifting bar in the entrance, and is frequented by motor boats of as much as 5 feet (1.5 m.) draft, but local knowledge is necessary for a greater draft than 3 feet (0.9 m.) at low water. The entrance is between two short jetties, and there is a light on the west jetty in the summer. The channel is marked on the west side by stakes and flags. From the south end of Threemile Harbor there is a channel through the lagoon to a casino on its southeast bight. Groceries, boat supplies, and gasoline can be had at the casino. There is a railway for boats 40 feet long and 5 feet draft. The difficult parts of the channel into the lagoon are staked. The tidal currents have a velocity of about 3 knots through the entrance of Threemile Harbor.

Hog Creek Point, south side of Gardiners Bay, is marked by a flagpole and beacon. **Lionhead Rock,** off the point, is awash at high water. There are fish traps westward of the point.

Napeague Bay.—The passage southward of Gardiners Island, known as Promised Land Channel, is used principally by the fishing vessels owned by the fish factories at **Promised Land** and **Hicks Island.** The deepest draft of the vessels regularly using the channel from Napeague Bay to Promised Land is 16 feet (4.9 m.), but coal-laden vessels drawing as much as 20 feet (6.1 m.) occasionally enter with the aid of local knowledge.

Promised Land Channel is well marked by buoys and beacons, the latter being lighted during the summer. It has a least depth of 17 to 19 feet (5.2 to 5.8 m.) in the center of the channel, but the

shoals are shifting in character and local knowledge is necessary for vessels of over 12-foot (3.7 m.) draft. A shoal with a depth of 9 feet (2.7 m.) extends over halfway across the channel, southwestward of buoy No. 2A. The shoal on the east side of the channel between buoys Nos. 4 and 4A is building out into the channel and vessels must not steer a straight course between these buoys. The tidal currents have considerable velocity through all the channels between the shoals.

Promised Land is a fishing village on the southwest side of Napeague Bay. Coal, gasoline, fresh water, and provisions in limited quantities can be obtained here. The depths at the wharves are 16 feet (4.9 m.) and under. A depth of 7 feet (2.1 m.) can be carried to the landing of the Devon Yacht Club, 1¼ miles westward of Promised Land.

Directions.—In the absence of local knowledge it is not considered advisable for vessels of a greater draft than 12 feet (3.7 m.) to attempt the passage to Promised Land or through to Gardiners Bay, and then only when the buoys can be seen. From the perpendicularly striped bell buoy at the entrance from Napeague Bay the course is 214° true (SW. ⅛ W. mag.) to a position midway between beacons Nos. 1 and 2 (lighted in summer), and this course leads northward of a perpendicularly striped nun buoy and between a horizontally striped buoy and a red nun buoy. From a position midway between these two buoys steer 231° true (SW. by W. ⅝ W. mag.), heading for beacon No. 3 (white light in summer), passing 50 yards northward of a black buoy. When 250 yards from beacon No. 3, and about 75 yards from a horizontally striped buoy, head to pass about 50 yards westward of the nearest wharves at Promised Land.

Or to go through into Gardiners Bay pass about 50 yards northward of the horizontally striped buoy and 150 yards northward of beacon No. 3, and steer 273° true (WNW. ¾ W. mag.); a house with dormer window southward of Hicks Island should be astern on this course, which should lead about midway between buoys Nos. 3 and 4. Buoys No. 4 and 4a are close to the edge of the flat, and should be given a good berth (about 150 yards), passing westward of them and then pass about 100 yards westward of buoy No. 6. Passing about ¼ mile eastward of buoy No. 5, a 334° true (N. by W. ¼ W. mag.) course will lead for Plum Island Lighthouse, easterly side of Plum Gut in a depth of about 16 feet (4.9 m.) across Crow Shoal about ¾ mile westward of Crow Head.

Napeague Harbor, having its entrance northeastward of Hicks Island, can be entered by vessels up to 7-foot (2.1 m.) draft at low water and is frequently used by small local craft, especially in northeasterly weather, when the adjoining bays are unsafe. The entrance is very narrow and is usually staked. There is a depth of only about 3 feet (0.9 m.) at the landings.

Gardiners Island is partly wooded and has an elevation of 130 feet (40 m.) near its middle. **Crow Head** is the high bluff at the western end of Gardiners Island. **Crow Shoal** extends 1¾ miles west-southwestward from Crow Head and is marked at its western end by a horizontally striped buoy. The shoal is generally steep-to.

Bostwick Bay is the bight on the northwest side of Gardiners Island. It affords excellent anchorage in easterly winds in depths

of 24 to 25 feet (7.3 to 7.6 m.), but is exposed to all westerly winds. There are no dangers in the bay or its approaches, with the exception of Crow Shoal and the bar extending from the north point of Gardiners Island to Gardiners Point.

Gardiners Point is a low spit on which there is a concrete structure about 20 feet (6 m.) high, and lies at the northerly end of the very shoal bar which extends 1½ miles north-northwestward from Gardiners Island. This shoal is steep-to on its north and west sides and is marked at its north end by a gas buoy and a bell buoy. A channel is gradually cutting across the shoal between Gardiners Point and the island. In 1925 a depth of 8 feet (2.4 m.) could be carried through this channel by passing about 200 feet southward of the old pier on the south side of the point and by avoiding the 5-foot (1.5 m.) spot lying ½ mile southeastward of the ruins at the north end of the point.

Tides.—The mean rise and fall of tides is about 2.5 feet.

DIRECTIONS, GARDINERS BAY

Courses to Gardiners Bay entrance are given in the directions for Block Island Sound. Little Gull Island and Orient Point Lighthouses and Gardiners Island gas and bell buoys are the principal guides for the entrance from Block Island Sound. This entrance is over 1 mile wide between the 6-fathom (11 m.) curve on the broken ground surrounding Constellation Rock and Bedford Reef and the 6-fathom (11 m.) curve eastward of Gardiners Point. A 274° true (WNW. ½ W. mag.) course for Orient Point Lighthouse leads in about the deepest water through the middle of this channel; or, heading to pass from ¼ to ½ mile northward of Gardiners Island gas and bell buoys on any course between 264° true (W. ½ N. mag.) and 253° true (W. ½ S. mag.) will also lead through this channel. These are the best courses for deep-draft vessels.

When past Gardiners Island gas and bell buoys vessels can stand over for an anchorage which affords the best lee in the prevailing winds, or from abreast Gardiners Island gas and bell buoys deep-draft vessels can steer westward or west-southwestward until Orient Point Lighthouse bears north, and then bring it astern on a 168° true (S. mag.) course, which leads in a least depth of about 6 fathoms (11 m.) until approaching the southern end of the bay.

The principal dangers are the broken ground between Constellation Rock and Bedford Reef, the shoal making out to Gardiners Point, and Crow Shoal. The shoaling is generally abrupt in approaching these dangers. In general the shoaling is gradual in approaching the shoals on the western side of the bay. There are fish pounds and many oyster stakes on most of the shoals.

Plum Gut is used by vessels entering Gardiners Bay from Long Island Sound. (See the description of Plum Gut preceding.) Courses to the north and south entrances of Shelter Island Sound are given in the directions under that heading.

SHELTER ISLAND SOUND AND PECONIC BAYS

These waters (charts 298 and 299) extend westward from Gardiners Bay about 22 miles to Riverhead, the head of navigation on

Peconic River. They are much frequented by yachts and motor boats in summer, and there are many summer resorts. In the summer steamers ply to the towns and villages on Shelter Island Sound from New York and New London. There are fish traps and oyster stakes on many of the shoals.

Channels.—At low water a depth of 21 feet (6.4 m.) can be carried through the north part of Shelter Island Sound and Little Peconic Bay as far as Robins Island, and 13 feet (4 m.) through the south part of Shelter Island Sound. Across the bar between Little and Great Peconic Bays 15 feet (4.6 m.) can be carried at low water, and there is a greater depth in Great Peconic Bay. A depth of 6 feet (1.8 m.) at low water can be carried to South Jamesport; above this only launches and lighters go as far as Riverhead. From Great Peconic Bay boats of 4½-foot (1.4 m.) draft can be taken through Shinnecock Canal and by inside waters along the south side of Long Island to East Rockaway Inlet.

Pilots.—There are no regular pilots. The piloting is generally done by fishermen or masters of small local vessels.

Towboats are rarely used, but they can be obtained from New London. The oyster steamers are available in case of necessity.

Supplies.—Coal, gasoline, provisions, ice, water, and ship chandlery can be best obtained at Greenport and Sag Harbor.

Repairs.—There are several shipyards and marine railways at Greenport, also inclosed basins with excellent facilities for laying up and fitting out yachts. The largest marine railway is 180 feet long, with a capacity of 1,200 tons, and can haul out vessels up to 20-foot draft aft and 8-foot draft forward. Ordinary repairs to machinery can be made.

Ice obstructs navigation in the coves and shallow harbors for about two months (January and February). There is some drift ice at Greenport, but not sufficient to interfere with navigation. In the south arm of Shelter Island Sound the ice is sufficiently heavy at times to be destructive to structures exposed to it.

Tides.—The mean rise and fall of the tides is about 2.5 feet.

Currents.—The tidal currents have considerable velocity wherever the channel is narrowed. The estimated velocity at strength in the narrower places is 1.5 knots or more. The currents turn from 1 to 1½ hours after high and low water.

SHELTER ISLAND SOUND, NORTH PART

Extensive flats make off from Ram Head and the shore between it and Hay Beach Point. Southward and southwestward of Long Beach Bar Lighthouse there are depths of 5 feet (1.5 m.) for a distance of nearly ¾ mile from the south shore, and the edge of the shoal is marked by a black buoy. The northerly part of these shoals, extending ½ mile off the eastern side of Hay Beach Point, are known as **Hay Beach Point Flats** and are marked at the northeast end by a black bell buoy. From southward of Long Beach Bar Lighthouse to Hay Beach Point the edge of the shoal is steep-to. **Hay Beach Point** is a low flat with a clump of scrub at the end, backed by wooded highland. There are fish pounds in places on the shoals and on both sides of Long Beach Point.

Long Beach Point is a low spit from which a bar with little depth extends to **Long Beach Bar Lighthouse,** a white tower and dwelling on piles. Shoals with 10 to 12 feet (3 to 3.6 m.) over them extend ½ mile southward from Long Beach Point. The south and west sides of the shoal have depths of 14 to 15 feet (4.3 to 4.6 m.), and rise abruptly from the channel.

Orient Harbor is an excellent anchorage lying northward of Long Beach Point and lighthouse, the depths ranging from over 20 feet (6 m.) in its southern part to 16 feet (4.9 m.) at its northern end. A shoal with 6 to 9 feet (1.8 to 2.7 m.) over it extends ⅞ mile from the western shore at the entrance of Orient Harbor and is marked at its end by a red buoy, which lies ⅝ mile northwestward of Long Beach Bar Lighthouse. Enter between the buoy and lighthouse, giving the latter a berth of over 300 yards, and steer about 359° true (N. by E. mag.) up the middle of the harbor; select anchorage as desired, giving the north shore a berth of about ¼ mile. The eastern part of Orient Harbor, eastward of a line from Long Beach Bar Lighthouse to the end of the wharf at Orient, has depths of 7 to 9 feet (2.1 to 2.7 m.), with the exception of a channel ¼ mile wide about midway between them, which leads to Long Beach Bay. There are fish pounds in places on the shoals.

Orient is a village at the northeast end of Orient Harbor. There is a depth of 8 feet (2.4 m.) at the end of the steamboat wharf. The white church spire is prominent.

Long Beach Bay makes eastward from Orient Harbor on the north side of Long Beach Point. A dredged channel, with a least width of 35 feet and protected by dikes in places, leads through the bay to a wharf on the west side near its north end. In 1925 there was a least depth of 5 feet (1.5 m.) in the channel and 6 feet (1.8 m.) at the wharf. This channel is marked by the dikes and private aids and is easily followed. Leave the first dike, on the port hand, then follow the next dike, leaving it on the starboard hand, until in the channel between the dikes, and when past them follow the bush stakes, leaving them on the port hand. The aids and dikes should be passed at a distance of about 20 feet.

Greenport Harbor is formed on the northeast by a breakwater, 5 feet (1.5 m.) high, which extends ¼ mile south-southeastward from Youngs Point, nearly to the 18-foot (5.5 m.) curve, and is marked at its outer end by Greenport Harbor Light. From the shore end of the breakwater a flat extends 200 yards southward to the 6-foot (1.8 m.) curve and 300 yards to the 12-foot (3.6 m.) curve, and the generally used anchorage is off the edge of this flat in 2 to 6 fathoms (3.6 to 11 m.), the lead being a good guide.

Sterling Basin, on the northeast side of Greenport, has a depth of about 6 feet (1.8 m.) in the entrance and 2 to 3 feet (0.6 to 0.9 m.) inside. There is a railway for small motor boats at the head of the basin. A staked channel good for 2½ feet (0.8 m.) leads to oyster wharves in the northern part. In the approach to the basin there are a marine railway and several wharves, of which the principal and only public one is Union Wharf, which has a depth of about 11 feet (3.4 m.) at its outer part. A 323° true (NNW. ¼ W. mag.) course for Union Wharf leads in the best water, or a depth of over 9 feet (2.7 m.) will be carried by steering for its end on any course between 337° true (N. by W. mag.) and 303° true (NW. mag.).

Greenport is an important town and the terminus of a branch of the Long Island Railroad. There are several shipyards, marine railways, and a well-equipped machine shop. The depths at the wharves range from 7 to 19 feet (2.1 to 5.8 m.), according to location. The steamship and railroad wharves are on the south front of the town. There is ferry communication with Sag Harbor and New London during the summer.

Derring Harbor, opposite (southward of) Greenport, is a favorite anchorage for yachts and motor boats. A shoal, with 5 to 7 feet (1.5 to 2.1 m.) over its outer part, extends halfway across the entrance from the southwest point at the entrance, and is marked at its northeast end by a red buoy. The entrance is between the buoy and the eastern shore. The depths in the harbor range from about 12 to 15 feet (3.6 to 4.6 m.) just inside the entrance to 8 or 9 feet (2.4 to 2.7 m.) near the shores. Motor boats should give the shores at the southeast end and west side of the harbor a berth of 200 yards; anchor eastward of the line of the coal pier at the southwest end of the harbor to avoid the grassy shoal on the west shore. Vessels too large to enter can anchor outside the entrance buoy in 3 to 6 fathoms (5.5 to 11 m.)

Shelter Island Heights is a post office on the southwest side; a ferry runs to Greenport.

Fanning Point is on the north shore at the southwest end of Greenport. A shoal extends 300 yards off the point and is marked at its end by a red buoy in a depth of 15 feet (4.6 m.).

Pipe Cove, about ¾ mile in extent, lies on the north side southwestward of Greenport and between Fanning Point and Conkling Point. Extensive shoals make off from the shores, and it is not much used except by motor boats, which moor on its northeast side. There are bowlders in places on the northwest side of the cove, and in general motor boats should give the shores a berth of over 200 yards.

Conkling Point, on the north shore 1 mile southwestward of Fanning Point, is low and sandy at the end and has deep water as close as 150 yards.

Jennings Point, the western end of Shelter Island, is high and wooded. There are no dangers off the point if it be given a berth of over 150 yards.

Southold Bay and the village of **Southold** are in a bight at the northwestern end of Shelter Island Sound westward of Jennings Point. Southold is on the Long Island Railroad. The wharf is out of repair and used only by small craft under 6-foot (1.8 m.) draft. A 270° true (W. by N. mag.) course for the wharf leads in about the best water in the approach. A black buoy is located on the south side of the channel leading to the wharf.

For a distance of 1 mile northeastward of the wharf shoals with 12 feet (3.7 m.) or less extend nearly ⅜ mile from shore and are generally steep-to. The southwest part of the bay is also shoal for a distance of 600 yards from shore. Anchorage can be selected with the wharf bearing between 292° true (NW. by W. mag.) and 253° true (W. ½ S. mag.) and distant from ⅛ to ⅜ mile, in 12 to 18 feet (3.7 to 5.5 m.).

Paradise Point, on the west side of the sound, is low and wooded, and from the point a sloping sand spit shows nearly out to Hallocks Point Shoal gas buoy, which marks the end of the shoal off the point.

Southward of Paradise Point shoals with depths of 10 to 15 feet (3 to 4.6 m.) extend from the west shore to mid-sound; the southeast point of the shoals is marked by a red buoy, which lies about ¾ mile southward of Paradise Point. There are oyster stakes in places on the shoals.

SHELTER ISLAND SOUND, SOUTH PART

The channel south of Shelter Island has numerous shoals, but is easily followed by vessels of 12 feet (3.7 m.) or less draft when the buoys can be seen. The approach from Gardiners Bay is across a shoal or bar which extends in a southeasterly direction from Ram Head to the south shore, the depths on which range from 7 to 11 feet (2.1 to 3.4 m.) for a distance of 1¼ miles from Ram Head, and thence 13 to 17 feet (4 to 5.2 m.) to the buoys which mark the south side of the entrance. The southern end of this shoal, across which the channel leads, is called **Sag Harbor Bar**, good for a depth of 17 feet (5.2 m.), and is marked by spar buoy No. 2.

Cedar Point Shoal extends ¼ to ⅜ mile from the shore eastward of Cedar Island Lighthouse (granite dwelling). The shoal has bowlders, and its edge is marked by buoys.

Nichols Point Shoal, with bowlders and little water in places, extends nearly ½ mile east-southeastward from Nichols Point and is marked at its end by a red buoy, which lies ½ mile northward of Cedar Island Lighthouse.

Single Rock buoy marks a bowlder with 4 feet (1.2 m.) over it, which lies on the western edge of the channel, 600 yards from shore, and ⅜ mile westward of Cedar Island Lighthouse.

Northeast Harbor is the usual anchorage for vessels bound to Sag Harbor and lies between Cedar Island Lighthouse and Mashomack Point. The depths are 15 feet to 6½ fathoms (4.6 to 12 m.), hard bottom. Small craft can find shelter in northerly gales with Cedar Island Lighthouse bearing 0° true (N. by E. mag.). With strong northerly winds it is not advisable for any vessel to anchor in mid-channel between the lighthouse and Mashomack Point, as there is a rough sea on the ebb; under such conditions the best anchorage is on the western side of the channel out of the strength of the current.

Gull Rocks, showing bare at half tide, lie nearly ⅜ mile northeastward of the breakwater at Sag Harbor, and are marked off their north end by a black buoy.

Sandspit is the extensive shoal, partly bare at low water, lying between Mashomack Point and Sag Harbor. The southeast and south sides of the shoal are marked by red buoys and a lighted beacon (pile of rocks with red spindle). The shoal extends 1⅜ miles northwestward from the beacon, has 5 to 9 feet (1.5 to 2.7 m.) over it, and its western edge is marked by red buoys.

Sag Harbor lies about 3 miles southwestward of Cedar Island Lighthouse and is formed on the northeast by a breakwater which is marked at its end by a light. The town of Sag Harbor has railroad communication. The deepest draft entering is about 12 feet (3.7 m.). The channel to the steamboat wharf has a depth of 8 feet (2.4 m.). The east and south sides of the harbor are shoal, but there is a limited anchorage for a few small vessels of less than 8-foot (2.4 m.) draft

eastward or northeastward of the end of the steamboat wharf. The depths at the steamboat wharf range from about 10 feet (3 m.) at the end and the outer end of the east side to 7 feet (2.1 m.) near its inner end, and there is a depth of about 2 feet (0.6 m.) at the ends of the landings in the harbor. There is a depth of about 3 feet (0.9 m.) in the channel to **Sag Harbor Cove**; the drawbridge across the entrance of the cove has an opening with a width of 35 feet and a high-water clearance when closed of 7½ feet. Coal in limited quantities, gasoline, water, provisions, and yacht supplies can be obtained at Sag Harbor. There is ferry communication with Greenport and New London during the summer months.

To enter Sag Harbor, pass 100 yards eastward of red buoy No. 12 (with cage) and steer 222° true (SW. ¾ W. mag.) to a position close to eastward of the red buoy off the end of the breakwater, or, coming from northward, from abreast the red buoy at the southwest end of the Sandspit, steer about 191° true (SSW. mag.), giving the western shore a berth of 300 yards, to a position close to eastward of the red buoy off the end of the breakwater. Then steer for the wharf house in range with a prominent white belfry. The end of the breakwater should not be rounded too closely, as a depth of about 6 feet (1.8 m.) is found near its end. The deepest water is found close to the red buoy. Anchor eastward or northeastward of the end of the steamboat wharf, taking care to keep westward of the range of the end of the breakwater and the foot of the bluff on the east side of North Haven. The north end of North Haven should be given a berth of over 200 yards.

Smith Cove, a bight ⅝ mile in diameter on the south side of Shelter Island, is a good anchorage for small craft in northerly weather. The depths range from 14 to 30 feet (4.3 to 9 m.). A ferry operates between **South Ferry** on the southwest side of the cove to **North Haven.**

West Neck Harbor and **West Neck Creek** are shallow, connecting bodies of water on the southwest side of Shelter Island. A depth of 5 feet (1.5 m.) can be carried from Shelter Island Sound through a narrow staked channel in West Neck Harbor to a yacht club landing on West Neck Creek. The entrance is close to eastward of the small island which separates the harbor from the sound, and the channel follows along the north side of this island to the west side of the harbor and thence to the landing on the west side of the creek, ½ mile above its mouth.

Noyack Bay lies between North Haven and Jessup Neck and southward of the western end of Shelter Island. There are no dangers if the shores be given a berth of about ⅜ mile.

PECONIC BAYS (CHART 299)

Jessup Neck is a long, narrow strip, partly high and wooded, which separates Noyack Bay from Little Peconic Bay. The north end of the neck is a sand spit, from which a shoal with 5 to 11 feet (1.5 to 3.4 m.) over it extends nearly ⅜ mile north-northwestward. The end of the shoal is marked by a black spar buoy.

Little Peconic Bay is about 5 miles long and 3¾ miles wide at its widest part. The southeasterly shore of the bay is clear if given a berth of ⅜ mile, but shoals extend ⅝ mile from that shore at the

south end of the bay. There is a prominent yellow bluff just westward of the entrance of **North Sea Harbor.** A shoal with depths of 5 to 7 feet (1.5 to 2.1 m.) extends 1½ miles southwestward from **Great Hog Neck,** on the northwest side at the entrance of Little Peconic Bay; this shoal is marked near the middle of its southeast side by a red buoy, a guide for the main channel of the bay.

Nassau Point, the long neck on the northwest side of Little Peconic Bay, has high bluffs on its eastern side. A shoal with little depth over it extends ½ mile southward from Nassau Point and is marked at its end by a spar buoy. The buoy should be given a good berth when rounding it to insure clearing the southeast part and west edge of the shoal. The southeast part of the shoal has 5 to 8 feet (1.5 to 2.4 m.) over it and lies ⅜ mile northeastward from the buoy.

Cutchogue Harbor, between Nassau Point and Robins Island, has numerous shoals and very irregular bottom, but is used by a number of local oyster boats of as much as 12-foot (3.7 m.) draft. A depth of 8 feet (2.4 m.) at low water can be taken to the town wharf, which is on the eastern side of **New Suffolk,** by passing eastward and about 200 yards northward of the black buoy and then steering for the wharf. There is a depth of about 8 feet (2.4 m.) at the end and at the sides of the outer part of the wharf. A small basin, with a depth of about 8 feet (2.4 m.), lies northward of the wharf. In southeast gales, local craft of less than 6-foot (1.8 m.) draft seek shelter in the small cove, locally known as **Horseshoe Cove,** in the eastern shore, 1 mile northeastward of the wharf. Supplies and gasoline can be had at New Suffolk, and repairs to gas engines and hulls up to about 35 tons. The through channel northward of **Robins Island** has no aids and is not used except by light-draft boats.

The channel southward of Robins Island has been dredged to a depth of 16 feet (4.9 m.) and is marked by buoys.

Great Peconic Bay is about 5 miles in diameter. The navigation is confined mostly to local motor boats from Shinnecock Canal and a few yachts. The bay is generally clear, but there are extensive shoals making off from the shores except on its south side. **Shinnecock Canal** is the entrance of a passage, good for boats of 5-foot (1.5 m.) draft, which leads through the bays on the south side of Long Island.

Sebonac Creek, on the southwest side of Great Peconic Bay, is used extensively by yachts and oyster boats. The entrance is marked by a gas buoy and in summer by a lighted range. A depth of 5 feet (1.5 m.) can be carried to the Sebonac Yacht Club landing on the south side of the entrance and a depth of 2 feet (0.6 m.) to the landings at **West Neck,** a small settlement northeastward of **Ram Island.** There is a small railway at West Neck capable of hauling out small vessels up to 4-foot draft at high water.

Near the middle of the western part of the bay is a red buoy, which marks the entrance of a channel, good for a depth of 6 feet (1.8 m.) at low water, leading to South Jamesport. Passing close southward of this buoy a 260° true (W. ¼ N. mag.) course will lead to the red buoy southward of South Jamesport, then steer northwestward to a black buoy, and then northward for the wharf at South Jamesport. The wharf is out of repair and not used. Motor boats anchor or moor

to piles in the bight westward of the wharf. **South Jamesport** is a summer resort and has railroad communication. There is a railway for boats 40 feet long, 3 feet draft forward and 4 feet aft.

Flanders is a small village at the head of **Reeves Bay,** 2½ miles west-southwestward of South Jamesport.

Riverhead, on the **Peconic River,** 4½ miles above South Jamesport, is at the head of navigation and has railroad communication; the deepest draft of the boats going there is 4½ feet (1.4 m.) at high water. A red buoy marks a shoal extending from the point ⅝ mile westward of South Jamesport. Passing close southward of this buoy, steer northwestward for a bluff, wooded point until the large hotel at South Jamesport shows over the low point; then steer for a small shed on the northern point of the entrance to Peconic River. Above this point the channel is partly a dredged cut and is marked on the north side by bush stakes to the town dock at Riverhead.

Gasoline, water, ice, and provisions can be obtained at Riverhead. A towboat is stationed at Riverhead. The river is usually frozen solid from about December 15 to March 1 of each year.

DIRECTIONS, SHELTER ISLAND SOUND, NORTH ARM

The channel north of Shelter Island is good for a depth of 21 feet (6.4 m.), is easily followed when the buoys can be seen, and is generally used by all vessels, including those going to Peconic Bays.

Vessels of less than about 7-foot (2.1 m.) draft can follow the south side of Long Beach at a distance of ¼ mile on a 239° true (WSW. ¼ W. mag.) course, passing about the same distance southward of Long Beach Bar Lighthouse. Vessels of less than 12-foot (3.7 m.) draft can follow the south side of Long Beach at a distance of ¾ mile or more until in the buoyed channel; or, coming from southeastward, can steer for Long Beach Bar Lighthouse on a 308° true (NW. ½ N. mag.) course, which leads ⅝ mile off Ram Head; when about 1 mile from the lighthouse the course should be changed to about west-northwest to pass between the buoys southward of the lighthouse. The following courses lead in the buoyed channel:

From Plum Gut, passing ¼ mile southeastward of Orient Point lighthouse, a 205° true (SW. ¾ S. mag.) course for 4 miles will lead to a position ¼ mile eastward of Shelter Island Sound entrance bell buoy; or, passing ¼ mile northward of Gardiners Island gas and bell buoys, a 239° true (WSW. ¼ W. mag.) course for 6 miles will lead to the bell buoy.

Gardiners Bay to Hay Beach Point.—From Shelter Island Sound entrance bell buoy steer 273° true (WNW. ¾ W. mag.) with buoy No. 1 a very little on the port bow. When Long Beach Bar Lighthouse bears 337° true (N. by W. mag.), steer 305° true (NW. ⅛ N. mag.), passing 200 yards eastward of buoy No. 1 and 250 yards northeastward of a black gas buoy. Rounding the gas buoy at this distance, steer 259° true (W. mag.) to a position 350 yards northward of Hay Beach Point, and then, if going to Greenport, steer southwestward and pass about 100 yards southeastward of the light on the end of the breakwater.

Hay Beach Point to Little Peconic Bay.—Rounding Hay Beach Point at a distance of 350 yards, steer 222° true (SW. ¾ W. mag.), follow the southern shore at a distance of 350 yards, and round

Conkling Point and Jennings Point at this distance. Then steer 154° true (S. by E. ¼ E. mag.), pass 100 yards eastward of the gas buoy off Paradise Point, and continue the course about ½ mile past the gas buoy until approaching a red spar buoy. Round this buoy at a distance of about 200 yards, steer 208° true (SW. ½ S. mag.), and pass 100 yards northwestward of Jessup Neck Shoal spar buoy.

Through Little and Great Peconic Bays.—Passing 100 yards northwestward of Jessup Neck Shoal spar buoy, continue the 208° true (SW. ½ S. mag.) course for 1 mile to a position ¼ mile southeastward of a red buoy. Then steer 218° true (SW. ½ W. mag.), pass 200 yards southeastward of the spar buoy off Nassau Point, and continue the course, passing midway between the buoys which mark the dredged channel, with a depth of about 16 feet (4.9 m.), southward of Robins Island. Westward of the dredged channel vessels of about 10 feet (3 m.) or less draft can cross the shoal anywhere southward of the horizontally striped buoy which marks a rock with 5 feet (1.5 m.) over it, lying 1 mile west-southwestward of the south end of Robins Island. Deeper-draft vessels should follow the buoys southward, the courses for which are: Passing 100 yards westward of buoy No. 11, 180° true (S. by W. mag.), passing 100 yards eastward of buoys Nos. 20 and 22, then 202° true (SW. by S. mag.), passing 100 yards eastward of buoy No. 24, and then 247° true (W. by S. mag.), passing northward of buoy No. 13.

DIRECTIONS, SHELTER ISLAND SOUND, SOUTH ARM

This entrance is little used except by vessels going to Sag Harbor, the usual draft of which is 10 feet (3 m.) or less and the greatest draft about 12 feet (3.7 m.). Vessels of greater draft should employ a pilot. Vessels from Greenport going to Sag Harbor or the reverse generally use the inside route around the western end of Shelter Island.

From Gardiners Bay vessels can cross Sag Harbor Bar, where the depth is about 14 feet (4.3 m.), on the range of Cedar Island Lighthouse and the white church spire at Sag Harbor, course 210° true (SW. ¼ S. mag.), and then steer about 216° true (SW. ¼ W. mag.) and pass 250 to 300 yards northwestward of the lighthouse. The following courses lead in the buoyed channel:

From Plum Gut, passing ¼ mile eastward of Orient Point Lighthouse, a 186° true (S. by W. ⅝ W. mag.) course for 6½ miles will lead to the red buoy on Sag Harbor Bar; or, passing ¼ mile northwestward of Gardiners Island gas and bell buoys, a 213° true (SW. mag.) course for 6¾ miles will lead to this buoy.

Sag Harbor Bar to Sag Harbor.—Passing close to the red buoy on Sag Harbor Bar, steer 247° true (W. by S. mag.), pass about 150 yards northward of buoy No. 3, and when Cedar Island Lighthouse bears southward of southwest shape the course to pass 300 yards northwestward and westward of it. Then steer 187° true (S. by W. ¾ W. mag.) to a position 350 yards eastward of Mashomack Point, then 202° true (SW. by S. mag.) to a position 150 yards southeastward of buoy No. 8, and then about 224° true (SW. by W. mag.) to abreast buoy No. 10. Pass about 200 feet northward of buoy No. 11, steer 272° true (WNW. ¾ W. mag.), and pass about 300 feet southward of the Sandspit spindle and about 200 feet north-

ward of buoy No. 13. Buoy No. 12 (with cage) will be nearly ahead; directions from this buoy to Sag Harbor are given in the description of the harbor preceding.

Sag Harbor to Peconic Bays.—Leave buoy No. 12 (with cage) on the port hand and the red buoy at the southwest end of the Sandspit, about 100 yards on the starboard hand. Then steer 337° true (N. by W. mag.), pass about 100 yards westward of buoy No. 4, and give the eastern shore of North Haven a berth of about 400 yards. Pass close to the black gas buoy and steer 253° true (W. ½ S. mag.) through the passage northward of North Haven, favoring the north shore. When the western shore of North Haven is abeam steer about 236° true (WSW. mag.) to the gas buoy in Noyack Bay. Passing southward of it, a 261° true (W. ¼ N. mag.) course for 1¼ miles will lead about 100 yards northward of Jessup Neck Shoal spar buoy at the entrance of Little Peconic Bay, or from a position about ¼ mile westward of the red gas buoy in Noyack Bay steer 326° true (NNW. mag.) for 1½ miles to a position about 100 yards eastward of the red gas buoy off Paradise Point.

FISHERS ISLAND SOUND

(chart 358) lies between the mainland of Connecticut and Fishers Island and forms one of the entrances into Long Island Sound that is used to some extent by light tows and other vessels of as much as 14-foot (4.3 m.) draft. Fishers Island Sound has numerous shoals, and the entire area is exceedingly treacherous, being characterized by bowlder patches which rise abruptly from deeper water. Vessels should follow the deep channels between the shoals and proceed with caution if obliged to cross shoal areas. In general, all shoal spots or abrupt changes of depth are indications of bowlders and should be avoided as anchorages. The south side of the sound is first described.

Gangway Rock is awash at low water and is part of a bowlder reef which extends 400 yards southward from Watch Hill Lighthouse. A red gas buoy marks the south end of the reef and the north side of Watch Hill Passage.

Watch Hill Passage is the principal entrance, and the only one used by strangers, to Fishers Island Sound from eastward. It has a least depth of about 17 feet (5.2 m.). The currents are sufficiently strong to tow spar buoys under at times, but set with the course through the passage. A spot, with 12 feet (3.7 m.) over it, in the passage is marked by a horizontally striped buoy; the best channel is northward of the buoy, giving it a berth of about 100 yards.

Watch Hill Reef, on the southwest side of Watch Hill Passage, has rocks bare at low water and is marked by a black spar buoy on the northwestern side and a black bell buoy on the northeast end. A wreck, with two masts showing about 30 feet (9.1 m.) above the water, lies close to northwestward of the spar buoy.

Sugar Reef Passage, between Watch Hill Reef and Sugar Reef, has a width of ¼ mile in which the least depths found are 20 to 23 feet (6.1 to 7 m.). The tidal currents have about the same velocity as in Watch Hill Passage.

Sugar Reef has little depth in places, and is marked at its northwest end by a spindle with conical cage. The reef extends 600 yards east-southeastward and ¼ mile southward from the spindle.

Catumb Passage, between Sugar Reef and Catumb Rocks, has a width of 250 yards in which the least depth found is 22 feet (6.7 m.). The tidal currents are stronger than in Watch Hill Passage.

Catumb Rocks, the highest part awash at high water, is marked by a red buoy at the west end and two black buoys at the east end. Rocks with 5 to 18 feet (1.5 to 5.5 m.) over them extend ¾ mile westward of Catumb Rocks to a red buoy which marks the rocks on east side of Lords Passage.

Lords Passage, eastward of Wicopesset Rock, has a width of nearly ¼ mile, in which the least depth found is 20 feet (6.1 m.). The tidal currents set diagonally across the passage.

Wicopesset Island, small, low, and rocky, is surrounded by foul ground. **Wicopesset Rock,** at the eastern end of the foul ground, is marked on the northeast side by a black buoy.

Wicopesset Passage lies between Wicopesset Island and East Point. This channel is narrow, and is obstructed by a rock in the middle which is marked by a horizontally striped buoy; it is suitable only for small craft and should not be used by strangers. A perpendicularly striped bell buoy marks the southern entrance. When using the passage, boats are apt to be set by the ebb current on the foul ground which extends ¼ mile northwestward from Wicopesset Island.

Seal Rocks, partly bare at low water, lie ⅛ to nearly ⅜ mile off the north side of **East Point** of Fishers Island, and are marked off the north side by a black buoy.

East Harbor and **Chocomount Cove,** in the north shore of Fishers Island, are sometimes used as anchorages by small craft owned in the vicinity. There is considerable foul ground in East Harbor and in the approach to Chocomount Cove, and they are exposed to northerly winds. The approach to East Harbor is marked by two spar buoys. There is a prominent Coast Guard station near South Beach, south side of East Harbor.

East Clump is a small cluster of rocks, partly bare at high water and marked on the north side by a black buoy, lying ¾ mile from Fishers Island and 1¼ miles 250° true (W. ¾ S. mag.) from Latimer Reef Lighthouse.

Middle Clump, a cluster of rocks awash at high water, lies ⅝ mile from Fishers Island and south-southwestward of Ram Island Reef gas and bell buoy. Rocks with 7 to 10 feet (2.1 to 3 m.) over them have been found on the shoals which extend south-southeastward from Middle Clump to Fishers Island.

From Middle Clump a shoal with rocky bottom and bowlders extends westward to South Dumpling. The least depths found are 5 feet (1.5 m.) between Middle Clump and **West Clump;** the latter is bare at low water. **Pulpit Rock,** ¼ mile westward of West Clump, is bare at low water and is marked by a buoy on the north side. **Flat Hammock** is a low grassy islet, from which a shoal with a grassy islet on it extends nearly ¼ mile northeastward, and is marked at its end by a red buoy. The shoal between Flat Hammock and South Dumpling has depths of 6 to 10 feet (1.8 to 3 m.). **South Dumpling** is a grassy island, from which a rocky shoal with 13 feet (4 m.) on it extend ¼ mile southward, being marked at its south end by a black buoy.

A bowlder reef partly bare at low water extends ¼ mile northwestward from the northwest end of Fishers Island, and is marked on its northeast side by two red buoys.

North Dumpling is a small grassy island marked by North Dumpling Lighthouse, a white tower on dwelling.

West Harbor is on the north side of Fishers Island southeastward of North Dumpling Lighthouse and affords shelter from southerly winds. A depth of about 10 feet (3 m.) can be taken to the wharves on the west side of the harbor; a channel with this depth or more and about 50 feet wide has been dredged along the wharf front. Anthracite and bituminous coal, provisions, and fresh water can be obtained. The post office is **Fishers Island.** A steamer from New London lands at the wharf on the north side of Hawks Nest Point in summer and inside West Harbor in winter. Foul ground extends halfway across the entrance of West Harbor to a bare rock, which should be given a berth of nearly 300 feet; at the north end of the foul ground is a horizontally striped buoy.

Approaching West Harbor from eastward small craft can cross the shoal between Pulpit Rock and Flat Hammock, where the general depth is between 13 and 14 feet (4 and 4.3 m.) by passing about 300 yards eastward of buoy No. 2 and steering 193° true (SSW. ¼ W. mag.) for Hawks Nest Point in range with the end of the wharf in West Harbor. From westward, pass close to the bell buoy lying ⅜ mile south-southwestward of North Dumpling Lighthouse, steer 140° true (SSE. ½ E. mag.) to a black buoy and then steer 117° true (SE. ½ E. mag.) which leads about 300 yards northward of Hawks Nest Point. Pass about 200 feet eastward of the red buoy at the entrance of the harbor, steer for Goose Islet until the bare rock is a little abaft the port beam and the face of the coal-bunker wharf is open, and then steer for the wharf. The head of the harbor is used by motor boats of less than 5-foot (1.5 m.) draft which enter by the narrow channel eastward of Goose Islet.

Hay Harbor is used only by small craft. It is a summer resort, and near its head are several hotels with small landings. The channel into the harbor is marked by four lights which are privately maintained during the summer. The three outer lights are fixed red. The inner light shows white on entering the harbor and red on leaving the harbor.

Silver Eel Pond is on the west end of Fishers Island, ⅝ mile northeastward of Race Point. The entrance is about 75 feet wide between jetties and has a depth of 16 feet (4.9 m.), shoaling to 14 feet (4.3 m.) inside. There are dolphins on the northeast side of the pond, and the channel is clear between them and the wharves on the southwest side. Vessels must go to the wharves as there is no room for anchorage. Buoys lie off the entrance, a black spar on the north side of the approach and red bell buoy on south side of approach. It is only necessary to open the entrance and stand in midway between the jetties. The entrance is difficult with northwesterly or westerly winds.

On the north side of Fishers Island Sound are Little Narragansett Bay and Pawcatuck River leading to Westerly, Stonington Harbor, and Mystic River, on which are the towns of Noank and Mystic.

Napatree Point Ledge is a bowlder reef on which there is little depth for a distance of nearly ¼ mile southward of the point. At

the end of the ledge is a 15-foot (4.6 m.) spot lying nearly 3/8 mile south-southwestward of the point; it is marked by a gas and bell buoy.

Napatree Beach, between Watch Hill Point and Napatree Point, is thickly settled; the sand spit extending northward from Napatree Point to Sandy Point is bare.

There is a wharf with about 10 feet (3 m.) at its end on the northwest side of **Napatree Point.** The wharf is protected on the south side by a breakwater which extends out to a depth of about 12 feet (3.7 m.).

Between Napatree Point and the East Breakwater off Stonington Harbor there is an extensive flat on which the general depths are 6 to 10 feet (1.8 to 3 m.). The bottom is generally rocky, with bowlders in places. **Middle Ground,** at the western end of the flat, is marked on its west side by two red buoys.

East Breakwater extends from **Bartlett Reef** to the north end of the Middle Ground, and is marked at its west end by a fixed red light on a red post. A depth of over 15 feet (4.6 m.) can be taken to an anchorage inside this breakwater by passing from 100 to 200 yards westward of the Middle Ground buoys and giving the light on the west end of the breakwater a berth of over 250 yards. When anchoring give the inside of the breakwater a berth of over 300 yards to avoid shoals and fish weirs which extend about this distance from it. This anchorage is not used much, although the shelter is good except in southwesterly and westerly winds.

Little Narragansett Bay.—This shallow bay at the eastern end of Fishers Island Sound is the approach to Pawcatuck River, which leads to Westerly, and is also used by small craft of about 5-foot (1.5 m.) or less draft going to **Watch Hill.** A channel 100 feet wide and 10 feet (3 m.) deep has been dredged through the bay to the entrance of Pawcatuck River. This channel is good for a depth of 9 feet (2.7 m.) and is well marked by buoys, some of them private. It has bowlders and very shoal water in places on both sides, however, and strangers are advised to take a pilot or towboat at Stonington. There are ranges for the axis of the dredged channels which can be seen under favorable conditions, but not in the morning with the sun behind them. The ranges are used in connection with dredging operations, are temporary in character, and may not always be in position. With care small craft of less than 5-foot (1.5 m) draft should have no difficulty in following the channel to Watch Hill. Motor-boat supplies and engine repairs can be had at Watch Hill during the summer.

Currents.—In the dredged channel northward of Sandy Point the currents have an average velocity at strength of 1.3 knots. Slack water occurs about 2½ hours before the current turns westward and eastward, respectively, at the Race (about the time of low and high water at New London). The strength of flood occurs about ½ hour after the current turns westward at the Race (about 2¾ hours after low water at New London) and sets 80° true (E. ¼ S. mag.); the strength of ebb occurs about the time the current turns eastward at the Race (about 2 hours after high water at New London) and sets 260° true (W. ¼ N. mag.).

Directions, Little Narragansett Bay.—Pass southward and about 100 yards eastward of the horizontally striped buoy southward of Stonington Point, and then head to pass 75 feet northwestward of buoy No. 2, and then to pass 100 feet northward of Rhodes Folly beacon (stone pier with spindle, 60 feet from south edge of dredged channel). Then steer 95° true (ESE. ½ E. mag.) in the dredged cut to buoy No. 3; two targets on the point ahead, 400 feet from its south end, are the range. Then steer 116° true (SE. ⅝ E. mag.) in the dredged cut to buoy No. 8; a target on Pawcatuck Point and the north edge of window in end of white house just north of flagpole (southeast side of Potters Cove) are the range. Then steer 133° true (SE. ⅞ S. mag.) in the dredged cut until between buoy No. 10, and a horizontally striped buoy marking a submerged rock pile with a reported depth of 7 feet; a target on the shore ahead and the north end of ridge of a barn, which shows over the top of the hill, are the range. Then steer south-southwestward and pass about 400 feet off the north point of Foster Cove, then about 200 feet off the next point southward, and then southward for the main landing at Watch Hill. There are a number of private buoys between buoy No. 10 and the point nearly ¼ mile northward of the landing; abreast the latter point the channel is narrow. Anchor in the bight northward or northeastward of the landing, where the depths are 5 to 9 feet (1.5 to 2.7 m.).

Pawcatuck River has a length of about 4 miles to Westerly, and has been improved by dredging a channel 10 feet (3 m.) deep with a width of 100 feet, except through the ledge at Pawcatuck Rocks, where the width is only 80 feet, to the lower wharves at Westerly and 40 feet wide along the wharves. The deepest draft towed up to Westerly is about 10 feet (3 m.) at high water. With local knowledge the channel is good for a depth of 9 feet (2.7 m.); the channel is marked by buoys, some of them private. Vessels should pass close to the buoys as the channel is narrow and its edges rocky in places. A pilot or towboat can be obtained at Stonington, or by telephoning from there to Westerly. About 1 mile above the entrance the current has a velocity of about ½ knot at strength. The river is generally closed by ice from January to March, although the local towboat sometimes keeps the channel open in mild winters.

At **Colonel Willie Cove,** ½ mile above the mouth of the river, there is a marine railway 60 feet long and capable of hauling out vessels up to 6-foot draft. There are also facilities for storing yachts here.

Westerly is an important manufacturing town and has railroad communication. There is a depth of about 9½ feet (2.9 m.) at some of the coal wharves and about 7 feet (2.1 m.) at the others. Coal, water, and supplies of all kinds can be obtained.

Stonington Point, at the south end of the town of Stonington, is marked by a white unused light tower. **Storm warnings** are displayed on the point. A horizontally striped buoy is placed off the south end of the shoal which surrounds the point to a distance of about 125 yards.

Stonington Harbor is well sheltered by the breakwaters, and is available for vessels of about 11 foot (3.4 m.) or less draft at low water and 13 feet (4 m.) at high water. Anchorage can be selected between the West Breakwater and **Penguin Shoal,** where the depths are 15 to 18 feet (4.6 to 5.5 m.), taking care to keep the south end

of Wamphassuck Point bearing northward of 270° true (W. by N. mag.). Vessels of about 10 feet (3 m.) or less draft can anchor in the inner harbor from Penguin Shoal and Inner Breakwater to the steamboat wharf, taking care to give the western shore a berth of 250 yards. Small vessels of less than 8 feet (2.4 m.) draft can anchor in the eastern half of the harbor, above the steamboat wharf.

West Breakwater extends 2,000 feet in a southeasterly direction from off **Wamphassuck Point,** and is marked at its eastern end by Stonington Breakwater Lighthouse, a white conical tower.

Inner Breakwater is about 400 yards northward of Stonington Point, on the east side of the entrance. It extends westward about 250 yards, and is marked at its western end by a small stone pyramid.

Stonington is a town with railroad communication, and there is an electric road to Westerly and New London. Coal, water, and boat supplies can be obtained at the wharves, where the depths are 7 to 12 feet (2.1 to 3.7 m.). There are marine railways about 35 feet long, and facilities for repairing small craft; larger vessels go to Noank or Mystic. A towboat will usually be found here, or may be ordered from Westerly by telephone.

Directions, Stonington Harbor.—The harbor is approached from southeastward, southwestward, and westward. The southeastern approach is the best, having fewer dangers, and the lights serve as guides to avoid them. In the daytime, with clear weather, no difficulty should be experienced in entering by any of the approaches. The southwesterly approach is through a dredged cut across Noyes Shoal (see description), and was used by the line of steamers formerly running to Stonington. This approach is now abandoned except for a few local vessels of less than 10-foot (3 m.) draft.

From southeastward.—Pass southward of Napatree Point Ledge gas and bell buoys and steer 298° true (NW. ⅜ W. mag.) for 1 mile until abreast the red buoy at the southwest end of the Middle Ground. Pass 100 to 200 yards westward of the two red buoys marking the west end of the Middle Ground on a 343° true (N. ½ W. mag.) course, or a 354° true (N. ½ E. mag.) course for the lighthouse on the east end of West Breakwater will lead about midway between Middle Ground and the eastern end of Noyes Shoal. Pass over 250 yards westward of the light on the west end of East Breakwater, 100 yards or more eastward of the lighthouse on the east end of West Breakwater, and enter the harbor between Inner Breakwater and the black buoy marking the eastern end of Penguin Shoal.

From westward.—From Ram Island Reef gas and bell buoy steer 51° true (NE. by E. ⅝ E. mag.) for White Rock, passing about midway between Ellis Reef south buoy No. 1 and the red buoy at the northwest end of Eel Grass Ground. Pass 200 yards southward and about ¼ mile eastward of White Rock, and bring the rock in range with the stone building with red roofs on Baker Island astern, course 88° true (E. ⅞ S. mag.), which leads 200 yards northward of Noyes Rock. Pass southward of the fish weirs which extend 100 yards or more southward from West Breakwater, pass 100 yards or more eastward of the lighthouse on its east end, and enter Stonington Harbor between Inner Breakwater and the black buoy marking the eastern end of Penguin Shoal.

Noyes Shoal, with 10 to 15 feet (3 to 4.6 m.) over it, is nearly 1½ miles long in a west-northwesterly direction, its easterly end lying 300 yards westward of the northerly Middle Ground buoy. A cut 160 feet wide and 17 feet (5.2 m.) deep was dredged across Noyes Shoal, the range for it being the lighthouse on the east end of Stonington West Breakwater and the small stone beacon on the west end of Inner Breakwater, bearing 27° true (NE. ½ N. mag.). The cut has narrowed and shoaled to a large extent, the beacon on the Inner Breakwater is not easily picked up by a stranger, and the direction of the tidal currents is across the cut, so that it is not easily followed by a stranger and is seldom used even by local boats. The depth on the shoal near the cut is about 12 feet (3.7 m.).

Latimer Reef is a very broken and rocky area ⅜ mile long; it is marked at its west end by Latimer Reef Lighthouse, a white conical tower, with a brown band midway of its height, on a brown cylinder. The eastern end of the reef has a least depth of 6 feet (1.8 m.), and is marked by a horizontally striped buoy. A rock, with 15 feet (4.6 m.) over it, lies nearly 300 yards southwestward of the buoy. Latimer Reef north buoy (horizontally striped) marks a 11-foot (3.4 m.) rocky patch lying ⅜ mile northeastward of Latimer Reef Lighthouse.

Eel Grass Ground is a shoal with a least depth of 6 feet (1.8 m.) lying ¾ mile northwestward of Latimer Reef Lighthouse. The southeast and northwest ends of this shoal are marked by red buoys. A rock with 16 feet (4.9 m.) over it lies 600 yards westward of the shoal.

The bight in the north shore of Fishers Island Sound between Wamphassuck Point and Mason Island is shoal and very broken, the rocks rising abruptly from deep water. **White Rock** is a prominent bare rock off the middle of the bight. **Red Reef,** a rock with 1½ feet (0.5 m.) over it, lies 400 yards northward of White Rock, and is marked on its south side by a red buoy. **Cormorant Reef,** on the northwest side of the bight, is awash at high water. **Baker Island,** at the western end of the bight, is marked by a prominent stone building with red roof. The south end of **Mason Island** is strewn with bowlders. There is an anchorage for small craft on the west side of the south end of Mason Island, where the general depths are 8 to 11 feet (2.4 to 3.4 m.). Care should be observed, as there are bowlders in places.

Ellis Reef is the easterly end of broken ground, which should be avoided by vessels, extending 1 mile eastward from Ram Island. The south end of the reef is awash at low water and is marked by a black buoy. The northeast side of the reef is also marked by a black buoy. **Gates Islet** is marked by a cottage, and lies on the shoals about midway between Ellis Reef and Ram Island.

Ram Island Reef lies 600 yards southward of Ram Island, with a shoal and no safe passage for vessels between. The reef is nearly awash at low water, and is marked at the southwest end by a red buoy. Another red buoy marks the south side of a rock with 6½ feet (2 m.) over it at the south end of the reef. Ram Island Reef gas and bell buoy is located southward of Ram Island Reef.

Ram Island, ⅜ mile long, is grass covered and has an old hotel and other houses on its south end. A shoal, on which are two rocky islets, extends 400 yards northeastward from Ram Island, and is marked at its northeast end by a black buoy. **Ram Island Shoal,** extending nearly ½ mile westward from Ram Island, has little water

over it and numerous rocks bare at low water. **Whaleback Rock** and the islet 300 yards northward of it are bare rocks. **Swimming Rock,** 200 yards westward of Whaleback Rock, is a bowlder awash at high water. The narrow, deep, buoyed channel along the north side of Ram Island Shoal is the easterly entrance to Mystic River. **Whale Rock,** bare at low water, at the northwest end of the shoal, is marked by a red spindle with square cage, which lies 150 yards east-southeastward of Mouse Island.

Between Ram Island Shoal and Groton Long Point is a shoal area, with rocks in places, which should be avoided by vessels. Leading across the shoal is a buoyed channel, good for a depth of about 11 feet (3.4 m.) at low water, used by vessels in entering Mystic River from westward. The south side of the shoal is marked by a red buoy, which lies ⅜ mile east-southeastward of Groton Long Point. A rock, with 10 feet (3 m.) over it, lying 400 yards eastward of Groton Long Point, is marked by a red buoy; the channel leading to Mystic River is northward of this buoy, and vessels will avoid the rock by giving the buoy a berth of over 100 feet, or by keeping northward of the range of Groton Long Point spindle and Seaflower Reef beacon when passing the buoy. Vessels should not pass eastward of this buoy between it and Ram Island Shoal.

Intrepid Rock, with 13 feet (4 m.) over it, lies ½ mile southward of Groton Long Point, and is marked by a horizontally striped buoy on its south side. A 26-foot (7.8 m.) shoal lies 450 yards south of Intrepid Rock.

Mouse Island, marked by several cottages, lies 150 yards southwestward of Morgan Point, the passage between them being blocked by rocks bare at low water. There are rocks, which show at extreme low water, on the shoal about 250 yards northwestward of Mouse Island, and there is a narrow channel between them and the island.

Morgan Point, on the west side at the entrance of Mystic River, is marked by an unused lighthouse tower.

Mystic River has a natural channel with a least depth of 15 feet (4.6 m.) and ample width, with the bends eased by dredging, to Willow Point. Between Willow Point and the first bridge a channel 100 feet wide and with a controlling depth of 14½ feet (4.5 m.) has been dredged. Between the bridges there is a natural channel with a least depth of 15 feet (4.6 m.). A channel 100 feet wide and 11½ feet (3.5 m.) deep has been dredged for about ¾ mile above the second bridge. A description of the upper part of the river is included in the directions. At Mystic the river is crossed by two drawbridges—railroad bridge, 62 feet opening, and town bridge, 58 feet. There is not room in the channel for anchorage, except for small craft, and vessels go to the wharves. South of the railroad bridge the current is less than ½ knot. Above Sixpenny Island the river is usually closed by ice during January and February. A pilot for the river can be obtained from Noank or New London.

Noank, a village on the west bank at the entrance, is on the New York, New Haven & Hartford Railroad. The chief industries are shipbuilding and fishing. The depths at the principal wharves are 10 to 16 feet (3 to 4.9 m.). Coal, water (limited), and supplies of all kinds can be obtained. There are facilities for yacht storage and for hauling and repairing motor boats and vessels up to 1,500 tons.

Willow Point (West Mystic post office) is on the west bank ⅝ mile below Mystic. There is a plant here for building yachts and motors, and a railway for hauling vessels up to 200 tons. A channel with a depth of about 12 feet (3.7 m.) has been dredged to the railway from abreast the red beacon opposite, and this depth can also be taken to the north side of the wharf. Water, gasoline, and provisions can be obtained.

Mystic is a town with railroad communication on both banks of the river, about 2 miles above Noank. The depth in the channel up to Mystic is 14½ feet (4.5 m.), and there is 9 to 12 feet (2.7 to 3.7 m.) at the principal wharves. Coal and other supplies can be obtained and there is a railway for small vessels.

Directions, Mystic River.—From Fishers Island Sound there are two buoyed channels leading between shoals to the entrance; the channel from eastward is very narrow but is good for a depth of about 15 feet (4.6 m.) at low water, that from westward 12 feet (3.6 m.). The channel is marked up to Mystic, but some local knowledge is needed to follow the channel and keep in the best water, and it is advisable for strangers to take a pilot; above Mystic there are no aids. The following remarks may assist small craft using the chart:

From eastward.—From southward of Napatree Point Ledge gas and bell buoys a 292° true (NW. by W. mag.) course for a little over 3 miles will lead 250 yards northward of North Latimer Reef buoy and northward of the black buoy on the northeast side of Ellis Reef. Passing 150 yards northward of this buoy steer 261° true (W. ¼ N. mag.) for Morgan Point unused lighthouse in range with the north end of the northern rocky islet off the north end of Ram Island until Mason Point is abaft the beam. Then haul northward and then westward, following the buoyed channel, and pass 225 feet eastward of Noank Light.

From westward.—Vessels using this channel should proceed with caution on account of the rocky bottom, with bowlders in places. Pass 100 yards or more southward of Groton Long Point spar buoy No. 16B and steer northeastward for the red buoy 400 yards eastward of Groton Long Point. Pass over 100 feet northward of this buoy, pass close to the perpendicularly striped buoys, leave Whale Rock spindle 150 feet on the starboard hand, and pass southward and eastward of Noank Light, rounding it at a distance of 225 feet.

From Noank Light to Mystic.—Passing 225 feet northeastward of Noank Light, steer for the first wharf, leave the red buoy about 300 feet on the starboard hand, then follow the wharves at a distance of 100 feet past the second red buoy to a position 150 feet northwestward of the third buoy (red spar No. 10). The sides of the channel are marked by dolphins and bush stakes. From a position 150 feet northwestward of buoy No. 10 haul eastward and then northward, passing 150 feet southward of black buoy No. 7 and 150 feet eastward of beacon No. 8. Pass 300 feet westward of the islet with single tree, and then follow the channel as defined by a black buoy, the quarry wharf on the east side, the piles on the west side from abreast Spence Point to Willow Point, the beacon opposite the marine railway at Willow Point, and the black buoy on the west side, ¼ mile

above Willow Point. In 1925 there was a stake to mark the west side of the channel at the turn northward of the black buoy. The channel then leads through the west side of the railroad draw opening, then follows the wharves on the west side, and then midway between the wharves to the highway bridge.

Mystic River above Mystic.—From the highway bridge the channel follows the wharves on the east side and continues on the same course 600 feet past the yacht club. It then curves gradually northward, favoring slightly the east bank, and passes close to the old piling on the southwest side of the turning point on the east side. Passing 200 feet off the north side of this point, the course leads to the first wharf, and then to the second wharf abreast the prominent factory, where the dredged channel ends. Above this point the channel is very narrow, but boats of about 5-foot (1.5 m.) draft can be taken to The Narrows. From the last wharf the channel curves northward, passing 125 feet off the first point on the east bank abreast the ropewalk (a landing extends nearly to the edge of the channel), and the same distance off the next point. The channel then trends a little more westward until the end of Halfway Dock is in range with the west side of the north end of The Narrows, and then passes close to the dock and in the middle through The Narrows and for nearly 500 yards above it to a bush stake. Above this point the channel is very narrow and winding, has a depth between 1 and 2 feet (0.3 and 0.6 m.) at low water to Old Mystic, is marked by port-hand bush stakes, and follows the east banks to the next narrows and the west bank to the casino in the bight, about ¼ mile below Old Mystic.

Groton Long Point has a summer settlement. A reef extends nearly 300 yards souhwestward from the point, and is marked near its end by a red buoy. A rock, awash at low water, lies 150 yards off the southwest end of Groton Long Point.

Horseshoe Reef is bare at low water, and is marked at its south end by a red buoy. Broken and rocky ground, on which the least depth found is 10 feet (3 m.) extends northward from Horseshoe Reef to the shore, eastward of Mumford Point.

Seaflower Reef lies near the middle of the western entrance of Fishers Island sound and ¾ mile northwestward of North Dumpling Lighthouse. It is marked near its southwest end by a lighthouse (red skeleton tower on a white tank house on a granite base), which should be given a berth of 150 yards. Depths less than 18 feet (5.5 m.) extend 350 yards northeastward from the beacon. For currents in Fishers Island Sound, see page 119.

Ice.—The strong tidal currents prevent the formation of heavy local ice, except in the shoal tributaries. The only ice to give trouble is that set in from Long Island Sound by wind and current. The ice formations in Little Narragansett Bay are sufficiently heavy to be destructive to structures exposed to it.

DIRECTIONS, FISHERS ISLAND SOUND

Fishers Island Sound is characterized by bowlder patches which rise abruptly from deeper water, and vessels should proceed with caution if obliged to cross shoal areas. The deepest draft of vessels passing through Fishers Island Sound is about 14 feet (4.3 m.).

Watch Hill Passage is the principal entrance from eastward, and the only one used by strangers. Courses to Watch Hill Passage are given in the directions for Block Island Sound.

Passing close southward of Gangway Rock gas buoy the course is 270° true (WNW. ⅞ W. mag.) for Ram Island Reef gas and bell buoy, and northward of the horizontally striped buoy in Watch Hill Passage, close southward of Napatree Point Ledge gas and bell buoy, and northward of the horizontally striped buoy which lies ½ mile southeastward of Latimer Reef Lighthouse. The course leads over the broken ground, with least depths of 18 to 22 feet (5.5 to 6.7 m.), which lies ½ mile west-southwestward of Latimer Reef Lighthouse; it is advisable for vessels to avoid the shoalest part of this broken ground by passing northward of it.

From Ram Island Reef gas and bell buoy a 257° true (W. mag.) course will lead ¼ mile northward of North Dumpling Lighthouse, from which the course can be shaped for Bartlett Reef Lightship. (See, also, the directions for New London Harbor.)

NEW LONDON HARBOR AND THAMES RIVER

The Thames River (chart 359) flows into the eastern end of Long Island Sound northwestward of the western end of Fishers Island Sound. The entrance forms New London Harbor, the most important harbor of refuge in this part of Long Island Sound. Vessels of deep draft find anchorage here in any weather and at all seasons. The river channel is marked by buoys and lights to Norwich, 13 miles above its mouth.

Pine Island is a bluff, grassy island. **Pine Island Channel,** between Pine Island and Black Ledge, has rocky, very broken bottom on which the least depth found is 12 feet (3.7 m.). It is used to some extent by local vessels between New London Harbor and Fishers Island Sound, but should be avoided by other vessels if drawing more than 10 feet (3 m.). **Black Rock,** on the north side at the northwesterly end of the channel, is a prominent rocky islet; a rock, with 3 feet (0.9 m.) over it, lies 100 yards northwestward of it.

Black Ledge lies ⅜ to ⅞ mile from the shore off the east side of the entrance of New London Harbor and 400 yards to nearly ¾ mile eastward of New London Ledge Lighthouse. The ledge has little depth in places, and its south end has been used as a dumping ground. The ledge is marked on its north side by a black buoy, a guide for Pine Island Channel, and at its west end by a large granite beacon. Two red buoys mark the south edge of the dumping ground on the south side of the ledge.

Southwest Ledge, with 7 feet (2.1 m.) over it, is small and is marked on its west side by New London Ledge Lighthouse. A rock, with 22 feet (6.7 m.) over it, lying ¼ mile 155° true (S. by E. ⅛ E. mag.) from the lighthouse, is the only danger in its southerly approach.

New London Ledge Lighthouse, on Southwest Ledge, is a red brick dwelling on a square pier. The light is group flashing white, alternating flashing red every 30 seconds (3 white flashes, eclipse 9 seconds, 1 red flash, eclipse 9 seconds, duration of each flash 0.7

second); 58 feet (17.7 m.) high and visible 13 miles. The fog signal is an air siren, blast 3 seconds, silent 17 seconds.

New London Harbor Lighthouse, on the west side of the entrance to the harbor, is a white, octagonal, pyramidal tower with a dwelling attached. The light is flashing white every 4 seconds (flash 0.4 second, eclipse 3.6 seconds), 89 feet (27 m.) high and visible for 15 miles. A red sector from 0° to 41° true, covers Sarah Ledge and the shoals to westward.

Broken ground fringes the shore southwestward of New London Harbor Lighthouse, and lies westward of a line running from the outer rocks near the lighthouse to the black buoy eastward of Cormorant Rock. Rocks, with 2 to 11 feet (0.6 to 3.4 m.) over them, extend 400 yards from shore in the bight just southward of the lighthouse, and a rock with 19 feet (5.8 m.) over it lies over ¼ mile off the bight at Ocean Beach and ¾ mile south-southwestward of the lighthouse.

Cormorant Rock, Goshen Ledge, and **Little Goshen Reef** are names of parts of an area of foul ground which extends about ½ mile from the shore for a distance of 1 mile southwestward from Ocean Beach. Three black buoys mark the southeasterly and southerly limits of this area, which has numerous rocky patches and bowlders, some showing above water, and which should be avoided even by small craft. Between the buoys marking this area and those marking Rapid Rock and Sarah Ledge there is a channel about ¼ mile wide, suitable for small vessels in the daytime, but the safer course is to pass southward and eastward of Rapid Rock and Sarah Ledge.

Sarah Ledge and other dangers on the west side of New London Harbor entrance are covered by a red sector in New London Harbor Lighthouse, the easterly edge of which bears 0° true (N. by E. mag.). The ledge is also marked by a horizontally striped bell buoy.

Ocean Beach is a summer resort lying ½ to ¾ mile southwestward of New London Harbor Lighthouse. It has communication by electric road with New London.

New London Harbor comprises the lower 3 miles of the Thames River below the bridge, including Shaw and Winthrop Coves, and is from about ¼ to 1¼ miles wide. The project provides for an entrance channel 600 feet wide and 33 feet (10 m.) deep from Long Island Sound to the natural deep water in the upper harbor; a channel 400 feet or more in width, 23 feet (7 m.) deep, skirting the water front of the city; and for dredging Shaw Cove to a depth of 15 feet (4.6 m.). In June, 1925, the entrance channel had a controlling depth of 32 feet (9.7 m.) in the eastern part and 29 feet (8.8 m.) in the western part; the channel along the water front a depth of 20 feet (6.1 m.); and Shaw Cove a depth of 9 to 14 feet (2.7 to 4.3 m.).

White Rock, an islet, lies off **Greens Harbor** and 200 yards from the 18-foot (5.5 m.) curve on the western edge of the channel. It is usually marked by a large pile of old lumber. **Hogback,** a small ledge awash at low water, lies 150 yards southwestward of White Rock and nearly ¼ mile from the western shore, and is marked off its southern side by a black buoy. There are rocks with 3 to 6 feet (0.9 to 1.8 m.) over them in the middle of the northern part of Greens Harbor. **Melton Ledge,** with ½ foot over it, lies 125 yards

eastward of Powder Island and ¼ mile southward of Fort Trumbull and is marked off its eastern side by a black buoy.

Shaw Cove, in New London Harbor, has a drawbridge (opening 42 feet) across the entrance and has been dredged to a depth of 15 feet (4.6 m.); but in 1925 the controlling depth was 9 to 14 feet (2.7 to 4.3 m.). There are some coal wharves, and facilities for storing yachts. It is usually closed by ice for about 2 months each winter.

Winthrop Cove has been dredged to a depth of 23 feet (7 m.), but in 1925 had a controlling depth of about 20 feet (6.1 m.). The deepest draft taken to the coal wharf here is about 22 feet (6.7 m.) at high water. Navigation in the upper part of the cove is limited to small craft by three bridges with fixed spans.

New London, a city on the west bank of the river 2½ miles above the mouth, has considerable trade by water. The principal items of commerce are coal, lumber, and package freight carried in barges, steamers, and schooners drawing from 10 to 29 feet (3 to 8. 8 m.). The deepest draft entering the harbor is 32 feet (9.7 m.). A shipyard and marine railways are located at New London, and also on the west bank of the river ⅞ miles above Winthrop Point.

Groton, a town on the east bank opposite New London, has coal and oil wharves and a marine railway. It is connected with New London by trolley and ferry.

Terminal facilities.—The wharves on both sides of the river and in Shaw and Winthrop Coves have a total shore frontage of about 1½ miles. They are, with few exceptions, of pile and timber construction. On the west side of the harbor there are several wharves directly connected with the railroads and nearly all provided with transfer facilities. The remaining wharves are generally smaller and are equipped to serve the business of the owner or operator only. The State and municipality each own a terminal open to public use. Several other wharves are owned or leased by Government agencies for departmental uses. Of the privately owned wharves there are several available for public use on equal terms.

The State Pier, the easterly one of two long piers on the east side of the entrance to Winthrop Cove, has a depth of 35 feet (10.6 m.), obtained by dredging, at the end and along both sides. The coal wharf in Winthrop Cove has a depth of about 22 feet (6.7 m.). The other wharves have depths of 10 to 16 feet (3 to 5 m.).

Bridges.—Two bridges cross the river at New London. These bridges are less than 200 feet apart and have draw openings with a least width of 150 feet. **Regulations** governing the opening of these bridges have been prescribed by the Secretary of War as follows:

1. As these bridges are less than 200 feet apart, they must be operated as a unit to insure the safety and convenience of navigation. The opening of the State Highway bridge shall be made upon signal from the operator of the railroad bridge, who shall direct the time of opening of both bridges.

2. The signal for opening the draws of both of the above-named bridges shall be given by three short blasts, each of about two seconds duration, of a horn or steam whistle. In case the draws can not be immediately opened when the signal is given, a red flag or ball by day, and a red light by night, shall be conspicuously displayed on each bridge.

3. The signal for the opening of the draws shall be answered by one short blast of a whistle or horn on the railroad bridge when the operation of opening is commenced, or, if the draws can not be promptly opened, by a series

of not less than four short, sharp blasts (each of not more than one second duration) from either bridge.

4. Except as hereinafter provided, the draws of the above-named bridges shall be immediately opened, upon the prescribed signal, at all times during the day or night, for the passage of foreign vessels and "vessels of the United States" as defined in section 4311 of the Revised Statutes. *Exception:* When a westbound train scheduled to cross the railroad bridge without stop has passed Midway Station, or a southbound train Groton Station, or an eastbound train New London Station, and is in motion toward the railroad bridge, the draws shall be opened for the above-named vessels as soon as the train has crossed the railroad bridge.

5. For all other vessels which can not pass the closed bridges the draws shall, upon the prescribed signal, be opened as soon as practicable; but in no case shall the delay be more than 20 minutes, except as hereinbefore provided.

Thames River.—This river is a tidal estuary varying in width from 400 feet to ¾ of a mile, and extending from the junction of the **Yantic** and **Shetucket Rivers,** at Norwich, 13 miles southward to Long Island Sound. The lower part of the river, below New London, is described under "New London Harbor" preceding. Above New London the project provides for a channel 200 feet wide and 20 feet (6.1 m.) deep to Allyn Point; thence of same width and 14 feet (4.3 m.) deep to Norwich; and the removal of obstructions in the Shetucket River at Norwich. In June, 1925, the project width and depths obtained to the wharves at Norwich with depths of 12 to 13 feet (3.7 to 4 m.) in front of the wharves, thence 12 feet (3.7 m.) to the town wharf on the Shetucket River. There are shoals with depths of 9 to 12 feet (2.7 to 3.7 m.) in the basin at Norwich. The river below Norwich is well marked by lights and buoys.

At the marine railway on the west bank of the river ⅞ mile above Winthrop Point, there is a privately dredged channel, said to have a depth of 16 feet (4.9 m.), which leads from the main channel in the vicinity of Bailey Point Light to the railway. It is marked by private stakes at the entrance.

The **United States Naval Station** is situated on the east bank about 2 miles above New London. There is a depth of 26 feet (8 m.) in the channel to this point.

Allyn Point, on the east bank, about 5 miles above New London, has a large coal-receiving pier for the railroad. The deepest draft brought up to the pier is about 22 feet (6.7 m.) at high water.

Fort Point, on the east bank about 8 miles above New London, receives considerable lumber in coasting vessels. Some red brick buildings are prominent.

Norwich, a city at the head of navigation on the Thames River, at its junction with the Shetucket and Yantic Rivers, is about 11 miles above New London. The deepest draft going to Norwich is about 13 feet (4 m.); the usual draft is not more than 10 feet (3 m.). Depths of 8 to 15 feet (2.4 to 4.6 m.) are found alongside the wharves. Motor boats generally anchor in the Shetucket River just above the bridges at Norwich.

Terminal facilities.—Wharves along the river and at Norwich are mainly of the bulkhead type, both with and without pile aprons. Of these, four along the river and one at Norwich have direct railroad connection and transfer facilities. There is a municipal wharf at Norwich not provided with cargo-handling machinery. Eight or more of the privately owned wharves along the river and at Norwich are open to the public on equal terms, but not all of these are in commercial use at the present time.

The prominent objects are New London Ledge Lighthouse, New London Harbor Lighthouse, Fort Trumbull on the west bank, the monument at Fort Griswold on the east bank, and the railroad bridge which crosses the river at New London.

Anchorage.—In New London Harbor vessels come to anchor at will anywhere in the channel from the mouth of the river up to New London. Large vessels keep eastward of a line drawn from the wharf ⅜ mile northward of New London Harbor Lighthouse, to Melton Ledge buoy, to Winthrop Point (west bank, upper part of New London), and give the eastern shore a berth of over 200 yards.

Vessels of light draft, 7 feet (2.1 m.) or less, can anchor in **Greens Harbor** by following the western bank at a distance of 250 yards when ½ mile above the lighthouse. Anchor at this distance from the bank southward or southwestward of Hogsback Shoal buoy. There is good anchorage southward or southeastward of the buoy in 12 to 18 feet (3.7 to 5.5 m.).

Vessels of 12-foot (3.7 m.) draft or less will find good anchorage in 14 to 23 feet (4.3 to 7 m.), soft bottom, between Fort Trumbull and the city of New London, favoring the latter. Many vessels anchor off New London.

Above New London anchorage is found anywhere in the channel.

Pilots are not generally employed by strangers, but if one is desired he may be had by making signal and coming to anchor outside of the entrance until boarded. Strangers bound to Norwich take a State pilot at New London, where one can be obtained by inquiry.

Pilotage is compulsory for all vessels in the foreign trade drawing 9 feet (2.7 m.) or over, if spoken. Charges for pilotage, inward or outward to New London, are as follows: Vessels of 12-foot or less draft $2 per foot of draft; 13 feet, $2.25 per foot, increasing 25 cents per foot of draft to 20 feet; vessels 20-foot draft or over $4 per foot of draft.

Towboats will be found at New London, and when likely to be needed will be found near the entrance. Strangers entering do not require a towboat unless with a head wind and contrary tide. Sailing vessels bound up the river above New London generally take a towboat at New London.

Hospital.—At New London there is a relief station of the United States Public Health Service.

Harbor regulations.—No special harbor regulations are in force for New London Harbor, except that a clear passage across the river must be left for the ferry between New London and Groton (this is above the usual anchorage), and vessels are prohibited from anchoring in the main channel. The harbor master has authority to berth vessels, shifting them if necessary, but occasion for doing so seldom arises.

Supplies.—Coal can be had alongside the wharves at New London, Groton, and Norwich, or in lighters in the stream at New London. Water can be obtained at the anchorage from water boats, or alongside the wharves at New London and Norwich; fuel oil, provisions, and shipchandler's stores at New London and Norwich.

New London is available as a coaling port for large vessels; eastward the nearest one for such vessels is Newport, R. I.

Repairs to vessels and to machinery of steamers can be made in New London, where there are several marine railways; the largest has a capacity of 2,500 tons and a cradle 310 feet long; it can haul out a vessel drawing 17 feet (5.2 m.). There are also excellent facilities for repairing engines and machinery.

Storm warnings are displayed near the customhouse at New London.

Communication.—There is steamer communication with New York and Norwich and good railroad communication. Ferries operate to ports on Long Island Sound during the summer.

Buoy depot.—One of the depots of the third lighthouse district is at the customhouse wharf, New London.

Ice seldom forms below the naval station. Above the naval station ice obstructs navigation about two months each year. In extremely severe winters, however, heavy ice from the Sound, driven in by winds, has been known to extend about 1¾ miles above the entrance. Between New London and the mouth of the river sailing vessels may navigate with comparative safety in ordinary winters; and even in severe weather there is rarely a stoppage of navigation for sailing vessels of more than a week's duration. Steamers can nearly always enter and leave with safety. Drift ice sometimes forms a decidedly dangerous obstruction in the approaches through Long Island Sound during severe winters, especially during February and March; and sailing vessels are much hindered in their movements during the months of January, February, and March.

Freshets usually occur in the river in the spring. It is reported that they seldom exceed 2 feet above mean high water at Norwich.

Currents.—The tidal currents follow the general direction of the channel and usually are not strong. At Gales Ferry, 4 miles above New London, the average velocity at strength is about ¾ knot, and at Easters Point, 7 miles above New London, ½ knot. During freshets, and when the river is high, the resulting current sometimes has considerable velocity, and vessels are often embarrassed in light winds, after getting in past the lighthouse, by a strong surface current setting out even on the flood.

Tides.—The mean rise and fall of tides at New London is 2.5 feet. Daily predictions for New London are given in the tide tables published annually by the Coast and Geodetic Survey.

DIRECTIONS, NEW LONDON HARBOR AND THAMES RIVER

The harbor is easy of access either day or night, but local knowledge is required at low water to take a greater draft than about 20 feet (6.1 m.) above the entrance.

From Fishers Island Sound, pass 200 yards or more southward of Seaflower Reef Lighthouse, steer 281° true (WNW. mag.) with North Dumpling Lighthouse a little on the port quarter, and pass southward of the red buoys marking the south side of Black Rock Ledge.

From the Race, pass southward and westward of Race Rock Lighthouse, giving it a berth of over 200 yards, steer for New London Ledge Lighthouse, and pass westward of it.

From westward, shape the course for Bartlett Reef Lightship, from it steer eastward or east-northeastward until New London

Ledge Lighthouse bears anything northward of 33° true (NE. mag.), and then haul up for it.

New London Ledge Lighthouse is the principal guide for the entrance. It has a fog signal, and it is necessary only to give it a berth of over 100 yards, passing westward of it. The southwest end of Black Ledge lies ⅜ mile 130° true (SE. ⅝ S. mag.), and a rock with 22 feet (6.7 m.) over it lies ¼ mile 155° true (S. by E. ⅛ E. mag.), from the lighthouse. These are the only dangers in the southeasterly or southerly approach. A 33° true (NE. mag.) course for New London Ledge Lighthouse leads over ¼ mile southeastward of **Rapid Rock** and 300 yards southeastward of the bell buoy marking Sarah Ledge, which are the easternmost dangers on the west side of the entrance.

Passing 225 yards westward of New London Ledge Lighthouse, steer 355° true (N. ⅝ E. mag.) for the middle of the drawbridge above New London, and select anchorage in the channel. See anchorage in the description preceding.

New London to Norwich.—Local knowledge is required to carry the best water in the river, and strangers are advised to take a pilot at New London. With the aid of the chart, small craft should have no difficulty in following the channel.

From the bridges a 356° true (N. ¾ E. mag.) course will lead 150 yards westward of Bailey Point Light. Favor the east bank of the river at a distance of about 175 yards, passing about 100 yards eastward of Mud Bank buoy No. 9 and about 100 yards off the wharves at the submarine base, and head for Scotch Cap Light No. 1 on course 336° true (N. by W. mag.). When about ¼ mile from the light, haul northward and pass 125 yards eastward of it. For about ⅜ mile above, the best water slightly favors the west bank, and a yellow chimney at Montville, a little open from a wooded point, is ahead. Then haul northeastward, pass 175 yards northwestward of Cow Point Light, and favor the east bank to Ice House Light No. 3 on the west side of the channel; in this reach a boathouse on the east bank is nearly ahead and the chimney of a black-roofed house is in range with a notch in the trees.

Pass 125 yards eastward of Ice House Light No. 3 in mid river and haul over to the west bank on the range of two targets ahead to pass between Bartlett Point Light and the red buoy. Pass close westward of the buoy and swing slowly to pass 75 yards off the wharves at Montville, and then follow a general mid-channel course to Allyn Point. Pass 75 yards off the wharf and steer north-northeastward, with the next light well on the starboard bow; on this course, local pilots keep an umbrella-shaped tree on the hill showing midway between two white houses. Pass 75 yards northward of the light and haul east-northeastward to pass close northward of a red buoy, then eastward to pass between the next light and the eastern bank. Follow the east bank at a distance of 50 yards to Stoddards Old Dock Light, then pass 75 yards westward of Waldens Island Light and Mohegan Dike Light; a small pier, covered at high water and marked by a stake and flag, lies 300 yards northward of Waldens Island. The channel then leads between dikes, in most cases awash at high water, to Thamesville and Norwich.

Bartlett Reef, marked at its southern end by a red buoy and at its northern end by a black buoy, is about 1⅜ miles long in a general north and south direction, and about ⅜ mile wide at its southern end. Bartlett Reef Lightship is placed nearly ⅜ mile southward of the southern end of the reef. The reef has numerous bowlders with little depth over them, and its northern part is partly bare at low water.

Bartlett Reef Lightship has a black hull with a white streak, black lettering "Bartlett" on each side, and two black masts with a black circular grating at each masthead. The light is occulting white (light 5 seconds, eclipse 2 seconds), 28 feet (8.5 m.) above the water and visible 11 miles. The fog signal is an air whistle, blast 2 seconds, silent 28 seconds. If the whistle is disabled, a bell will be struck by hand, group of 2 strokes, silent 30 seconds.

Twotree Island is a small, bare island lying about ¾ mile south-southeastward of Millstone Point, the eastern point at the entrance to Niantic Bay. Shoals extend nearly ⅜ mile eastward and southward from the island and also 300 yards northward, where the edge is marked by a black buoy, a guide for Twotree Island Channel.

Twotree Island Channel (chart 214) leads northward of Bartlett Reef and Twotree Island. With an adverse current in the sound this channel is used to some extent by light tows, and by sailing vessels with a leading wind in the daytime, as the tidal currents turn about one hour earlier along the north shore than in the middle of the sound. The channel is well buoyed, but strangers are advised to use it with caution and should never attempt to beat through.

To go through Twotree Island Channel from eastward pass southward of Rapid Rock buoy and Little Goshen Reef buoy, giving the latter preferably a berth of about ¼ mile, and steer about 300° true (NW. ¼ W. mag.). Pass 200 to 300 yards northward of the black buoy at the north end of Bartlett Reef, give the shore northward of Bartlett Reef a berth of over 300 yards, and pass about 300 yards northward of the black buoy northward of Twotree Island. Then shape the course to pass ⅜ mile or more southward of Black Point, and then stand westward toward Hatchett Reef and pass southward of it.

The shore westward of **Goshen Point** has scattered bowlders, which extend off 400 yards in places. The northern part of **Indian Cove** is foul. A short breakwater has been built out from the eastern point at the entrance of this cove to form an anchorage on its north side for the boats of a summer settlement here. There is a small wharf and quarry about ¼ mile northward of the breakwater. **Flat Rock,** bare at low water, lies 400 yards from the shore just southward of the wharf. **High Rock,** which shows at high water, lies in the entrance of the bight 350 yards east-southeastward of Fox Island, eastern side of Millstone Point; a rock awash at high water lies 100 yards southward of High Rock.

Millstone Point, on the east side at the entrance of Niantic Bay, is occupied by the buildings of an old stone quarry. There is a cove with depths of 6 to 15 feet (1.8 to 4.6 m.) on the west side of the point. A reef with 2 feet (0.6 m.) over it lies just off the mouth of the cove, and is marked at its south end by a private red buoy. Leaving

this buoy on the port hand, a depth of about 9 feet (2.7 m.) can be taken into the cove and to the inside of the wharf on its north side, where the depth is about 12 feet (3.6 m.).

Niantic Bay (chart 214), lying 4½ miles westward of New London Harbor, is a good anchorage, sheltered from easterly, northerly, and westerly winds. It is important as a harbor of refuge in northerly gales, and is used by sailing vessels and tows. The general depth in the bay is about 19 feet (5.8 m.), the water shoaling gradually northward. The entrance is 1¼ miles wide, and the dangers are marked by buoys or show above water. There is a prominent high, square, white tower on the west side of Niantic River, ¾ mile above the head of the bay.

Niantic and **Crescent Beach** are summer resorts with railroad communication at the north end and northwest side of the bay. There is bus service to East Lyme and New London. There is a depth of about 9 feet (2.7 m.) at the end of the wharf at Crescent Beach. Above the bridges there is a marine railway at Niantic for small craft up to about 10 tons and 40 feet length. Motor boat and other supplies are obtainable.

White Rock is an islet on the east side of the entrance, ½ mile westward of Millstone Point. **Little Rock,** partly bare at low water and lying 150 yards east-southeastward of White Rock, is marked at its south end by a red buoy. A rock, on which the least depth found is 11 feet (3.3 m.), lies about midway between Little Rock and the cove at Millstone Point. A rock with 14 feet (4.3 m.) over it lies 285 yards 151° true (S. by E. ½ E. mag.) from White Rock and 150 yards southward of the red buoy marking Little Rock.

Black Rock, small and bare, lies ⅜ mile northward of White Rock and 400 yards from shore. It is marked by a red buoy.

Waterford Island, small and bare, lies ¼ mile from the eastern shore, with a shoal between, and ½ mile from the head of the bay.

Wigwam Rock, high and bare, lies 200 yards from the northwest shore between Niantic and Crescent Beach. A rock bare at low water lies 250 yards southwestward of Wigwam Rock, and is marked on its south side by a black buoy. The range of Wigwam Rock and the railroad station or the high white tower above the head of the bay leads clear southeastward of the rock.

Niantic River, at the northeast end of the bay, is navigable, with local knowledge, about 3 miles above the entrance to **East Lyme** for vessels of 6-foot (1.8 m.) draft on a good high water. The entrance is through a narrow passage crossed by two bridges. The lower or railroad bridge is 11 feet above high water, and has a lift opening 45 feet wide; the highway drawbridge is 3 feet above high water and has a clear opening 27 feet wide. For a distance of 1 mile above the bridges to ⅜ mile below Sandy Point the river is about ½ mile wide, with extensive shoals, between which is a winding staked channel from 100 to 300 feet wide. The river from westward of Sandy Point to the wharf at East Lyme, a distance of 1 mile, is about 800 feet wide, deep, and clear, vessels generally following the west bank. From eastward of Sandy Point a shallow cove extends northeastward. **Sandy Point** and **Pinegrove,** southwestward of the former, are summer resorts, with communication by boat with New London

during the summer. **Smith Cove** is on the west side of the river nearly 1 mile above the entrance; there is a prominent white tower on the south side of the entrance. The river is generally closed by ice for about three months during the winter.

Tides.—The mean rise and fall of the tides is 2.7 feet in Niantic Bay and about 2 feet at East Lyme; high and low water occur about 1 hour later at East Lyme than in the bay. The tidal currents through the bridges have an average velocity of 2½ knots at strength and set fair with the channel; slack water occurs about 1 hour before the slacks at the Race (about 1½ hours after high and low water at New London); the strength of flood and ebb occurs about 2½ hours after the current turns westward and eastward, respectively, at the Race (about 1¼ hours before high and low water, respectively, at New London).

Directions, Niantic River.—Strangers should not attempt to enter Niantic River without a pilot. One can be had from Niantic. Pilots aim to pass through the bridges either at slack water or against the current. Motor boats can stand for the entrance with the middle stone pier of the railroad bridge a little on the starboard bow and the wharf at Crescent Beach astern. From the railroad bridge the channel leads through the highway draw, then follows the east bank for 100 yards to the the first point, then northwestward across the river, then northeastward for ½ mile to mid river, thence west-northwestward curving to northward to abreast the entrance of Smith Cove, then about 340° true (N. ¾ W. mag.) for the west end of Sandy Point, avoiding a shoal which extends 500 feet southwestward from Sandy Point. In addition to the bush stakes the channel is also indicated by the grass on the flats during the summer. The channel into Smith Cove is indicated by the grass, and deepens inside. The bottom is soft in the river.

Black Point, on the west side at the entrance of Niantic Bay, is flat with bluffs at the water, and is occupied by a number of summer cottages. Broken ground, on which the least depth found is 21 feet (6.4 m.), extends ½ mile off the southwest side of the point.

The bight between Black Point and Hatchett Point has numerous rocks showing above water. **Griswold Island,** on the northeast side of the bight, is high, wooded, and prominent. The rocks extending ¼ mile southward and southwestward from Griswold Island, **South Brother** and **North Brother,** are prominent bare rocks. The following sunken rocks were developed by the survey: A rock with 6 feet (1.8 m.) over it lies 250 yards off the west side of Black Point. **Black Boys,** two rocks bare at low water, lie ⅜ mile southward of Griswold Island, and a rock with 6 feet (1.8 m.) over it lies 150 yards southeastward of them; a rock with 3 feet (0.9 m.) over it, lying 400 yards southward of Black Boys, is marked by a red buoy. **Johns Rock,** with 5 feet (1.5 m.) over it, lies ¼ mile off the northwest side of the bay; the range of South Brother open northward of Griswold Island leads southward of Johns Rock. Strangers entering the bight between Black Point and Hatchett Point should proceed with caution, as the bottom is broken; the best route is to pass southward and westward of the buoy off Black Boys, and pass on either side of South Brother. There is a warehouse and wharf on the north side of the bay northward of North Brother.

Hatchett Point has several large residences, and there is a wharf on its southeast side. A reef extends about 400 yards off the southwest side of the point.

Hatchett Reef lies 5/8 to 1 mile south-southwestward of Hatchett Point, has a least depth of 5 feet (1.5 m.), and is marked at its south end by a red buoy, and at its northeast end by a black buoy. There are depths of 5 to 8 fathoms (9 to 15 m.) close to the southeast side of the reef. A bar with 10 to 15 feet (3 to 4.6 m.) over it extends westward from Hatchett Reef to Saybrook Bar.

Saybrook Bar, obstructing the mouth of Connecticut River, is a shifting bar with depths of 2 to 9 feet (0.6 to 2.7 m.) which extends nearly 2 miles off the mouth of the river and is marked off its southern end by a red gas and bell buoy.

CONNECTICUT RIVER

(chart 215) one of the largest and most important in New England, is navigable for vessels at far as Hartford, and considerable tonnage, mostly steamers and barges, is employed in the commerce of the towns and landings. Barges must be equipped with steering gear in order to make the sharp turns.

The river is under improvement by dredging and the construction of dikes to maintain a channel 100 feet wide and 12 feet (3.6 m.) deep at mean low water to Hartford. Each year after the spring freshets, shoals, with a least depth of about 10 feet (3 m.), are found in places on the bars in the upper river; dredging for the removal of such shoals is begun as soon as the water subsides. Vessels of 16-foot (4.9 m.) draft go to Saybrook Point at high water. The deepest draft usually taken up the river to Middletown and Hartford is 10 to 11 feet (3 to 3.4 m.), but during freshets vessels drawing 14 feet (4.3 m.) have sometimes gone up to Hartford.

Between the entrance and Middletown the river banks are hard and in some places rocky, but between Middletown and Hartford the river flows through alluvial bottom land, where shoaling may occur from freshets and ice jams.

The entrance is obstructed by Saybrook Bar. At the western side of the entrance jetties have been built, and a channel 300 feet wide and 15 feet (4.6 m.) deep has been dredged between them; this improved channel is not subject to material change. The bar eastward of the jetties has several channels with a depth of 6 feet (1.8), but they shift and are not reliable, lumps with little depth sometimes forming in them. The west jetty is marked at the outer end by a light (while conical tower on brown pier), and there is another lighthouse (white stone tower attached to gray dwelling) on Lynde Point, near the inner end of the breakwater.

The principal towns or landings, with their distance in nautical miles above Saybrook Breakwater Lighthouse, are: **Saybrook Point,** 1.4; **Lyme,** 3; **Essex,** 6; **Ely Wharf,** 6.9; **Brockway Landing,** 8.6; **Deep River,** 10.5; **Hadlyme,** 11.8; **East Haddam,** 14.5; **Haddam,** 17.5; **Rock Landing,** 18.6; **Higganum** 19.8; **Middle Haddam,** 23; **Middletown,** 27.8; **Portland,** 28; **Cromwell,** 30; **South Glastonbury** and **Rocky Hill,** 35; **Glastonbury,** 40; **Wethersfield,** 42; and **Hartford** (bridge), 45.2. A railroad on the west bank of the river affords communication to all the towns and

landings on that side. Steamers run regularly from Hartford to New York and stop at the principal landings. There is also communication by busses from the principal towns on the river to Hartford, New London, and New Haven.

Terminal facilities.—There are two or three wharves of the bulk-head type at each of the river towns, one or more in each town being open to public use. At Hartford and at Middletown there is approximately one-half mile of wharf frontage along the west bank of the river. The towns of Saybrook and Cromwell and the city of Middletown each own or lease wharf property. Rail connection and transfer facilities are available at Middletown, Portland, and Hartford.

Saybrook Point, a village eastward of Saybrook, is about 1 mile northward of Saybrook Lighthouse. There are depths of 13 to 20 feet (4 to 6 m.) at the steamer landing.

Hamburg Cove and **Eightmile River** are on the east side of Connecticut River, 6 miles above Saybrook Point. The river has been improved by dredging a channel 75 feet wide and 8 feet (2.4 m.) deep for a distance of 1½ miles to **Hamburg,** with a small turning basin at Hamburg, which is the head of navigation. There are bowlders in places outside the dredged channel, and there is a least depth of about 7 feet (2.1 m.) over bowlders in the turning basin. The narrow entrance channel from Connecticut River has a depth of 10 feet (3 m.) and is indicated by the grassy flats on both sides. There is good anchorage in the cove. The dredged channel between the cove and Hamburg is marked at times by bush stakes on the inside of the turns. The deepest draft of vessels taken to or from Hamburg is about 10 feet (3 m.).

Salmon River, on the east side of Connecticut River, about 1 mile above the bridge at East Haddam, is navigable for vessels of 5 to 6 foot (1.5 to 1.8 m.) draft as far as Scovilles Landing, about 1½ miles above the entrance, and for small craft of less than 3-foot (0.9 m.) draft about 1 mile farther.

Wethersfield Cove is on the west side of Connecticut River, 3¼ miles below Hartford Bridge. It has a narrow, dredged entrance channel, with a least depth of about 4 feet (1.2 m.), and is extensively used by motor boats.

Connecticut River above Hartford is navigable about 30 miles to **Holyoke** for boats of not exceeding 3-foot (0.9 m.) draft, when the river is not low. For a distance of about 10 miles above Hartford to **Enfield Rapids** there are bars with depths of 2½ feet (0.8 m.) at low water and numerous obstructions. At **Windsor Falls** there are locks 88 feet long and 19 feet wide, with a depth of about 3 feet (0.9 m.) on the sill, by which boats can pass around Enfield Rapids, above which the depth is ample to Holyoke. The bridges are closed, but there is ample overhead clearance for small craft, generally about 18 feet.

Bridges.—The Connecticut River, between the entrance and Hartford, is crossed by five bridges, all having wide draw or lift openings.

The railway bridge at Lyme, 1½ miles above Saybrook Point, has a lift opening 150 feet wide, and about 20 feet headroom above mean high water when closed.

The highway bridge, nearly 5/8 mile above the railroad bridge at Lyme, has a double lift opening 200 feet wide, and 30 feet headroom at center above mean high water when closed.

The highway bridge at East Haddam is a center-pier draw, with openings 160 and 200 feet wide on the east and west sides, respectively, and 21 feet headroom above mean high water when closed.

Two center-pier drawbridges cross the river at Middletown. The railroad bridge has openings 100 feet wide, and 23 feet headroom above mean high water (summer stage) when closed; and the highway bridge has openings 205 feet wide, and 26 feet headroom above mean high water (summer stage) when closed.

A closed arched bridge crosses the river at Hartford. On the western side of the river the width of the openings between the piers ranges from 101 to 119 feet, and the height of the center of the arches above mean high water (summer stage) ranges from 39 to 43 feet.

Bridge regulations have been prescribed by the Secretary of War for the drawbridges at Lyme, East Haddam, and Middletown, as follows:

1. The signal for opening the draws of the railroad and highway bridges at Lyme, the highway bridge at East Haddam, and the railroad bridge at Middletown shall be one long blast (of about five seconds' duration) of a horn or steam whistle; for the highway bridge at Middletown, three long blasts. This signal shall be answered by one long blast of a whistle or horn on the bridge when the operation of opening is commenced, or, if the draw can not be promptly opened, by a series of not less than four short, sharp blasts (each of not more than one second duration), and in addition a red flag or ball by day and a red light by night shall be conspicuously displayed on the bridge.

2. Except as hereinafter provided, the draws of the above-named bridges shall be promptly opened, upon the prescribed signal, at all times during the day or night, for the passage of foreign vessels and "vessels of the United States," as defined in section 4311 of the Revised Statutes. *Exceptions:* (*a*) Railroad bridge at Lyme.—When a westbound train scheduled to cross the bridge without a stop has passed Lyme and Blackhall Station, or an eastbound train Saybrook Junction Station, and is in motion toward the bridge, the draw shall be opened for the above-named vessels as soon as the train has crossed the bridge. (*b*) Railroad bridge at Middletown.—When a westbound train scheduled to cross the bridge without stop has passed Portland Station, or an eastbound train Middletown Station, and is in motion toward the bridge, the draw shall be opened for the above-named vessels as soon as the train has crossed the bridge.

3. For all other vessels which can not pass the closed bridges the draws shall, upon the prescribed signal, be opened as soon as practicable, but in no case shall the delay be more than 20 minutes.

4. For every vessel that can not pass the closed bridge the operation of the draw shall afford full horizontal and vertical clearance in the draw opening, regardless of the size of requirements of the passing vessel.

Anchorage.—Secure anchorage for vessels can be had in the channel eastward or northeastward of Saybrook (Lynde Point) Lighthouse, or abreast the wharf at Saybrook Point. Farther up anchorage can be selected anywhere in the wider parts of the channel.

Pilots and towboats.—The headquarters for pilots and towboats is at the steamboat wharf at Saybrook Point, where the wharf agent will attend to any orders. A pilot, at reasonable rates, can be had at Saybrook Point, and strangers bound up the river should take one.

Supplies.—Coal and water for steamers can be had at the wharves at Saybrook Point, Middletown, and Hartford. The river water is fresh at and above Deep River. Gasoline and other motor-boat supplies can be had at the principal towns and landings.

Repairs.—There are railways and facilities for repairing small craft at Essex, Portland, and East Hartford.

Hospital.—At Hartford there is a relief station of the United States Public Health Service.

Storm warnings are displayed at Saybrook Point.

Freshets occur principally in the spring, when the snow is melting, although occasional floods have occurred in every month of the year except July and September. The average annual variation in the height of the river at Hartford is about 18 feet, and the maximum about 6 feet more. The highest freshets are generally of short duration, but the period during which the river at Hartford is at the level of 8 feet or more above mean low water averages nearly two months each year. It is stated that a freshet of 22 feet at Hartford gives a freshet of about 15 feet at Middletown, and below this point it rapidly decreases. At the mouth the variation in water level is due to the tides.

Tides.—High and low water occur later than at New London, as follows: Saybrook Breakwater Lighthouse, 1 hour 5 minutes and 45 minutes; Deep River, 2 hours 15 minutes and 2 hours 30 minutes; Higganum, 3 hours 15 minutes and 4 hours 0 minute; Middletown, 4 hours 5 minutes and 5 hours 5 minutes; Two Piers, 4 hours 55 minutes and 6 hours 10 minutes; and Hartford, 5 hours 50 minutes and 7 hours 40 minutes.

The mean rise and fall of the tides at Saybrook Breakwater Lighthouse is 3.6 feet; Deep River, 2.5; Higganum, 2.1; Middletown, 1.7; Two Piers, 1.4; and Hartford, 1.2.

Currents.—At the entrance the currents have considerable velocity at times, and always require careful attention, as the tidal current of the sound often sets directly across the direction of the current setting out or in between the jetties.

Off Saybrook Lighthouse, slack before flood comes about ½ hour after the current turns westward at the Race (about 3 hours after low water at New London) and slack before ebb about the time the current turns eastward at the Race (about 2½ hours after high water at New London). The strength of the tidal current has an average velocity of 0.7 knot and occurs about 2¾ hours before the current turns eastward and westward at the Race (about ¼ hour before the time of high and low water at New London) and sets 340° true (N. ⅝ W. mag.) on the flood and in the opposite direction on the ebb.

At the railroad bridge, Lyme, the average maximum tidal current is about 2 knots. At the railroad bridge, Middletown, the average tidal current at strength is about 0.5 knot. The strength of flood and ebb occur about the time the current turns eastward and westward at the Race (about 2½ hours after high and low water, respectively, at New London).

Because of river discharge the ebb currents will usually be greater and the flood currents smaller than given above. Ebb-current velocities of 1 knot or more have been observed, under normal conditions,

on the bars in Connecticut River between Higganum and Hartford; the velocities of the flood currents are much less.

Ice closes the river to navigation a part of every winter, the average date of closing and opening navigation being January 12 and March 15, respectively. The closed season, however, varies greatly, in one lasting only a few days and in another nearly four months. In recent years the dates of closing navigation have ranged from December 9 to February 27, and of opening from February 20 to April 14.

DIRECTIONS, CONNECTICUT RIVER

For charts of Connecticut River, see index map facing page 1.

From eastward.—Pass southward of Hatchett Reef and Saybrook Bar, or keep Cornfield Point Lightship, bearing westward of 241° true (WSW. ½ W. mag.) until Saybrook Breakwater Lighthouse bears 315° true (NW. by N. mag.). Steer for Saybrook Breakwater Lighthouse on this course, which will lead through the buoyed channel between the south end of Saybrook Bar and the east end of Long Sand Shoal, and on approaching the lighthouse keep it on the starboard bow. The dangers eastward of the entrance are described with the coast preceding.

From westward.—Passing 1 mile southward of Falkner Island Lighthouse, a 76° true (E. ⅛ N. mag.) course will lead about ⅜ mile northward of the gas and bell buoy on the western end of Long Sand Shoal and about the same distance southward of Cornfield Point Shoal buoy. Or, passing 1 mile northward of Falkner Island Lighthouse, an 85° true (E. ⅝ S. mag.) course will lead southward of the bell buoy off Kelsey Point Breakwater, and then an 83° true (E. ½ S. mag.) course will lead southward of the buoys marking the dangers along the north shore until abreast Cornfield Point Shoal. Passing ¼ mile or more southward of Cornfield Point Shoal buoy steer about 67° true (E. by N. mag.), with Saybrook Breakwater Lighthouse a little on the port bow. Long Sand Shoal and the dangers westward of the entrance are described with the coast following. Cornfield Point Shoal is covered by a red sector in Saybrook Breakwater light, the southerly edge of which bears 74° true (E. ⅜ N. mag.).

Entrance to Saybrook Point.—Pass about 200 feet eastward of Saybrook Breakwater Lighthouse, steer 4° true (N. by E. ½ E. mag.), and pass the buoys which mark the edges of the dredged cut between the jetties, at a distance of about 150 feet. When past Saybrook (Lynde Point) Lighthouse, head up for the red buoy opposite the northeast end of Lynde Point, and leave the buoy 200 to 300 feet on the starboard hand on a course about 334° true (N. by W. ¼ W. mag.). Anchorage can be had in the channel about 200 yards off the steamboat landing at Saybrook Point, in about 4 fathoms.

Saybrook Point to Hartford.—Local knowledge is required to carry the best water in the river, and strangers are advised to take a pilot at Saybrook Point. Small craft, with the aid of the chart, should have no difficulty in following the channel, and the following remarks indicate the channel now used. Most of the range lights have white-target daymarks, front diamond shape and rear square.

From Saybrook Point steer for the railroad lift bridge at Lyme, with the station at Saybrook Point astern; follow the east bank be-

tween the bridges, and then follow the west side of Calves Island at a distance of about 500 feet. Pass 170 feet westward of Calves Island Light and head for the northwest end of Goose Island (marked by a white daymark) until through the cut at **Calves Island Bar.** Follow the west side of Goose Island at a distance of about 500 feet, and then keep in mid river until abreast the lower end of Nott Island. Pass about 200 feet eastward of Essex Reef Light (off Haden Point), and when past black spar buoy No. 5, bring the light astern on a 303° true (NW. mag.) course, passing through the dredged cut at the south end of the middle ground abreast Essex. Pass about 300 feet off the wharves at Essex and then head for Ely Wharf, on the east bank of the river.

Above Ely Wharf follow the eastern bank, or small craft can cross the river and follow the western bank at a distance of about 350 feet to the lower end of Eustasia Island. At **Brockway Bar** pass eastward of Joshua Rocks Light, favoring the light, and then midway between Brockway Reach Light and Meadows Light. A dredged channel, 12 feet (3.6 m.) deep, leads close westward of Joshua Rocks and Brockway Reach Lights; range targets ahead guide through the channel. The channel then widens to nearly the full width of the river to the lower end of Eustasia Island. A channel follows both banks of the river passing Eustasia Island and the shoals above it, but the eastern channel is easier to follow. The ¾-foot (0.2 m.) sounding lying ¼ mile below Potash Bar is on a rocky patch, marked by grass in summer. At **Potash Bar** the channel leads about 300 feet off the edge of the grass at the mouth of Seldens Cove; Whalebone Creek range lights (red posts with white targets) lead through the short dredged channel at Potash Bar.

Above Potash Bar the channel follows the east bank until ¾ mile above Hadlyme Landing, then the west bank until past the mouth of the creek ⅜ mile above Eddy Rock Light; two sets of range targets, the first ahead, the second astern, lead in the channel at the turn above Eddy Rock Light. A day mark (square target on pile) is on the west side of the channel at the mouth of the creek. The channel leads in mid river through the bridge at East Haddam, then follows the east bank, passes westward of East Haddam Meadows Light and the shoal which extends 300 feet from the east bank at the mouth of Salmon River, then in mid river for ¾ mile, and then follows the west bank to Red Store Landing. The channel then follows the east bank until the Haddam Island range lights are in line astern. This is a slow range which leads in the channel until approaching Rock Landing Light. Follow the east bank at a distance of about 200 feet until abreast the mouth of the creek just above Rock Landing light, then cross **Rock Landing Bar** in the dredged cut with the range lights in line astern, and then favor the west bank to Higganum.

Above Higganum follow the west bank at a distance of about 200 feet until abreast the north end of Sears Shoal, a rocky patch bare at low water and marked by a bunch of grass and sometimes by a stake. Then stand across the river with the Sears Shoal range lights, in line astern, which leads about 350 feet westward of the training wall extending southward from the mouth of Hurds Brook.

Then follow the eastern bank past Middle Haddam to Paper Rock Light. Pass 150 feet off the light, stand across for the point on the south bank ½ mile above it, favor the south bank until approaching Bodkin Rock light, and then cross to the north bank at the light. Then follow the south bank through the narrow channel from the next point on that side to **Mouse Island Bar;** the shoal on the north side of this narrow channel has rocky patches, partly bare at extreme low water. Pass 150 feet off the light, stand across for the point on the south side of the channel at Mouse Island Bar; range targets for the channel are maintained by the steamship company at the east end of the bar; the channel is narrow and care is required at Mouse Island Bar. From the second light edge out quickly and keep about 200 feet off the coal landing and the next point westward; there is a submerged crib in the water off the point, near the 5-foot sounding on the chart. Then follow the south and west bank past Middletown.

From Middletown pass through the bridges and in mid-channel eastward of Willow Island, and then cross over gradually with the coal hoist at Cromwell ahead, and follow the west bank to the upper stone bulkhead at Cromwell. Then cross over and follow the east and south bank, drawing in to 100 feet when passing the point of the shoal, sometimes marked by a pile, making off from the lower end of **Gildersleeve Island.** At the mouth of the stream, lying southeastward from the lower end of Gildersleeve Island, the outer one of the remains of two rock cribs is a danger; the inner one shows above water and is marked by a tree and brush, and the outer one has 6 feet (1.8 m.) over it at low water and lies 100 feet off the tree. Pass about 75 feet off Siam Dock light and then follow the east bank at a distance of 100 feet until on the line of the Pistol Point range lights astern, which lead in the dredged channel across **Pistol Point Bar.**

From Pistol Point Bar follow the west bank for nearly 1½ miles, and then follow the east bank until on the line of the Dividend Bar range lights astern, which lead in the dredged channel across **Dividend Bar.** The channel then follows the west bank past Rocky Hill to abreast Calf Brook, and then through the partly dredged channel in the next reach on the line of Two Piers Channel range lights.

The channel then leads about 200 feet from the east bank, drawing in to about 125 feet abreast the next set of range lights just above, and is narrow. Follow this range (South Glastonbury range lights) for nearly ½ mile, and then follow the eastern bank at a distance of 200 feet for ½ mile. The channel then widens and follows the west bank until on the line of the **Pressbarn Bar** range lights.

From the Pressbarn Bar range follow the east bank to the coal dock at Naubuc, and then cross over and follow the west bank to the mouth of Wethersfield Cove; two range lights mark the dredged channel at **Cys Hollow Bar,** and will be carried in range astern when bound up the river. There is an old stone pier, sometimes marked by a stake and flag, on the west side of the channel nearly ¼ mile below the mouth of Wethersfield Cove. From the mouth of this cove cross over gradually and follow the east bank, drawing in to 100 feet from that bank for a distance of ¼ mile below the Clay Banks range lights; the range leads in the dredged channel across **Clay Banks Bar.** Then follow the east bank until on the line of

the Colt Pier range lights, which lead about 100 feet eastward of Hartford Jetty Light. Follow the jetty at a distance of about 100 feet, and then follow the west bank to Hartford.

CONNECTICUT RIVER TO NEW HAVEN

Long Sand Shoal extends 6 miles westward from off the entrance of Connecticut River and has a greatest width of nearly ⅜ mile. The general depths on the crest of the ridge are 8 to 12 feet (2.4 to 3.7 m.), bottom hard and lumpy; but as the lumps are shifting in position and size, spots with but 4 feet (1.2 m.) over them may sometimes be found at extreme low tides. The shoaling is abrupt on both sides of the shoal, but especially on the south side, where the 10-fathom (18 m.) curve is only 200 yards from it in places and the 15-fathom (27 m.) curve about ¼ mile. The shoal is marked at its eastern end by a horizontally striped buoy. The 4-fathom (7 m.) curve at the western end of the shoal is marked by a horizontally striped gas and bell buoy.

Cornfield Point Lightship is about 1 mile southward of Long Sand Shoal, midway of its length. It has a red hull, with "Cornfield" on each side and two masts with a red lantern above a black cylindrical, latticework day mark at the foremasthead. The light (on foremast) is occulting white, light 1 second, eclipse 1 second, 63 feet (19.2 m.) high and visible 12 miles. A fixed red light is exhibited from the mainmast, 43 feet (13.1 m.) high and visible 11 miles. The fog signal is an air siren, blast 2 seconds, silent 13 seconds. If the siren is disabled, a bell will be struck by hand, 1 stroke, silent 30 seconds, group 2 strokes, silent 30 seconds. The submarine bell strikes groups of 4 and 8 ("48") every 32 seconds. The radio station receives and transmits *emergency messages only*. Call letters WWAM.

Lying 1 mile southward of the western end of Long Sand Shoal is an area about 1½ miles long, with depths less than 6 fathoms (11 m.), in which the bottom is rocky and broken. The least depth found is 23 feet (7 m.), but the area has not been closely developed.

Sixmile Reef is an area of broken ground about 3 miles long, in a west-northwesterly direction, with depths less than 6 fathoms (11 m.). The shoalest part of the reef is an area about ½ mile long with depths of 4 fathoms (7.3 m.) or less, and a least found depth of 19 feet (5.8 m.), lying 6 miles 253° true (W. ½ S. mag.) from Cornfield Point Lightship. The bottom is rocky and shoaling abrupt in places. With extreme low tides, due to northerly and westerly winds, this shoal may be dangerous to vessels of as little as 15-foot (4.6 m.) draft. It is on the direct course of vessels from southward of Stratford Shoal Lighthouse to Cornfield Point Lightship. The safer course is to pass southward of Sixmile Reef, keeping Cornfield Point Lightship bearing anything northward of 67° true (E. by N. mag.).

A ridge 1¼ miles long, with depths of 4¾ to 6 fathoms (8.5 to 11 m.), as determined by means of a wire drag, lies near midsound southward of Sixmile Reef and 5 miles north-northwestward of Horton Point Lighthouse.

Cornfield Point, lying 2 miles westward of Saybrook Lighthouse, is marked by a large red-roofed building. **Cornfield Point Shoal,**

a small, rocky patch with 3 feet (0.9 m.) over it, lies nearly ½ mile southward of Cornfield Point, and is marked on its south side by a red buoy. Small craft passing inside the shoal should proceed with caution, especially at low water, when crossing the broken ground, on which the least depths found are 10 to 15 feet (3 to 4.6 m.), extending ½ mile west-southwestward from Cornfield Point. On the north side of this broken ground and ½ mile west-northwestward of Cornfield Point is **Halftide Rock,** which has not been closely developed, especially on its northwest side.

Hen and Chickens, bare in places at low water and marked by a horizontally striped buoy near the east side of the rocks, lies ⅞ mile west-southwestward of Cornfield Point, and is about ⅝ mile long, with depths less than 18 feet (5.5 m.).

Crane Reef, lying ⅞ mile westward of Hen and Chickens buoy, is an area of broken ground, about ¼ mile in diameter, with a least depth of 3 feet (0.9 m.), and is marked on its south side by a red buoy.

The open bight between Cornfield Point and Menunketesuck Point, the western part of which is called **Westbrook Harbor,** has numerous unmarked sunken rocks, and is seldom used as an anchorage for vessels; the anchorage in Duck Island Roads is better. The bight is characterized by bowlders, and has not been thoroughly developed. The best entrance is between Crane Reef and Menunketesuck Point, heading for Salt Island on any course between 337° true (N. by W. mag.) and 22° true (NE. by N. mag.); vessels should proceed with caution when inside the 5-fathom (9 m.) curve.

Two bare rocks lie ¼ mile from the eastern end of the bight, and a rock bare at low water lies 300 yards westward of them. Other rocky patches lie about ¼ mile from shore, as shown on the chart. **Salt Island,** bare and rocky, lies near the shore abreast the eastern end of Westbrook. **Lobster Rock,** which shows at very low water, lies ⅜ mile 219° true (SW. ½ W. mag.) from Salt Island.

Westbrook, a town on the north side of Westbrook Harbor, is marked by a prominent white church spire with black top. The wharf has a depth of about 4 feet (1.2 m.) at its end.

Menunketesuck Point is formed by several low, narrow islands, connected at low water and surrounded by bowlders. A bowlder reef extends nearly ½ mile south-southeastward from the point to the 18-foot (5.5 m.) curve. The range of Kelsey Point and the south end of Duck Island, bearing 273° true (WNW. ⅝ W. mag.), leads southward of the reef. Reefs extend about 400 yards off the western side of the point.

All broken ground along the north shore between Menunketesuck Point and Hammonasset Point, including Duck Island Roads and approaches, but excluding Clinton Harbor inside the depth of about 14 feet (4.3 m.), has been examined by means of a wire drag, and the dangers are shown on the charts. A drag set at 24½ feet (7.5 m.) was passed over **Southwest Reef,** lying 1 mile southeastward of Kelsey Point Breakwater.

A bowlder reef extends nearly ½ mile southward from **Duck Island** to the 18-foot (5.5 m.) curve, and is marked at its south end by a red buoy. A rock with 1 foot (0.3 m.) on it lies on this reef 350 yards off Duck Island.

Duck Island Roads (chart 216) lies between Menunketesuck and Kelsey Points and has been made a harbor of refuge by the construction of breakwaters 1,100 feet northward and nearly ½ mile westward from Duck Island and the Kelsey Point Breakwater on Stone Island Reef. A white light marks the end of the north breakwater extending from Duck Island and a red light the end of the west breakwater.

The anchorage inclosed by the breakwaters extending northward and westward from Duck Island has been dredged to 17 feet (5.2 m.). This area is subject to shoaling and in 1925 had a controlling depth of 16 feet (4.9 m.) in an area 2,000 feet long and 800 feet wide in the northern part of the dredged area. The controlling depth in the southern part of the anchorage was 11 feet (3.3 m.). Northward of the dredged area the depths are 14 to 17 feet (4.3 to 5.2 m.) for about ¼ mile and then shoals gradually northward. This is a good harbor for vessels less than 14 feet (4.3 m.) draft, which is about the deepest draft that can anchor with swinging room.

In addition to the area inside the breakwaters there is a small area northward and northeastward of Duck Island North Breakwater Light which can be used as an anchorage in southwesterly weather in case of necessity.

The western entrance of Duck Island Roads is easy of access and should be used by vessels of a greater draft than 8 feet (2.4 m.). Passing southward of Duck Island keep the light on the end of Kelsey Point Breakwater bearing northward of 264° true (W. ½ N. mag.) until Duck Island West Breakwater Light bears 348° true (N. mag.) and then steer northward, keeping the latter light on the starboard bow. In a rough sea avoid the 16-foot (4.9 m.) spots extending ¼ mile 194° true (SSW. ⅜ W. mag.) from Duck Island West Breakwater Light. Approaching from westward the only dangers are the two 16-foot (4.9 m.) spots south-southwestward of Kelsey Point Breakwater Light. Note that Kelsey Point, which is thickly settled, is northward of Kelsey Point Breakwater, while Hammonasset Point, which is marked by a flagpole, shows over the breakwater.

The eastern entrance of Duck Island Roads is obstructed by a sand shoal with a least depth of 8 feet (2.4 m.) lying 600 yards eastward of Duck Island, and by bowlder reefs which extend 400 yards off the western side of Menunketesuck Point. This entrance is easy of access for vessels of 8-foot (2.4 m.) draft. To enter, when westward of Crane Reef steer for Kelsey Point in range with or open southward of the south end of Duck Island, course 273° true (WNW. ⅝ W. mag.), until about ½ mile from Duck Island. When a 315° true (NW. by N. mag.) course will lead about 300 yards eastward of Duck Island North Breakwater Light; steer this course and pass eastward and northward of the light, rounding it at a distance of about 100 yards into the harbor.

Between the 16-foot (4.9 m.) spots which extend ¼ mile south-southwestward from Duck Island West Breakwater Light and the 17-foot (5.2 m.) rocky patches lying about ⅜ mile southeastward of Kelsey Point, a distance of ⅝ mile, **anchorage** can be had in 3 to 4 fathoms (5.5 to 7.3 m.); bottom generally sticky, exposed, however, to winds southward of about east and west.

Kelsey Point Breakwater extends on **Stone Island Reef** over ½ mile south-southeastward from Stone Island and is marked at its south end by a white light. The least depth on the rocky broken ground southwestward of the light is 16 feet (4.9 m.) on two spots lying 300 yards and a little over ⅜ mile 202° true (SW. by S. mag.) of the light. The outer spot is marked by a bell buoy. **Stone Island** at the north end of the breakwater is mostly covered at high water, and there are some rocks bare at low water between the island and the shore.

Depths of 18 feet (5.5 m.) or less near Kelsey Point Breakwater indicate areas of broken, rocky bottom, which should be avoided in anchoring. Those east of the breakwater include depths of 12 feet (3.7 m.) close to it; the 18-foot (5.5 m.) patch lying ¼ mile east-northeastward of the end of the breakwater; East Ledge (depths 2 to 17 feet (0.6 to 5.2 m.)), which extends ⅜ mile southward from Kelsey Point and 600 yards eastward from the north half of the breakwater; and the broken ground with depths of 8 to 17 feet (2.4 to 5.2 m.) which extends over ⅜ mile southeastward from Kelsey Point.

The bight at the entrance of Clinton Harbor and westward of Kelsey Point Breakwater affords anchorage, exposed, however, to southeasterly and southwesterly winds. **Anchorage** can be selected between the broken ground which extends about 300 yards westward from Kelsey Point Breakwater and the 18-foot (5.5 m.) curve of the shoal which extends over ⅝ mile southeastward from Hammonasset Point, where there is an area nearly ¾ mile wide, with depths of 3 to 4 fathoms (5.5 to 7.3 m.), bottom soft in places. Or anchorage can be selected farther northward, toward Wheeler Rock buoy, in a depth of about 14 feet (4.3 m.), taking care to avoid the sunken rocks with depths of 5 to 12 feet (1.5 to 3.7 m.) which extend ⅜ mile westward from the north end of the breakwater; these rocks will be avoided by keeping the light on the south end of the breakwater bearing anything eastward of 123° true (SE. mag.). See also the description of Hammonasset Point following.

Clinton Harbor (chart 216), the bight westward of Kelsey Point Breakwater, is the entrance to Hammonasset River, a stream of no commercial importance. There is a depth of about 4 feet (1.2 m.) on the bar, and no less depth in the channel to the coal bunker wharf at Clinton, northwestward of the eastern end of Sandy Point Island. The greatest draft taken to the wharf does not exceed 8 feet (2.4 m.) at high water. **Wheeler Rock** buoy marks a rock with 1 foot (0.3 m) over it just outside the bar; above the bar the channel is staked to just above the coal bunker wharf. Motor boats can enter by the following directions, but should not depend on carrying more than 3 feet (0.9 m.) at low water across the bar.

Pass 200 feet eastward of Wheeler Rock buoy, steer 8° true (N. by E. ¾ E. mag.) for a prominent church in Clinton until across the bar, then head up for the eastern end of Sandy Point Island and be guided by the chart and stakes. Northeastward of Sandy Point Island there are two narrow, very crooked channels close together and with a depth of about 1 foot (0.3 m.) at low water. The eastern one is usually marked on the port side entering by bush stakes and leads to a landing float just inside the mouth of the stream, and the western channel on the starboard side by bush stakes and leads into Indian River.

Hammonasset Point is generally a low, marshy area with a number of wooded knolls. The end of the point is a rocky knoll marked by a flagstaff. Broken ground, with rocky irregular bottom and least depths of 10 to 11 feet (3.0 to 3.4 m.), extends ½ mile southward of Hammonasset Point. This broken ground has been examined by means of a wire drag. **West Rock** is the outermost of the bare rocks which extend a short distance off the east end of Hammonasset Point. A reef, with two bare rocks on its inner part and a depth of 7 feet (2.1 m.) on its outer part, extends ⅜ mile west-southwestward from Hammonasset Point and is marked at its end by a red buoy.

Approaching from westward the broken ground, with depths less than 18 feet (5.5 m.), extending southward and southeastward from Hammonasset Point, will be avoided by keeping the light on the end of Kelsey Point Breakwater bearing northward of 78° true (E. mag.); and the range of a prominent church in Clinton and the eastern end of Sandy Point Island, bearing 6° true (N. by E. ⅝ E. mag.), leads eastward of the broken ground.

The broad bight westward of Hammonasset Point is sometimes used as an anchorage, and is sheltered in northerly and northeasterly winds, but has little to recommend it. The bight is characterized by bowlders, and has not been thoroughly developed. Vessels of as much as 15-feet (4.6 m.) draft can be taken to the anchorage northward of Madison Reef, but should proceed with caution when crossing the ridge with depths less than 4 fathoms (7.3 m.) which extends eastward and westward from Madison Reef. The bottom is soft southward of Madison Reef, and vessels can stand in anywhere eastward of Kimberley Reef and over 1 mile westward of Hammonasset Point and select anchorage in 5 to 6 fathoms (9 to 11 m.).

Vessels can pass eastward of Madison Reef by giving Hammonasset Point a berth of over ¾ mile and steering for Tuxis Island on any course between 304° true (NW. mag.) and 315° true (NW. by N. mag.). From westward a 56° true (ENE. mag.) course for Tuxis Island will lead westward of Madison and Charles Reefs; note that Charles Reef buoy is at the south end of the reef. Anchor about ¼ mile southward of Tuxis Island and the same distance northward of Madison Reef in 20 to 24 feet (6 to 7 m.).

Madison Reef lies about ⅝ mile southward of Tuxis Island and extends a little over 1 mile east and west. This reef has 4 to 10 feet (1.2 to 3 m.) over it and consists of several rocky patches with deeper water between them. A black buoy, lying 164° true (S. ⅜ E. mag.) from Tuxis Island, marks the west side of a passage across the eastern part of the reef; the eastern end of the reef lies 600 yards eastward of the buoy. The western end of the reef is marked by a red buoy.

For a distance of 1 mile eastward of Tuxis Island, foul ground extends off a greatest distance of ⅜ mile from shore. The outer rock has 2 feet (0.6 m.) over it, with 18 to 20 feet (5.5 to 6.1 m.) around it, and lies ½ mile 106° true (SE. by E. ½ E. mag.) from Tuxis Island.

Tuxis Island is high and rocky and has several houses. There is foul ground and little depth between the island and the shore. A rock, bare at low water and sometimes marked by a private spindle with keg, lies about 200 yards eastward of the island, and a high bare ledge lies between this rock and the shore; a cluster of rocks,

bare at low water, sometimes marked by a stake and flag, lies 300 yards east-southeastward of the ledge. A bare rock lies 100 yards westward of Tuxis Island. A rock, bare at low water and sometimes marked by a private spindle with flag, lies midway between the island and the shore.

Madison, a town on the railroad, has two landings; the easterly one is out of repair and not used; the westerly landing, lying northwestward of Tuxis Island, has about 5 feet (1.5 m.) at its end, and a few motor boats moor in the cove on its north side. A rock, bare at low water and usually marked by a small spindle, lies 100 yards eastward of the landing. There is a church with a prominent tower and gilded dome in Madison ¾ mile 356° true (N. ¾ E. mag.) from Tuxis Island.

Guilford Harbor (chart 217), lying northward of Falkner Island Lighthouse, is frequented only by small craft. Boats of 6-foot (1.8 m.) draft at high water can be taken up **East River** to the railroad bridge, which is about 3 feet above high water. **Sluice Creek** enters East River ¼ mile above Guilford Point at the entrance; at high water boats of 6-foot (1.8 m.) draft can be taken a short distance up Sluice Creek to the landing, from which a road leads to Guilford. The mouth of East River up to Sluice Creek is filled by flats, between which there is a narrow channel with a depth of about 2 feet (0.6 m.) on the bar at low water. At high water boats of about 4-foot (1.2 m.) draft can be taken up **West River** above the railroad bridge to Guilford; the railroad bridge is about 5 feet above high water.

The entrance of Guilford Harbor is much obstructed by rocks, between which there are two buoyed channels. The channel westward of Indian Reef is unfit for a stranger. The better entrance is from southward on a 354° true (N. ½ E. mag.) course with Falkner Island Lighthouse astern, and passing 100 to 200 yards eastward of the black buoys eastward and northeastward of Lobster Rock. Proceed with caution and do not go above the latter buoy without a pilot.

Halfacre Rock, which just shows at high water, and **Lobster Rock** are the most easily identified of those off the entrance of Guilford Harbor. Scattered rocks, some bare at low water and others with 7 to 16 feet (2.1 to 4.9 m.) over them, extend about 1 mile eastward from Halfacre Rock; the easternmost lie about ⅜ mile northward and northwestward of **Charles Reef.**

The group of rocks westward of buoy No. 3 is covered at half tide, and those northwestward are covered at high water. A rock bare at low water lies 400 yards north-northeastward of buoy No. 3. There are numerous stakes and fish traps in this area.

Lobster Rock is marked by a watch house. There is a bare rock east-southeastward of it, and several rocks bare at low water northward. The large reef northwestward of Indian Reef has numerous rocks bare at half tide. There are two bare rocks on the reef extending southward from Mulberry Point; eastward of the bare rocks there are numerous rocks bare at half tide.

The highest part of **Indian Reef,** near its northeast end is covered at high water; and near the north end of the reef are rocks which are covered at half tide. The balance of Indian Reef consists

of sunken rocks with little depth over them, and the reef is marked off its south side by a red buoy. An area of broken ground, on which the least depths found are 15 to 18 feet (4.6 to 5.5 m.), extends about ½ mile southeastward and southward from Indian Reef.

An unmarked rock with 6 feet (1.8 m.) over it lies nearly ⅜ mile west-southwestward of Indian Reef and ½ mile southeastward of the southeasterly point of the peninsula of Sachem Head.

Falkner Island, marked by Falkner Island Lighthouse, is nearly ¼ mile long; and from it a reef, mostly bare at low water, extends ⅜ mile northward and is marked at its end by a black buoy. A bank, with depths of 3 to 4 fathoms (5.5 to 7.3 m.) not closely developed, extends 1½ miles eastward from Falkner Island to **Kimberley Reef.** The latter is an area of broken ground with a least depth of 12 feet (3.7 m.), and is marked by a horizontally striped buoy. The bottom is generally hard and very broken between Falkner and Goose Islands. A shoal on which the least depth found is 10 feet (3 m.) extends 300 yards westward from the south end of Falkner Island.

Falkner Island Lighthouse is a white, octagonal tower attached to a dwelling. The light is flashing white, flash 1 second, eclipse 14 seconds, 94 feet (28.7 m.) high and visible 16 miles. The fog signal is an air siren, blast 3 seconds, silent 27 seconds.

Goose Island is low and grassy, and there are small, bare islets just northward and 300 yards southward of it. A bell buoy about 600 yards southward of Goose Island marks the south end of the reef. A rock bare at low water lies ¼ mile eastward of Goose Island. Reefs, partly bare at low water, extend ½ mile northeastward from Goose Island. From the end of these reefs a narrow reef, on the outer part of which depths of 14 feet (4.3 m.) have been reported, extends ½ mile north-northwestward, its north end lying 1⅛ miles 308° true (NW. ½ N. mag.) from Falkner Island Lighthouse; it should be avoided by vessels. A bank, with depths of 4 to 5 fathoms (7 to 9 m.), not closely developed, extends west northwestward from Goose Island to the end of the broken ground extending southwestward from Sachem Head.

Jefferson Rock, covered at high water, lies at the entrance of the foul bight on the south side of **Sachem Head.** Numerous rocks lie southeastward of Jefferson Rock. The southeasterly one, lying 600 yards east-southeastward of Jefferson Rock, is bare at low water and is sometimes marked by a bush stake; the southwesterly one, lying 300 yards south-southeastward of Jefferson Rock, is covered at half tide. Two bare rocks lie off the south point of Sachem Head. Rocks bare at low water extend 100 yards southward and 250 yards westward from the bare rocks, and the west end of the reef is sometimes marked by a private spindle. These aids are placed to assist local motor boats in approaching Sachem Head Harbor from eastward.

Chimney Corner Reef is a rocky broken area off the south side of Sachem Head; the least depth found on the reef is 9 feet (2.7 m.) at a point 400 yards southward of the southernmost bare rock on the south side of Sachem Head. The bottom is rocky and very broken for a distance of 1 mile southwestward from Chimney Corner Reef; the least depths found are 19 to 23 feet (5.8 to 7 m.), but the area has not been closely developed.

Goose Rocks are two principal rocks; the northeasterly one is a bare rock, and the southwesterly one is covered at high water. Broken ground extends in a southeasterly direction from Goose Rocks toward Chimney Corner Reef; depths of 4 to 13 feet (1.2 to 4 m.) have been found on it for a distance of 600 yards from the rocks. **Goose Rock Shoal,** a rocky broken area, extends ¼ mile southwestward from Goose Rocks, has a width of 250 yards, a least depth of 2 feet (0.6 m.), and is marked at its south end by a red bell buoy. Care should be taken not to round the buoy too closely, in order to insure clearing the west end of the reef.

Sachem Head Harbor (chart 217) is an anchorage for small craft on the southwest side of Sachem Head. The harbor is ¼ mile long, about ⅛ mile wide, has depths of 6 to 10 feet (1.8 to 3 m.) in its lower half, and is sheltered except from westerly winds. The island forming the south point at the entrance is connected with the shore by a bridge, and there is a yacht clubhouse on the island. From the north point of the island a breakwater which shows above water extends 100 yards in a west-northwesterly direction. A rock covered at half tide lies 50 yards off the southeast side of the harbor, just northward of the opening on that side, and 350 yards above the end of the breakwater.

The approach to Sachem Head Harbor for small craft from eastward is along the south side of the rocks making off from the south side of Sachem Head (see the description of Jefferson Rock preceding). Approaching eastward of Goose Rocks give the rocks a berth of over 300 yards. The approach from westward is clear between Goose Rocks and the red buoy at the south end of Leete Rocks.

Joshua Point, the west end of Sachem Head, is marked by a rocky islet on its west side. Just northward of the islet a stone jetty with a bulkhead on its north side extends about 100 yards in a northwesterly direction from the shore. The bulkhead is in bad repair, but launches can anchor in the angle near the shore where the depth is about 6 feet (1.8 m.).

Joshua Cove (Great Harbor) is little used, but affords good anchorage in its entrance for small vessels in northerly or easterly winds, in 6 to 10 feet (1.8 to 3 m.), soft bottom. The approach from southwestward is clear between Goose Rocks and the red buoy at the south end of Leete Rocks.

Two short jetties have been built at the entrance to **Little Harbor** to protect a private landing with a depth of 2 feet (0.6 m.) at the end.

Leete Rocks, lying midway between Sachem Head and the north end of The Thimbles, are two rocks, bare at low water, and an area of broken ground around them. A rock with 3 feet (0.9 m.) over it lies nearly 400 yards eastward of the northeast rock. A rock with 9 feet (2.7 m.) over it lies 200 yards southward of the southwest rock, and is marked on its west side by a red buoy.

Leete Island Quarry is a prominent feature on the south side of **Hoadley Point;** the shipping point is a wharf, with a depth of about 7 feet (2.1 m.), on the north side of the cove eastward of the point. A straight channel about 50 feet wide and 12 feet (3.6 m.) deep has been dredged into the cove and to the wharf, between the northeast end of Narrows Island and the islet eastward. This chan-

nel is no longer used and was reported in 1925 to have a depth of about 6 feet (1.8 m.). There are rocks bare at low water eastward of the channel and northward of the islet.

Thimble Island Harbor (chart 217) is a well-sheltered anchorage for small vessels and small craft between Pot and Money Islands on the east and High Island and West Crib on the west. Although open southwestward, the sea from that direction loses much of its force before reaching the anchorage. A rock, with 3 feet (0.9 m.) over it and marked by a black buoy, lies 80 yards off the east side of High Island, just above its south end. The anchorage for small vessels is near midchannel, between this rock and the north end of Pot Island, in 13 to 18 feet (4 to 5.5 m.), soft bottom. Small craft of 6 feet (1.8 m) or less draft anchor between West Crib and Money Island. The anchorage is easy of access by the best entrance between Twotree Island and Inner Reef. Approaching from westward, pass southward of Negroheads buoy, steer about 73° true (E. ½ N. mag.) for the south end of Twotree Island, and pass northward of Northwest and Wheaton Reefs buoys and southward of Inner Reef buoy.

The following are the principal outlying dangers off and westward of The Thimbles:

East Reef, Wheaton Reef, and **Browns Reef** show at a good low water, and are parts of a broken area about ⅜ mile in diameter, which lies ½ to ¾ mile southwestward of Twotree Island. The reefs are marked at the southeast end by a red gas buoy and at the north end by a black buoy. The gas buoy is maintained between April 1 and December 10 of each year; a spar buoy is on station throughout the year. **Northwest Reef,** a rock with 7 feet (2.1 m.) over it, lies ¼ mile westward of Wheaton Reef and is marked by a horizontally striped buoy.

Inner Reef, bare in places at low water, is 200 yards long in a northeast direction, and is marked at its south end by a red buoy. A rock with not over 12 feet (3.6 m.) over it, probably less, lies 350 yards northwestward of the buoy. A rock with 8 feet (2.4 m.) over it lies ⅜ mile west-northwestward of Inner Reef, in line between it and Hooker Rock, and is marked by a horizontally striped buoy.

Hooker Rock, bare at low water, is marked at its south end by a red buoy. A rock with 10 feet (3 m.) over it lies about 300 yards west-northwestward of the buoy.

Gangway Rock, with 5 feet (1.5 m.) over it, lies ⅜ mile west-southwestward of Hooker Rock buoy, a little southward of a line joining it and Negroheads buoy.

Negroheads is described on page 186.

Branford Reef, lying 1¾ miles from the north shore of the Sound and 5 miles eastward of New Haven entrance, is marked by a flashing white light on a black skeleton tower. There is little depth for a distance of 150 yards northward and southward from the light; depths of 16 feet (4.9 m.) or less extend 450 yards northward and 250 yards southward from the light.

The Thimbles and the shore westward are occupied by summer residences, and the waters are much frequented in summer by motor boats and other small pleasure craft. The water area from The Thimbles to the entrance of Branford Harbor is occupied by numer-

ous islands, ledges, and rocks, and is not suitable for anything but small craft. In the absence of local knowledge, chart 217 is the best guide; strangers should proceed with caution, having in mind the possible existence of uncharted rocks in so broken an area. Gasoline and motor-boat supplies are generally obtained at Stony Creek, Pine Orchard, or Branford.

Twotree Island is the outermost of The Thimbles. A bare rock lies 100 yards southeastward of it. There is a boat landing protected by a stone jetty on the northeast side of Twotree Island. An unmarked rock, bare at lowest tides, lies 200 yards eastward of Twotree Island.

Horse Island, the next northeastward of Twotree Island, has two outlying bare rocks off its southeasterly side. The ends of the ledges surrounding the northeast rock are bare at low water.

Old Cobble Rocks is a long reef, nearly all bare at a good low water, near the middle of which is a large bowlder awash at high water. The southwest end of the reef is marked by a red buoy, which is at the entrance of a channel for small craft leading northward between Pot and Money Islands.

Pot Island has a number of houses, and there is an observatory on it northwest side showing above the trees.

High Island has several buildings; a rock bare at low water lies close to its southwest end, and there is a bare rock 300 yards southwestward of the island. A rock bare at low water lies near the end of the ledge, extending 150 yards northeastward from the bare rock.

Dicks Rock and the rock 150 yards southwestward of it are bare at half tide, and are marked at the west end by a red buoy. Foul ground extends southeastward from these rocks, and **Goshen Rock,** with 3 feet (0.9 m.) over it, lies 200 yards southeastward of them.

A rock bare at half tide lies 50 yards east-southeastward of the northeast end of **West Crib.** From the rock foul ground extends northeastward and joins the shoal which extends 80 yards east-southeastward from **East Crib.** This shoal is marked on its northeast side by a horizontally striped spar buoy, at the junction of the deep channel along the north side of East Crib and Davis Island with that leading southwestward through Thimble Island Harbor.

Money Island is thickly settled. The channel along its southeast side is not closely developed.

Prudden Island is marked by a small shack. There are bare ledges on its northwest side and 200 yards east-southeastward of it. The island northeastward of Prudden Island is marked by a house and flagstaff. Sometimes there is a private spindle at the end of the ledge about 50 yards northward of the island, and another on the rock bare at low water lying 100 yards eastward.

Hen Island is marked by a small summerhouse. A ledge extends 90 yards south-southwestward and a rock, bare at low water, lies 90 yards southeastward of the island; the end of the ledge and the rock are sometimes marked by private spindles.

Wayland Island is marked by red buildings and a red pavilion at its south end. Between Wayland Island and the two red buoys eastward is the entrance of two of the deeper and clearer channels which lead through The Thimbles from eastward. One channel passes between Davis Island and the large bare rock northeastward,

then southward of **Dogfish Rock** (marked by a white house), and then northward of East Crib; or, passing eastward of the horizontally striped buoy eastward of East Crib, a channel good for a depth of about 6 feet (1.8 m.) leads southwestward through Thimble Island Harbor. The other channel passes eastward of the horizontally striped buoy eastward of Davis Island and joins the channel described in the second paragraph following.

A bare rock lies 75 yards eastward of **Smith Island,** and there is a rock bare at low water between them. A bare rock lies 150 yards southward of Smith Island; a rock bare at extreme low water lies 175 yards west-southwestward of the bare rock. These rocks are marked on the south side by a red buoy.

A high, bare, rocky islet lies off the southwest end of **Narrows Island.** Lying 200 and 400 yards west-southwestward of the rocky islet are two rocks which are covered at three-quarters flood and are marked by private spindles. Between these two rocks is the entrance of a channel which leads between Smith Island and the bare rock off the south side of **Bear Island,** then between **Mermaid Rock** (bare at low water and sometimes marked by a private stake) and the rocks bare at half tide off the southwest end of Bear Island, then northeastward of the large bare rock northeastward of Davis Island, then westward of a red buoy, and then around the north end of **Cut-in-two Island** (marked by the bridges joining it). The red buoy eastward of Cut-in-two Island marks a rock bare at low water, northeastward of which there is a bare rock. This channel then leads southward of the grassy islet lying 200 yards southward of **Flying Point** (marked by a sea wall). A rock bare at low water lies 150 yards west-northwestward of the islet and a private spindle and cage marks the western end of the foul ground extending 75 yards northward of the islet. The two rocks off Flying Point show above water. The ledge extending 100 yards westward from the point just north of Flying Point is sometimes marked at the outer end by a spindle and cage.

Stony Creek, a village on the railroad, extends southward to Flying Point. The boat landing is on the point east-northeastward of Lewis Island. Gasoline and other supplies can be had there. The principal danger in the approach is the shelving ledge, largely bare at low water, making off from the next point southward of the landing. A channel 6 feet (1.8 m.) deep has been dredged to the boat landing, but is subject to shoaling and is little used.

Governors Island is thickly settled. There is a bare rock off its northeast end. Rocks fill the bight on its south side, the southerly rock lying 175 yards from the island, being bare at low water. Small craft anchor eastward and southeastward of the island.

Potato Island is low and is marked by a large house. Bare rocks extend 150 yards northeastward from it, and there is a rock bare at low water close to its southwest end.

Rogers Island is marked by a prominent red-roofed house. There is a landing with a depth of 4 feet (1.2 m.) on the northeast side, and a small breakwater about 75 yards northwestward of the landing. About 175 yards northeastward of the landing is a spindle marking a rock. There is a bare rocky islet off its southeast side, and midway between the islet and the southwest end of Potato Island there is a rock, which shows at lowest tides and is sometimes marked

by a stake. The rocks westward of Rogers Island are bare at half tide; those southwestward show at all times.

Between the rocks westward of Rogers Island and Blackstone Rocks, a channel about 75 feet wide and 10½ feet (3.2 m.) deep, marked by bush stakes, has been dredged northeastward to a quarry wharf. A small turning basin, marked by piles, lies eastward of the wharf. The depth at the wharf is about 8 feet (2.4 m.), but it is subject to shoaling from crushed stone which is loaded on barges.

Blackstone Rocks are a chain of islets and ledges extending about 1 mile southwestward from Brown Point. The most prominent are a rock with a white house lying 400 yards southward, a prominent white-topped rock lying nearly ½ mile south-southwestward, and the two high, bare rocks of **Middle Rock** lying over ¾ mile south-southwestward of Brown Point. Bare rocks lie 100 yards west-northwestward and 200 yards north-northeastward of the white-topped rock, and most of the other rocks are covered at half tide. There are, however, sunken rocks around and westward of the group, and great care is required to insure safety.

Pine Orchard is a summer resort extending northward and westward of Brown Point. Northeastward of the point is a yacht basin 800 feet long and 300 feet wide, and dredged to a depth of 6 to 7 feet (1.8 to 2.1 m.). The entrance channel extends eastward and northward of the island lying 200 yards northeastward of Brown Point. Future developments contemplate the construction of a breakwater on the south side of this basin, extending eastward from Brown Point.

A sea wall extends westward from **Brown Point,** and the shore is thickly settled. A rock bare at half tide lies 600 yards westward of Brown Point and 300 yards from shore; a rock with 4 feet (1.2 m.) over it lies in mid-channel northward of the rock.

Two rocks, bare at low water, lie ⅜ mile northeastward of **Haycock Point** and 300 yards from shore off the middle of a good-sized bight. There are other rocks eastward and westward of it which lie closer to shore.

A bare rock lies 200 yards southeastward of Haycock Point; northward of the rock are numerous rocks bare at low water.

Green Island is marked by a single house. Rocks bare at half tide lie off the southeast side and southwest end of Green Island. A rock bare at low water lies ¼ mile southeastward of Green Island. There are numerous sunken rocks, as shown on the chart. The large ledge lying 200 yards from the shore westward of Green Island is covered at high water.

Foot Rocks show above water, but there are also some that cover around them.

Spectacle Island, the outer one off the southeast side of Indian Neck, has some grass on top. **Negroheads,** a reef bare in one place at low water, extends ⅝ mile southward from the island and is marked at its south end by a red buoy. In addition to sunken rocks, rocks bare at low water lie about 200 yards northward, westward, and southwestward of Spectacle Island. **Moon Rock,** bare at low water, lies ¼ mile west-southwestward of Spectacle Island.

Sumac Island is marked by a prominent house, and a prominent landing with house on its southeast side. There is foul ground be-

tween the island and the rock bare at low water between it and Spectacle Island. A rock with 4 feet (1.2 m.) over it lies 200 yards southwestward of Sumac Island.

Sedge Island and **Squaw Rocks** are low and grassy. There is a narrow channel with a depth of about 5 feet (1.5 m.) between them.

Clam Island is settled, and there is a boat landing on its northwest side. Entering between the bare rocks off the southwest end of Clam Island and Jeffrey Rock, motor boats can enter **Maltby Cove,** favoring the northwest side of Clam Island. There is a marine railway for small motor boats. The northwest side of the cove is foul, the principal danger being a rock bare at low water lying near the middle northwestward of Clam Island; the range of the bare rock northward of Jeffrey Rock and the middle of Taunton Rock leads close to it.

Jeffrey Point, the eastern point at the entrance of Branford Harbor, has a bare rock close to its western end, and three bare rocks, the southernmost called **Jeffrey Rock,** extending 300 yards southward from the point.

Branford Harbor (chart 217), 4 miles eastward of New Haven Harbor entrance, is a shallow cove between Jeffrey Point and Johnson Point. Vessels up to 10-foot (3 m.) draft can select anchorage in the harbor southward of the Mermaids in 10 to 14 feet (3 to 4.3 m.); protected against all but southerly and southwesterly winds. Boats up to 5-foot (1.5 m.) draft can select a well-sheltered anchorage in the upper part of the harbor above the Mermaids. The dangers in the approach and entrance of Branford Harbor either show above water or are marked by buoys.

Little Mermaid (showing but little above high water) and **Big Mermaid** (a high rock) lie near the middle of the harbor, and there are two bare rocks near the head of the harbor. A rock, bare at low water and usually marked by stakes, lies about 100 feet north-northeastward of the north end of **Lovers Island,** and the same distance off the hotel boat landing; the latter has a depth of 2½ feet (0.8 m.) at its end. During the summer a ferry runs to **Sunset Beach,** on the east side of Branford Harbor.

Branford River, a narrow and crooked stream, has been improved by dredging a channel 100 feet wide and 8½ feet (2.6 m.) deep for a distance of nearly 2 miles above the Mermaids to the wharf of the large iron works at **Branford.** In 1925 the outer channel had a depth of about 8 feet (2.4 m.), with deeper water in the river above. The upper channel, along the wharves at Branford, had a depth of 7½ feet (2.3 m.). Coal, gasoline, and boat supplies can be obtained at Branford. The principal commerce is in coal, iron, and foundry supplies, carried in barges and small steamers of 8½ to 10 feet (2.6 to 3 m.) draft. The deepest draft going up to the iron works is 11 feet (3.3 m.) at high water. There is a depth of about 11 feet (3.3 m.) at this wharf and 6 feet (1.8 m.) at the coal and lumber wharf ¼ mile farther down. At the upper end of the iron works the river is crossed by a bridge, which is practically the head of navigation, although the draw can be opened. Boats, without masts, of about 3-foot (0.9 m.) draft can go over 1 mile above the bridge and through the railroad trestle. There are boat landings, with about 3 feet (0.9 m.) alongside, on the east side of **Branford Point,**

where gasoline and launch supplies can be obtained. There is an electric road from Branford to New Haven.

Directions, Branford Harbor.—From eastward, pass southward of Negroheads buoy, steer about 306° true (NW. ¼ N. mag.) for Taunton Rock, and enter the harbor between the latter and Jeffrey Rock; or, a 333° true (N. by W. ¼ W. mag.) course with Branford Reef Light astern will lead into the harbor between Jeffrey Rock and Taunton Rock. From westward, pass southward and over 100 yards eastward of Cow and Calf gas buoy, and enter the harbor between Johnson Point on the west and Blyn Rock and Bird Rock buoy on the east; or pass between Blyn and Taunton Rocks.

From Branford Harbor the dredged channel to Branford River leads between the Mermaids. Passing 125 yards southeastward of Lovers Island, and steering for the eastern side of Big Mermaid, leads in the first section of the dredged channel. The middle of the next section of the dredged channel then leads 90 feet southeastward of Big Mermaid and 125 feet southeastward of the end of the stone pier at Branford Point. Above this point there are no aids, and strangers should either take it on a rising tide, using the chart, or employ some one with local knowledge. There are some stakes on the shoals in places. At low water the channel above Branford Point is defined by the bare shoals on each side.

Bird Rock, with 5 feet (1.5 m.) over it, is marked on its southwest side by a red buoy.

Johnson Point, the western point at the entrance of Branford Harbor, has a rock awash at a good low water about 100 yards off its southwest side. A small yacht basin has been dredged on the southwest side of the point and is well protected in all but southerly winds.

Blyn Rock, a small rock which is covered at a good high water, lies midway between Johnson Point and Taunton Rock.

Taunton Rock is a large, low, bare rock near the middle of the entrance of Branford Harbor.

Five Foot Rock is marked on its south side by a red buoy.

Cow and Calf are two bowlders close together; the western one is covered at high water and the other is bare at low water. Broken ground, on which the least depth found is 11 feet (3.4 m.), extends 400 yards north-northwestward from Cow and Calf. A gas buoy with a red spar marker alongside marks the south side of the rocks.

Gull Rocks lie on the eastern side of the entrance of the cove westward of Johnson Point. From the islets in the north half of the group, rocks, some sunken, extend 300 yards southward and 600 yards south-southwestward. At the northwest end of the cove there is a boat landing with a depth of about 2 feet (0.6 m.) alongside. Lying about 350 yards off **Short Beach** and 200 yards from the west side of the cove there is a rock, bare at half tide, which is marked at its southwest end by a private spindle. There is a marine railway for boats under 40 feet in length at Short Beach. The bight on the west side of the cove at the entrance of **Farm River Cut** has an old wharf on the south side; there is a depth of about 5 feet (1.5 m.) at its end, and boats can anchor just westward of it. **Old Clump** is a bare rock.

East Haven River has been improved by dredging a channel 6 feet (1.8 m.) deep for a distance of 1¼ miles above the entrance to an old quarry, just westward of which is a dike, which forms the head of navigation. A bar has formed across this channel at its entrance which, in 1925, had a controlling depth of 3 feet (0.9 m.) at low water. A drawbridge, with an opening 50 feet wide, crosses the river about ¾ mile above its mouth. There is little navigation on the river and this drawbridge may soon be permanently closed.

Darrow Rocks, on the east side of East Haven River, show above water, and the southernmost rocky knoll is marked by a flagstaff. A ledge, bare at low water, lies 100 yards south-southwestward of the flagstaff, and in 1925 was marked on its south side by oyster stakes with flags. Lying 600 yards south-southeastward of the flagstaff there is a ledge with 5 feet (1.5 m.) over it; the range of New Haven (West Breakwater) Lighthouse and the south edge of Stony Islet leads over the ledge.

Stony Islet is low, bare, and surrounded by ledges, bare at low water to a distance of about 100 yards. A large reef, locally known as **East Indies Rocks,** covered at half tide, lies 300 to 450 yards eastward of Stony Islet. A small ledge, bare at low water, lies midway between the reef and the rocks, covered at high water, off the south side of **Mansfield Point.** The latter and the shore westward are thickly settled, and have communication by electric road with New Haven.

Lying 400 yards north-northwestward of Stony Islet there is a partly bare ledge. Extending westward from this ledge and Stony Islet to the entrance of New Haven Harbor, there is an area of foul ground, which extends about ½ mile from shore. There are numerous rocks, bare at low water, in this area, and it should be avoided even by motor boats. **Round Rock** is bare at low water and is surrounded by sunken ledges. It is marked by a red nun buoy, placed at the southern end of the 12-foot (3.7 m.) curve, nearly ¾ mile from shore. Depths of 20 feet (6 m.) or less, broken and irregular bottom, extend ⅜ mile southeastward and southward from the buoy.

Townshend Ledge, with 18 feet (5.5 m.) over it and marked by a horizontally striped buoy, lies 2 miles from shore, 2¾ miles 122° true (SE. mag.) from Southwest Ledge Lighthouse, and 2⅝ miles 256° true (W. ⅛ S. mag.) from Branford Reef Light.

NEW HAVEN HARBOR

(chart 218) is commercially one of the most important harbors in Long Island Sound and is an important harbor of refuge for vessels of less than 24-foot (7.3 m.) draft. The harbor has been improved by the construction of breakwaters at the entrance and by dredging a channel 20 feet (6.1 m.) deep to Tomlinson Bridge at New Haven. This channel has a width of 400 feet from the entrance to Fort Hale and greater width above that point. Anchorage basins with depths of 20, 16, and 15 feet (6.1, 4.9, and 4.6 m.) have been dredged on the sides of the channel above Fort Hale (see descriptions under "Anchorage" following). In 1925 the main channel had a controlling depth of 19 feet (5.8 m.) to **Cranes Bar,** thence a depth of 15 to 16 feet (4.6 to 4.9 m.) to Tomlinson Bridge. The river channels are described under separate heads.

From the northwest corner of the 16-foot (4.9 m.) anchorage, a channel 140 feet wide and 18 feet (5.5 m.) deep was dredged to the railroad coal hoists, lying about 400 yards southwestward of Long Wharf. This channel is no longer used and in 1925 had shoaled to a depth of about 8 feet (2.4 m.). A range for this channel is two pyramidal towers shut in behind two coal hoists.

From the 15-foot (4.6 m.) anchorage a channel 100 feet wide and 12 feet (3.7 m.) deep has been dredged toward Brewery Street, the southwest edge of the channel lying 130 feet off the northeast side of Canal Wharf. Shoals bare at low water lie on both sides of this channel in places, between which are channels leading to some of the wharves as shown on the chart. The upper end of the channel is marked by piles on the southwest side. The wharves bordering on this channel have depths of 8 to 10 feet (2.4 to 3 m.) at their ends and sides, with the exception of the city wharf, which nearly bares at its southwest end at low water.

A dredged channel 150 feet wide and about 15 feet (4.6 m.) deep leads to the coal wharf of the Winchester Repeating Arms Co. on the east shore. The entrance is about 400 yards southwestward of Tomlinson Bridge. Range targets ahead lead through the channel. This channel is no longer used.

New Haven is an important manufacturing city at the head of the harbor and is the chief commercial port of Connecticut. The port has a large carrying trade, the chief item being coal. The depths at the principal wharves range from 12 to 18 feet (3.7 to 5.5 m.). The deepest draft of vessels going up to the city is 21½ feet (6.5 m.) at high water.

Terminal facilities.—The principal terminals and particularly all the wharves open to public use are located along the northwesterly side of the main harbor at its head. These terminals are piers, either solid-filled or open, ranging in length up to 2,300 feet and separated by slips. The total frontage occupied approximates nearly a mile. Several of these terminals have direct railroad and transfer facilities and nearly all are open to public use. One, city wharf, is publicly owned. Throughout Mill, Quinnipiac, and West-Rivers the wharves are usually of the bulkhead and apron type. At Oyster Point are several small timber piers used in the oyster industry. The river frontage developed amounts to over ¾ mile in Mill River, over 1 mile in the Quinnipiac, and about ⅝ mile in West River and at Oyster Point. Some of the West River wharves are open to general public use, but in the other branches nearly all are private and closed to the public.

The city wharf has a depth of 15 feet (4.6 m.) at its southeast end; the other sides of the wharf are shoal. Canal Dock has a depth of 4 to 12 feet (1.2 to 3.7 m.) at low water along the outer 2,000 feet. Depths alongside the wharves in Quinnipiac River approximate closely the depths in the adjacent channel. The wharves along Mill River have depths of 8 to 18 feet (2.4 to 5.5 m.). Depths along the West Haven wharves, bordering on the 12-foot (3.7 m.) channel, vary from 5 to 12 feet (1.5 to 3.7 m.).

Charges for towing, pumping, and watering are in accordance with a schedule fixed by the local towboat company. Wharfage, dockage, and handling charges at the municipal wharf and at the railroad wharves are in accordance with a regular published tariff

schedule. Pilotage charges are given under a separate heading following.

East Breakwater extends 3,450 feet in an east-northeasterly direction from Southwest Ledge Lighthouse to Quixes Ledge. The area northward of the breakwater is obstructed by ledges and is not available for anchorage except northward of the lighthouse, where the depth is 18 to 20 feet (5.5 to 6.1 m.), bottom soft in places. The passage eastward of the breakwater has bowlder patches and is very broken, but can be used by small craft of less than 6-foot (1.8 m.) draft, taking care, however, to avoid the foul ground along the northeast side of the passage. Local vessels of as much as 10 to 12 feet (3 to 3.7 m.) draft, use the passage at high water, but it is not recommended for strangers. Avoiding **Quixes Ledge,** which extends about 200 yards southeastward from the eastern end of the breakwater, pass about 100 yards eastward of the breakwater. The principal danger inside the breakwater is the reef extending 300 yards southwestward from **Fivemile Point** (marked by a prominent unused, white, lighthouse tower). **Adams Fall,** a rock with 5 feet (1.5 m.) over it and marked on its west side by a horizontally striped buoy, lies ⅜ mile west-southwestward of Fivemile Point.

Southwest Ledge Lighthouse, on the west end of East Breakwater, is a white, octagonal house on a brown, cylindrical pier.

Luddington Rock Breakwater is 4,450 feet long in a west-southwesterly direction. Its easterly end lies about ½ mile westward of Southwest Ledge Lighthouse, and is marked by two white lights, one above the other. The westerly end of the breakwater is marked by a red light. The depths northward of the eastern half of the breakwater are 14 to 18 feet (4.3 to 5.5 m.), bottom generally hard.

West Breakwater is 4,200 feet long in a northwesterly direction. New Haven Lighthouse is just inside its easterly end, and a red light marks its westerly end. Anchorage in 18 to 28 feet (5.5 to 8.5 m.), bottom generally soft, can be had inside West Breakwater and the westerly half of Luddington Rock Breakwater, and vessels of as much as 24 feet (7.3 m.) draft can anchor with swinging room. There is a clear entrance with a depth of about 24 feet (7.3 m.) between the breakwaters and another with somewhat greater depth westward of West Breakwater.

New Haven Lighthouse, lying just inside the east end of West Breakwater, is a conical tower, lower half brown, upper half white, on a black, cylindrical pier.

Morris Cove, on the east side of New Haven Harbor between Fivemile Point and Fort Hale, is much used by yachts during the summer. The dangers for vessels of less than 8-foot (2.4 m.) draft will be avoided by giving the eastern shore of the cove a berth of ¼ mile, and vessels up to 12-foot (3.7 m.) draft can select anchorage off the cove and eastward of the dredged channel. The bottom is generally soft. **Black Rock,** bare at lowest tides, lies 200 yards from shore at the north end of the cove; there is little depth between it and the shore northeastward.

West River, between New Haven and **West Haven,** has been improved by dredging a channel 12 feet (3.7 m.) deep and 100 feet wide, with increased width at the bends and along the wharves at

West Haven, for a distance of 1¼ miles to **Kimberly Avenue Lift Bridge** (opening 44 feet wide); and 12 feet (3.7 m.) deep and 75 feet wide for a further distance of ½ mile to the fixed railroad trestle, which has a clear height of about 5 feet above high water. An anchorage basin 100 feet wide and 4 feet (1.2 m.) deep has been dredged on the south side of the bend in the channel eastward of the shipyard wharf at West Haven. In 1925 the channel had a depth of 10 feet (3 m.) between Kimberly Avenue Bridge and the railroad bridge.

The entrance of the dredged channel into West River is marked by a gas buoy, lying ⅝ mile southward of Long Wharf. Thence the channel leads for a greenhouse on a wharf at **Oyster Point,** then southwestward along the outer wharves at Oyster Point, and then leads for a white house, southward of a larger cream-colored one until halfway across the river, and then curves westward and northward, passing about 50 feet off the outer wharves at West Haven. The channel is marked by stakes in places and the flats on both sides are largely bare at low water and covered with oyster stakes. The depths at the wharves at West Haven and the outer wharves at Oyster Point range from 4 to 12 feet (1.2 to 3.7 m.).

Tomlinson Bridge, at the head of the main harbor, has a double bascule draw with a clear opening 125 feet wide.

Mill River has been improved by dredging a channel 200 feet wide and 12 feet (3.7 m.) deep for a distance of ⅜ mile above Tomlinson Bridge to the junction of the two branches above **Chapel Street Bridge** (a pivot draw with openings 71 feet wide on either side). This channel is subject to shoaling and in 1925 had a controlling depth of 10½ feet (3.2 m.). The point of the shoal lying between the dredged channels leading to Mill and Quinnipiac Rivers is marked by a dolphin. From the dolphin, the channel leads for the draw openings in Chapel Street Bridge. From just above this bridge to the fixed bridges at Grand Avenue, a distance of about ¼ mile, channels 12 feet (3.7 m.) deep have been dredged along the wharves on both sides of the river; the eastern channel has a width of 100 feet, and the western one 125 to 150 feet. These channels had shoaled to a controlling depth of 11 feet (3.4 m.) in 1925. The depths at the wharves range from 10 to 15 feet (3 to 4.6 m.) in the eastern channel and 8 to 11 (2.4 to 3.4 m.) in the western one.

The bridges crossing Mill River at and above Grand Avenue are fixed spans, with a least horizontal clearance of 19 feet and least vertical clearance of 10.5 feet at mean low water. Small unmasted boats go as far as the bridge at State Street, ½ mile above Grand Avenue, the channel depth to which is about 3 feet (0.9 m.) at low water. At high water motor boats up to 4 feet (1.2 m.) draft can go about 2 miles above Grand Avenue to the dam at Whitneyville.

Quinnipiac River has been improved by dredging a channel 200 feet wide and 12 feet (3.7 m.) deep for a distance of ⅝ mile above Tomlinson Bridge to **Ferry Street Bridge,** a pivot draw with openings 78 feet wide on either side. This channel is marked by pile dolphins on its north side for a short distance eastward from the dredged channel leading to Mill River. From abreast the dolphins the range of the northeast eave of the Belle Dock building and a black iron stack leads in the channel until about 150 feet off the

wharves on the south shore; the channel then leads for the draw opening in Ferry Street Bridge. The northern opening is always used.

Above Ferry Street Bridge to the west opening in Grand Avenue Bridge, a distance of ½ mile, a channel 50 to 100 feet wide and 8 feet (2.4 m.) deep has been dredged. The shoals and sides of the channel are marked by bush stakes, but strong currents often make navigation difficult. **Grand Avenue Bridge** over Quinnipiac River is a pivot draw with openings 70 feet wide, the west opening only being used. Above this bridge the river has depths of 2 to 3 feet (0.6 to 0.9 m.) in a crooked channel, and the bridges are closed. From Ferry Street Bridge, the channel leads for the flagstaff on a red barn, then along the wharves on the east side, then across the river on the range of the northern one of two masts on a coal dock and the east side of a brick schoolhouse, and then for the west opening of the Grand Avenue Bridge.

Bridge regulations have been prescribed by the Secretary of War governing the opening of the Tomlinson Bridge, Chapel Street Bridge across the Mill River, Ferry Street Bridge across the Quinnipiac River, Grand Avenue Bridge across the Quinnipiac River, Kimberly Avenue Bridge across the West River, as follows:

1. The signals for opening the draws of the above-named bridges shall be given by blasts of a horn or steam whistle as follows: For Tomlinson Bridge, two short blasts; for Chapel Street Bridge, three short blasts; for Ferry Street Bridge, one short blast; for Grand Avenue Bridge, one long blast; for Kimberly Avenue Bridge, three short blasts. The signal shall be answered by one long blast (of about five seconds duration) of a whistle or horn on the bridge when the operation of opening is commenced, or, if the draw can not be promptly opened, by a series of not less than four short, sharp blasts, and in addition a red flag or ball by day and a red light by night shall be conspicuously displayed on the bridge.

2. Except as hereinafter provided, the draws of the above-named bridges shall be immediately opened, upon the prescribed signal, at all times during the day or night, for the passage of foreign vessels and "vessels of the United States," as defined in section 4311 of the Revised Statutes. *Exceptions:* Closed periods when the draws need not be opened are authorized as follows: Between 6.30 a. m. and 7 a. m., between 12 m. and 12.15 p. m., and between 12.45 p. m. and 1 p. m.

3. Except during the closed periods specified in the preceding paragraph, the draw of any bridge shall be opened for the passage of any vessel, or water craft of any kind other than described in that paragraph, which can not pass the closed bridge, at such time within 20 minutes after the prescribed signal from the vessel or craft as in the judgment of the bridge tender will cause the least interference with the land traffic over the bridge.

4. For every vessel that can not pass the closed bridges the operation of the draws shall afford full horizontal and vertical clearance in the draw opening, regardless of the size or requirements of the passing vessel.

The harbor master has charge of the berthing and anchoring of vessels. Harbor regulations are not strictly defined. The harbor master's headquarters are at the Belle Dock, just below Tomlinson Bridge.

Pilots are not generally taken, except by vessels subject to compulsory pilotage (foreign and registered vessels drawing 9 feet and over, if spoken). Charges for pilotage are as follows: Vessels 9 to 12 foot draft, $1.50 per foot of draft; over 12-foot, $2 per foot of draft. Vessels outward bound are charged one-half the above rate.

Towboats are used by sailing vessels, and can always be had by making signal (ensign in the rigging), few vessels entering for anchorage take a towboat.

Anchorage.—The anchorage inside West Breakwater and the southwest half of Luddington Rock Breakwater is available for vessels of as much as 22-foot (6.7 m.) draft. Vessels can anchor on either side of the dredged channel from just inside the breakwaters up to Fort Hale, the depths ranging from 12 to 20 feet (3.7 to 6.1 m.). Morris Cove affords good anchorage, and is used by yachts, but is rough in westerly winds.

An anchorage basin, with a depth of 20 feet (6.1 m.), has been dredged on the east side of the channel from the red buoy abreast Fort Hale to the red buoy ¾ mile above. The total width of the channel and basin is 1,000 feet. In 1925 this anchorage had a depth of 19 feet (5.8 m.).

An anchorage basin, with a depth of 16 feet (4.9 m.), has been dredged on the west side of the channel below Long Wharf. The total width of the channel and basin is 1,200 feet. This anchorage is frequently used. In 1925 this anchorage had depths from 6 to 16 feet (1.8 to 4.9 m.), but was soon to be redredged to project depth.

An anchorage much used by small craft is in the 15-foot (4.6 m.) basin which has been dredged above Canal Wharf. There is a public wharf on the northwest side of this anchorage where fresh water can be had through pipe and hose.

There are no special regulations prescribing the limits within which vessels must anchor, except that the dredged channel must be left clear. The harbor is under the immediate supervision of the harbor master, who gives his attention to the berthing of vessels, when necessary, in order to keep a clear channel for the steamers.

Supplies.—Coal, water, provisions, and ship chandler's stores can be obtained. Water can be had from towboats and at some of the wharves.

Repairs to wooden hulls and machinery of steamers can be made at New Haven. The largest marine railway (at West Haven) has a length of 100 feet and a capacity of about 350 tons.

Hospital.—There is a relief station of the United States Public Health Service at New Haven.

Storm warnings are displayed at the customhouse, New Haven, and at the old light tower at the entrance to the harbor.

Communication.—Steamboats run daily between New York and New Haven. There are good railroad connections, and bus service to the near-by cities.

Ice generally obstructs navigation to some extent for sailing vessels from December to March, sometimes extending to the mouth of the harbor. Steamers can generally enter and depart, except in severe winters, when the ice is exceptionally thick. During severe winters the accumulation of ice is local and begins to obstruct the movements of sailing vessels in December. From that month until the latter part of March it frequently bars the passage of sailing vessels without the assistance of towboats. Except in extraordinarily severe weather, however, steamers can always enter and leave the harbor without much difficulty. In New Haven Harbor northerly winds have a tendency to clear the harbor of ice if the forma-

tion is sufficiently light; southerly winds are apt to force in drift ice from the Sound.

Tides.—The mean rise and fall of tides is 6.3 feet.

Currents.—In the entrance channel, between the breakwaters, slack water occurs about 1 hour before the current turns eastward and westward at the Race (about 1¼ hours after high and low water at New London). The average velocity of the current at strength is about 1.2 knots. The strength of flood and ebb occur about 1¼ hours after the current turns westward and eastward at the Race (about 2½ hours before high and low water, respectively, at New London); the flood sets 320° true (NNW. ½ W. mag.) and the ebb in the opposite direction.

In the draw of Tomlinson Bridge slack water occurs about the time the current turns eastward and westward at the Race (about 2¼ hours after high and low water at New London). The strength of flood occurs about 3 hours before the current turns eastward at the Race (about ¾ hour before high water at New London) and has an average velocity of 1 knot. The strength of ebb occurs about 2½ hours after the current turns eastward at the Race (about 1 hour before low water at New London) and has an average velocity of 1.1 knots, increased slightly during freshets. The flood current sets easterly just southward of the bridge.

DIRECTIONS, NEW HAVEN HARBOR

Directions from westward are given on page 123.

From eastward.—It is safer for large vessels to pass southward of Branford Reef and Townshend Ledge. Passing 1 mile or more southward of Falkner Island Lighthouse a 270° true (W. by N. mag.) course will lead well southward of Townshend Ledge. When Southwest Ledge Lighthouse bears anything northward of 312° true (NW. ¾ N. mag.) the course can be changed for the entrance.

Or, passing ½ mile southward of Branford Reef light, a 274° true (WNW. ⅝ W. mag.) course for New Haven Lighthouse will lead ⅜ mile northward of Townshend Ledge. Round Rock and the shoals, with less than 12 feet (3.7 m.), eastward of the entrance will be avoided by keeping in the white rays of Southwest Ledge Lighthouse, with the light bearing anything northward of 284° true (NW. by W. ¾ W. mag.).

Shoals with depths of 16 to 18 feet (4.9 to 5.5 m.) extend over ½ mile southeastward from Luddington Rock Breakwater. The range of the old light tower on Fivemile Point open eastward of Southwest Ledge Lighthouse leads eastward of these shoals. The deepest water in the main entrance will be carried by approaching Southwest Ledge Lighthouse on any bearing between 0° true (N. by E. mag.) and 312° true (NW. ¾ N. mag.) and passing about 200 yards westward of the lighthouse.

Entrance to New Haven.—From a position 350 yards northwestward of Southwest Ledge Lighthouse steer 5° true (N. by E. ½ E. mag.) for the monument on East Rock, and follow the red buoys which mark the east side of the dredged channel at a distance of 200 feet until nearly up with Fort Hale and abreast spar buoy No. 6; a buff chimney will be in range with the monument on this course. The horizontally striped nun buoy marking Adams Fall is

about 300 yards eastward of the channel. The light on the south end of the dike off Sandy Point is 400 yards westward of the channel; the black can buoy off the dike is also westward of the dredged channel. **East Rock** is a hill with bluff sides over 300 feet high, and is marked by a high monument, which shows well above the sky line and is prominent from the Sound.

From abreast the buoy opposite Fort Hale steer 355° true (N. ½ E. mag.) with the end of Long Wharf a little on the port bow, and leave the red buoys which mark the eastern side of the dredged channel on the starboard hand. This course leads in the middle of the dredged channel, which is 700 feet wide in its narrowest part. **Long Wharf,** the next one southwestward of Canal Dock, is marked at its end by a light and a fog bell. Pass 150 to 200 yards off Canal Dock and steer for the draw of Tomlinson Bridge. (See "Anchorage," in the description preceding.)

NEW HAVEN TO BRIDGEPORT

From New Haven to Bridgeport the shore is generally settled, and there is communication by an electric road, which follows it in most places, as shown on the chart. Wepawaug (Milford) and Housatonic Rivers are available as harbors of refuge for small vessels with local knowledge.

Savin Rock, a part of West Haven, is a summer resort on the northwest shore of New Haven Harbor. Boats of about 5-foot (1.5 m.) draft run from the landings at Savin Rock across the harbor to the landings at the summer resort northeastward of Fivemile Point.

Woodmont is a post office and summer settlement on **Merwin Point,** 2 miles west-northwestward of New Haven Lighthouse. The shore is rocky at Woodmont, and there are two large bare rocks and much foul ground in the bight westward of the point.

Pond Point, 3½ miles westward of New Haven Lighthouse, has a rocky shoal, with little depth over the greater part of it, extending 600 yards southward, which is marked at its south end by a red buoy. Lying ½ mile northeastward of the point is a large, yellow residence with a lawn in front of it, and there is a prominent white beacon on the point.

Welch Point, 1 mile westward of Pond Point, is on the east side at the entrance of Milford Harbor. A reef extends 600 yards southward from the point, and is marked at its south end by a red buoy. There is a prominent flagstaff near the end of the point.

Milford Harbor (chart 219) is a bight between Welch Point and Charles Island, about 5 miles westward of New Haven Lighthouse, and nearly 4 miles northeastward of Stratford Point Lighthouse. The bight affords anchorage in 6 to 15 feet (1.8 to 4.6 m.), sheltered from all but southerly and southeasterly winds. The entrance is clear between the buoy southward of Welch Point and the buoy eastward of Charles Island. The shoaling is gradual and the lead is a good guide on the northwest side of the cove; the western side of Welch Point and the reefs around Charles Island and between it and the shore should be approached with caution, as the shoaling is abrupt. The mean rise and fall of tides is 6.6 feet.

Wepawaug River, on the north side of Milford Harbor, has been improved by dredging a channel 100 feet wide and 10 feet (3 m.)

deep from the entrance to Merwin Wharf; in 1925 there was a depth of 10 feet (3 m.) in the channel to Merwin Wharf. A small anchorage basin with a depth of 10 feet (3 m.) has been dredged on the east side of the channel from 100 feet northward of Long Jetty to Merwin Wharf, and another basin with depths of 6 to 10 feet (1.8 to 3 m.) has been dredged on the southwest side of the channel opposite Merwin Wharf. In 1925 the eastern and western anchorages had depths of 7 and 6½ feet (2.1 and 1.9 m.), respectively. **Long Jetty,** which shows at high water, extends in a westerly direction from the eastern side at the entrance of the river, and is marked at its end by a light which lies 120 feet eastward of the dredged channel. **Burns Point Jetty,** partly bare at half tide, extends southward from the western point at the entrance; it lies about 75 feet westward of the dredged channel, and is marked at its south end by a stake. There is a yacht club on the north side of Burns Point.

The dredged channel is marked by bush stakes on its western side and by range targets. The ranges are used in connection with dredging operations, are temporary in character, and may not always be in position. In 1925 the rear range was obscured by trees. There is a perpendicularly striped buoy at the entrance. Passing close westward of this buoy, steer 5° true (N. by E. ½ E. mag.) through the dredged channel, with two white targets on the shore eastward of Merwin Warf in range ahead. When inside of Long Jetty pass 100 feet off the boat landings on the northeast side of Burns Point, and steer to pass 50 feet off Merwin Wharf. Vessels should go to Merwin Wharf, as there is not swinging room in the anchorages except for small craft. Above Merwin Wharf the channel is not difficult for motor boats, with the aid of the chart, but vessels require a pilot.

Above Merwin Wharf there is a narrow, dredged channel with a depth of 6 feet (1.8 m.) for a distance of nearly ½ mile to the town wharf of Milford, on the north side of which there is a dredged slip with piles on its north side. Vessels of 10-foot (3 m.) draft can be taken to the wharf at high water. The depth at the wharf is about 6 feet (1.8 m.). For a distance of 350 yards above the wharf the channel has depths of 3 to 5 feet (0.9 to 1.5 m.), and is used as an anchorage by motor boats.

Merwin Wharf, on the east side just above Burns Point, has depths of 7 to 10 feet (2.1 to 3 m.) alongside. Vessels of 12 feet (3.7 m.) draft can be taken to the wharf at high water, but the usual draft is not more than 8 feet (2.4 m.). The principal trade is in coal and oysters. Gasoline, fresh water, and some coal can be obtained. Towboats can be had from New Haven or Bridgeport. A pilot can be had from Merwin Wharf.

Charles Island, on the southwest side at the entrance of Milford Harbor, is low and partly covered with scrubby trees. A beacon, with white pole, in the center of the island is prominent. It lies ½ mile from the shore northwestward, with which it is connected by a bar, bare at low water. A black buoy marks the end of a shoal, which extends 250 yards east-northeastward from the island. **Charles Island Rocks** is the name given to the rocky shoal which extends ⅜ mile southward from the island; the south end of the

shoal is marked by a gas and bell buoy. There is good anchorage in 10 to 16 feet (3 to 4.9 m.) northward of Charles Island, sheltered from southerly to southwesterly winds.

Myrtle Beach, Walnut Beach, and **Laurel Beach** are summer resorts on the beach between Milford Harbor and Housatonic River. Walnut Beach is a post office.

Housatonic River is described under a separate heading.

Stratford Point Lighthouse is a white, conical tower with a brown band midway of its height. The light is flashing white, flash 3 seconds, eclipse 42 seconds, 52 feet (15.8 m.) high and visible 13 miles. The fog signal is an air siren, group of 3 blasts every 50 seconds; blasts each 2 seconds duration; 2 silences each 7 seconds; 1 silence 30 seconds.

Stratford Point, on the western side of the entrance to Housatonic River, is marked on the south side by a lighthouse. The shoals, which extend southward toward Stratford Shoal (Middle Ground) Lighthouse from the shore westward of Stratford Point Lighthouse, consist of narrow ridges of hard sand with deeper water between, and are occupied by oyster beds, marked by stakes. Depths of 12 feet (3.7 m.) or less extend 1 mile from shore, and are marked at the south end by a red spar buoy, which lies about 1½ miles southwestward of Stratford Point Lighthouse.

Directions.—The shoals, with depths of 12 feet (3.7 m.) or less, will be avoided by keeping Stratford Point Lighthouse bearing northward of 34° true (NE. mag.) and Bridgeport Harbor Lighthouse bearing northward of 304° true (NW. mag.). Lumps, with 16 to 18 feet (4.9 to 5.5 m.), extend ⅞ mile southward and 1 mile southwestward of the spar buoy and are marked by a gas and bell buoy. These will be avoided by keeping Penfield Reef Lighthouse bearing northward of 273° true (WNW. ¾ W. mag.), while Stratford Point Lighthouse bears between 34° true (NE. mag.), and 11° true (NNE. mag.), and by passing southward of the gas and bell buoy. The 5-fathom (9 m.) curve at the south end of the shoals lies 3⅛ miles from shore and 2¼ miles northward of Stratford Shoal Lighthouse.

All vessels of less than 10 feet (3 m.) draft trading between Housatonic River and Bridgeport pass northward of the spar buoy, as follows: Passing ¼ mile southward of Stratford Point Lighthouse, steer 251° true (W. ⅝ S. mag.) for Penfield Reef Lighthouse until southward of **Point No Point,** marked by a group of bathhouses and a large yellow building; then steer 271° true (WNW. ⅞ W. mag.) for Black Rock Lighthouse until about ¾ mile off the beach and Bridgeport Harbor Lighthouse and East Breakwater Light are in range. Then follow the beach at this distance and enter between the breakwaters.

Stratford Shoal Middle Ground, with depths of 8 to 16 feet (2.4 to 4.9 m.), extends about ⅜ mile northward and southward from the lighthouse marking it. The south point of the shoal is marked by a red buoy. Shoal spots, with 14 to 15 feet (4.3 to 4.6 m.), extend ¾ mile northeastward and northward from the lighthouse. The north end of the shoal is marked by a black buoy, placed in a depth of 6 fathoms (11 m.), about 1 mile northward of the lighthouse.

Stratford Shoal (Middle Ground) Lighthouse is a gray granite, octagonal tower, projecting from a house, on a pier. The

light is flashing white, flash 1.5 seconds, eclipse 8.5 seconds, 60 feet (18.3 m.) high and visible 13 miles. The fog signal is an air siren, blast 2 seconds, silent 13 seconds.

HOUSATONIC RIVER

(chart 219) is marked on the west side of its entrance by Stratford Point Lighthouse. The river has been improved by dredging a channel 7 feet (2.1 m.) deep with a width of 200 feet across the bar at the entrance and 100 feet on the bars in the river, to the head of navigation at the wharves at the towns of Derby and Shelton, a distance of 11½ miles above the entrance. At high water a draft of 11 feet (3.3 m.) can be taken up the river to the oil company's wharf, about ½ mile above the railroad bridge, and 9 feet (2.7 m.) to Derby and Shelton. The river is closed by a power dam at a point about 1 mile above Shelton. Small vessels can anchor in the river abreast Stratford, where the channel has an available width of about 500 feet.

On the east side of the entrance a breakwater has been built out from **Milford Point** across the bar, and is marked at its south end by a flashing green light. The outer section of the breakwater shows at high water, while the inner section, extending in to Milford Point, is covered at three-quarters flood.

Stratford beacon is a prominent stone structure with spindle and cask, lying westward of the dredged channel and ⅝ mile northward of Stratford Point Lighthouse.

Stratford is a town on the west bank of the river, 2¼ miles above the entrance. The principal wharf has a depth of about 14 feet (4.3 m.) at its end. Coal and gasoline can be obtained. There is a marine railway for vessels 100 feet long, 5 feet draft forward, and 12 feet aft; it has a capacity of about 100 tons. There is a plant for building wooden ships just above the railroad bridge.

Shelton, a town on the western bank of the river, and connected with **Derby** by two bridges, has many important manufactories. Coal and lumber are brought mainly in barges. There are depths of 5 to 7 feet (1.5 to 2.1 m.) at low water at the wharves at Derby and Shelton. Gasoline, provisions, and some motor-boat supplies can be obtained at Derby. Communication is by electric road and busses with Bridgeport.

Terminal facilities.—There are three wharves in commercial use at Stratford, one at Devon, and seven at Shelton and Derby. The usual types are longitudinal timber or mansonry bulkheads, and short filled piers with vessel berths at the ends parallel with the stream. Adequate highways lead to practically all of the wharves, and one wharf at Stratford and one at Devon have railroad transfer facilities. There are no publicly owned terminals on the river. Of the private wharves, one at Stratford, two at Derby, and two at Shelton, are open to public use.

Bridges.—Two bridges cross the river. The first, lying 1 mile above Stratford, has a lift opening over 100 feet wide; the second, or railroad bridge, lying ⅜ mile farther up, has a lift opening 81 feet wide. The overhead wires at the railroad bridge are 180 feet (55 m.) above high water. The whistle signals for the bridges are

one long and one short blast for the lower one and three blasts for the railroad bridge.

Pilots and **towboats** can be obtained at Bridgeport.

Tides.—The following are the times of high and low waters at points on the river referred to Willet Point: Entrance, high water 15 minutes before, low water 15 minutes before; Stratford, high water 5 minutes after, low water 20 minutes after; Pecks Mill, high water 20 minutes after, low water 55 minutes after; Shelton, high water 1 hour and 15 minutes after, low water 2 hours and 45 minutes after. The mean range of the tide is 6.2 feet at Stratford, 5.8 feet at Pecks Mill, and 4.5 feet at Shelton.

Currents.—Between Milford Point and Crimbo Point slack water before the flood occurs about ¾ hour after the current turns westward at the Race (about 3¼ hours after low water at New London). The strength of flood comes 1¾ hours before the current turns eastward at the Race (about ½ hour after high water at New London) and sets 300° true (NW. ¼ W. mag.) with an average velocity of 2 knots. Slack water before the ebb occurs about ½ hour after the current turns eastward at the Race (about 2¾ hours after high water at New London). The strength of ebb comes about 2¾ hours before the current turns westward at the Race (about ¼ hour before the time of low water at New London) and sets 120° true (SE. ¼ E. mag.) with an average velocity of 2.4 knots.

In the draw of the railroad bridge above Stratford, slack water before flood occurs about 1 hour after the current turns westward at the Race (about 3½ hours after low water at New London). The strength of flood comes about 1¾ hours before the current turns eastward at the Race (about ½ hour after high water at New London) and has an average velocity of 1.3 knots. Slack water before ebb occurs about ¾ hour after the current turns eastward at the Race (about 3 hours after high water at New London). The strength of ebb comes about 3 hours before the current turns eastward at the Race (about ½ hour before low water at New London) and has an average velocity of 1.6 knots.

When the river is high and during freshets the ebb current will be increased and the flood current diminished. Elsewhere in the river the tidal currents have less velocity, but are strong throughout, decreasing, however, toward the head of navigation. At the entrance, near the end of the breakwater, there is a strong westerly set on the flood. In the openings of the bridge above Stratford the flood current has some easterly set, while the ebb sets fair with the openings.

Freshets.—Spring freshets at Shelton rise to 10 feet or more above mean high tide. The river water is fresh above **Oronoque Bar** (½ mile above Fowlers Island) and above Mill Bar on the ebb.

Ice closes the river above Stratford during the winter, and sometimes extends to the entrance.

DIRECTIONS, HOUSATONIC RIVER

The channel is narrow and crooked, with little depth on either side, and across the bars in the river the channels are dredged cuts 100 feet wide. Moreover, the tidal currents are strong, especially in the lower part of the river, and strangers are advised to take a

pilot. Small craft, without a pilot, should proceed with caution and preferably on a rising tide. The ranges mentioned in the following description were erected in connection with dredging operations and may not always be in position.

Passing about 200 feet southwestward of the perpendicularly striped bell buoy at the entrance, steer 306° true (NW. ¼ N. mag.), following the red buoys at a distance of 75 to 100 feet, until Stratford beacon is about abeam. On this course, during a flood tide, care must be used to avoid being set on the shoals on the west side by the strong westerly currents. Then steer 314° true (NW. ⅞ N. mag.) until abreast Milford Point; then about 306° true (NW. ¼ N. mag.) on the range of two white targets just northward of the dike. Round Nun buoy No. 14 at a distance of 100 feet and follow the curve of the channel northward, passing about 250 feet eastward of the wharves at Stratford.

The channel follows the north end of **Nells Island** southward of a black buoy opposite it, and then favors the east bank to the lower bridge. Pass through the bridge and favor the west bank between the bridges, taking care to avoid a shoal with 5 feet (1.5 m.) over it extending 100 yards northward from the west draw pier of the lower bridge. Above the railroad bridge the channel is near mid river until approaching the oil company's wharf, and then follows 150 feet off the east bank to **Mill Bar,** 1 mile above the railroad bridge. The dredged channel at Mill Bar is marked by two red buoys and by a range of two targets on the east bank astern. The channel then follows the west bank, keeping out of the bight on that side abreast the upper end of **Fowler Island** (marked by a conspicuous tree.) Two range targets ahead guide through the bight, and two range targets astern guide in the crossing at **Oronoque Bar,** about ¼ mile above the bight. The channel then follows the east bank to **Campmeeting Bar,** where two range targets ahead guide in the cut across the river about ¼ mile southward of an island.

The channel then follows the west bank; two sets of range targets astern guide in the dredged cuts at **Drew Bar,** about ½ mile below Woosters Island. Two sets of range targets, the first ahead, the second astern, guide in the cuts at the crossing at **Moulthrop Bar,** just above Woosters Island. The channel then follows the east bank until about 300 yards above Twomile Island, then crosses the river on the range of two targets astern, and then follows the west bank to the next bend, and then the east bank from **Sow and Pigs Jetty** (covered at high water) to Derby. From the point opposite Derby the channel favors the west bank to the wharves at Shelton. The channel is in part a dredged cut from the middle of Twomile Island to the crossing 300 yards above it, and from just above the point opposite Derby to the wharves at Shelton.

BRIDGEPORT HARBOR

(chart 220) is on the north side of Long Island Sound, north-northwestward of Stratford Shoal Lighthouse. It is the principal approach to Bridgeport, and is a secure harbor for vessels of 21 feet (6.4 m.) or less draft. The harbor has been improved by the construction of two converging breakwaters on the flats at the entrance and by dredging a straight channel 300 feet wide and 22 feet (6.7 m.)

deep from the entrance to the anchorage basin of the same depth opposite the breakwater making off from Tongue Point. From this basin a channel 18 feet (5.5 m.) deep, with anchorage basins on the east side, has been dredged in the harbor and Poquonock River. (See also the description of the tributaries of the harbor following.) In 1925 the entrance channel and anchorage basin had shoaled to 21 feet (6.4 m.). Much of the traffic of Bridgeport is done on Poquonock River and the tributaries of the harbor and Black Rock Harbor and Cedar Creek; the latter are described under a separate heading.

Bridgeport is one of the important manufacturing cities of Connecticut. The carrying trade by water is large, the principal cargoes being coal, petroleum products, and iron; most of the coal is brought in barges and canal boats. The deepest draft of vessels going up Poquonock River above the bridges is about 17 feet (5.2 m.) The depths alongside the railroad wharf and City Dock (foot of Wall Street just below the first bridge) are 18 to 20 feet (5.5 to 6.1 m.). There are depths of 10 to 15 feet (3.0 to 4.6 m.) at some of the wharves in Poquonock River, but there is little depth at others.

Bridgeport East Breakwater Light is a red light on a post on the end of the east breakwater at the entrance of the harbor.

Bridgeport Harbor Lighthouse, a white structure on piles, lies 200 feet westward of the dredged channel and 500 feet inside the ends of the breakwaters at the entrance. The remains of an old structure, which show at low water about 150 feet northward of the lighthouse, are marked on the southeast side by a buoy.

Outer beacon is a black barrel on a steel pipe and lies 3/8 mile northward of Bridgeport Harbor Lighthouse and 160 yards westward of the dredged channel.

Bridgeport Breakwater Lighthouse, a black, conical tower on pier, is at the end of the breakwater making off from Tongue Point to the edge of the channel.

Johnson Creek entrance lies eastward of Bridgeport Breakwater Lighthouse and at the northeast corner of the 22-foot (6.7 m.) anchorage basin. It is under improvement to maintain a channel 12 feet (3.7 m.) deep and 125 to 175 feet wide to the first bend above the drawbridge; thence 9 feet (2.7 m.) deep and 175 to 100 feet wide to a point 350 yards below the dam at the head of navigation. In 1925 the lower portion of the improvement had a depth of 12 feet (3.7 m.) and the upper portion 8 to 12 feet (2.4 to 3.7 m.). **Pleasure Beach Highway Bridge** at the entrance has a center pier draw with openings 70 feet wide on the south side and 65 feet wide on the north side. Vessels require local knowledge to follow the best water, but small craft proceeding with care can use the channel, as follows:

Pass midway between the red and black buoys at the entrance, steer for the center pier of the draw, pass preferably through the south opening, and then keep in line with the center pier until abreast the shipyard wharf. Then make the bend, keeping about 100 feet off the row of piles at the shipyard, and then follow the wharves at a distance of 75 feet. Pass about 100 feet off the yacht club landing, exercise care in making the turn, and stand up the straight reach with a lone tree in line with a bridge opening in the dam at the head. Keep a little westward of the range on approach-

ing the head of the creek, pass 100 feet off a boat landing on the west side, and when about 200 feet from the dam haul in for the coal wharf on the west side.

A channel 80 feet or more wide and 10 feet (3 m.) deep has been dredged on the north side of **Tongue Point** to the wharf on the south side of the slip and the coal hoist on the north side; there is a depth of 6 to 12 feet (1.8 to 3.7 m.) at the wharf and hoist. The channel has shoaled and in 1925 had a depth of 6 to 8 feet (1.8 to 2.4 m.). To enter, open slightly the face of the wharf on the south side, pass about 75 feet off the bulkhead on the south side of the entrance, about the same distance off the lower end of the wharf, and then cross to the coal hoist. There is a prominent yellow chimney at the factory on Tongue Point.

On the eastern side of the harbor ¼ mile northward of Bridgeport Breakwater Lighthouse is the entrance of a dredged channel from 50 to 70 feet wide and 6 to 7 feet (1.8 to 2.1 m.) deep, which has been dredged to the power plant on the east side of the harbor. A range for the channel, used by local pilots, is the chimneys of the large brick schoolhouse just open northward of the trees above the power house.

Yellow Mill Pond has been improved by dredging a channel 100 feet wide and 12 feet (3.7 m.) deep to the upper wharf, above which it has a depth of 6 to 3 feet (1.8 to 0.9 m.). The entrance is on the northeast side of the harbor ¼ mile above Tongue Point and is marked on its north side by a horizontally striped buoy. **Yellow Mill Highway Bridge** has draw openings 55½ feet wide (the east opening only being used) and crosses the channel at Stratford Avenue. Below the bridge the wharves extend out to the eastern edge of the channel. Above the bridge the yellow chimney on Tongue Point in range with the west side of the east draw opening leads about in the axis of the channel, passing about 150 feet off the coal wharf. The coal wharf has a depth of 12 feet (3.7 m.) and the sand dock on the west side above the coal wharf 8 feet (2.4 m.). The flats on both sides of the channel are largely bare at low water.

Poquonock River has been improved by dredging a channel 18 feet (5.5 m.) deep for a distance of ⅞ mile above the Stratford Avenue Bridge to the angle in the channel nearly ⅜ mile above the East Washington Avenue Bridge. The short section of dredged channel above the 18-foot (5.5 m.) channel has a depth of about 12 feet (3.7 m.). The channel in Poquonock River is easily followed by small craft with the aid of the chart, but a towboat is needed by vessels to assist in making the sharp bends. Proceeding up the river the following bridges cross the river:

Stratford Avenue Bridge is a double-leaf lift, with an opening 135 feet wide. **The railroad bridge** is a single lift, with an opening 70 feet wide; the overhead wires at the bridge are 160 feet (49 m.) above high water. **Congress Street Bridge** is a double lift, with an opening 67 feet wide. **East Washington Avenue Bridge** is a bascule draw, with an opening 70 feet wide. **Grand Street Bridge** has a lift span with an opening 70 feet wide.

Bridge regulations have been prescribed by the Secretary of War to govern the opening of the drawbridges across Poquonock River, Yellow Mill Channel, and Johnson Creek, as follows:

1. The signals for opening the draws of the above-named bridges shall be given by blasts of a horn or steam whistle as follows: Stratford Avenue Highway Bridge, one long and one short blast. Railroad bridge, three short blasts. Congress Street Highway Bridge, four short blasts. East Washington Avenue Bridge, one long and two short blasts. Grand Street Highway Bridge, one long and three short blasts. Yellow Mill Highway Bridge, one long and one short blast. Pleasure Beach Highway Bridge, one long and one short blast. In case the draw of any bridge can not be immediately opened when the signals are given, a red flag or ball by day and a red light by night shall be conspicuously displayed on the bridge.

2. Except as hereinafter provided, the draws of the above-named bridges shall be immediately opened, upon the prescribed signal, at all times during the day or night, for the passage of foreign vessels and "vessels of the United States," as defined in section 4311 of the Revised Statutes, and for any other vessels or water craft which can not pass the closed bridges the said draws shall be opened at such time within 20 minutes after the prescribed signal from the vessel or craft as in the judgment of the bridge tender will cause the least interference with the land traffic over the bridge. *Exceptions:* (*a*) Closed periods when the draws of the highway bridges over Poquonock River and Yellow Mill Channel need not be opened for vessels of any class are authorized as follows: Between 6.30 and 7.15 a. m., between 7.45 and 8 a. m., and between 4.40 and 5.10 p. m. (*b*) Periods when the draws of the highway bridges over Poquonock River and Yellow Mill Channel need be opened only for the passage of power-driven vessels, other than yachts and pleasure craft, 40 feet and over in length or 10 tons and over net register, are authorized as follows: Between 7.15 and 7.45 a. m., between 11.30 a. m. and 1 p. m., and between 5.10 and 6 p. m. (*c*) Closed periods when the draw of the Pleasure Beach Highway Bridge need not be opened for vessels of any class are authorized as follows: Between 10.30 and 11 p. m., and between 11.15 and 11.45 p. m. (*d*) Delay in opening the draw of the New York, New Haven & Hartford Railroad Bridge for not more than seven minutes after the giving of signal is authorized when a passenger or mail train is actually ready to pass over the bridge.

3. For every vessel that can not pass the closed bridges the operation of the draws shall afford full horizontal and vertical clearance in the draw opening, regardless of the size or requirements of the passing vessel.

Pilots are not generally taken except by vessels subject to compulsory pilotage, which are foreign and registered vessels drawing 9 feet and over if spoken. A pilot can be obtained from the towboats. The following are the rates of pilotage: $1.50 per foot of draft inward and $1 per foot outward; for sailing vessels, $2 per foot inward and the same outward; from November 1 to April 1 in every year 25 cents per foot additional to the preceding rates.

Towboats can always be had by making signal.

Anchorage basins have been dredged on both sides of the channel in the harbor, and are well marked so as to render them fully available and easily made.

The 22-foot (6.7 m.) anchorage basin on the southeast side of the channel opposite Tongue Point Breakwater has a width of 800 feet and is the best anchorage for large vessels. In 1925 this anchorage had a least depth of 21 feet (6.4 m.).

On the eastern side of the harbor, extending northwestward from the 22-foot (6.7 m.) anchorage basin to the entrance of Yellow Mill Pond, is an anchorage basin 12 feet (3.7 m.) deep and 300 feet wide.

The generally used anchorage is on the east side of the channel close to southwestward of the 12-foot (3.7 m.) anchorage. It is 500 feet wide, and has a depth of 18 feet (5.5 m.) up to the anchorage described in the next paragraph.

An anchorage dredged to a depth of 12 feet (3.7 m.), generally used by small craft, is on the east side of the channel at the upper

end of the harbor between the former steel works and the Stratford Avenue Bridge. In 1925 this anchorage had shoaled to a depth of 9 to 11½ feet (2.7 to 3.5 m.).

Vessels sometimes anchor off the entrance of Bridgeport Harbor for shelter in strong northerly winds; the holding ground is good, and the lead a good guide.

Supplies.—Coal, water, provisions, and ship chandler's stores can be obtained. Water can be had through hose at the City Dock or from towboats which act as water boats.

Repairs to vessels and machinery of steamers can be made at Bridgeport, where there are several marine railways; the largest, on Johnson Creek, has a length of 150 feet and a capacity of about 500 tons, draft 8½ feet forward and 16 feet aft.

Hospital.—There is a relief station of the United States Public Health Service at Bridgeport.

Storm warnings are displayed from a prominent flagstaff at Seaside Park, western entrance of Bridgeport Harbor.

Communication.—Steamers make regular trips to New York and Port Jefferson. Bridgeport is on the line of the New York, New Haven & Hartford Railroad.

Currents.—In the entrance channel, between the breakwaters, slack water occurs about ½ hour before the current turns eastward and westward at the Race (about 2 hours after high and low water at New London). The strength of flood and ebb occur about 2¼ hours after the current turns westward and eastward at the Race (about 1½ hours before high and low water, respectively, at New London). The average velocity at strength is 0.7 knot; the flood sets 340° true (N. ¾ W. mag.) and the ebb 175° true (S. ⅝ W. mag.).

Ice does not, as a rule, interfere seriously with navigation; the steamers keep the channel open in the main harbor to the railroad bridge over Poquonock River. The tributaries of the harbor are closed at times.

Tides.—The mean rise and fall of tides is 6.8 feet.

DIRECTIONS, BRIDGEPORT HARBOR

From eastward.—Approaching around Stratford Point note the description of the shoals off the point in connection with the coast from New Haven to Bridgeport. Small vessels generally make the red spar buoy, which lies about 1 mile from shore and 1½ miles southwestward of Stratford Point Lighthouse. Passing over 200 yards southward and southwestward of the spar buoy, a 293° true (NW. by W. mag.) course for 2½ miles will lead in a least depth of about 15 feet (4.6 m.) to the entrance of the harbor southward of nun buoy No. 4, or a 282° true (WNW. mag.) course for 2½ miles will lead to the gas and bell buoy at the entrance of the 22-foot (6.7 m.) dredged channel.

From westward.—Passing about ½ mile southeastward of Penfield Reef Lighthouse, a 40° true (NE. ½ E. mag.) course for about 2 miles will lead to the gas and bell buoy at the entrance of the 22-foot (6.7 m.) dredged channel.

Nun buoy No. 4 lies on the east side of the dredged channel ⅜ mile southward of Bridgeport Harbor Lighthouse, and marks ap-

proximately the 18-foot (5.5 m.) curve at the entrance of the harbor. A 2° true (N. by E. ¼ E. mag.) course for the lighthouse will lead to this buoy.

The entrance of the 22-foot (6.7 m.) dredged channel, however, lies nearly 1 mile 189° true (S. by W. ¾ W. mag.) from Bridgeport Harbor Lighthouse, and is marked on the east side by a gas and bell buoy. The course through the middle of the dredged channel is 13° true (NNE. ¼ E. mag.), passing 350 feet eastward of Bridgeport Harbor Lighthouse and 150 feet eastward of Bridgeport Breakwater Lighthouse (on end of Tongue Point Breakwater). With the aid of the lighthouses and buoys there should be no trouble in clear weather in following the axis of the dredged channel. There is little depth on either side of the dredged entrance channel.

The axis of the 18-foot (5.5 m.) dredged channel leads about 150 yards off the horizontally striped buoy on the east side and about 100 feet off the end of the wall at the former steelworks (east side of harbor, nearly ¼ mile below Stratford Avenue Bridge). The course through the channel is 318° true (NNW. ¾ W. mag.)

BLACK ROCK HARBOR

(chart 220) lies 2 miles westward of the entrance of Bridgeport Harbor and is well marked by Black Rock and Penfield Reef Lighthouses on the north and south sides of the entrance. **Anchorage** exposed only to southeasterly winds, can be selected in the entrance northeastward of Fairfield Bar in 18 to 22 feet (5.5 to 6.7 m.). The lead is a good guide, except in the vicinity of the easterly part of Fairfield Bar and the reef on the north side of the entrance. The depths on either side of the dredged channel westward of Fayerweather Island are 6 to 8 feet (1.8 to 2.4 m.), and small craft of less than 6-foot (1.8 m.) draft can select anchorage as far up as the yacht club.

Black Rock Harbor and the creeks at its head are the approach by water to the large manufactories in the western part of Bridgeport. A channel 200 feet wide and 12 feet (3.7 m.) deep is dredged from the harbor to **Cedar Creek,** thence the same depth and 150 feet wide to the branches, and the same depth and 100 feet wide in the branches. There are depths of 10 to 15 feet (3 to 4.6 m.) at some of the wharves. The channel is marked by buoys, and there are sometimes bush stakes on the shoal flats on each side of the channel.

The channel in **Burr Creek** has been dredged 100 feet wide and 7 feet (2.1 m.) deep in the lower part; in the straight reach leading to the coal wharf at its head, the channel is 75 feet wide, except in one place where there is rock. In 1925 the channel had a controlling depth of 3½ feet (1.1 m.) to the head. The channel is not marked except for a horizontally striped buoy at the eastern side of the entrance. The range of a distant white church spire and the eastern end of a small shed, in front of a concrete house with a red roof, on the point on the west side leads in the first section of the channel. Then keep in mid-channel around the point and then steer for the coal wharf at the head. The flats at the entrance, between Burr and Cedar Creeks, are mostly bare at low water.

At high water vessels of 16-foot (4.9 m.) draft can go to the heads of the two branches of Cedar Creek and 6-foot (1.8 m.) draft in Burr Creek, but they will lie aground at low water.

Fayerweather Island, on the eastern side of the entrance, is marked at its south end by Black Rock Lighthouse (white tower). A breakwater and a seawall connect its northern part with the shore eastward. **Point Rock Shoal,** which shoals abruptly, extends ⅜ mile southward from the south end of the island, and is marked at its south end by a red buoy. There is little depth for a distance of 400 yards from the island, and thence it shelves off to 18 feet (5.5 m.) at the buoy.

Fairfield Bar and Penfield Reef, on the south side of Black Rock Harbor, are described on page 208.

Bridgeport Yacht Club is on the point on the west side of the harbor, nearly ½ mile north-northwestward of Black Rock Lighthouse. There is anchorage off the landing and between it and another yacht club landing, 300 yards northward, in 5 to 8 feet (1.5 to 2.4 m.). A shoal with 3 or 4 feet (0.9 to 1.2 m.) over it lies between this anchorage and the dredged channel. An old stone landing which shows near low water extends 150 yards from the shore at a point 250 yards southward of the Bridgeport Yacht Club. Gasoline can be obtained at the upper yacht club landing. The Standard Oil Co. has a fuel station at Black Rock Harbor.

Pilots.—See under Bridgeport Harbor.

Tides.—The mean rise and fall of tides is 6.9 feet.

DIRECTIONS, BLACK ROCK HARBOR

From eastward.—Approaching around Stratford Point, note the description of the shoals off the point in connection with the coast from New Haven to Bridgeport. Small vessels generally make the red spar buoy which lies about 1 mile from shore and 1½ miles southwestward of Stratford Point Lighthouse. Passing southward of the spar buoy, a 273° true (WNW. ¾ W. mag.) course for 4 miles will lead to the entrance at the red buoy southward of Black Rock Lighthouse.

From Bridgeport.—From abreast the red nun buoy lying ⅜ mile southward of Bridgeport Harbor Lighthouse a 242° true (WSW. ½ W. mag.) course will lead southward of the red buoy southward of Black Rock Lighthouse.

From westward.—Pass ⅜ mile or more southeastward of Penfield Reef Lighthouse and ¼ mile or more eastward of Black Rock beacon; or Black Rock Lighthouse bearing westward of 349° true (N. mag.) will lead ¼ mile or more eastward of Black Rock beacon. When Penfield Reef Lighthouse bears 237° true (WSW. mag.), the course can be shaped to pass westward of the red buoy southward of Black Rock Lighthouse.

The following are the courses to the head of Cedar Creek in the dredged cuts, which are 200 to 100 feet wide and 12 feet (3.7 m.) deep, with increased width at the turns. The ranges mentioned were erected in connection with dredging operations, and when in position mark the axis of the dredged cuts.

From the red buoy lying 400 yards west-southwestward of Black Rock Lighthouse 352° true (N. ¼ E. mag.) on the range of two white targets which show just clear of the shore at the Bridgeport Yacht Club to buoy No. 6. Then 15° true (NNE. ⅜ E. mag.) on the range of a narrow white target and a white strip on a prominent

red brick chimney ahead to the red buoy southward of the wharves; then 35° true (NE. 1/8 E. mag.) keeping in mid-channel on the range of two white targets ahead to the next red buoy; then 54° true (NE. by E. 3/4 E. mag.) on the range of two white targets ahead to a black buoy; then 34° true (NE. mag.), on the range of two white targets astern and pass about 75 feet off the wharves on the northwest side of the channel. A square pyramidal tower will be ahead. A shoal has been left off the point separating the two branches at the head of the creek and must be carefully avoided. To enter the east branch, pass about 100 feet off the wharf on the southeast side below the entrance and head up the middle of the branch. To enter the west branch, pass 100 feet off the wharves on the northwest side below the entrance and 75 feet off the wharves on the southeast side of the branch.

BLACK ROCK HARBOR TO NORWALK ISLANDS

Fairfield Bar, forming the southwest side of Black Rock Harbor, is well bare at low water out to **The Cows,** a distance of nearly 1 mile; and a shoal with little depth extends 1/4 mile eastward from The Cows to **The Little Cows,** which are awash at low water. The easterly point of the reefs, lying nearly 1/4 mile southward of the northeast point of the shoal near The Little Cows, is marked by a skeleton iron beacon with cage. **Penfield Reef,** on which are rocks bare at low water, extends 1/4 mile southward from The Cows to Penfield Reef Lighthouse; the 18-foot (5.5 m.) curve lies 250 yards southeastward of the lighthouse, and the lighthouse should not be approached closer, even by small craft.

Penfield Reef Lighthouse is a white tower on a granite dwelling and pier. The light is flashing red, flash 1.5 seconds, eclipse 3.5 seconds, 51 feet (15.5 m.) high and visible 12 miles. The fog signal is a reed horn, blast 3 seconds, silent 17 seconds.

Flat Island, lying nearly 2 miles westward of Penfield Reef Lighthouse, is covered at high water, and is the highest part of a reef, partly bare at low water and with little depth over any part of it, which extends over 3/8 mile southward from **Pine Creek Point.** A red buoy marking the end of the shoal lies about 300 yards southward of Flat Island and over 1/2 mile southward of the point.

Southport Harbor (chart 220) is the entrance of **Mill River** at the head of the bight over 1 mile northwestward of Flat Island. It has been improved by dredging a channel 8 feet (2.4 m.) deep to the wharves at Southport. In 1925, the entrance channel had a least width of 50 feet until 200 yards inside the outer beacon, above which extensive dredging by private interests has made a channel of various widths and depths, and an anchorage basin with depths of 20 feet (6 m.) or more on the northwest side of the channel below the wharves. The entrance is marked by two large granite beacons, the outer one lying on the bar 500 feet inside the 6-foot (1.8 m.) curve and 175 feet westward of the middle of the dredged channel, and the inner one on the end of the breakwater which extends in a southwesterly direction from the eastern point at the entrance of the river. The outer section of the channel is marked by buoys maintained by the Pequot Yacht Club from May 1 to November 1 of each year. The mean rise and fall of tides is 7.1 feet.

Directions, Southport Harbor.—Head for the breakwater beacon on course 351° true (N. ¼ E. mag.), passing midway between the black and red buoys and 75 yards eastward of the outer beacon. When past black can buoy No. 5, haul about one point to westward and round the breakwater beacon at a distance of about 75 yards, passing also to westward of red nun buoy No. 8. Pass 150 feet northwestward of the angle of the breakwater, 70 feet southeastward of White Rock, then favor slightly the west side of the narrow entrance, then head for the brick buildings at the wharf, and then pass 100 feet off the wharves. Strangers should proceed with caution.

Southport is a village on the north side of Mill River. Gasoline, hardware, and other supplies can be obtained, and there is a marine railway where vessels up to 35 feet in length and 3-foot draft can be hauled out. The deepest draft of vessels entering is 11 feet (3.4 m.). A **towboat** can be obtained at Bridgeport. **Ice** closes the river at times during the winter.

Frost Point, 1 mile westward of Southport entrance, is marked by two large residences and by an observation pier on its southeast side. A reef, partly bare at low water, extends about ⅜ mile southward from the point.

Sherwood Point is marked by a bare bowlder on the reef which extends about 250 yards off the point. A rocky patch on which the least depth found is 12 feet (3.7 m.) lies ¾ to 1 mile southward of Sherwood Point. There are numerous oyster stakes between Frost and Sherwood Points.

WESTPORT HARBOR

Saugatuck River, or Westport Harbor (chart 221), lies 6 miles westward of Penfield Reef Lighthouse and northward of Cockenoe Island. Anchorage exposed to southeasterly winds can be had in the entrance in 12 to 22 feet (3.7 to 6.7 m.), ¼ to ⅜ mile southward of **Cedar Point** (marked by a short breakwater) at the east side of the entrance. Anchorage for small craft, sheltered from all winds, can be had 75 to 100 yards off the beach westward of Bluff Point (north end of **Seymour Point**). The channel in Saugatuck River is narrow and crooked, there are few aids, and vessels suffer damage at times by striking projecting ledges or bowlders. Vessels should therefore proceed with caution and preferably on a rising tide.

The channel is good for a depth of about 6 feet (1.8 m.) at low water to Saugatuck, above which the channel was improved to obtain a width of 60 feet and depth of 4 feet (1.2 m.) to Westport. Shoaling has occurred at the upper end of the channel; in 1925 the depth was 3½ feet (1.1 m.) to the lower wharves at Westport and 1 foot (0.3 m.) to the upper wharves. The deepest draft taken to Saugatuck is 10 feet (3 m.) and to Westport, 7 feet (2.1 m.).

A channel 100 feet wide and 10 feet (3 m.) deep has been dredged to a private bulkheaded basin about 200 feet wide and 10 feet (3 m.) deep, on the east side of the river. The entrance, southward of **Kitts Island** (low and grassy), is marked by private buoys, and a range of two white targets ahead lead in the dredged channel. On the west side of the basin are a prominent concrete tower and a boat garage.

Saugatuck, a village about 2½ miles above the entrance, is the railroad station for Westport. Gasoline, coal, and other supplies

are obtainable. There are depths of 8 to 10 feet (2.4 to 3 m.) at the principal wharves.

Westport, a town at the head of navigation, about 1 mile above Saugatuck, has several manufactories and some trade in coal and cement by water.

Bridges.—The lower, or railroad, bridge at Saugatuck has a lift opening 57 feet wide. The overhead wires at the bridge are 135 feet (41 m.) above high water. The upper, or highway, bridge at Saugatuck is a center pier draw with openings 55 feet wide, the east opening only being used. The highway bridge at Westport has a lift opening 50 feet wide.

Bridge regulations prescribed for the railroad bridge require that the draw shall be immediately opened at any time between 5 a. m. and 9 p. m. upon a signal of three short blasts (each of about two seconds' duration) of a horn or steam whistle; except when a train scheduled to pass beyond the bridge without stop has passed the last station nearest the bridge and is in motion toward the bridge, the bridge shall be opened for the vessel as soon as the approaching train has been brought to a stop at the drawbridge signal. In case the bridge can not be immediately opened when the signal is given, a red flag or ball by day or a red light by night shall be conspicuously displayed. Signals for the opening of the draw shall be answered by a whistle or horn on the bridge with three short blasts when the opening is commenced or by not less than four short, sharp blasts, each of not more than one second duration, when the bridge can not be promptly opened.

For small unlicensed craft which can not pass the closed bridge the draw will be opened as soon as practicable, but in no case shall the delay be over 20 minutes.

Towboats can be had at Bridgeport and South Norwalk, and are employed by vessels.

Tides.—The mean rise and fall of the tides is about 7 feet. Freshets do not affect appreciably the height of the water in the navigable part of the river.

Ice forms in winter the whole length of the river to its mouth.

DIRECTIONS, WESTPORT HARBOR

From eastward.—From the red buoy southward of Flat Island a 261° true (W. ¼ N. mag.) course for 4 miles will lead to the outer mid-channel buoy ¼ mile southward of Cedar Point. **Approaching from westward** outside of Norwalk Islands, pass southward of the gas and bell buoy southward of Georges Rock and eastward of the black buoy eastward of the rock, giving the buoys a good berth. Pass over ¼ mile northward of the black buoy and steer 292° true (NW. by W. mag.) to the outer mid-channel buoy ¼ mile southwestward of Cedar Point. From Cockenoe Island Harbor, a depth of 1 foot (0.3 m.) at low water and over 7 feet (2.1 m.) at high water can be taken across the bar southward of Seymour Point on the range of **Seymour Rock** (large and bare) and the bathhouses at Compo Beach. When ¼ mile from the rock haul eastward and pass over 100 yards southward of it.

From a position 150 yards westward of outer mid-channel buoy, steer 318° true (NNW. ¾ W. mag.) for a flagpole in range with a

white target showing above the trees until past the upper buoy; then steer for Kitts Island and follow the curve of the channel westward and southward to **Bluff Point,** passing southward of the private buoys southeastward of Kitts Island. The channel then follows the west bank, as shown on the chart, to the large bare rock near **Judys Point,** and then crosses the river on a course about 89° true (E. by S. mag.). Sometimes there are stakes on the south side of the lower end and north side of the upper end of the channel at the crossover. The channel then follows the east bank to the lower bridge, the west bank to the second bridge, and then through the east opening.

The west edge of the channel is then about on the line of the center pier of the draw for a little over 100 yards, and then heads for a white house on the east bank above. From a small landing on the east bank the channel crosses to the west bank abreast the tannery, then near the middle until the river widens, and then follows the west bank, keeping out of the bights, to the lower wharves at Westport. From abreast the lower wharves a narrow channel leads across to the wharves on the east bank below the bridge.

NORWALK ISLANDS

(chart 221) are a group of islands, rocks, and shoals which extend from 1 to nearly 2 miles off the north shore of Long Island Sound and have a length of 6 miles from Georges Rock to Greens Ledge Lighthouse. Cockenoe Island Harbor and Sheffield Island Harbor, good at low water for vessels of about 9 and 12-foot (2.7 to 3.7 m.) draft, respectively, are available anchorages, and are the approaches to Norwalk River. These anchorages are marked by Peck Ledge and Greens Ledge Lighthouses and are easily made. The bottom is very irregular around the islands and rocks in the Norwalk Islands; and, although the area is well surveyed, vessels should, as a measure of safety, avoid all broken ground and proceed with caution when crossing shoal areas.

Cockenoe Island, at the eastern end of Norwalk Islands, is marked on its south side by two knolls, the rest of the island being low and level. A shell fish commission signal is located on the southeast side of the island. A bar, dry in places at low water but with general depths of 1 to 2 feet (0.3 to 0.6 m.), connects the island with the north shore at Seymour Point.

Cockenoe Island Shoal is an extensive and dangerous area which extends 1¼ miles eastward and east-southeastward and ⅝ mile southward from Cockenoe Island. The least depths found are shown on the chart, but the entire area is exceedingly broken with bowlders and should be avoided by strangers, even in small craft.

Georges Rock, awash at lowest tides, is at the eastern end of the shoal, and is marked off its northeast side by a black buoy. A gas and bell buoy marks the southeast end of the shoal. Vessels rounding the eastern end of Cockenoe Island Shoal should give the buoys a good berth.

Channel Rock, with 2 feet (0.6 m.) over it, lies 400 yards southwestward of Cockenoe Island and is marked by a red buoy placed 300 yards southwestward of the rock.

Peck Ledge Lighthouse, on the west side at the entrance of Cockenoe Island Harbor, is a white conical tower, middle part brown,

on a black cylindrical pier. The light is group flashing white (first flash 0.5 second, eclipse 7 seconds, second flash 0.5 second, eclipse 22 seconds), 54 feet (16.5 m.) high, and visible 13 miles. The fog signal is an air siren, blast 2 seconds, silent 6 seconds.

Cockenoe Island Harbor lies westward of Cockenoe Island, and is marked by Peck Ledge Lighthouse. It has an anchorage for vessels of less than 9-foot (2.7 m.) draft, and is also an entrance from eastward to Norwalk River. The best anchorage for vessels is in the deeper part of the harbor, depths 12 to 25 feet (3.7 to 7.6 m.), lying northward and northwestward of the lighthouse. Vessels should proceed with caution at low water when crossing the shoal with 12 to 15 feet (3.7 to 4.6 m.), lying southward and westward of Channel Rock buoy.

Directions, Cockenoe Island Harbor.—From eastward pass southward of Cockenoe Island Shoal gas and bell buoy, steer 254° true (W. ½ S. mag.) until Peck Ledge Lighthouse bears northward of 285° true (NW. by W. ¾ W. mag.), then steer for the lighthouse until up with Channel Rock buoy, and then pass eastward and northward of the lighthouse at a distance of 200 to 300 yards. From westward give the edge of the shoals a good berth until Peck Ledge Lighthouse bears westward of 350° true (N. mag.), and then steer this course with the lighthouse on the port bow, passing preferably eastward of the 12-foot (3.7 m.) spot lying 250 yards southeastward of the lighthouse.

The following islands and rocks are on the northwest side of Cockenoe Island Harbor: **Sprite Island** is high and has some trees. **Calfpasture Island** has several houses and a few trees. The island eastward of Calfpasture Island is low and covered with bowlders. **Sheep Rocks** are covered at half tide. **East White Rock** is a high, white rock. **Grassy Hammock Rocks** are bare at half tide; the rock at the south end of the group is awash at high water, and is marked by Grassy Hammock Light.

Goose Island and **Grassy Island** are low. The rest of the Norwalk Islands are hilly and are partly settled. **Chimon Island** is marked by a windmill and water tank. A shell fish commission signal is located on the north side. **Copp Island** has a prominent survey signal and a shell fish commission signal. **Sheffield Island,** the westernmost of the Norwalk Islands, is marked by an unused lighthouse tower (granite building). There is a boat landing on the north side of Sheffield Island.

Great Reef, lying ¼ mile southward of the western end of Sheffield Island, is covered at half tide and marked by a spindle. **Hiding Rocks, Old Baldy,** and **Old Pelt,** lying northwestward of Great Reef, are bare at low water.

Greens Ledge is a rocky ridge extending from Sheffield Island to Greens Ledge Lighthouse. There is little depth and rocks bare at low water in places for a distance of nearly ½ mile from the island, and thence to the lighthouse there is a depth of about 7 feet (2.1 m.) on the ledge. Depths of 10 to 15 feet (3 to 4.6 m.) extend about 400 yards westward and southwestward from the lighthouse, and this part of the ledge is marked at its southwest end by a red buoy. A rocky ledge, on which the least depth found is 21 feet (6.4 m.), extends 1 mile west-southwestward from the lighthouse.

Greens Ledge Lighthouse is a conical tower, lower half brown, upper half white, on a black cylindrical pier. The light is fixed white with a red flash of 1 second duration every 15 seconds, 62 feet (18.9 m.) high and visible 12 miles. The fog signal is a reed horn sounding a group of 2 blasts every 40 seconds, first blast 3 seconds, silent 2 seconds, second blast 3 seconds, silent 32 seconds.

Budd Reef, a small ledge with a least depth of 24 feet (7.3 m.), lies 7/8 mile south-southeastward of Greens Ledge Lighthouse. The bottom is very broken on the south side of Greens Ledge, and deep-draft vessels should pass southward of Budd Reef and the ledge with a least found depth of 21 feet (6.4 m.) lying 7/8 mile south-southwestward of Copp Island.

Sheffield Island Harbor, also known as **Norwalk Harbor,** is formed by the western Norwalk Islands. It is frequently used in the fall and winter, and by tows. The depths of the anchorage northwestward of Sheffield Island range from 12 to 16 feet (3.7 to 4.9 m.). The directions from westward for Norwalk River lead through the harbor. The shoal flats on the north side of the harbor have rocks and bowlders in places. Two black buoys and a horizontally striped buoy mark the edge of the shoals with depths less than 10 feet (3 m.) on the north side of the harbor southwestward of Tavern Island.

Tavern Island has a number of houses. **Little Tavern Island** is marked by a prominent, high-water tank. A row of piles extends from Tavern Island to Little Tavern Island. A rock covered at half tide lies 250 yards northeastward of Little Tavern Island. A bare rock, marked by telegraph poles, lies westward of Little Tavern Island. A shoal with little depth over it extends 250 yards southwestward of Tavern Island. A rock bare at low water lies about midway between the southwest end of Tavern Island and the wharf at Wilson Point.

The following are objects near the channel leading from Sheffield Island Harbor to Norwalk River. **White Rock** shows above high water. **White Rock Reef Light,** northward of White Rock, is located in a depth of about 9 feet (2.7 m.) on the southeast edge of the channel. **Long Beach Light** is on the west side of the channel, which passes between it and Long Beach. **Round Beach Light** is on the east side of the channel at the entrance of Norwalk River, and lies 300 yards westward of **Round Beach.** The latter is a grassy shoal awash at high water, and is marked on its western side by a private spindle with cask.

NORWALK RIVER

(chart 221) is on the north side of Long Island Sound northward of Norwalk Islands, and is important commercially. The river has been improved by dredging a channel 150 feet wide and 12 feet (3.7 m.) deep to South Norwalk, where the channel width is 250 feet along the wharves, and 100 feet wide and 8 feet (2.4 m.) deep to Norwalk. The principal entrance to the river is from westward, through Sheffield Island Harbor, from which there is a straight dredged channel 200 feet wide and 12 feet (3.7 m.) deep extending to the mouth of the river. The entrance from eastward, through Cockenoe Island Harbor, is good for a depth of about 7 feet (2.1 m) at low water.

An anchorage basin 10 feet (3 m.) deep and about 17 acres in area has been dredged on the east side of the river channel opposite Fitch Point.

Gregory Point, marked by a clubhouse and wharf, is on the east side of Norwalk River ½ mile above the entrance.

At Harborview, on the west side of the river abreast Gregory Point, is a shallow creek, crossed by a lift bridge with an opening 30 feet wide, above which are several marine railways to which a draft of 3 feet (0.9 m.) can be taken at high water.

South Norwalk is an important commercial and manufacturing city on the west bank of Norwalk River about 1½ miles above its mouth. The depths at the wharves below the bridges range from about 5 to 12 feet (1.5 to 3.7 m.).

East Norwalk, opposite South Norwalk, is reached through a channel dredged 75 feet wide and 6 feet (1.8 m.) deep, which is used mainly by small pleasure craft. Fitch Point Light marks the entrance of the channel at the junction with the main channel leading to South Norwalk. A stake and flag marks the southeast point of the entrance and another stake the turn abreast the lower wharves. The upper section of the channel is marked on both sides by stakes, to which small craft moor. The yacht club is at the head of navigation.

Norwalk is a city on both banks of Norwalk River at the head of navigation 1½ miles above South Norwalk. There is a depth of about 10 feet (3 m.) at the wharves. The channel from South Norwalk to Norwalk is winding, with extensive flats on both sides, and requires local knowledge, even at low water, to follow it.

Terminal facilities.—The wharves in Norwalk Harbor line the west bank for over half a mile at South Norwalk and surround, with a frontage of over 2,000 feet, the basin at the head of navigation in Norwalk. There are also a few small wharves on the East Norwalk shore. The general type of construction is a stone or timber bulkhead with earth fill, in front of which is a narrow pile apron, except that the lower wharves at South Norwalk are narrow open-pile piers with slips 100 to 200 feet long between them. A majority of these wharves are private, but one or more in each group are open to public use. The city of Norwalk owns a small wharf on the east side of the river near the basin at Norwalk and has constructed a second wharf at South Norwalk.

The principal items of commerce are coal, building materials, oysters, wood pulp, and general merchandise. Coal and building materials are usually carried in barges drawing from 8 to 12 feet (2.4 to 3.7 m.); oysters in steamers and motor craft drawing from 4 to 12 feet (1.2 to 3.7 m.); and wood pulp and lumber in steamers and schooners drawing up to 15 feet (4.6 m.).

Bridges.—Two bridges cross the river at South Norwalk. The lower one is a double-leaf lift, with an opening 70 feet wide. The second, or railroad bridge, is a center pier draw, with an opening 60 feet wide on either side. The overhead wires at the railroad bridge are 170 feet above high water.

Bridge regulations prescribed for the **railroad bridge** require that the draw be immediately opened at any hour of the day or night upon a signal of one long blast of about five seconds' duration and two short sharp blasts, each of about two seconds' duration, of

a horn or steam whistle; except when a train scheduled to pass beyond the bridge without stop has passed the last station nearest the bridge and is in motion toward the bridge, the bridge shall be opened for the vessel as soon as the approaching train has been brought to a stop at the drawbridge signal; also, except between the hours of 7 a. m. and 9 a. m. or between 4 p. m. and 6 p. m., and low tide is predicted in the tide tables published by the United States Coast and Geodetic Survey to occur within one hour before or after the time when such signal is given, the opening of the bridge may be delayed not to exceed 20 minutes from the time such signal is given. In case the bridge can not be immediately opened when the signal is given a red flag or ball by day or a red light by night shall be conspicuously displayed. Signals for the opening of the draw shall be answered by a whistle or horn on the bridge with one long and two short blasts when the opening is commenced or by not less than four short, sharp blasts, each of not more than one second duration, when the bridge can not be promptly opened.

For small unlicensed craft which can not pass the closed bridge the draw will be opened as soon as practicable, but in no case shall the delay be over 20 minutes.

Regulations prescribed for the **highway bridge** require that, except between the hours of 6.45 and 7 a. m., 12 and 12.15 p. m., and 12.45 and 1 p. m., the draw shall be promptly opened upon a signal of three short blasts of a whistle or horn. In case the draw can not be immediately operated when the signal is given, a red flag or ball by day and a red light by night shall be conspicuously displayed.

For small unlicensed craft and vessels propelled exclusively by hand which can not pass the closed bridge, the draw shall be opened promptly, except between the hours of 6 and 7 a. m., 11.45 a. m. and 1 p. m., and 5 and 6.15 p. m., provided that for the passage of a barge or other vessel to be hauled through by a line the opening need not commence until a line has been carried through the draw and made fast at a sufficient distance beyond to permit the vessel to be hauled clear of the draw at one operation.

A **towboat** is stationed at South Norwalk.

Communication.—Freight steamers make regular trips to New York from Norwalk and South Norwalk. The latter is on the main line of the N. Y., N. H. & H. R. R.

Supplies.—Coal and water can be had at the wharves of South Norwalk and Norwalk. Provisions, gasoline, and other supplies can be obtained.

Ice forms in the river and usually obstructs navigation for about six weeks in winter.

Tides.—The mean rise and fall of tides is about 7 feet.

DIRECTIONS, NORWALK RIVER

From eastward.—The entrance from Cockenoe Island Harbor is good for vessels of about 6 feet (1.8 m.) draft at low water. Follow the directions for Cockenoe Island Harbor and pass eastward and northward of Peck Ledge Lighthouse at a distance of 200 to 300 yards; then steer westward to a position 150 yards southward of Grassy Hammock Light, and then steer 270° true (W. by N. mag.). When the northern one of the two knolls on Cockenoe Island is a

little open southward of Grassy Hammock Light bring this range astern, course 251° true (W. ¾ S. mag.), until ¼ mile from **Raymond Rocks** (awash at high water); then steer about 309° true (N. W. ½ N. mag.) for Round Beach Light in range with a gray building having a dark-red roof. A more prominent light stone building with red roof will be seen a little eastward of the range. Pass 200 to 250 feet eastward of the light.

From westward.—The entrance from Sheffield Island Harbor is good for a depth of 12 feet (3.7 m.) at low water, and is well marked by lights and buoys.

Passing southward of Execution Rocks Lighthouse a 53° true (NE. by E. ¾ E. mag.) course will lead clear of danger for Greens Ledge Lighthouse, passing ¼ mile southward of The Cows gas buoy. Proceed with caution when crossing the rocky ridge, on which the least depth found is 21 feet (6.4 m.), extending 1 mile west-southwestward from Greens Ledge Lighthouse, and pass over ¼ mile westward and 200 yards northward of Greens Ledge Lighthouse. Then bring the lighthouse astern on a 50° true (NE. by E. ½ E. mag.) course, which will lead to a position 100 yards southeastward of the black buoy lying 300 yards southeastward of Tavern Island.

Then steer 33° true (NE. mag.) through the dredged channel, passing 100 feet eastward of the black buoys, 125 feet westward of red buoy No. 2 and White Rock Light, and 125 feet eastward of Long Beach Light and Round Beach Light.

Round Beach Light to South Norwalk.—When about 300 feet northeastward of the light, haul northward and then northwestward, passing 150 feet to eastward of black buoys Nos. 11, 13, and 15, and about 150 feet off the wharf at Gregory Point. When up to buoy No. 15, steer 323° true (NNW. ¼ W. mag.), passing about 100 feet northeastward of the black buoy and continue to the wharves at South Norwalk.

NORWALK RIVER TO STAMFORD

Wilson Point, on the north shore of Sheffield Island Harbor, is a coal and oil receiving wharf. There is a depth of 11 to 16 feet (3.4 to 4.9 m.) in a channel 60 feet wide, obtained by dredging, alongside the wharf for a distance of 420 feet from its end, and 12 feet (3.7 m.) in a channel 150 wide in the approach.

Directions.—Approaching the wharf pass 100 yards westward of the horizontally striped buoy lying 400 yards southeastward of Noroton Point, and steer for the water tank in range with the radio pole until ¼ mile from the wharf. Then steer for the end of the wharf and go alongside its western face. Towboats with high pilot houses approaching Wilson Point at night pass 300 yards northward of Greens Ledge Lighthouse and steer 60° true (ENE. ⅜ E. mag.) with Peck Ledge Lighthouse showing over a barn on Chimon Island. The range to the wharf is lighted when vessels are expected at night. Water can be obtained at the wharf. Between Wilson Point and the northern part of Noroton Point there is good **anchorage** for small craft in depths of 3 to 6 feet (0.9 to 1.8 m.).

Noroton Point is occupied by a summer settlement. **Pine Point,** just westward of Noroton Point, has a wharf with a depth of about

9 feet (2.7 m.) at its end where excursion steamers land. A shoal with depths of 8 to 12 feet (2.4 to 3.7 m.) extends about ¼ mile from the shore westward of Noroton Point. The bottom is broken and there are bowlders in places, and small vessels crossing the shoal should proceed with caution.

Ballast Reef, bare at low water, extends 300 yards off **Roton Point.** At the southeast end of the reef there is a detached bowlder which is covered at high water. The reef is marked off its southwest side by a red buoy.

Fivemile River (chart 221) is a narrow inlet the entrance to which lies 351° true (N. ¼ E. mag.) from Greens Ledge Lighthouse. It is about 1 mile long, from 100 to 300 yards wide, and shallow except in the dredged channel. A channel 100 feet wide and 8 feet (2.4 m.) deep has been dredged for a distance of ¾ mile above the entrance to the bend at the upper end of the wharves, and thence 4 feet (1.2 m.) deep for a distance of 500 feet to the next bend. For a distance of ¼ mile above this point to the head of navigation the channel shoals gradually and is partly dry at low water, but a depth of about 4 feet (1.2 m.) can be carried this distance at high water. The river is mostly used by small oyster boats. The mean rise and fall of tides is 7.2 feet.

Directions.—Small craft can enter Fivemile River by the following directions: Approaching from eastward, give the shore westward of Noroton Point a berth of over 250 yards and pass southward of Ballast Reef buoy. From westward, avoid the rock with 2 feet (0.6 m.) over it, lying ⅜ mile 204° true (SW. ⅞ S. mag.) of the western point at the entrance. From the entrance buoys steer 1° true (N. by E. mag.), keeping the eastern red chimney of a large yellow house in range with a double tree until approaching a red buoy. Pass 75 feet westward of the buoy and steer 22° true (NE. by N. mag.), passing 75 feet off the first wharf and to a position 120 feet off the oil company's wharf. From abreast the latter steer 8° true (N. by E. ¾ E. mag.), heading 50 feet outside the oyster company's wharf.

Rowayton, a village on Fivemile River, has railroad and electric railroad communication. Coal, gasoline, and water can be obtained. There is a depth of about 4 feet (1.2 m.) at the coal wharf and oyster company's wharf and less at the others.

Scott Cove has its entrance westward of **Fish Islands** and about 1 mile 290° true (NW. by W. ¼ W. mag.) from Greens Ledge Lighthouse. The bottom in the cove and approach is very broken, and it is suitable only for launches or small craft. Proceed with caution when crossing the broken ground which extends ¼ mile off the entrance of the cove. In the cove the channel favors the west side. The two reefs near the middle of the lower part of the cove are bare at low water, and the other reefs shown on the chart show, or are awash, at high water. The channel into the small cove on the west side at the entrance of Scott Cove has been dredged to 9 feet (2.7 m.) and follows the north side closely to an anchorage with the same depth, favoring the north side. The bare rock off the south side of the entrance is marked by a private spindle from which a light is sometimes shown.

Long Neck Point has numerous summer residences, and there is a flagstaff on the end of the point. There are a number of boat

landings on both sides of the point. Shoals extend about ¼ mile off the point.

The bight between Long Neck Point and Shippan Point has numerous reefs and bowlders, and the bottom is exceedingly broken, necessitating caution in navigation. It is the approach to several shallow coves, of which Cove Harbor is the only one of importance. The brick chimney at the dye works in Cove Harbor is a prominent feature from well offshore.

Darien River is a small, shallow stream on the west side of Long Neck Point. There is a least depth of about 2 feet (0.6 m.) in the approach to **The Gut** at the entrance. The best route is along the west side of Long Neck Point, taking care to avoid the rocks, bare at low water, which extend nearly 200 yards from shore between the two piers lying 600 yards above the south end of Long Neck Point. Above The Gut the river is practically dry at low water but at high water a draft of 6 feet (1.8 m.) can be taken a distance of ⅝ mile to the lower dam. The higher rocks of the group on the west side of the approach show above water. The rock at the northeast end of the group is bare at low water. A rock which shows at lowest tides lies a little westward of midway between the southerly bare rock of the group and the southerly pier on the west side of Long Neck Point.

Cove Harbor is a small dredged basin between bulkhead wharves, lying about 1 mile west-northwestward of Long Neck Point. The basin has a depth of about 9 feet (2.7 m.), and there is a least depth of about 8 feet (2.4 m.) in the approach. The deepest draft taken into the harbor is about 15 feet (4.6 m.). The harbor is occupied by large dye works, the brick chimney on the west side of the works being prominent. The captain of a steamer owned by the works does the piloting, and local knowledge is needed for the approach and entrance.

The entrance of Cove Harbor is a narrow dredged channel, marked on the east side by dolphins. The ledges on the west side of the channel are bare at low water only. The harbor is usually approached westward of Smith Rock, and then between the end of the ledge extending northward from Smith Rock and the prominent white rock northward; the rock is marked by crossed targets, and a light is shown when a vessel is expected at night. A range used by local pilots for the latter course is two cedar trees at the mouth of Holly Pond in line with the iron stack on the Soldiers' Home, bearing 8° true (N. by E. ⅝ E. mag.). A rock, bare at low water and marked by a spindle with double cone, lies 100 yards northward of the white rock. In approaching from eastward, the foul ground extending northward from Smith Rock can be crossed on the range of the target on the white rock and a white house with a bright red roof, course about 300° true (NW. ⅜ W. mag.). The ledge, 400 yards west-northwestward of the white rock, is marked by an iron spindle.

Passing eastward of the spindle with double cone, the course is northwestward for the dolphin at the entrance; then follow the dolphins at a distance of about 50 feet, passing westward of them. Small vessels entering without a local pilot should do so on a rising tide and proceed with caution.

Smith Reef is two rocks, bare at half tide and marked at the south end by a red buoy lying ¾ mile southwestward of Long Neck Point.

Bold Rock, bare at half tide, is at the east end of the rocky ridge extending northward from Smith Rock. From Bold Rock the rocky ridge with depths of 6 feet (1.8 m.) or less extends ⅜ mile 316° true (NW. by N. mag.). There are numerous oyster stakes on this ridge.

A large group of rocks, covered at high water, lies ¾ mile northwestward of the south end of Smith Rock. The largest rock, near the middle of the group, is sometimes marked by a bush stake and a spindle.

STAMFORD HARBOR

(chart 221) is shoal and much obstructed by ledges and rocks, and is of little importance as an anchorage. It is commercially important, however, as the approach to Ship Canal and Rippowam River, which afford access to Stamford. The outer harbor is exposed to southerly and southwesterly winds, but small vessels can enter either Ship Canal or Rippowam River, the latter being generally used by those of less than 7-foot (2.1 m.) draft.

Anchorage.—A vessel of less than 10-feet (3 m.) draft can anchor just westward of the line of the Pine Island range lights and just northward of a 10-foot (3 m.) rocky patch, with High Water Rock bearing 259° true (W. mag.), distant 350 yards, in 13 feet (4 m.). Deeper draft vessels should anchor southward of the 10-foot (3 m.) rocky patch. Small craft can anchor off the yacht club and southward or southeastward of Rhode Island Rocks red buoy, where the depths are 5 to 7 feet (1.5 to 2.1 m.).

Shippan Point, the eastern point at the entrance of Stamford Harbor, is marked by a prominent residence and is surrounded by rocks which show at low water; **Forked Rock** is covered at high water. Red buoys mark the westerly edge of these rocks and the easterly side of the channel in Stamford Harbor. **The Cows** are a cluster of rocks, partly bare at a good low water, which are marked off the south end by a gas and bell buoy lying ⅞ mile southward of Shippan Point. Sunken rocks, with 14 feet (4.3 m.) or less over them, extend ¾ mile southeastward from Shippan Point.

Stamford Harbor Lighthouse is located on **Harbor Ledge** on the west side at the entrance of Stamford Harbor. The lighthouse is a white, conical tower on a pier. Broken ground surrounds the light to a distance of 300 yards, and is marked off its southeast edge by a black buoy.

Highwater Rock is awash at high water, and rocks bare at low water extend ¼ mile southward from it to a point 350 yards northeastward of Stamford Harbor Lighthouse.

Channel Rock, bare at low water and marked by a black buoy, lies on the west side of the channel eastward of Grass Island.

The **entrance channel** has been dredged to a width of 200 feet and a depth of 12 feet (3.7 m.) and extends from the 12-foot (3.7 m.) curve in the harbor to the junction of the East and West Branches. The channel is marked by buoys and by Pine Island range lights.

East Branch, or **Ship Canal,** has been improved by dredging a channel 100 feet wide and 12 feet (3.7 m.) deep to the head of navigation at the railroad. This channel had shoaled in 1925 to a depth of about 10½ feet (3.2 m.). The bottom of the channel is hard clay and there are rocks, partly showing at high water, on both sides of

the cut. The channel is marked by lights and sometimes by range targets erected in connection with dredging operations. The ranges, when in position, mark the axis of the dredged cuts, and by means of them small vessels of less than about 8-foot (2.4 m.) draft should have no difficulty in going up to the wharves, but strangers should proceed with caution. The deepest draft taken to the wharves is about 16 feet (4.9 m.) at high water. The depths at the principal wharves range from about 6 to 10 feet (1.8 to 3.0 m.).

West Branch, in the entrance to **Rippowam River,** has been improved by dredging a channel 100 feet wide and 9 feet (2.7 m.) deep, and by dredging an anchorage basin of the same depth and 200 feet wide at the head of the branch. The bottom of the channel is rocky and vessels of over 6-foot (1.8 m.) draft should not attempt this passage without a pilot or a favorable tide. The lower end of the anchorage basin is 400 feet above **White Rock;** the latter is 100 feet westward of the dredged channel and shows above high water. The head of navigation is at a dam at Oliver Street Bridge, 450 feet above the head of the anchorage basin. The depths at the principal wharves range from 5 to 8 feet (1.5 to 2.4 m.).

Stamford is a manufacturing city on the peninsula lying between East and West Branches. The principal items of commerce are coal, sand, and stone, general package freight, lumber and petroleum products, carried in steamers, schooners, and barges drawing from 6 to 16 feet (1.8 to 4.9 m.).

There are three wharves on West Branch open to public use; the others are for the owners' use exclusively. In the East Branch there is about 700 feet of frontage open to public use. Railroad connection exists at the head of the branch and along the wharves on the west side. There is no publicly owned terminal in the West Branch, but the city of Stamford has constructed one in the East Branch.

Pilots.—There is a local pilot who is employed by the deeper-draft vessels entering the harbor. Pilotage is compulsory for foreign and registered vessels drawing 9 feet (2.7 m.) or over if spoken. Charges for pilotage are $1.50 per foot of draft during the summer, and $2 per foot of draft in the winter.

The **harbor master** has charge of the berthing and anchoring of vessels.

Communication.—Steamers make regular trips to New York from the steamboat wharf on Ship Canal. Stamford is on the line of the New York, New Haven & Hartford Railroad.

Supplies.—Coal and water can be had at the wharves at Stamford. Provisions, gasoline, and other supplies can be obtained.

Repairs.—There is a shipyard and facilities for hauling small craft. The largest railway is 52 feet long, draft at high water 3 feet forward and 7 feet aft, and capacity about 40 tons.

Tides.—The mean rise and fall of tides is 7.3 feet.

Ice forms in the harbor and usually obstructs navigation for about six weeks in winter. Ice frequently extends down to the lighthouse, and sometimes beyond.

DIRECTIONS, STAMFORD HARBOR

From eastward.—Passing ½ mile or more southward of Norwalk Islands a 245° true (WSW. ¾ W. mag.) course will lead south-

ward of The Cows gas buoy off Shippan Point. Passing 100 yards westward of the buoy a 323° true (NNW. ⅜ W. mag.) course will lead westward of the red buoys on the east side of the entrance.

From westward.—Passing southward of Execution Rocks Lighthouse a 47° true (NE. by E. ⅛ E. mag.) course will lead to the entrance. Or passing southward of the red buoy off Greenwich Point a 51° true (NE. by E. ½ E. mag.) course will lead southward of the black buoy off Stamford Harbor Lighthouse.

Passing about midway between the red buoys and black buoy at the entrance east-southeastward of Stamford Harbor Lighthouse, the course up the harbor is 358° true (N. ¾ E. mag.) with Pine Island range lights in line ahead; a prominent church spire will be seen a little to the left of the range. This range leads too close to the west side of the channel, and deep-draft vessels should keep slightly to eastward of it.

Ship Canal.—Pass 70 feet eastward of Pine Island range front light and steer for two targets in range showing just to the left of Ship Canal lower light (black structure). When about 200 yards below the latter light and abreast a small island steer for two targets in range showing to the right of Ship Canal lower light and pass 50 feet eastward of the light. Then steer for two targets in range showing over the wharf of the Stamford Rubber Supply Co., on the east side of the channel, and pass 65 feet westward of Ship Canal upper light (red structure). When about 200 yards past the light steer for two targets in range showing to the left of the wharf of the Stamford Rubber Supply Co., with Ship Canal upper light astern. Then follow the wharves on the west bank at a distance of 50 feet.

Rippowam River.—Pass 75 feet southwestward of the horizontally striped buoy southward of Pine Island range front light and steer for the north end of the wall at Cook Point until approaching the red buoy. Pass 100 feet westward of the buoy and haul gradually northward for two black buoys. Then steer for the east end of the gasometer, passing 75 feet eastward of the black buoys, to a position 125 feet off the landing of the boat repair plant on the east bank. Then head 80 feet off the wharves on the east bank abreast White Rock and follow the wharves at this distance until 400 feet above the rock, above which the entire harbor is clear.

CAPTAIN HARBOR

(chart 222) is on the north shore of Long Island Sound, northward of Great and Little Captain Islands and the reefs between them, and affords shelter from all winds. The harbor is entered for shelter by vessels drawing 12 feet (3.7 m.) or less. The depths at the anchorage in the deeper part of the harbor, about ½ mile northward of Great and Little Captain Islands, are 15 to 30 feet (4.6 to 9 m.). Vessels of less than 7-foot (2.1 m.) draft anchor on the flats. The bottom is soft, but the entire harbor and entrances are characterized by bowlders, and strangers should proceed with caution, especially on the flats and other shoal areas which are not thoroughly developed.

The eastern entrance to Captain Harbor, between Flat Neck Point and Little Captain Island, is the clearer and better one for strangers.

The western entrance, northwestward of Great Captain Island, is also easy of access, but the broken ground in this entrance requires caution on the part of vessels using it.

Greenwich Point, lying 1½ miles westward of Stamford Harbor Lighthouse, is marked by a gray monument on a grassy hill. Reefs extend ¼ mile southeastward from Greenwich Point. **Woolsey Rock,** near the easterly end of the reefs, is bare at low water. A red buoy is placed nearly ½ mile southward of Greenwich Point and marks the south end of the broken ground off the point.

Flat Neck Point, the western end of Greenwich Point, is wooded and forms the easterly side of the easterly entrance to Captain Harbor. A reef of bare and sunken rocks extends over ¼ mile southwestward and westward from Flat Neck Point, and is marked at its southwest end by a red buoy.

A spot with 10 feet (3 m.) over it lies on the northeast side of the channel nearly ½ mile northeastward of the spindle on Hen and Chickens.

Greenwich Cove opens into Captain Harbor from eastward, northward of Flat Neck Point. It is of no commercial importance, and is frequented only by small craft. **Cove Rock** (depth 1 foot (0.3 m.)), marked by a horizontally striped buoy, and Finch Rock (depth 2 feet (0.6 m.)) lie in the entrance. The post village of **Sound Beach** is on Greenwich Cove.

Coscob Harbor, on the northeast side of Captain Harbor, has a channel depth of about 7 feet (2.1 m.) for a distance of 1 mile above the entrance to the railroad bridge at **Coscob** and **Riverside.** A channel 100 feet wide and 6 feet (1.8 m.) deep has been dredged in **Mianus River** for a distance of 1,300 feet above the bridge. For a distance of ½ mile above the improved channel to the head of navigation at **Mianus** the river has a narrow, somewhat crooked channel, with a least depth of about 2 feet (0.6 m.) at low water, which follows generally the edge of the marsh on the west side of the river. The deepest draft taken to the power plant below the railroad bridge is 12 feet (3.7 m.) and to Mianus 7 feet (2.1 m.). There is good anchorage for vessels of less than 7-foot (2.1 m.) draft in the channel below the yacht club.

The Riverside Yacht Club is prominent on the east side of Coscob Harbor ½ mile above the entrance. There is a large power plant on the west side, just below the bridge. The railroad bridge has a lift opening 66 feet wide. The overhead wires at the bridge are 110 feet (33 m.) above high water. There is a wharf and plant for the construction of launches and motors and a marine railway for small craft at the head of the improved channel above the bridge.

The **channel** of Coscob Harbor is easily followed as far as the yacht club, the principal dangers either showing above water or being marked. Passing on either side of Hitchcock Rock buoy, the channel leads between Diving Island and Peck Rock buoy, then 200 to 300 feet eastward of Goose Island, and then about 300 feet westward of Sunken Rock spindle and the landing at the yacht club. Above this point the channel is narrow. It leads about 300 feet from the east bank, heading for a barn in range with the middle of a span of the bridge until 350 yards below the bridge, and then leads for the lift opening.

The following are rocks in Coscob Harbor: The rock on the east side of the entrance westward of Bluff Islet is partly bare at high water. A rock with 3 feet (0.9 m.) over it lies 175 yards southward of it. **Salt Rock** is covered at half tide. **Ring Rock** is covered at high water. **Diving Island** is a mass of rugged bare rocks; the passage eastward of it is foul. These are numerous oyster stakes; the ledge extending from the shore northeastward of Diving Island is marked at the end by a private spindle and can. **Hitchcock Rock,** bare at a good low water, is marked by a horizontally striped buoy. **Peck Rock,** bare at low water, is marked by a black buoy. A rock covered at half tide lies on the west side of the channel 100 yards southeastward of **Saw Island;** the latter is marked by a house and sea wall. A sunken ledge lies 100 yards off the east side of the point northward of **Goose Island. Sunken Ledge,** covered at half tide, is marked at the northwest end by a spindle with red keg.

Newfoundland Reef is a small patch with 3 feet (0.9 m.) over it lying in the northeast part of Captain Harbor, 600 yards southward of the outer bare rock at the entrance of Coscob Harbor. It is marked on the south side by a red buoy.

Red Rock, bare at half tide, lies ¼ mile southeastward of Tweed Island. It is marked by a spindle, and on its south side by a horizontally striped buoy.

Tweed Island, also called **Finch Island,** has a sea wall on its southern side and lies on the south side of Chimney Corner.

Chimney Corner is a narrow inlet on the north side of Captain Harbor. A privately dredged channel, with a least depth of about 9 feet (2.7 m.) passes about 100 feet westward of Tweed Island on a northerly course, and then follows closely the west bank to the bulkhead on the west side of the cove 300 yards above the entrance. Small craft can anchor in the channel just above this point, favoring the bulkhead. A narrow, crooked channel, nearly dry at low water, leads to the head of navigation, ¾ mile above the entrance, as shown on the chart. There is a prominent, large, white residence, with red roof and adjacent white clock tower, on the point separating Chimney Corner and Indian Harbor.

Indian Harbor is an open bight with a depth of about 4 feet (1.2 m.) in the entrance and shoaling northward. Rocks extend nearly 200 feet from the shores at the entrance. A rock covered at high water lies in the middle 300 yards above the entrance; nearly 100 yards below this rock there is a rock covered at half tide eastward of mid-harbor, and another bare at low water westward.

Depths of 6 feet (1.8 m.) or less extend 250 yards southward from the point separating Indian Harbor and Greenwich Harbor. Bare ledges extend 200 feet southeastward of the point. Sunken rocks lying 100 and 250 yards southward of the point are marked by buoys. The yacht club, on the end of the point, usually maintains lights on a flagstaff during the summer.

Greenwich Harbor (chart 222) lies on the north side of Captain Harbor, east side of Field Point, and 2° true (N. by E. ⅛ E. mag.) from Great Captain Island Lighthouse. The harbor has been improved by dredging a straight channel 130 feet wide and 12 feet (3.7 m.) deep to the yacht club on the east point at the entrance; and thence 100 feet wide and 12 feet (3.7 m.) deep to within 500 feet of the causeway at the head, where the channel is widened to form a

turning basin. This channel passes 250 feet eastward of the landing on the east side of Round Island and then follows the wharves. The axis of the channel is sometimes marked by range targets erected in connection with dredging operations; a natural range for the axis of the channel is the east end of a large red brick building showing between a spire and a cupola, favoring the latter. The deepest draft of vessels entering the harbor is 15 feet (4.6 m.).

Greenwich is a town on the railroad, the wharves being on the point on the east side of Greenwich Harbor. Coal, water, gasoline, and other supplies can be obtained. There are facilities for the construction and repair of wooden hulls and for small repairs to machinery. The largest railway is 83 feet long, draft 5 feet forward and 8 feet aft. Steamers make regular trips to New York, and during the summer a ferry runs to Bayville, on Oyster Bay.

Terminal facilities.—There are eight wharves of the bulkhead and apron type along the eastern side of the channel and at the head of the harbor, five of which are in commercial use, and also several landings for pleasure craft. Public use of several of these wharves may be had by special agreement. There is no direct connection with the railroad. The town of Greenwich owns two small unimproved wharves, neither of which is accessible to commercial vessels.

Field Point, northward of Great Captain Island Lighthouse, is occupied by a settlement.

Byram Harbor is a bight, frequented only by small craft, at the northwest end of Captain Harbor northward of **Calf Islands. Wilson Head,** which shows at high water, is in the middle of the entrance of the bight, and is marked by a horizontally striped buoy on its south side. From eastward of Wilson Head a channel 50 feet wide and 6 feet (1.8 m.) deep has been dredged by private parties to the head of the bight, where there is an anchorage basin with a depth of 4 feet (1.2 m.). The entrance to Byram Harbor from eastward is between **Otter Rocks** and **Bowers Island.** The former are covered at high water, are marked by a red buoy on the south side, and should be given a berth of 100 yards; the latter is marked by a house and clump of trees, and from it a reef extends 200 yards north-northwestward, being marked at its end by a black buoy.

Entering Byram Harbor from southwestward, southward of Huckleberry Islands, there is a narrow channel used by launches between the northwest one of the Calf Islands and the two nearest rocks, sometimes marked by private spindles, northwestward. The rocks lying 90 yards off the southwest end of Huckleberry Islands are bare at low water. **Little Ross Rock** shows at high water, and **Great Ross Rock** is a rocky islet with some grass. The ledge lying 350 yards southwestward of Great Ross Rock is bare at low water. **Grassy Rocks** are covered at high water. The four large ledges lying northwestward and westward of Grassy Rocks generally show above water.

Jones Rocks, partly bare at high water, are at the southeast end of the foul ground which extends ¼ mile southeastward from the south end of Calf Islands. The southeast end of the rocks is marked by Jones Rocks Light, which is on the north side of the channel leading into Captain Harbor from westward.

Cormorant Reef lies northward of Great Captain Island, and part of it is bare at high water. A red buoy is placed northwestward

of the main part of the reef and close to a rock which is bare at about half tide.

Great Captain Island is ⅜ mile long, and is marked near its southeast end by Great Captain Island Lighthouse. The island is fringed with reefs. A red buoy is placed 400 yards southwestward of the island to mark the reef making off from that end. A rocky, broken area, on which the least depth found is 13 feet (4 m.), extends ⅜ mile west-northwestward from the island. The passage between Great and Little Captain Islands is foul.

Great Captain Island Lighthouse is a white tower on the south gable of a granite dwelling. The light is fixed white with a group of two red flashes every 10 seconds, 73 feet (22.3 m.) high, and visible 14 miles. The fog signal is an air siren, blast 3 seconds, silent 27 seconds.

Little Captain Island is two islands connected by reefs. There is a summer resort and landing on the island. **Little Captain Island East Reef** is an area of bowlders and broken ground which extends ⅜ mile eastward and northeastward from the island. It is marked at its eastern end by a gas and bell buoy. **Hen and Chickens** is a group of these rocks and bowlders lying 600 yards northeastward of Little Captain Island, and is marked by a spindle.

Repairs.—There are marine railways for small vessels at Coscob and Greenwich.

Tides.—The mean rise and fall of tides is 7.3 feet. The tidal **currents** have little velocity in the harbor except in the channel between Jones Rocks and Cormorant Reef, where the estimated velocity is about 1 knot.

Ice forms in winter in all the coves and over the greater part of Captain Harbor. It sometimes extends out to the line of Little and Great Captain Islands.

DIRECTIONS, CAPTAIN HARBOR

From eastward.—Passing southward of The Cows gas buoy off Shippan Point, steer for Great Captain Island Lighthouse on any bearing westward of 255° true (W. ⅜ S. mag.) which will lead southward of the red buoy off Greenwich Point. A 278° true (WNW. ⅜ W. mag.) course will then lead southward of the red buoy southwestward of Flat Neck Point.

It is advisable for vessels to follow the deeper water in the eastern entrance of Captain Harbor. Passing 250 yards eastward of the gas and bell buoy eastward of Little Captain Island, steer 316° true (NW. by N. mag.); or, passing 250 yards southward of the red buoy southwestward of Flat Neck Point, steer 293° true (NW. by W. mag.). Pass ¼ mile northward of Hen and Chickens spindle, steer 250° true (W. ⅞ S. mag.) for the south end of Calf Islands and select anchorage in the harbor.

From westward.—A course for Great Captain Island Lighthouse on any bearing northward of 46° true (NE. by E. mag.) will lead clear of dangers. A 20° true (NNE. ¾ E. mag.) course for Jones Rocks Light will lead 350 yards southeastward of Bluefish Shoal buoy and 200 yards southeastward of Four Foot Rocks buoy. Proceed with caution when crossing the broken, rocky area, on which the least depth found is 13 feet (3.9 m.), extending ⅜ mile north-

westward from the western end of Great Captain Island. Pass 100 yards southeastward of Jones Rocks Light, the same distance, northwestward of the red buoy northwestward of Cormorant Reef, and steer 70° true (E. ¾ N. mag.) in the harbor.

PORT CHESTER TO THROGS NECK

Port Chester Harbor (chart 222), lying 1 mile west-northwestward of Great Captain Island, is the entrance to Byram River, which leads to the town of Port Chester. The harbor is under improvement to secure a channel 150 feet wide and 12 feet (3.7 m.) deep to the entrance of Byram River at Fox Island; then 100 feet wide and 10 feet (3 m.) deep in Byram River to a point 900 feet below the head of navigation at Mill Street Bridge, including a turning basin at the steamboat wharf at Port Chester; and then 175 to 100 feet wide and 3 feet (0.9 m.) deep to a point 100 feet below the fixed bridge. In 1925 there was a depth of 12 feet (3.7 m.) in the 150-foot channel to the entrance of Byram River at the south end of Fox Island, thence 8 feet (2.4 m.) to the turning basin, thence 10 feet (3 m.) through the turning basin to Willet Avenue, thence 2 feet (0.6 m.) to the fixed bridge.

Port Chester Harbor is protected by a breakwater, which is marked at its south end by Port Chester Light. Small craft can anchor in the harbor west-southwestward of Port Chester Channel Light, where there is a small area with depths of 6 to 7 feet (1.8 to 2.1 m.). Vessels can select anchorage off the harbor between Great Captain Rocks and the south end of Calf Islands in a depth of about 16 feet (4.9 m.) exposed to southerly winds. From the harbor small motor boats can be taken through the slough on the north side of **Manursing Island** to Rye Beach. The fixed bridge crossing the slough is about 3 feet in the clear above high water.

Byram River has a length of 1 mile to Mill Street Bridge, a width of 100 to 300 feet, and is rocky. The deepest draft of vessels taken up to **Port Chester** is 13 feet (4 m.). The latter is an important town, with railroad communication, and steamers make regular trips to New York. Coal, water, gasoline, and other supplies can be obtained, and there are facilities for hauling out small vessels up to 5-foot draft. The principal items of commerce are building material, coal, ashes, and general merchandise, carried in barges and vessels of from 5 to 11 foot (1.5 to 3.4 m.) draft.

Terminal facilities.—Water terminals, 20 in number, with available dockage of 3,197 feet, are located on Byram River at and between Fox Island and the fixed bridge; one of these is connected with the main line of railroad by spur track. One terminal, with available dockage of 75 feet, is publicly owned, but is not used because of its inconvenient location; 18, with available dockage of 3,122 feet, are either corporately or privately owned; and 1 consists of an earth slope occupied by a trestle supporting a pipe line.

Directions, Port Chester Harbor.—The approach to Port Chester is obstructed by rocks, but is not difficult with the aid of the chart. From southwestward it is safer to pass eastward of Bluefish Shoal buoy. **Fourfoot Rocks** may be passed on either side, remembering that the buoy is at the south end of the rocks. Entering the harbor pass westward of Great Captain Rocks, eastward of Manur-

sing Island Reef, 150 feet southward of Port Chester Light (on end of breakwater), and 75 feet eastward of Port Chester Channel Light and 75 feet westward of the red buoy. The channel then curves northeastward into the river; a rock, covered at half tide, lies on the north side of the channel just westward of the entrance of the river. The channel in Byram River is fairly well defined at low water, but requires local knowledge for the best water; strangers should take it on a rising tide and proceed with caution.

Channel Rock, bare at low water, lies 250 yards eastward of Port Chester Light, and there is foul ground between.

Manursing Island Reef, the outer part bare at low water, extends 200 yards from the shore, and is marked at its end by a black buoy, which lies 200 yards southeastward of Port Chester Light.

Great Captain Rocks, lying ¼ mile southeastward of Port Chester Light, are three principal rocks, which are covered at high water. The southwesterly rock is marked by a private spindle with cage, and there is a red buoy on its south side. Rocks partly bare at low water extend nearly 100 yards west-northwestward from the spindle.

Broken ground and numerous rocks fringe the shore southwestward of Great Captain Island. There are several summer settlements on the south side of Manursing Island and Rye Neck.

Transport Rock is a part of several ledges, which lie ¼ to ⅜ mile off the south side of Manursing Island, and are partly bare at high water. Two sunken rocks lying southwestward of these ledges are marked by a red buoy and a black buoy; between the buoys there is a channel for small craft leading to **Rye Beach.** A sunken reef with 9 to 14 feet (2.7 to 4.3 m.) over it lies 600 yards southeastward of these ledges and ⅜ to ⅝ mile southward of the south end of Manursing Island. A ferry runs to Sea Cliff in summer.

Forlies Rocks are the outer part of the partially bare rocks and ledges which extend 600 yards from shore at the south end of Rye Beach. A private spindle is sometimes maintained on the south end of Forlies Rocks.

A channel good for a depth of 9 feet (2.7 m.) and marked by buoys, leads southward of Forlies Rocks to the wharf at **Oakland Beach.** Another channel with a least depth of 9 feet (2.7 m.) leads southward from this wharf to the sound, passing about 100 yards off the shore and about 25 yards southward of the red buoy No. 2.

Porgy Shoal, ½ mile east-northeastward of **Parsonage Point,** has a least found depth of 8 feet (2.4 m.) and is marked on its southeast side by a gas buoy with a spar marker alongside. The gas buoy is removed from station from December 15 to April 1 of each year when it is endangered by ice.

Scotch Caps are two rocky islets lying ¼ mile southwestward from Rye Neck. They lie on the northwest side of the extensive reefs which extend ⅞ mile in a southwesterly direction from Rye Neck. The southwesterly end of the reefs is marked by a gas buoy which lies nearly ⅝ mile south-southwestward of Scotch Caps, and by two spar buoys. The gas buoy is removed during the winter. The entire area of the reef lying northward and northeastward of the gas buoy is exceedingly broken, and should be avoided even by small craft in the absence of local knowledge.

Mill Creek, between Rye Neck and Hen Island, is used as a summer anchorage by small pleasure craft, and is exposed only to southwesterly winds. The depth in the creek shoals gradually from 8 feet (2.4 m.) between Scotch Caps and the southwest end of Hen Island to 6 feet (1.8 m.) abreast the end of Rye Neck, and then decreases gradually northeastward. There is foul ground on the northwest side of the creek near **Hen Island**; otherwise the principal danger in the creek is a rock, bare at low water and marked by a private spindle, lying a little northward of midway between the end of Rye Neck and the northeast end of Hen Island. The best entrance is between the two horizontally striped buoys off the entrance, lying ⅜ mile west-southwestward of Scotch Caps. In 1925 a privately marked channel for small craft led eastward of Scotch Caps to the yacht club on Rye Neck. At high water small craft can go for a considerable distance up the narrow part of Mill Creek, which is crossed at its lower end by two fixed highway bridges, 26 feet wide and 4 feet above mean high water.

Mamaroneck Harbor (chart 222), lying 3½ miles 16° true (NNE. ⅜ E. mag.) from Execution Rocks Lighthouse, is an open bight between Hen Island and Delancey Point. It is exposed to southerly winds, but affords shelter against northerly winds, the depths in the outer harbor ranging from 7 to 12 feet (2.1 to 3.7 m.). The important dangers are buoyed.

Approaching from eastward, pass southward and 100 yards or more westward of Scotch Caps gas buoy, and steer about 321° true (NNW. ½ W. mag.) for the western end of the large building on the eastern side of the entrance of the inner harbor, which will lead to Outer Steamboat Rock buoy. From Larchmont pass 100 yards southward of the breakwater, steer 57° true (ENE. mag.) to a position 200 yards southeastward of the black buoy off Delancey Point, and then steer 16° true (NNE. ⅜ E. mag.). Or, a 16° true (NNE. ⅜ E. mag.) course, with Execution Rocks Lighthouse astern, will lead 200 yards southeastward of the black buoy off Delancey Point. Anchor according to draft southward of the line joining the buoys marking **Turkey** and **Outer Steamboat Rocks.**

From the northwest end of the outer harbor a channel 80 feet wide and 7 feet (2.1 m.) deep, with increased width at the bends, has been dredged for a distance of ¾ mile in the inner harbor to the steamboat wharf at the village of Mamaroneck. This channel leads eastward of Grassy Knoll, thus cutting off the former sharp bends in the old channel. The end of the upper wharf on the southwest side of Mamaroneck Harbor, in line with a gabled house to the right of a large tree, leads in the axis of the outer section of the channel; pass about 80 feet off the wharf opposite Shootfly Island and 250 feet beyond it, taking care to avoid a ledge, with a depth of 1 foot (0.3 m.) at the outer end, extending nearly 200 feet off the point northward of the wharf. Then steer 338° true (N. by W. mag.), passing eastward of **Grassy Knoll** and 250 feet northeastward of the old steamboat wharf on **Harbor Island** until between a stake and barrel on a small grassy islet on the east side of the channel and a stake on the edge of the flats at the northeastern end of Harbor Island; then follow the west shore at a distance of 150 feet. Without local knowledge only small craft should attempt to go above

the entrance; the channel is fairly well defined at low water. A privately dredged channel, 60 feet wide and 6 feet (1.8 m.) deep, has been dredged through the flats northward of Harbor Island to the yacht club landing. The mean rise and fall of tides is 7.3 feet.

Mamaroneck has railroad communication and regular freight steamboat service with New York. The principal items of commerce are building material, coal, and ashes, carried in vessels from 4½ to 9 feet (1.4 to 2.7 m.) draft. Coal, gasoline, and boat supplies can be obtained, and there is a boat yard where repairs to small vessels can be made.

Terminal facilities.—Water terminals, five in number, with a total available dockage of 815 feet, are located at the head of navigation; two of these are connected by spur track with the electric trolley service; one of the terminals with available dockage of 70 feet is publicly owned; the remainder are privately owned, one of which, with available dockage of 60 feet, is open to the public.

The rocks at Mamaroneck Harbor rise abruptly, and some of them are bare at low water. Vessels should proceed with caution when inside the 5-fathom (9 m.) curve.

Black Tom shows above water, and there is a rock bare at low water southwestward of it. The large ledge which extends toward Black Tom from **Delancey Point** shows above water; there is a boat landing inside the ledge. A rock, bare at lowest tides, lies 350 yards off the southeast side of Delancey Point, and is marked by a horizontally striped buoy. Delancey Point is marked on its south side by an observation pier. A reef extends ¼ mile southward from the pier, and is marked at its south end by a black buoy.

A breakwater, which shows at high water, extends 1,410 feet south-southeastward from **Long Beach Point,** on the eastern side of the entrance of Larchmont Harbor. **Larchmont Harbor Light** is on the south end of the breakwater. The passage between the north end of the breakwater and the point is blocked by rocks, which are bare at low water.

Larchmont Harbor (chart 222) lies between Long Beach Point and **Umbrella Point,** and northward of Execution Rocks Lighthouse. The harbor is the headquarters of the Larchmont Yacht Club. The depths at the anchorage for small vessels in the harbor range from about 12 feet (3.7 m.) in the entrance to 6 feet (1.8 m.) near Rock Island. In summer the harbor is full of mooring buoys for small yachts. The rocks on the west side are marked, while unmarked shoals extend 200 yards from the eastern shore. The anchorage for larger vessels is westward of the breakwater.

The private lights in Larchmont Harbor are maintained by the yacht club from about May 10 to September 10 of each year, as follows: **Umbrella Rock,** marked by a spindle and green light, lies 250 yards eastward of Umbrella Point, and may be passed on either side; a few rocks of a breakwater, which was started on Umbrella Rock, are awash at high water. **South Ledge,** near the western shore, is marked at its north and south ends by a spindle with can; the north end of the ledge is bare at half tide and the south end is bare at low water. **North Ledge** is near the western shore southeastward of the yacht club. The south end is bare at half tide, and is marked by a spindle with round target and red light. The north end is bare at low water, and is marked by a

spindle with round target and green light. The principal landing, on the southeast side of the yacht club is lighted; the back landing, northeastward of the yacht club, is marked by a spindle, with box and red light, which is on the end of the ledge, bare at low water, just southward of the landing. A red light is shown from the flagstaff of the yacht club.

The entrance of Larchmont Harbor is on either side of Hen and Chickens. The easterly entrance is about 300 yards wide, with a depth of about 18 feet (5.5 m.), between the 15-foot (4.6 m.) spot lying 100 yards south-southwestward of the end of the breakwater and the unmarked rocky spots off the northeast end of Hen and Chickens.

Directions.—From eastward, passing 200 yards southward of Scotch Caps gas buoy, a 253° true (W. ½ S. mag.) course will lead the same distance southward of Larchmont Harbor Light, on the end of the breakwater, but the course leads close to the rock, with 15 feet (4.6 m.) over it, which lies ⅝ mile eastward of Larchmont Harbor Light. From southwestward, passing southeastward of the bell buoy off the south end of Hart Island, a 21° true (NNE. ¾ E. mag.) course will lead westward of the buoys marking Execution Rocks and eastward of the buoy marking the south end of Hen and Chickens. In the westerly entrance of Larchmont Harbor, northwestward of Hen and Chickens, the dangers are buoyed, and the entrance is easy of access with the aid of the chart.

Hen and Chickens, a reef bare at low water in places near the middle, lies off the entrance of Larchmont Harbor. The area with depths less than 18 feet (5.5 m.) is marked by four buoys—at its eastern end by a gas and bell buoy, at its northern end by a black buoy, at its western end by a red buoy, and at its south end by a red buoy. **Dauntless Rock** (depth 10 feet (3 m.)) and other rocky spots, with 14 to 15 feet (4.3 to 4.6 m.), lie off the northeast end of Hen and Chickens, and extend 300 yards northward from the gas buoy and the same distance eastward from the black buoy at the north end of the reef. There are also rocky spots, with 16 to 18 feet (4.9 to 5.5 m.), for a distance of 350 yards southwestward, and a rock with 16 feet (4.9 m.) the same distance southeastward, of the red buoy at the south end of Hen and Chickens.

Horseshoe Harbor is a small cove just westward of Larchmont Harbor. It is used as a launch anchorage, for which there are a number of float landings. The deeper water in the entrance favors the eastern side; the northwest side of the cove is bare at low water. A rock, bare at low water and marked by a private spindle with can, lies 60 yards off the south side of the point on the west side at the entrance.

Premium Point, marked by a prominent residence, is on the northeast side at the entrance of Echo Bay. **Spindle Rock,** lying 100 yards southwestward of Premium Point, is covered at high water, and is marked at its southwest end by a red buoy. The passage between Spindle Rock and Premium Point is practically blocked by rocks, which are awash at a good low water. There is a rock bare at low water at the northeast end of Spindle Rock.

Bailey Rock, bare at half tide, is near the end of a reef which extends about 200 yards off the point of **Davenport Neck,** on the

southwest side at the entrance of Echo Bay. The rock is marked off its eastern side by a gas buoy.

Echo Bay (chart 222) is a small bay lying north-northwestward of Execution Rocks Lighthouse, its entrance lying between Spindle Rock and Bailey Rock. The bay is an anchorage for small craft, and is generally fully occupied during the summer. The depths at the anchorage range from 4 to 15 feet (1.2 to 4.6 m.), and launches can anchor in the shallow cove on the northeast side of the harbor, entering between Harrison Islands and the rocky, grassy islet off the northwest side of **Echo Island.** There is a spindle on the end of the ledge making out from the southwest end of **Harrison Islands.** Vessels frequently anchor between the entrance of Echo Bay and **Hicks Ledge,** in depths of 20 to 24 feet (6.1 to 7.3 m.). (*See anchorages, port of New York, in appendix.*) On the northwest side of Echo Bay a dredged channel 100 feet wide and 10 feet (3 m.) deep, marked by buoys, leads to the wharf at **Beaufort Point.** From the head of the improved channel there are two dredged channels; the one leads northwestward to a coal and lumber wharf and has a depth of about 5 feet (1.5 m.), and the other leads northward to a small shipyard and marine railway and has a depth of 4 feet (1.2 m.).

New Rochelle, a town on the western shore of Echo Bay, has railroad communication. Coal, water, gasoline, and other supplies can be obtained. There are several marine railways, the largest for boats 60 feet long, 4 feet draft forward, and 6 feet aft. The principal items of commerce are building material, coal, and petroleum products, carried in vessels of 6 to 8 feet (1.8 to 2.4 m.) draft.

Terminal facilities.—Water terminals, six in number, with available dockage of 2,395 feet, are scattered along the water front at and between Beaufort Point and the head of navigation. One, with available dockage of 450 feet, is publicly owned; it is inconveniently located with reference to the business center; three, with available dockage of 1,645 feet, are privately owned; one, with available dockage of 200 feet, is corporately owned; and one, with a frontage of 100 feet, supports two pipe lines on trestles and is privately owned.

Storm warnings are displayed at New Rochelle.

Just southwestward of Echo Bay there is a stone pier, marked by a private light, which protects a private boat landing on its southwest side. The end of the ledge making out from the shore just southward of the pier is marked by a private spindle.

Pine Island is rocky and covered with brush. Two bare rocks lie 200 yards southwestward of Pine Island. Southwestward of the rocks there is a long, bare ledge, the southwest end of which is marked by a private spindle with cage. Southward of this spindle are two rocks, sometimes marked by private spindles; the southwesterly rock is bare at low water and the easterly one bare at half tide. Between these rocks and the spindle northward is a channel used by small craft between Echo Bay and Glen Islands. There is a clear channel southwestward of these rocks, between the southwesterly one and the black buoy northward of David Island.

Middle Ground is a large bowlder reef, near the middle of which there are a few bowlders which show at high water. The north end

of the reef is marked by a black buoy. **Emerald Rock** (depth 9 feet (2.7 m.)), off the western end of Middle Ground, is marked by a horizontally striped buoy. Detached sunken rocks lie off the south end of Middle Ground and are marked at the south end by a red buoy which lies 200 yards northward of Huckleberry Island.

David Island is occupied by numerous buildings. The high, square, red-brick tower, with pointed top, on the south end of the island is prominent in the western end of the sound. The principal landings, at the western end of the island, have a depth of 12 feet (3.7 m.) at the ends, but there are rocks with 8 feet (2.4 m.) over them in the approaches. Reefs partly bare at low water and marked at the north end by a black buoy extend 350 yards northward from David Island.

David Island is surrounded on its east and south sides by a foul area of islands and rocks, the passages between which should not be used by strangers, even in small craft. **Huckleberry Island**, at the eastern end of the group, is wooded. **Pea Island** and **Little Pea Island**, southeastward of David Island, are grass-covered, and there are rocks bare at low water southeastward of Pea Island. **Middle Reef**, ½ mile southward of David Island, has some bowlders which show at high water. **Lower Green Flats**, between Little Pea Island and Middle Reef, is a bowlder patch partly bare at the lowest tides. The Huguenot Yacht Club maintains a buoy on the northeast side of Lower Green Flats and one on the east side of the rock bare at low water lying 500 yards to westward, from June 15 to October 15 of each year. The channel between these reefs should not be attempted without local knowledge.

East and **South Nonations** are rocks bare at half tide between Middle Reef and Hart Island. South Nonations is marked on its south side by a red buoy.

New Rochelle Harbor is a narrow channel between Davenport Neck, Glen Islands, and the mainland, and lies off the southerly part of the town of New Rochelle. It has been improved by dredging a channel 120 feet wide and 8 feet (2.4 m.) deep from the deep-water channel between Glen Islands and Davenport Neck through New Rochelle Creek up to a point about 300 feet below the dam at the head of navigation in the vicinity of Leland Avenue. The water terminals, eight in number, are located mainly along the shore of this improvement. Of these, the public wharf is not used, due to lack of water caused by shoaling, but two privately owned wharves are open to public use. The principal items of commerce are coal and building material, carried in vessels of 6 to 8 feet (1.8 to 2.4 m.) draft.

The channel on the northwest side of Glen Islands is much used as an anchorage by small pleasure craft; it is well marked from southwestward by private spindles and cans, and is used extensively by small craft bound to the club on **Travers Island**. A rock, bare at low water and marked by a spindle, lies on the south side of the channel, and 150 yards westward of the wharf at the north end of Glen Islands.

Glen Islands are used as a pleasure resort. The steamboat wharf, at the north end of Glen Islands, has a depth of about 11 feet (3.4 m.) alongside. Opposite the wharf there is a boat landing at the southwest end of Davenport Neck; just off the landing there is a rock bare at low water.

New Rochelle Harbor can be approached from northeastward between Middle Ground and Pine Island. (See the description of Pine Island preceding.) The easterly approach is between Huckleberry Island and the red buoy 200 yards northward, then between the black buoy northward of David Island and the red buoy marking the southwesterly rock northeastward, then about 100 feet westward of Spindle Rock black buoy, the same distance southward of Harbor Rock buoy, and then about 100 feet eastward of the steamboat wharf at the north end of Glen Islands. **Spindle Rock,** bare at three-quarters ebb, is marked on its south side by a red buoy and on its north side by a black buoy. **Spindle Rock Beacon,** white wooden crate on iron spindle, is maintained on the rock from April 1 to December 1 by the Huguenot Yacht Club. A rock with 6 feet (1.8 m.) over it lies midway between Spindle Rock and the bare rock lying 125 yards northeastward of Aunt Phebe Rock.

The approach to New Rochelle Harbor from southwestward is through City Island Harbor, passing eastward of Rat Island and the black buoy marking the rocks southeastward of Chimneysweeps; the channel then leads westward of Machaux Rock buoy, then between David Island and Goose Islands, and then between Aunt Phebe Rock light and Corning Rock buoy. Strangers should proceed with caution when crossing the shoals, on which the general depths are 8 to 12 feet (2.4 to 3.7 m.) lying between Machaux Rock and Goose Islands. There is also a clear channel between the red buoy marking South Nonations and the reef extending northwestward from the north end of Hart Island.

Anchorage is prohibited in the eastern and southern approaches to New Rochelle Harbor. (*See "Anchorages, port of New York," in the appendix.*)

Aunt Phebe Rock, bare at half tide, is marked by a light and fog bell. The channel is westward of the light, and is marked on its west side by **Corning Rock** buoy (black), which lies about midway between the light and the wall surrounding Goose Islands. Southeastward of Corning Rock buoy the channel is but little over 200 feet wide between it and a reef, bare at low water, making off from David Island.

R. R. Stevens Rock, with 2 feet (0.6 m.) over it, lies southwestward of the wall surrounding Goose Islands, and is marked off its southeast end by a horizontally striped buoy.

Machaux Rock, bare at low water and marked on its west side by a red buoy, lies nearly ½ mile southwestward of the tower on the south end of David Island; and there is a rock, covered at half tide, midway between the tower and Machaux Rock, which is marked in summer by a private buoy.

Goose Islands, between David Island and Glen Islands, are surrounded by a wall, which shows above water. Westward of Goose Islands there are several bare rocks off the southeast side of Glen Islands, but there is a rock, bare at low water, at the southwest end of the bare rocks.

Twin Islands are two wooded islands joined to each other and to **Hunters Island** by a causeway. An islet with a few trees and two bare rocks lie 200 and 400 yards, respectively, northeastward of Twin Islands. Rocks, bare at low water, lie 100 yards southeastward of the bare rocks and 175 yards southeastward of the islet. Rocks,

bare at low water, extend about 80 yards southward of Twin Islands. Two bare bowlders lie 70 yards off the southwest end of Twin Islands. Lying 175 yards southward of the bowlders there is a rock, which is bare at half tide and marked by a private spindle and round cage; the entrance of Pelham Bay has a clear width of over 200 yards southwestward of this spindle.

Rocks, a few of them bare at half tide, extend nearly ⅜ mile eastward from the western shore at the entrance of Pelham Bay, and are marked near the eastern end by a spindle, but sunken rocks extend about 100 yards eastward and northward from the spindle. The range of the prominent chimney on Hart Island and the east end of Chimneysweeps leads eastward of the rocks on the southwest side at the entrance of Pelham Bay.

Pelham Bay lies between Hunters Island and Rodman Neck, and ½ mile northward of the north end of City Island. There is a yacht club and landing on the southwest side of the bay ⅜ mile above the entrance, and many small boats anchor in the clear part of the bay off and above the landing in depths of 4 to 6 feet (1.2 to 1.8 m.). Below the landing the depths near the middle of the bay range from 8 to 10 feet (2.4 to 3 m.). There are bowlders on the shoal, which extends 150 yards off the landing, and it should be crossed with caution at low water. The shore of Rodman Neck above the yacht club is very foul, with bowlders, as shown on the chart. Rocks, bare at half tide, lie 400 yards northward of the landing.

The channel between City Island and Rodman Neck is used extensively as an anchorage by small pleasure craft during the summer. There are yacht clubs and railways for small craft on the northwest side of City Island, and gasoline and other supplies can be obtained. The shores are generally fringed with bowlders and should be approached with caution. The north shores of High Island and City Island northeastward of the bridge are very foul, and boats should avoid the shoals with depths less than 12 feet (3.7 m.) on that side. On the north side of the channel the principal danger are the rocks in the entrance of Pelham Bay, which are marked near the easterly end by a spindle, and a ledge bare at low water which lies ¼ mile northward of the bridge and about 110 yards southeastward of the south end of an island. Southwestward of the bridge the range on the north side of Twin Islands and the south opening in the draw will lead in about the best water. The **bridge** joining the north end of City Island to Rodman Neck is a center-pier draw, with openings 53 feet wide and 12 feet above mean high water when closed on both sides.

High Island is wooded and lies 200 yards eastward of the north end of City Island, with foul ground between.

Chimneysweeps, two prominent bare rocks, lie 300 yards northeastward of High Island; the passage between the island and the rocks should be used with caution. A rock bare at low water lies 50 yards west-southwestward of the northwesterly rock, and another lies close to its north side. Rocks with 5 to 6 feet (1.5 to 1.8 m.) on them lie 275 yards east-southeastward of the Chimneysweeps, and are marked on the east side by a black buoy.

Rat Island is a high bare rock, marked by a number of sheds, lying 600 yards off the easterly side of City Island and the same distance south-southeastward of High Island. **Green Flats** is a

bowlder reef, the higher parts awash at high water, which extends 350 yards northwestward and westward from Rat Island.

Hart Island, nearly 1 mile long, is occupied by the buildings of one of the institutions of the city of New York. There is a high buff-brick chimney near the middle of the southeast side of the island. A red bell buoy marks the end of the reef which extends nearly 200 yards southeastward from the south end of the island. **The Blauzes,** partly bare at high water, are a part of the reef which extends 600 yards northwestward from the north end of Hart Island.

CITY ISLAND HARBOR

(chart 223), also called **Hart Island Roads,** lies between Hart Island and City Island, and is well sheltered from easterly and westerly winds. It is an important anchorage for coasting vessels in the western end of Long Island Sound. Besides serving as a harbor of refuge, it is often used by vessels desiring pilots or towboats, or waiting for orders.

The usual **anchorage** for deep-draft vessels is southeastward of City Island, southward of a line joining the south ends of Hart and City Islands. When anchoring, avoid **Deep Reef,** which is a small rocky patch, with about 5 fathoms (9 m.) over it and 9 to 13 fathoms (16 to 24 m.) around it, lying 450 yards eastward of the end of the wharf at the south end of City Island. The marks for this spot are the northern wharf on the east side of City Island in range with the little hut on High Island, and the sea wall at the south end of City Island in range with a dark church spire in Westchester. (*See also the anchorage chart for the port of New York in the appendix.*)

Vessels of less than 14 feet (4.3 m.) draft anchor anywhere southward of a line drawn from the north end of Hart Island to Town Dock on City Island. **Town Dock** is the large wharf ⅝ mile above the south end of City Island. Submarine water pipes and cables cross from just above Town Dock, City Island, to the wharf on Hart Island, a little over ⅜ mile above its south end; vessels should be careful not to anchor in that locality. The western shore of Hart Island and the wharves on City Island should be given a berth of about 150 yards.

City Island is 1¼ miles long, and at its northern end is connected with the mainland by a drawbridge. There are several shipyards, engaged principally in building and repairing yachts, and storage facilities for laying them up for the winter.

Pilots.—City Island is one of the headquarters for East River (Hell Gate) and Sound pilots.

Towboats will generally be found at City Island.

A reporting station is located near the south end of City Island, from which passing vessels are reported at the Maritime Exchange, New York City, and to the Associated Press.

Supplies.—Coal, gasoline, and supplies of all kinds can be had at City Island. Water is piped to some of the wharves, and can also be had from towboats.

Repairs to vessels and the machinery of steamers can be made at City Island. The largest railway is 165 feet long, draft 12 feet forward and 21 feet aft, and has a capacity of about 1,000 tons.

Ice.—In the winter drift ice sometimes interferes with navigation to the extent that sailing vessels are obliged to take a towboat.

Tides.—The mean rise and fall of the tides is 7.2 feet.

EAST CHESTER BAY

(chart 223), between City Island and Throgs Neck, has general depths of 7 to 10 feet (2.1 to 3 m.). The shores of the bay are fringed with bowlders, and, together with all shoals, should be approached with caution. In addition, there are indications of scattered bowlders in the bay, and it is advisable to proceed with caution, especially where the depth is not more than 3 feet (0.9 m.) greater than the draft. At the head of the bay there is a buoyed channel, with a least depth of about 5 feet (1.5 m.), which follows the eastern shore to the mouth of East Chester Creek. There are several landings, used by motor boats, on the western shore of the bay and on the northwest side of City Island.

Big Tom, bare at low water and marked by a horizontally striped buoy on its south side, lies 600 yards 247° true (WSW. ⅞ W. mag.) from the south end of City Island. Other rocks show around it at extreme low tides, and the rock should be given a berth of over 200 yards. Bowlders with a least depth of 2 feet (0.6 m.) lie 130 yards, 85° true, from Big Tom, and a depth of 7 feet (2.1 m.), hard bottom, 200 yards 60° from Big Tom. A black buoy marks the easterly extension of this reef.

Cuban Ledge is covered at half tide and is marked by a horizontally striped buoy on its southeast side. Broken ground, with depths of 5 to 6 feet (1.5 to 1.8 m.), extends ¼ mile southeastward and northwestward from Cuban Ledge, as shown on the chart.

East Chester Creek has been improved by dredging a channel 150 feet wide from the bay to Pelham Bridge, thence 5 feet (1.5 m.) deep with varying widths to the head of improvement. Improvements are in progress to secure a channel 5 feet (1.5 m.) deep with a width of 150 feet from below Pelham Bridge to 700 feet above the railroad bridge, thence 100 feet wide to about 1,200 feet below Post Road Bridge, and thence 70 feet wide to about 300 feet above Fulton Avenue Bridge.

East Chester has some trade in building material, coal, and petroleum products, carried in vessels of 6 to 10 foot (1.8 to 3 m.) draft. The water **terminals** are nine in number, located in the upper 3,500 feet of the improved channel. One publicly-owned terminal, with available dockage of 500 feet, is open to the public; four, with available dockage of 1,600 feet, are corporately owned; and four, with available dockage of 475 feet, are privately owned; one of the corporately-owned wharves, with available dockage of 1,250 feet, is open to the public.

Bridges.—The following bridges cross East Chester Creek: Pelham Bridge, at the entrance, has a double-lift opening 60 feet wide; the railroad bridge, 700 feet above Pelham Bridge, has a lift opening 68½ feet wide; Post Road Bridge, 1.8 miles above Pelham Bridge, has an opening 100 feet wide; Fulton Avenue Bridge, 2.2 miles above Pelham Bridge, has a double-lift opening 70 feet wide and 13 feet above high water when closed.

Tides.—The mean rise and fall of tide is 7.1 feet.

ORIENT POINT TO PORT JEFFERSON

From Orient Point to Horton Point the shore is generally bluff and rocky. The 10-fathom (18 m.) curve lies from ¼ to ¾ mile from shore, and the shoaling is generally abrupt. The outlying dangers are Orient Shoal and the rocky patch northward of Horton Point. The **prominent features** are Browns Hills, the white church spire at Orient, the Coast Guard station at Rocky Point, a prominent standpipe in the northwest part of Greenport, and Horton Point Lighthouse.

Several rocky shoals, including **Orient Shoal,** with a least depth of 7 feet (2.1 m.), lie off the shore in the vicinity of **Rocky Point;** the chart is the guide for avoiding them. The north end of Orient Shoal is marked by a black buoy.

Horton Point Lighthouse, on the summit of the bluff at Horton Point, is a white, square tower, with attached dwelling. The light is fixed white, 103 feet (31 m.) high, and visible 16 miles.

A rocky shoal, with a least found depth of 28 feet (8.5 m.), lies 1⅝ miles north-northeastward of **Horton Point.** The shoal is a ridge having an east-northeast and west-southwest direction, and the shoaling is abrupt on its northwest and southeast sides.

From Horton Point to Old Field Point the shore is a line of high bluffs, especially westward of Mattituck. The shore is fringed with shoals, which extend off a greatest distance of 1½ miles and rise abruptly from the deep water of the sound. There are generally bowlders near the shore on the shoals, which extend off ½ mile in places. The old cordwood landings, formerly shown on the charts, are not used; there are usually a few old buildings on the beach which mark the former location of each of the landings.

Goldsmith Inlet, 2¼ miles southwestward of Horton Point Lighthouse, is dry at low water, and generally has a depth of about 3 feet (0.9 m.) at high water. It is closed at times by northwest winds, but is dug out by clam diggers every spring. There are rocks bare at low water and with about 2½ feet (0.7 m.) over them at high water in the entrance at the old mill. The tidal currents are strong in the entrance. The depths inside the entrance are 8 to 10 feet (2.4 to 3 m.) at low water.

A shoal with little depth in places fills the bight between Horton Point and **Duck Pond Point,** and extends off a greatest distance of nearly 1 mile abreast Goldsmith Inlet. The bluffs begin about 1 mile westward of Goldsmith Inlet and reach their greatest elevation just eastward of Duck Pond Point; there is a grassy valley, forming a break in the bluffs, just westward of the point. There are bowlders, bare at low water, on the shoals which fringe the shore between Duck Pond Point and Mattituck Inlet.

Mattituck Inlet (chart 299) lies 6¾ miles west-southwestward of Horton Point Lighthouse. The entrance is between two short jetties, and is also marked by a long break in the bluffs at the inlet. The outer end of the west jetty is marked by a light. The inlet has been improved by dredging a channel 7 feet (2.1 m.) deep at low water, with a width of 100 feet at the entrance and 80 feet to the drawbridge, ⅞ mile above the entrance, and thence a channel 80 feet wide and 7 feet (2.1 m.) deep at high water a further distance of about 1 mile to Mattituck. The sides of the channel are sand and

gravel. Shoaling is liable to occur at the entrance, and the inlet should not be used by strangers. In 1925 the entrance had shifted to eastward and had a controlling depth of 5 feet (1.5 m.).

The **tidal currents** have an estimated velocity of about 5 knots at strength in the narrow parts of the entrance of Mattituck Inlet and at the site of the old dam at the drawbridge; slack water occurs possibly one hour after the time of high and low water. There is a bad sea in the entrance, with northerly and westerly winds. The mean rise and fall of the **tides** is 4.8 feet at the entrance, about 4 feet at the drawbridge, and about 3.5 feet at Mattituck. The inlet is rarely closed by ice.

The drawbridge is about 6 feet above high water, and has an opening about 57 feet wide on the west side of the center pier; the east opening is blocked. There is a private landing on the west bank just below the drawbridge; fresh water and a small quantity of gasoline can be obtained.

Mattituck is a village on the railroad. Repairs can be had for motors. Provisions, ice, gasoline, and hard coal can be obtained. The commerce consists chiefly of vegetables and oyster seed, carried in vessels of 3 to 5½ feet (0.9 to 1.7 m.) draft.

Terminal facilities.—There is one small landing, with 150 feet of available dockage, open to general use, and several private trestles at which landings are made. The landing is of light construction, being built of stakes; it is removed each year about November 1, and rebuilt about April 1. The commerce is of such a light nature that much of it can be handled from small boats run up on the shore.

Between Mattituck Inlet and Port Jefferson the shore is fringed with rocks and shoals extending in places 1½ miles from shore. The outer ends of the shoals are marked by black buoys.

Horse in Bank are white patches in the brush-covered bluff at **Friar Head,** which resemble a horse's head, facing eastward. There are a few houses on the beach at the nose. This feature is at the western end of **Roanoke Point Shoal,** and 14 miles westward of Horton Point Lighthouse.

At **Fresh Pond Landing,** 2¼ miles westward of Friar Head, there is a considerable break in the bluffs. There are a few houses and a prominent water tank in the valley.

Wading River, at the western end of **Herod Point Shoal,** has a reported depth of about 5 feet (1.5 m.) at high water. The valley of the river forms a broad break in the high bluffs.

Tuttles White Bank is a high, white bluff, ⅝ mile westward of Wading River.

Mount Sinai Harbor is marked by a low break, nearly 1 mile long, in the beach, and is a prominent feature. The entrance is narrow, by the last survey was nearly dry at low water, and is subject to change. Some dredging has been done by private parties. There are strong tidal currents in the entrance.

Mount Misery is a hill 180 feet (55 m.) high lying between Mount Sinai Harbor and Port Jefferson. It slopes off gradually toward the Sound, where there are bluffs about 60 feet (18 m.) high.

(chart 361[4]) is on the south shore of Long Island Sound, eastward of Old Field Point. The entrance is between two converging jetties, between which a channel 200 feet wide and 12 feet (3.7 m.) deep has been dredged into the harbor. There is a light and fog signal on the east jetty and another light on the point on the west side at the inner end of the entrance. There are shoals with little depth on both sides of the channel from the entrance to buoy No. 1, inside the entrance. The harbor is easily entered by powered vessels, but sailing vessels require a favorable wind or current. The deepest draft of vessels entering is about 16 feet (4.9 m.) at high water; at ordinary low water a draft of 10 feet (3 m.) can be taken through the entrance.

The harbor is 1½ miles long, and has a clear width of about ½ mile in its widest part; the depths are 10 to 12 feet (3 to 3.7 m.) for a distance of ½ mile from the head, and thence 20 to 30 feet (6 to 9 m.) nearly to the black buoy inside the entrance. There are depths of 12 to 15 feet (3.7 to 4.6 m.) at the outer part of the steamboat wharf, 11 feet (3.4 m.) at the outer part of Bayles's shipyard wharf, and 8 to 12 feet (2.4 to 3.7 m.) at the wharves at the yacht storage basin on the southwest side of the harbor.

Port Jefferson is a town at the southern end of the harbor. The principal industry is shipbuilding and repairing, for which there are excellent facilities. There are also good facilities for laying up yachts during the winter. The commerce consists chiefly of fruit, vegetables, sand, and gravel, carried in vessels and barges of 6 to 10 feet (1.8 to 3 m.) draft.

Terminal facilities.—Water terminals, three in number, with available dockage of 1,625 feet, are located at and near the head of navigation. One, in fair condition, with available dockage of 250 feet, is privately owned, and two, in good condition, with available dockage of 1,375 feet, are corporately owned. Two, with available dockage of 875 feet, are open to the public, and one, with available dockage of 250 feet, has mechanical appliances for handling cargoes. None has rail connection. All are of open pile construction.

Conscience Bay is entered through a long, narrow channel at the northwest end of the harbor. The bay and entrance have a depth of 1 to 2 feet (0.3 to 0.6 m.) at low water.

Setauket Harbor, on the western side of Port Jefferson Harbor, has a narrow, crooked channel, with a least depth of about 2 feet (0.6 m.) and usually marked by stakes, leading to the village of **Setauket,** on the south shore of Setauket Harbor, about 1 mile above the entrance.

Supplies.—Coal, gasoline, and supplies of all kinds can be obtained. Water can be had at the principal wharves.

Repairs.—There are several marine railways; the largest is 210 feet long, draft 12 feet forward and 21 feet aft, and has a capacity of about 1,200 tons. There is a machine shop where ordinary repairs can be made.

Communication.—Port Jefferson has railroad communication, and steamers make regular trips from Bridgeport for the greater part of the year. A bus line affords communication across the island to Patchogue, Riverhead, and Greenport.

Ice forms over the entire harbor and interrupts navigation in very cold weather, but does not endanger the shipping in the harbor.

Currents.—In the channel just south of the jetties, slack water occurs about the time the current turns eastward and westward at the Race (about 2½ hours after high and low water at New London). The strength of flood and ebb occurs about 3 hours before the current turns eastward and westward at the Race (about ½ hour before high and low water, respectively, at New London), and has an average velocity of 3 knots. The flood sets 150° true (S. by E. ¾ E. mag.) and the ebb in the opposite direction. Vessels at anchor in the harbor swing with the wind.

DIRECTIONS, PORT JEFFERSON HARBOR

From New Haven.—From the main entrance of New Haven Harbor between Southwest Ledge Lighthouse and Luddington Rock Breakwater, a 209° true (SW. ½ S. mag.) course for 17 miles will lead to a position off the entrance of Port Jefferson Harbor westward of Mount Misery Shoal.

From Bridgeport.—From buoy No. 4, at the entrance of Bridgeport Harbor, a 159° true (S. ⅞ E. mag.) course for 11 miles will lead to the buoy at the entrance of Port Jefferson Harbor.

The tidal current in the Sound should be considered in shaping the course across it. (See "Currents, Long Island Sound" on p. 119.)

Or, a 176° true (S. ⅝ W. mag.) course with Stratford Shoal (Middle Ground) Lighthouse astern will lead for the entrance of Port Jefferson Harbor.

Approaching from westward, give Old Field Point Lighthouse a berth of ½ mile and steer for the light on the east jetty on any course southward of 124° true (SE. mag.).

Mount Misery Shoal, the principal danger in the approach to Port Jefferson, will be avoided by keeping Old Field Point Lighthouse bearing southward of 248° true (W. by S. mag.). The range of the light on the east jetty and the light on the west side of the entrance inside the jetties, bearing 176° true (S. ⅝ W. mag.), leads clear westward of Mount Misery Shoal.

Pass about 250 yards westward of the perpendicularly striped buoy at the entrance of Port Jefferson Harbor, and steer 153° true (S. by E. ½ E. mag.) through the middle of the narrow entrance inside the jetties, heading for the end of a pier on the western shore of the harbor, or for a flagstaff, which is a better mark, southward of the pier. Can buoy No. 1 will be nearly ahead; pass 100 feet or more westward of it and steer about 136° true (SE. by S. mag.) up the middle of the harbor. Good anchorage in 10 to 12 feet (3 to 3.7 m.) can be had for a distance of ½ mile from the head.

OLD FIELD POINT TO EATON NECK (CHART 1213)

Old Field Point is a low bluff, on the summit of which is the lighthouse. Bowlders extend a short distance off the point and the lighthouse should be given a berth of about ¼ mile, even by small craft. A rocky patch with 17 feet (5.2 m.) over it lies ⅜ mile northeastward of the lighthouse.

Old Field Point Lighthouse is a white tower on a gray dwelling. The light is fixed white, 76 feet (23.2 m.) high and visible 14 miles.

Crane Neck Point, 2 miles westward of Old Field Point, is a bare bluff about 90 feet (27 m.) high.

Smithtown Bay is a broad, open bight on the south side of the Sound and extends about 7 miles westward from Crane Neck Point. Rocky shoals extend 1 mile in places from the shore, the water shoaling abruptly from 7 fathoms (13 m.) in places. A good summer anchorage in 5 to 8 fathoms (9 to 15 m.), sheltered from easterly winds, is found about 1 mile southward of Crane Neck Point.

Stony Brook Harbor is a shallow bay in the southeastern part of Smithtown Bay. The channel is over a bar which extends ¾ mile off the entrance; it has a least depth of about 2 feet (0.6 m.) just outside the entrance, and 1 foot (0.3 m.) just inside the entrance northeastward of the first islet. On the east side of the harbor, ½ mile inside the entrance, there is a bulkhead wharf at the village of **Stony Brook.** The railroad station is about 1 mile from the wharf. Only small craft enter the harbor; the greatest draft is about 7 feet (2.1 m.) at high water, and there is about this depth at the wharf. The estimated velocity of the tidal currents is about 5 knots in the narrowest part of the entrance.

At times there is a barrel buoy at the entrance to the channel at the outer edge of the bar, the depths shoaling abruptly from 8 fathoms (14.6 m.) at this point. The range of a prominent white spire in Stony Brook and a green house with white trimmings on the spit on the east side of the entrance leads to the buoy. From the buoy the channel trends east-southeastward for ⅓ mile, and then curves gradually southward to the west side of the spit on the east side of the entrance. The channel then leads in mid-channel northeastward of the first islet, passes close to the east side of the northeast end of the islet, and then follows the east bank to the wharf.

There is a high bluff between Stony Brook Harbor and Nissequogue River, another between the latter and **Sunken Meadow Creek,** and bluffs in places between the latter and Northport Bay.

Nissequogue River is a shallow, crooked stream, the mouth of which is about 4 miles westward of Stony Brook. There are rocks and shoals, bare at low water, on the bar outside the entrance, through which there is a narrow channel, sometimes marked by stakes, with a depth of about 1 foot (0.3 m.) at low water. About ½ mile southwestward of the mouth of the river is a State hospital, a prominent group of buildings with green roofs and a large red-brick chimney; there is a red standpipe farther westward. The railroad station is **Kings Park.**

There is a prominent tower about ⅝ mile inland and 2 miles eastward of Northport Bay.

Eaton Neck is a prominent, wooded head, with elevations of 100 feet (30 m.) or more, and marked at its north end by the lighthouse. The northwest end of the neck is a low spit. On the west side of the spit, ½ mile southwestward of the lighthouse, there are two small jetties between which is the entrance to a pond which has been dredged inside the spit by a sand and gravel company. There is a depth of about 8 feet (2.4 m.) through the entrance, favoring the south jetty.

Eaton Neck Lighthouse is a white, stone tower with attached dwelling at the north end of the high land of Eaton Neck. The light is fixed white, 144 feet (44 m.) high and visible 18 miles. The fog signal is an air siren, blast 5 seconds, silent 40 seconds.

A shoal with rocky patches and bowlders in places extends 2⅝ miles northward. from Eaton Neck. There are bowlders and little depth for a distance of ¼ mile from shore; farther out are shoals on which the least depth found is 13 feet (4 m.), which are marked by a black buoy, lying ⅞ mile north-northeastward of the lighthouse. A rocky patch, with 16 to 24 feet (4.9 to 7.3 m.) over it, lies 1½ to 1¾ miles northward of the lighthouse; the 16-foot (4.9 m.) spot is marked by a horizontally striped buoy. The outer part of the shoal is a rocky ridge, on which the least depth found by a careful development is 21 feet (6.4 m.), lying 1¾ to 2⅝ miles northward of the lighthouse. The best channel across the shoal is about midway between the black buoy and the horizontally striped buoy, where the least depth indicated by the survey is 28 feet (8.5 m.); but it is not advisable for vessels of a greater draft than about 18 feet (5.5 m.) to use it. Otherwise, vessels of a greater draft than about 15 feet (4.6 m.) should pass in mid sound northward of the entire shoal, between it and the 4¾-fathom (8.5 m.) patch lying 2 miles southward of Sheffield Island.

HUNTINGTON BAY

This bay (chart 224), on the south shore of Long Island Sound just westward of Easton Neck, is an excellent anchorage for large vessels, protected against all but northerly winds. The bay is about 2½ miles long in a southerly direction and 1 mile wide abreast West Beach. The depths in the bay range from 4¾ to 6 fathoms (8.5 to 11 m.) until 1½ miles from its southern end, and anchorage can be selected according to draft and direction of wind. Farther in there are depths of 20 feet (6 m.) or less in places as shown on the chart, the 18-foot (5.5 m.) curve extending ¼ mile from the east shore, ⅜ mile from the west shore, and ¾ mile from the south shore. **Anchorage** with shelter from northwesterly winds can be had for small vessels at the southwesterly end of Huntington Bay ¼ to ⅜ mile northeastward of Lloyd Harbor Lighthouse and the same distance eastward of the unused light tower on East Beach, in 3 to 6 fathoms (5.5 to 11 m.). The arms of the bay are secure harbors, Northport Bay being generally used by vessels.

Lloyd Harbor extends westward from Huntington Bay nearly to Oyster Bay, from which it is separated by a narrow strip of beach at high water. Vessels of less than 7-foot (2.1 m.) draft can anchor just inside the entrance, where the depths are 7 to 11 feet (2.1 to 3.4 m.). The narrow part of the harbor extending westward has a narrow, crooked channel, with a least depth of about 3 feet (0.9 m.) to a point about ½ mile from its head. **East Beach**, extending halfway across the entrance, is marked near its south end by an unused lighthouse tower. The eastern shore of East Beach should be given a berth of ¾ mile until the unused lighthouse bears 271° true (W. by N. mag.), and then enter on a 248° true (W. by S. mag.) course, passing 200 yards southward of the unused lighthouse.

Lloyd Harbor Lighthouse is on the outer part of a bowlder reef lying between the entrance of Lloyd Harbor and the channel leading

into Huntington Harbor. The lighthouse is a square tower attached to a dwelling on a pier.

Huntington Harbor, at the southwest end of Huntington Bay, has been improved by dredging a channel 200 feet wide and 8 feet (2.4 m.) deep through the entrance and through the harbor to a turning basin of the same depth and 230 feet wide at the Old Town Dock. This channel is subject to shoaling on the bar at the entrance, and in 1925 there was a controlling depth of 7½ feet (2.3 m.) over this bar in a channel of navigable width. Above the entrance the project depth and width existed. The entrance is difficult on account of the narrow channel, the bowlder reef which forms its western side and extends out to Lloyd Harbor Lighthouse, and the strong tidal **currents** which have an estimated velocity of 3 knots or more at strength. In the absence of local knowledge, only small craft should attempt the entrance and should proceed with caution.

Directions.—Passing about 150 feet westward of the black buoy off the entrance, and 500 feet southeastward of Lloyd Harbor Lighthouse, steer for the southeast end of a clump of cedars, which are on the west side just inside the entrance. Pass about 150 feet northwestward and in mid-channel westward of **Sandy Point,** on the east side of the entrance. A private light is maintained on the southwestern side of Sandy Point during the summer. Follow the west shore at a distance of 150 feet, heading slightly westward of a large yellow residence on the south shore. Pass 200 feet northward of the wharf in front of the residence, and head a little southward of a lone tree northward of the yacht club, with an old mill at the western end of the harbor astern. On approaching the yacht club, haul southeastward, keeping a square, yellow tower with red roof open westward of the yacht club, pass 100 feet westward of the yacht-club wharf, and head just clear of the wharf at the electric-light plant (marked by a red chimney), which is also the steamboat wharf. In 1925, bush stakes marked the west side of the channel for a short distance on both sides of the yacht-club wharf.

Huntington is a village at the head of the harbor. There is a depth of about 9 feet (2.7 m.) at the steamboat wharf and 6 feet (1.8 m.) at the oil company's wharf. About 400 yards northward of the steamboat wharf is the entrance of a narrow channel, with a depth of about 3 feet (0.9 m.), which leads to the coal and lumber wharves on the west side of the harbor; in 1925, the south entrance was marked by a bush stake and another marked the north side of the channel about halfway across. The north end of the wharf is shoal. Coal, water, gasoline, and launch supplies can be obtained. There is a marine railway 65 feet long, which can take out boats of 5-foot (1.5 m.) draft. There is an electric road to the railroad station, about 2½ miles distant.

West Beach, which extends more than halfway across the entrance of Northport Bay, is occupied by a large plant of a sand and gravel company. A channel has been dredged from southward in to the beach by the company.

Northport Bay is a large bay opening from the southeast end of Huntington Bay. The western part of Northport Bay has a good anchorage in 4 to 8 fathoms (7 to 15 m.), and the eastern part in 8 to 11 feet (2.4 to 3.4 m.). The entrance from Huntington Bay is

through a narrow, buoyed channel having a depth of 18 feet (5.5 m.). The course through the middle of the narrow entrance to Northport Bay is 68° true (E. by N. mag.), passing 150 feet southward of the black buoys which mark its north side. From the inner black buoy a 57° true (ENE. mag.) course will lead well northward of the red buoy, which marks the shoal extending ¼ mile northward from Little Neck Point. The hull of a wrecked schooner is reported to lie 175 yards 40° true from Great Neck Flats nun buoy No. 2. A vessel drawing 11½ feet (3.5 m.) is reported to have struck this wreck. Vessels should exercise caution in entering Northport Bay until this obstruction is definitely located or removed.

Centerport Harbor is a shoal bight in the south shore of Northport Bay just eastward of the entrance. A narrow, crooked channel, with a depth of about 3 feet (0.9 m.), leads to the village of **Centerport.** This channel leads a little eastward of midharbor in approaching the bare spit, which extends nearly across the bay, follows the north side of the spit at a distance of about 200 feet, curves around the southwest end of the spit, then follows its south side northeastward, and then trends southward somewhat eastward of midharbor. The tidal currents through the narrow channel at the end of the spit have an estimated velocity of 3 knots at strength.

Duck Island Harbor is a shallow cove on the north side of Northport Bay westward of **Duck Island Bluff,** which is the southwest one of two wooded knolls. There are depths of 7 to 9 feet (2.1 to 2.7 m.) in the entrance, and 1 to 3 feet (0.3 to 0.9 m.) in the upper part of the harbor. A spit, with 4 feet (1.2 m.) on its outer part extends east-southeastward nearly across the entrance from **Winkle Point.** The range of a large tank on the north side of Duck Island Harbor, shut out by the trees on Duck Island Bluff, leads eastward of the spit, but the south side of Duck Island Bluff must be given a berth of nearly 200 yards.

There is a summer resort on **Asharoken Beach,** at the northeast end of Northport Bay, and a number of private boat landings at which the depth is about 3 feet (0.9 m.).

Northport Harbor, at the southeast end of Northport Bay, has a depth of 10 feet (3 m.) in the entrance, shoaling gradually to between 7 and 8 feet (2.1 and 2.4 m.) abreast the wharves at Northport. Vessels select **anchorage** according to draft; the bottom is soft. **Ice** closes Northport Harbor about two months each winter; there is no danger from drift ice.

Northport is a village with railroad communication on the eastern shore of Northport Harbor. The depths at the principal wharves are 6 to 8 feet (1.8 to 2.4 m.). The greatest draft that can be taken to Northport is 14 feet (4.3 m.) at high water. Coal, gasoline, water, ice, and other supplies can be obtained. **Repairs** to vessels can be made at Northport; there is a marine railway capable of hauling out vessels of about 200 tons.

Currents.—About 1 mile west of Eaton Point the current is rotary, turning counterclockwise. The strength of flood occurs about 2½ hours after the current turns westward at the Race (about ¾ hour before high water at New London) and sets southwestward; the strength of ebb occurs about 2¼ hours after the current turns eastward at the Race (about 1¾ hours before low water at New

London) and sets northeastward. The average velocity at strength is about ½ knot. Since the current is rotary there is no true slack; the minimum current of about 0.2 knot sets northwestward about 1 hour before the current turns westward at the Race (about 1½ hours after low water at New London), and southeastward about ¼ hour after the current turns eastward at the Race (about 2¾ hours after high water at New London).

At the entrance to Northport Harbor, the strength of flood occurs about 2½ hours after the current turns westward at the Race (about 1 hour before high water at New London), and the strength of ebb about 3 hours before the current turns westward at the Race (about ½ hour before low water at New London); the average velocity at strength is about 1¼ knots. Slack water occurs about ¼ hour before the slack at the Race (about 2 hours after high and low water at New London).

Tides.—The mean rise and fall of the tides is 7.3 feet.

DIRECTIONS, HUNTINGTON BAY

From eastward.—Note the description preceding of the shoals northward of Eaton Neck. If entering across the shoals and desiring to carry the best water, pass ⅜ mile or more northward of the black buoy and ¼ mile or more southward of the horizontally striped buoy. From northwestward of Eaton Neck the course up the bay is about 181° true (S. by W. mag.), keeping the eastern shore a little the best aboard, but giving it a berth of over ¼ mile.

Or, from the sound, a 170° true (S. mag.) course, with Greens Ledge Lighthouse astern, will lead into Huntington Bay.

From westward.—A course for Eaton Neck Lighthouse on any bearing southward of 96° true (ESE. ½ E. mag.) will lead northward of the shoals off Lloyd Point. Passing ¼ mile northward of the bell buoy off Lloyd Point, a 116° true (SE. ¾ E. mag.), course will lead to the entrance, giving the shore a berth of over ½ mile. When Lloyd Harbor Lighthouse bears 196° true (SSW. ⅜ W. mag.), a 170° true (S. mag.) course will lead up the middle of the bay.

OYSTER BAY

This bay (chart 224) is on the south side of Long Island Sound, about 5 miles westward of Eaton Neck Lighthouse, the entrance lying between Lloyd Neck and Center Island Point. The entrance and harbor are characterized by extensive shoals, bowlder reefs, and broken ground making off from the shores, and vessels should proceed with caution if obliged to approach or cross shoal areas. The bay south of Cold Spring Harbor Lighthouse is a secure harbor, and is available for vessels of less than about 18-foot (5.5 m.) draft.

Lloyd Neck, between Huntington and Oyster Bays, is high and wooded, and has a high yellow bluff on its north side ¾ mile eastward of Lloyd Point. There are bowlders on the shoal which extends off from the north side of the neck, and it should be given a berth of over ¼ mile by small craft.

Lloyd Point, the north end of Lloyd Neck, is a low spit. A rocky shoal extends ½ mile north-northeastward from Lloyd Point, and is marked at its northeast edge by a black bell buoy, placed in a depth

of about 23 feet (7 m.). A rocky area, on which the least depth found is 22 feet (6.7 m.), extends ⅝ mile west-northwestward from the bell buoy. Morris Rock, with 2 feet (0.6 m.) over it and marked by a horizontally striped buoy, lies ⅜ mile eastward of Lloyd Point and 600 yards from shore.

About ⅝ mile southwestward of Lloyd Point there are two small jetties between which is the entrance to a pond with various depths which has been dredged into the spit by a sand and gravel company. This project is abandoned at present and in 1925 the entrance channel had nearly filled up.

Center Island Point is a small bluff, on the summit of which there is a large, red house, with white trimmings, showing among the trees. **Center Island Reef** is a dangerous bowlder reef, which extends 1¼ miles northward from Center Island; there is a small, 21-foot (6.4 m.), rocky patch at the north end of the reef.

A shoal, with 5 to 9 feet (1.5 to 2.7 m.) over it, extends eastward from the northern part of Center Island nearly across Oyster Bay, and is marked near its eastern end by Cold Spring Harbor Lighthouse. There is a depth of 12 feet (3.7 m.) at the lighthouse, 18 feet (5.5 m.) 100 yards eastward, and 19 feet (5.8 m.) 350 yards eastward of the lighthouse. A depth of 8 or 9 feet (2.4 or 2.7 m.) can be taken across the shoal on a course about north or south, passing about 100 yards eastward of the red buoy.

Cold Spring Harbor Lighthouse is a white, square, pyramidal tower on a pier.

Cold Spring Harbor, the south end of Oyster Bay, extends about 2¼ miles southward of Cooper Bluff. The harbor is free from dangers if the shores be given a berth of 300 to 400 yards, the depths being 15 to 18 feet (4.6 to 5.5 m.) to near its head. **Cold Spring** is a village on the eastern shore, near the head of the harbor. There are depths of 6 to 8 feet (1.8 to 2.4 m.) at the principal wharves. Gasoline can be obtained. The railroad station is about 3 miles from the wharves.

Cooper Bluff is a prominent bluff at the northeast end of Cove Neck. A bowlder reef extends ¼ mile northward from **Cove Point,** the northwest end of Cove Neck, and is marked at its north end by a black buoy. The entrance of Oyster Bay Harbor is nearly 400 yards wide between this buoy and Plum Point.

Plum Point is marked at its south end by a small stone tower, and there are boat landings on the southwest side of the point. There is a prominent yacht club and landing nearly ¼ mile west-northwestward of Plum Point.

Oyster Bay Harbor is a long, crooked arm on the western side of Oyster Bay. A channel, with a depth of over 5 fathoms (9 m.), leads into the harbor to Moses Point, and good anchorage can be selected; one of the best is southward of Moses Point, in 4 to 6 fathoms (7 to 11 m.). Above this point the channel is narrow, and is not suitable for vessels of a greater draft than about 10 feet (3 m.), for which there is good anchorage in the channel between **Moses Point** and **Soper Point,** and northwestward of the latter. Vessels of less than 7-foot (2.1 m.) draft can anchor in the bight between Cove Neck and the wharf at Oyster Bay, and also in the large bight on the northwest side of **Center Island.**

Oyster Bay is a village with railroad communication on the south shore of Oyster Bay Harbor. There is a depth of about 8 feet (2.4 m.) to the wharf and along its west side, and 6 feet (1.8 m.) along its east side. Stand in to the wharf on the line of its west side. Parallel to, and about 60 feet off the west side of the wharf is a row of sunken barges. Coal, gasoline, ice, and other supplies can be obtained. About 650 yards westward of the wharf is a dredged channel, with a depth of about 6 feet (1.8 m.), leading into a slip having a number of private landings at the head.

Two rocks, lying near the shore of Center Island northwestward of Soper Point, are sometimes marked by private spindles.

Mill Neck Creek, at the northwest end of Oyster Bay Harbor, has a channel depth of about 3 feet (0.9 m.) for a distance of nearly 1 mile above the drawbridge at the entrance and is much used by launches. Approach the entrance with a skeleton lookout tower on Oak Neck in range with the north end of the draw span, give the south shore inside the bridge a berth of 200 yards, favor the north shore when approaching the narrow part ½ mile above the bridge, and then keep near the middle. There are generally numerous stakes on the shoals in the creek. **Bayville** is the post office on **Oak Neck,** on the north side of the creek. The bridge has a lift opening 75 feet wide and 4½ feet above mean high water when closed.

Storm warnings are displayed at the yacht club on Plum Point.

Ice usually extends the whole length of the bay during a part of January and February, and in exceptionally severe winters extends into the sound.

Currents.—About ¼ mile north of Cold Spring Harbor Lighthouse, the velocity at strength is 0.6 knot; about ¼ mile north of Cove Point, it is about 0.8 knot, the strength of flood and ebb occurring about 2½ hours after the current turns westward and eastward at the Race (about 1 hour before high and low water, respectively, at New London).

Tides.—The mean rise and fall of the tides is 7.3 feet.

DIRECTIONS, OYSTER BAY

Approaching from eastward, deep-draft vessels should pass 1 mile or more northward of Lloyd Point and avoid the 22-foot (6.7 m.) sounding shown on the chart a little over ¾ mile off the point and ⅝ mile west-northwestward of the bell buoy. Approaching from westward, pass ½ mile northward of the black buoy marking Center Island Reef. Heading for Cold Spring Harbor Lighthouse on any course between 140° true (SSE. ⅝ E. mag.) and 130° true (SE. ½ S. mag.) will lead in the deepest water between Northwest Bluff and Center Island Reef.

The principal channel is eastward of Cold Spring Harbor Lighthouse and is good for a depth of over 5 fathoms (9 m.). To go through this channel, give the lighthouse a berth of over 350 yards, passing about 225 yards off the eastern shore. Small craft sometimes strike the shoal in the bight ¼ mile northward of the lighthouse. Vessels of about 7-foot (2.1 m.) draft at low water or 12-foot (3.7 m.) draft at high water can cross the shoal westward of the lighthouse on a course about north or south, passing about 100 yards eastward of the red buoy.

In shaping the course for Oyster Bay Harbor, avoid a bowlder reef which extends 250 yards off the east side of Plum Point, and enter the harbor between the point and the black buoy marking the bowlder reef making off from Cove Point.

Shoals with 10 to 12 feet (3 to 3.7 m.) on them extend 350 yards in places from shore in the bight of Center Island for a distance of ⅝ mile southwestward of Plum Point. The best water will be carried by passing about 100 yards northwestward of the black buoy off Cove Point and heading for the principal wharf at Oyster Bay.

The deepest water then leads along the south end of Center Island, passing about 100 yards southward of the red buoy off Moses Point and 200 yards southward of Soper Point, and then leads about in mid harbor northwestward of Soper Point.

OYSTER BAY TO WILLETS POINT

Center Island Point and Reef are described with Oyster Bay preceding.

Oakneck point is marked by a prominent water tank and a number of large residences. A stone jetty to protect a private boat landing extends a short distance from the shore just westward of the point. A shoal strewn with bowlders extends ¼ to ½ mile from the shore between Oakneck Point and Matinicock Point. A black buoy is maintained about ½ mile off Oakneck Point to mark the end of the shoal.

Just eastward of **Peacock Point** is **Frost Creek,** which has been improved by dredging a channel about 40 feet wide and 8 feet (2.4 m.) deep to a private estate. The channel at the entrance is well defined with the water below half tide, and is marked on both sides by private spindles and by stakes on the east side of the channel; it is protected by a stone jetty which extends a short distance from the shore about 150 feet eastward of the dredged channel. A stone jetty to protect a private boat landing extends a short distance westward from Peacock Point.

Matinicock Point is marked on its western side by a stone pier. A shoal extends about 600 yards off the point, and is marked at its end by a gas and bell buoy with a spar marker alongside. The gas and bell buoy is removed between December 15 to April 1 of each year.

Hempstead Harbor (chart 223) is 4 miles wide at the entrance between Matinicock Point and Prospect Point. It is free from dangers if the shores be given a berth of ¼ mile, and is much used by vessels seeking shelter in any but strong northerly winds, affording excellent anchorage with good holding ground. Vessels can anchor in any part of the harbor according to draft and direction of the wind. A good anchorage for vessels drawing 20 feet (6 m.) or less is just inside of a line from Mott Point to the breakwater, and small vessels can anchor behind the breakwater. There are several villages on the eastern shore, and large sand and gravel plants on the western shore above and below Bar Beach.

Weeks Point is marked by a short breakwater which protects a private boat landing. A black buoy is maintained about ¼ mile off the point. Nearly ½ mile southward of Weeks Point is the entrance to a basin protecting a private wharf which has a depth of

8 feet (2.4 m.) at the end. The basin shoals to the head and there are rocks bare at low water near the northern end.

Directions.—Passing northward and westward of the gas and bell buoy off Matinicock Point, a 213° true (SW. ⅛ S. mag.) course will lead westward of the black buoy of Weeks Point, and then a 184° true (S. by W. ¼ W. mag.) course will lead westward of the light on the end of the breakwater. Passing ¼ mile northward of the bell buoy off Prospect Point, a 113° true (SE. by E. mag.) course will lead for the light on the end of the breakwater.

Glen Cove is a village with railroad communication on Glencove Creek, about 1 mile back from the eastern shore of the bay. The landing for the village is at the inner end of the breakwater. The breakwater has been built to 4 feet (1.2 m.) above high water, extends 1,564 feet west-southwestward from this wharf, and is marked at its end by a light. The anchorage behind the breakwater is known as **Glencove Harbor,** the depths ranging from 18 to 22 feet (5.5 to 6.7 m.) behind its outer half and 7 to 9 feet (2.1 to 2.7 m.) nearer shore.

Glencove Creek, lying ¾ mile southward of Glencove Breakwater, is a crooked stream with an average width of 40 to 50 feet and depth of 1 to 2 feet (0.3 to 0.6 m.). At high water boats of as much as 7-foot (2.1 m.) draft can be taken about ¾ mile above the entrance, nearly to the village of Glen Cove. Work is now in progress to deepen this channel.

Sea Cliff is a village on the steep hill on the south side of Glencove Creek. The steamboat wharf has a depth of 9 to 10 feet (2.7 to 3 m.) at its end. Water can be obtained at the wharf and by water boat. From Sea Cliff to the northerly wharves at Glenwood a shoal extends 300 yards from the eastern shore.

The head of Hempstead Harbor above Bar Beach is occupied by extensive flats, and the narrow channels require local knowledge. From the entrance at Bar Beach a channel 6 feet (1.8 m.) deep and 100 feet wide has been dredged to a point opposite Ward's wharf, a distance of 5,600 feet; thence 80 feet wide to Roslyn Town Wharf, a distance of about 3,200 feet; and thence 50 to 70 feet wide to the head of navigation, a distance of about 1,700 feet. In 1925 a controlling depth of 6 feet (1.8 m.) existed to within 4,000 feet of the head of improvement; above this the controlling depth to the head of improvement was 4 feet (1.2 m.). The tidal currents have an estimated velocity of about 4 knots at strength through the narrow channel at Bar Beach.

Glenwood is a village on the eastern shore, abreast Bar Beach, and **Roslyn** is a village on the railroad at the head of the harbor. Gasoline can be obtained. There is a repair plant and marine railway for boats under 60 feet in length. The deepest draft of the vessels taken up to Roslyn is 12 feet (3.7 m.). **Ice** generally closes navigation about six weeks during January and February.

Terminal facilities.—Water terminals, 9 in number, with available dockage of 2,700 feet, are located—8 along the east shore of the harbor from Glen Cove to Roslyn and 1 on the west shore; none has railroad connection. Five, with available dockage of 900 feet, are open to the public, and 3, with available dockage of 1,400 feet, have mechanical appliances for handling cargo. Two are owned

by the town, 6 are privately owned, and 1 is corporately owned. Six have macadam highway connection; the remaining 3 have connections in fair to good condition, but not paved. All are either of open pile or of timber and pile bulkhead construction.

The principal items of commerce are sand and gravel; there is also trade in coal, ashes, and building material. The usual draft of vessels and barges engaged in this commerce is from 2 to 10 feet (0.6 to 3 m.).

Currents.—In the channel west of the breakwater the velocity is small, being about 0.3 knot at strength.

Tides.—The mean rise and fall of tides is 7.2 feet.

From **Mott Point** to Prospect Point there are bluffs in places. A shoal, with bowlders, extends ¼ mile from shore between the points, and also for a short distance southward of Mott Point. Abreast Mott Point the shoal is marked by a bell buoy. **Picket Rock,** awash at low water, lies ¼ mile northward of Mott Point and 300 yards from shore.

Prospect Point has a rocky shoal making out nearly ½ mile northward from it. The shoal rises abruptly from a depth of 10 fathoms (18 m.) to 16 feet (4.9 m.), and has bowlders. **Old Hen,** a bowlder awash at low water, lies 400 yards from shore. The north end of the shoal is marked by a black bell buoy, which lies ⅞ mile east-southeastward of Execution Rocks Lighthouse.

Execution Rocks are marked by Execution Rocks Lighthouse, and the rocks with depths of 18 feet (5.5 m.) or less extend ½ mile northward and 600 yards southwestward from the lighthouse. The 18-foot (5.5 m.) curve at the north and southwest ends of the rocks is marked by horizontally striped buoys, and a red buoy marks the east side of the rocks 300 yards northeastward of the lighthouse. Rocks, with 8 to 9 feet (2.4 to 2.7 m.) over them, extend about 400 feet southward from the lighthouse.

Execution Rocks Lighthouse is a white, stone tower, with a brown band about midway of its height, attached to a granite dwelling. The light is flashing white every 10 seconds, flash 1.5 seconds, eclipse 8.5 seconds, 55 feet (16.8 m.) high and visible 13 miles. A red sector from 34° to 70° true covers the shoals to southwestward. The fog signal is an air siren, blast 3 seconds, silent 17 seconds.

Sands Point is marked by a lighthouse. A bowlder reef extends 600 yards off the point and is marked by a black buoy. The bowlders show at low water for a distance of about 300 yards from shore.

Sands Point Lighthouse marks the outer extremity of the reef extending off the point. The light is flashing green, exhibited from a red steel tower.

Barker Point is a high bluff on the northeast side of the entrance of Manhasset Bay. **Gangway Rock,** marked by a black bell buoy, is at the northerly end of a broken line of rocks and shoal water, which extends ⅝ mile north-northwestward from Barker Point. **Success Rock,** awash at low water and marked by a spindle, is one of this broken line of rocks. A rock with about 6 feet (1.8 m.) on it lies between Gangway Rock and Success Rock.

Manhasset Bay is nearly 1 mile wide between Barker Point and Hewlett Point, and over 3 miles long. It affords excellent shelter

for vessels of about 12-foot (3.7 m.) or less draft, and is much frequented by yachts in the summer. The principal traffic is in barges, which take sand and gravel from the bay and bring coal and building material to Port Washington. The depths in the outer part of the bay range from about 12 to 16 feet (3.7 to 4.9 m.), and about 8 to 12 feet (2.4 to 3.7 m.) in the inner part inside Plum Point. The head of the bay is shoal.

Plum Point is a low spit extending southward from the eastern shore about 1 mile southward of Barker Point. There is a gas buoy about 150 yards southwestward of the point. The bight eastward of Plum Point is shoal. The edge of this shoal is marked by a black buoy, placed in a depth of 11 feet (3.4 m.) about ¼ mile southeastward of the point.

Port Washington is a village, with railroad communication, on the south side of a shoal bight about 1 mile southeastward of Plum Point. A channel, with depths of 6 to 8 feet (1.8 to 2.4 m.) and marked at its entrance by buoys, leads along the south side of the bight from 100 to 400 feet off Copps Wharf and Town Wharf. Copps Wharf is the lumber wharf just inside the entrance buoys, and Town Wharf is 300 yards above it. The depths at these wharves are about 7 and 5 feet (2.1 to 1.5 m.), respectively, and at the principal boat landings about 4 feet (1.2 m.). Yacht supplies, gasoline, and water can be obtained, and there are facilities for repairing small boats.

Tides.—The mean rise and fall of the tides is 7.2 feet.

A bowlder reef, largely bare at low water and marked by a black buoy, extends over 300 yards northward from **Hewlett Point,** on the west side at the entrance of Manhasset Bay.

Stepping Stones is a dangerous bowlder reef, which extends about ¾ mile in a northwesterly direction from the shore and is marked near its end by Stepping Stones Lighthouse. There are three rocks which show at low water southeastward of the lighthouse, and little depth at other places as shown on the chart. Vessels should not approach the lighthouse closer than 250 yards on the northwest side.

Stepping Stones Lighthouse is a red-brick dwelling on a granite pier, with a white horizontal band on the southwest side of the pier. The light is fixed red, 46 feet (14 m.) high and visible for 8 miles. The fog signal is a bell sounding a group of 2 strokes every 20 seconds.

Little Neck Bay is nearly 1 mile wide eastward of Willet Point, and about 2 miles long. The shores of the bay are generally settled, and there are numerous boat landings. The depths are about 9 feet (2.7 m.) in the entrance, 6 feet (1.8 m.) about halfway to its head, and thence shoaling gradually. There are bowlders in places close to shore. A much used boat anchorage is in the cove on the east side 1 mile southward of **Elm Point,** the depths being 5 to 7 feet (1.5 to 2.1 m.) and beach sandy. The two branches of the bay are bare at low water. There is a railway and repair plant for motor boats on a small creek at the head of the east branch.

The creek at the head of the south branch is crossed by three drawbridges, as follows: Railroad bridge, swing draw, 29 feet wide and 3 feet above mean high water when closed; highway bridge,

swing draw, 40 feet wide and 1.2 feet above mean high water; and the trolley bridge, lift span, 34 feet wide and 6 feet above mean high water.

EAST RIVER

(charts 223, 226, and 369[4]) is the name given to the narrow strait which connects Long Island Sound with New York Bay. At its eastern end the river is about 5/8 mile wide between Throgs Neck and Willet Point, and thence its course is westward and southwestward for about 14 miles, being in many places extremely narrow, and in no place more than 1 mile wide. Its channel is much obstructed by rocks and islands, and the currents have great velocity, especially in the narrow passage between Wards Island and Hallet Point, known as Hell Gate. Five bridges, having a vertical clearance at mean high water of 135 feet (41 m.), cross the river between the Battery and Lawrence Point. From the Battery to Port Morris, a distance of about 10 miles, both shores are occupied by wharves, practically continuous, except where shoals or currents prevent access.

The traffic in East River is very great, the number of steamers passing through Hell Gate amounting to about a thousand daily. Barges are towed in sets of three astern. Car floats are towed one on each side of the tug, thus making up a tow of about 327 feet in length and 105 feet in breadth; about 100 of these car-float tows pass through the river daily.

Depths.—The project for the improvement of East River provides for channels of the following dimensions: From deep water in the upper New York Bay to the Brooklyn Navy Yard, 40 feet (12.2 m.) deep and 1,000 feet wide; from the Brooklyn Navy Yard to Throgs Neck, 35 feet (10.7 m.) deep with widths varying from about 550 feet to 1,000 feet, according to locality; east of Blackwells Island up to English Place, Long Island City, 30 feet (9.1 m.) deep and varying in width from 500 feet to 900 feet, with widening in the approach from the main channel; between South Brother and Berrian Islands, 20 feet (6.1 m.) deep and 300 feet wide, with widening in the approach from the main channel; and also the removal of many rocks and reefs to varying depths.

In 1925 there was available for navigation a channel 34 feet (10.4 m.) deep and of navigable width connecting deep water in the Upper Bay, New York Harbor, with deep water in the East River off Old Slip, Manhattan; thence a channel 40 feet (12.2 m.) and over in depth and of varying but navigable width was available up to Hell Gate; the controlling depth through Hell Gate was 32 feet (9.7 m.); thence to Clason Point 40 feet (12.2 m.), and thence to Throgs Neck at Long Island Sound, 37 feet (11.3 m.).

Caution.—Dredging and blasting operations are continuously in progress removing the rocks and reefs in East River to the project depths. Mariners are requested to use all precautions against fouling the plants on this work. Buoys are usually placed to mark the areas of blasted rock, and their locations and descriptions are published in the weekly Notices to Mariners. Regulations for the navigation of East River in the vicinity of improvement operations are prescribed by the Secretary of War and copies of these regulations can be obtained from the Army Engineers, 39 Whitehall Street, New York City.

Throgs Neck, on the north shore at the eastern entrance of East River, is marked by a lighthouse and a wharf at its south end. **Storm warnings** are displayed at Throgs Neck. A shoal extends 200 yards south-southeastward from Throgs Neck, and is marked by a red buoy which should be given a berth of over 50 yards. Shoals extend 400 yards from the north shore of the bight between Throgs Neck and **Old Ferry Point;** the north side of the channel off the edge of the shoal is much used as an anchorage by vessels and barges.

Throgs Neck Lighthouse is a red-brick, conical tower on the south bastion of Fort Schuyler.

Willet Point, on the south shore at the eastern entrance of East River, is marked by a large granite fort, and there are two wharves on its west side. A channel with a depth of 13 feet (4 m.) has been dredged to the wharves. A shoal extends off from Little Bay, its edge passing nearly 400 yards northwestward of Willet Point.

Little Bay, westward of Willet Point, has general depths of 7 to 8 feet (2.1 to 2.4 m.) if the shore be given a berth of 200 yards. Its south and west shores have been improved by filling in behind bulkheads, and are generally settled. **Beechhurst** is a settlement extending westward from the bay toward Whitestone. There are a number of private landings.

Whitestone is a town on the south shore eastward of Whitestone Point. There is communication by railroad and electric road, and coal, water, and other supplies can be obtained. The depths at the principal wharves range from about 16 to 24 feet (4.9 to 7.3 m.).

Whitestone Point is a small wooded bluff, marked at its end by a light and fog bell. There are bowlders partly bare at low water for a distance of about 100 yards off the point.

Powell Cove, ½ mile westward of Whitestone Point, has general depths of 3 to 4 feet (0.9 to 1.2 m.) and less near the shore. A wharf with a depth of about 9 feet (2.7 m.) at its end makes off in a northwesterly direction from the eastern point at the entrance.

Tallman Island is located on the west side of the entrance to Powell Cove. There is a landing with a depth of about 2 feet (0.6 m.) at its end in the bight on the west side of the island. Gasoline and motor-boat supplies can be obtained.

Old Ferry Point is located on the north side of East River on the east side of the entrance to Westchester Creek. Three fixed red lights are exhibited in a vertical line from a black post located on the southwest side of the point. These lights are maintained from May 15 to October 15 of each year by the Morrisania Yacht Club.

Westchester Creek (chart 223) has its entrance in the shoal bight on the north side of East River, between Old Ferry and Clason Points. The project for the improvement of the creek provides for a channel 12 feet (3.7 m.) deep and 100 feet wide through the estuary; thence the same depth and 80 to 60 feet wide to Fort Schuyler Road, the head of navigation, a total distance of about 2¼ miles; and for two turning basins, one near the upper end of the channel and one near Unionport Bridge. Work on this project is being delayed pending the fulfillment of certain conditions by the local interests. In 1925 the controlling depth was 7½ feet (2.2 m.) to within 200 feet of the head of improvement; thence to the head the depth gradually reduced to 5 feet (1.5 m.).

The channel is buoyed from East River to the entrance of the narrow part of the creek. **Unionport Bridge** has a lift span, 60 feet wide and with a vertical clearance of 14 feet at mean high water when closed. The mean rise and fall of tide is 7.1 feet at the entrance and 6.8 feet in the creek.

Unionport and **Westchester** have some commerce in building material, coal and ashes, carried in vessels of 6 to 10 feet (1.8 to 3 m.) draft. There are 14 water terminals located on the creek, of which two are publicly owned. Small boat supplies of all kinds can be obtained.

Pugsley Creek joins Westchester Creek at **Castle Hill Point.** From the buoys just eastward of the point a crooked channel, marked by stakes during the summer, leads up Pugsley Creek to the head of navigation, at a sewer crossing, about ¼ mile above Castle Hill Point. This channel has a least depth of about 3 feet (0.9 m.) in the entrance and 5 feet (1.5 m.) in the creek. There are a repair plant and railways for small craft under 50 feet in length on the creek. There is a wreck which shows, except at high water, and is marked by a stake, on the flats off the entrance of the creek and about 250 yards northward of Clason Point.

Clauson (Clason) Point is a large amusement resort. There is an automobile ferry to College Point. The city wharf, at the southeast end of the point eastward of the ferry slip, has a depth of about 12 feet (3.7 m.) at its end. The oil company's wharf extends out to a depth of about 20 feet (6 m.). Water, gasoline, oils, and motor-boat supplies can be obtained. Many small boats anchor on the flats on the west side of the point.

Bronx River (charts 226 and 1213) has its entrance at the head of the shoal bight on the north side of East River between Clason Point and Hunts Point. Improvements are authorized to straighten the river and obtain a channel with a least width of 100 feet and depth of 10 feet (3 m.) from the channel of East River to the head of navigation, at the dam at East One Hundred and seventy-seventh Street, a total distance of 2⅞ miles. In 1925 there was a controlling depth of 10 feet (3 m.) from East River to Spofford Avenue; above Spofford Avenue to within 250 feet below Westchester Avenue it was 9 feet (2.7 m.); thence to the head of improvement 2½ feet (0.8 m.) for a width of 30 to 50 feet. Little work has been done on the improvement above Westchester Avenue.

The river is crossed by three bridges. At Westchester Avenue there are two bridges. The highway bridge has a retractile draw span 40 feet wide and with a vertical clearance when closed of 16.1 feet, and the I. R. T. bridge (over the highway bridge) has a fixed span with a vertical clearance of 61 feet. The railroad bridge, 600 feet above Westchester Avenue, has a lift span 69½ feet wide and with a vertical clearance when closed of 8.2 feet. The vertical clearances as given are at mean high water. The mean rise and fall of tide is 7.1 feet at the entrance and 6 feet at the head of navigation.

The principal items of commerce are building material and coal, carried in vessels of 5 to 10 foot (1.5 to 3 m.) draft. There are 15 water terminals in the river, 1 publicly owned, 7 privately owned, and 7 corporately owned. One has railroad connections.

Hunts Point is marked by a light and fog signal on a red skeleton day mark on a white tank house, located 70 yards off the wharf. A

red buoy marks the end of a sunken wharf off the point. Many small boats anchor on the flats on the east side of the point.

College Point Reef, with 4 feet (1.2 m.) over it, lies 350 yards north-northeastward of the dock at the north end of College Point, and is marked by a black bell buoy.

College Point is a town on the south side of East River and east side of Flushing Bay, and has communication by railroad and electric road with Flushing and New York. There is a ferry operating to Clason Point throughout the year. The shoal bight on the northwest side of the town is used as an anchorage by motor boats; there is a shipyard for repairing hulls and motors on the south side of the bight; the largest marine railway is 60 feet long, draft 4 feet forward and 6 feet aft, and capacity 25 tons. A dry dock is located on the northeast side of College Point with a length of 300 feet, width 35 feet, depth over keel blocks 14 feet, and with a capacity of 1,000 tons. The principal wharves at the west end of College Point have depths of about 8 to 10 feet (2.4 to 3 m.). Water can be obtained at the ferry wharf. Coal can be obtained from one of the wharves lying in the shoal bight about ½ mile southeastward of the ferry wharf, but there is little depth, as shown on the chart. Gasoline, ice, and other supplies are obtainable. There are bowlders in places near the shore around College Point.

Flushing Bay (chart 226) is 1 mile wide between College Point and Sanford Point and 1½ miles long. The depths are 5 to 6 feet (1.5 to 1.8 m.) at the entrance, and shoal gradually to the head. A wreck which shows at high water lies near the middle of the bay, 400 yards northwestward of Flushing Bay Light. A convenient anchorage for small craft and very small vessels is from 100 to 200 yards westward of the wharves at the west end of College Point, the depths being 8 to 11 feet (2.4 to 3.4 m.); depths of 6 to 7 feet (1.8 to 2.1 m.) will be found farther westward.

Flushing Creek has its entrance at the southeast end of Flushing Bay. A channel 200 feet wide and 10 feet (3 m.) deep has been dredged through the bay and about ⅜ mile up the creek to Broadway Bridge; thence 7 feet (2.1 m.) deep to Main Street Bridge and narrowing in width from 200 feet at Broadway Bridge to 160 feet at Main Street Bridge. This channel has not been recently redredged and in 1925 had a controlling depth of 7½ feet (2.3 m.) to Broadway Bridge and 7 feet (2.1 m.) to Main Street Bridge. Coal barges are taken about 1 mile above Main Street Bridge to Strongs Causeway, above which the creek is very crooked but is navigable for a farther distance of about 1 mile.

The entrance to the dredged channel through Flushing Bay is marked on its eastern side by a black can buoy, which also marks a rock lying 50 feet to eastward. The western side of the channel is marked by lights, beacons, and a dike. The dike has a total length of 4,663 feet and lies 50 feet from the western edge of the channel. The entire dike is covered at high water and its location is then shown by the lights and beacons which are built on it.

Flushing has some trade in building material, coal, and ashes, carried in vessels of 5 to 12 foot (1.5 to 3.7 m.) draft. There are 17 water terminals, of which 3 with available dockage of 1,000 feet are open to public use under lease. Two terminals have railroad

connections. Vessels must go to the wharves, as there is no room in the creek for anchorage. Coal, gasoline, water, ice, and other supplies can be obtained.

Bridges.—The creek is crossed by five drawbridges, as follows: Broadway Bridge, 0.4 mile above the mouth, has a double-lift opening 62 feet wide and a vertical clearance when closed of 11 feet; railroad bridge, 0.5 mile above the mouth, has center pier openings 42 feet wide and a vertical clearance when closed of 4 feet; Roosevelt Avenue Bridge (new bridge), 1 mile above the mouth, has a double lift opening 70 feet wide and 25 feet vertical clearance when closed; Main Street Bridge, 1.1 miles above the mouth, has center-pier openings 47 feet wide and with a vertical clearance when closed of 3 feet; Strongs Causeway, 2.1 miles above the mouth, has center-pier openings 47 feet wide and with a vertical clearance of 3 feet when closed. The vertical clearances as given are at mean high water.

Ice generally obstructs navigation in Flushing Bay and Creek during a part of January and February.

Tides.—The mean rise and fall of tide at College Point is 7 feet.

Rikers Island is partly occupied by buildings of the Department of Correction of New York. A large area of the flats on the southeast side of the island has been reclaimed. The main channel of East River leads northward of Rikers Island. The channel has been examined by means of a wire drag and several rocks of 19 to 24 feet (5.8 to 7.3 m.) depth were found between Rikers Island and **Barretto Point,** the point on the north shore abreast the north end of Rikers Island. Most of these shoals have now been removed. The south side of the main channel off the north edge of the eastern part of the flats extending eastward from Rikers Island is much used as an anchorage by coasting vessels, the depths being 23 to 30 feet (7 to 9 m.).

The buoyed channel southward of Rikers Island has ample width and is easily followed, except at its western end between Rikers Island and Lawrence Point. At this point the channel is narrow, with rocky, uneven bottom, and has rocks, with little depth, on both sides. The generally used channel leads eastward of the horizontally striped buoy, westward of the red buoy lying westward of South Brother Island Light, and eastward of the black buoys northwestward. Strangers should proceed with caution and should not depend on a greater depth than about 12 feet (3.7 m.) at low water.

Lawrence Point is occupied by extensive gas and power works. **Lawrence Point Ledge Light** is located on the reef, partly bare at low water, which extends ¼ mile off the wharves extending southeastward from Lawrence Point. The northerly and northeasterly sides of the reef are marked by black buoys. A privately buoyed channel leads from the southeastward along the wharves.

The passage between Rikers Island and **South Brother Island** is much used as an anchorage by motor boats, the depths being 5 to 12 feet (1.5 to 3.7 m.). Care should be taken to avoid the extensive reef, partly bare at low water, which extends about ¼ mile southward and south-southeastward from South Brother Island.

The reefs northeastward and westward of North Brother Island that extend into the projected 35-foot (10.7 m.) channel are being removed to a depth of 35 feet (10.7 m.).

There are extensive railroad terminals at **Port Morris,** northward and northwestward of North Brother Island, to and from which car floats are taken through East River.

North Brother Island is occupied by hospitals and other buildings, and is marked at its south end by a lighthouse (white dwelling). The main channel is northward of North Brother Island. A reef extends nearly 100 yards off the north end of North Brother Island, and is marked by a light.

A channel 300 feet wide and 26 feet (7.9 m.) deep has been completed midway between North and South Brother Islands. The direction of the improved channel is 79° true (E. 1/8 N. mag.), and its north edge lies 270 feet southward of North Brother Island lighthouse.

Bronx Kill is a narrow, shallow, unnavigable passage on the northeast side of Randall Island, connecting East and Harlem Rivers. **Randall Island** has municipal buildings scattered over it, and is prominently marked by the elevated railroad which extends across it and Wards Island. **Sunken Meadow,** lying off the southeast side of Randall Island, is marked on its southeast side by a light.

Middle Ground is a large rocky area on which there are numerous heads with depths of 15 to 19 feet (4.6 to 5.8 m.). The northwest side has been removed to a depth of 26 feet (7.9 m.), the southeasterly limit of the improved channel lying 520 feet southeastward of Sunken Meadow Light. The reef is marked at its south end by a red buoy, and on its northwest side by a black buoy, which are towed under water at times by the currents. Work is now in progress to remove this reef to a depth of 35 feet (10.7 m.).

Wards Island lies southward of Randall Island and Sunken Meadow, and is separated from them by **Little Hell Gate,** a narrow and foul passage leading into Harlem River. The insane asylum and some hospitals are located on this island.

Hell Gate Bridge crosses the East River from Negro Point Bluff, southeast side of Wards Island. The height of the bridge above mean high water is 135 feet (41 m.).

Hell Gate (chart 226) is the name of the part of East River south of Wards Island and north of the northern end of Blackwells Island. The reefs and rocks in Hell Gate and approaches that extend into the proposed 35-foot channel are being removed to a depth of 35 feet (10.7 m.). In 1925 there was a channel of navigable width and 32 feet (9.7 m.) deep through Hell Gate. **Regulations** governing the navigation of Hell Gate during improvement operations on Middle Reef are prescribed by the Secretary of War, and copies of these regulations can be obtained from the Army Engineers, 39 Whitehall Street, New York City. The great velocity of the current, the crooked channel, and crowded traffic in Hell Gate require extra caution on the part of the navigator to avoid accident or collision, and make it dangerous for sailing vessels. Strangers in low-powered vessels should never attempt it.

Negro Point, the south end of Wards Island, is marked by a light and fog bell. A ledge extends about 200 feet off Negro Point.

Holmes Rock and **Hogback,** which show above water, lie in the bight on the south side of Wards Island westward of Negro Point. Ledges extend 300 feet southwestward from the easterly rock and 400 feet southwestward from the westerly one.

Hallet Point, on Long Island southward of Wards Island, is marked by Hell Gate Light and fog bell. The channel extends close to this point.

Mill Rock, lying northwestward of Hallet Point, is 250 yards long and is occupied by buildings of the United States engineers in connection with the work of improving Hell Gate. There is a light at the north and south ends of the rocks. **Middle Reef** extends southeastward from Mill Rock; the outer part of the reef has been removed to a depth of 26 feet (7.9 m.), and the northwesterly edge of the channel passes about 200 feet south-southeastward of Mill Rock southerly light on a 58° true (ENE. mag.) line.

Rhinelander Reef, lying westward of Mill Rock, has depths of 9 to 10 feet (2.7 to 3 m.), and less in places close to the piers. It extends about 300 feet off the ferry slips at the foot of East Ninety-second Street, and extends northward to the north line of East Ninety-third Street.

Blackwells Island divides East River, forming two channels. The western channel is the wider, has the deeper water, and is generally used; the eastern channel favors generally the island, and has a least depth of about 22 feet (6.7 m.), but is narrow and difficult. The north end of the island is marked by a light maintained by the city of New York; **Bread and Cheese Reef** extends 70 yards northeastward from the north end of Blackwells Island. The island is occupied by municipal buildings of the city, and a sea wall extends along both sides of the island to its south end.

Queensboro Bridge, a cantilever structure 135 feet (41 m.) above mean high water, crosses East River and Blackwells Island nearly ½ mile from the south end of the island.

Blackwells Island Reef, partly bare at half tide, extends 900 yards southwestward from the southerly end of Blackwells Island. The reef has a general width of about 125 yards, and is marked at its end by a horizontally striped bell buoy. **Blackwells Island Reef Light** is shown from a skeleton tower on the reef, 125 yards from its southerly end.

Man of War Rock has been removed to a depth of 26 feet (7.9 m.), and that portion of the rock extending into the projected 35-foot (10.7 m.) channel is being removed to 35 feet (10.7 m.).

Ferry Reef is being removed to a depth of 35 feet (10.7 m.). In 1925 the least depth was 23 feet (7 m.).

Newton Creek (charts 369 and 369[4]) entrance is on the east side of East River ¾ mile southward of the southerly end of Blackwells Island. The project for the improvement of the creek is to maintain a channel 20 feet (6.1 m.) deep and 150 feet wide to Grand Street Bridge; thence 125 feet wide to the head of navigation at Metropolitan Avenue; 150 feet wide in **English Kills** to the Metropolitan Avenue Bridge; 100 feet wide for a distance of 2,000 feet up **Maspeth Creek;** and 75 to 100 feet wide for a distance of 2,800 feet up **Dutch Kills,** with a turning basin at the head. In 1925 the project was 65 per cent completed. The controlling depths were 18 feet (5.5 m.) in Newton Creek to Meeker Avenue Bridge; thence 14 feet (4.3 m.) to the head of improvement; 14 feet (4.3 m.) in English Kills; 8 feet (2.4 m.) in Maspeth Creek; and 20 feet (6.1 m.) in Dutch Kills. **Whale Creek** is navigable for vessels of 11 feet

(3.4 m.) draft for about ⅓ mile. The mean rise and fall of tide is 4.2 feet.

The traffic in the creek is very extensive. The principal items of commerce are coal, building materials, petroleum products, copper, and chemicals, carried in vessels of 4 to 20 feet (1.2 to 6.1 m.) draft.

Terminal facilities.—The length of water front measured along both sides of the projected improvement is 8½ miles, of which 6½ miles are bulkheaded and 2 miles, near the head of the stream, are yet undeveloped. The total available dockage is 56,125 feet, of which the State of New York owns 450 feet as a barge canal terminal, the city of New York owns 2,040 feet, a rapid transit railroad company owns 510 feet, and 6,500 feet are owned by railroad companies. The remainder, 46,625 feet, is owned by firms and corporations doing business on the creek. Twelve terminals have railroad connection, and three, two of which are owned by the city of New York and one by the State of New York and used as a barge canal terminal, are open to the public.

Bridges.—Four drawbridges cross Newton Creek, and their distances in nautical miles above the entrance and widths of openings are as follows: Vernon Avenue, ⅜ mile, opening 120 feet wide; Greenpoint Avenue, 1⅛ miles, opening 79 feet wide; Meeker Avenue, 1¾ miles, opening 38 feet wide; and Grand Street Bridge, 2⅝ miles, opening 87 feet wide. Two drawbridges cross English Kills with widths of openings 57 and 47 feet, respectively. Dutch Kills is crossed by four drawbridges, with least width of opening 46 feet. **Regulations** for the drawbridge crossing Newton Creek at Vernon Avenue are as follows:

The draw shall be opened promptly upon signal for the passage of all vessels unable to pass under the closed bridge at any hour of the day or night except on week days between the hours of 6.20 to 6.30 a. m.; 7.20 to 7.30 a. m.; 7.50 to 8 a. m.; 8.20 to 8.30 a. m.; 12 to 12.10 p. m.; 12.50 to 1 p. m.; 5.10 to 5.20 p. m.; and 5.50 to 6 p. m.

Whenever a vessel unable to pass under the closed bridge approaches it the signal of a desire for the draw to be opened shall be three blasts of a whistle or horn blown on the vessel. This signal shall be repeated at intervals until it is answered from the bridge. Upon receiving the signal from the vessel, the tender or operator of the bridge, in case the draw can be opened immediately, shall reply by three blasts of a whistle or horn. In case of accident to the machinery, or other contingency, necessitating delay in opening the draw, the signal from the vessel shall be answered by the tender or operator of the bridge by two blasts of a whistle or horn.

From Pier No. 72, at the foot of East Twenty-fourth Street nearly to the Williamsburg Bridge, sunken reefs extend from 300 to 400 yards off the piers on the New York side of the river. **Shell Reef,** with a least depth of 15 feet (4.6 m.), is marked by a red buoy lying about ½ mile northward of the Williamsburg Bridge.

The **United States Navy Yard,** on **Wallabout Bay,** is on the south shore southward of Williamsburg Bridge, where the East River makes a bend westward.

Wallabout Channel, with entrance on the east side of Wallabout Bay, is 2,000 feet long and is maintained at a depth of 20 feet (6.1 m.).

Williamsburg, Manhattan, and **Brooklyn Bridges,** crossing East River, are suspension bridges 135 feet (41 m.) in the clear at the middle above mean high water, and less at the piers. Allowing

for changes of temperature, a masted vessel should not depend on a greater height than 130 feet (39 m.) at mean high water for a width of about 400 feet at the middle of the bridge.

Governors Island lies in the middle of East River, where it joins New York Upper Bay. **Fort Columbus** is on the northeast part of the island, and **Castle William** at its northwest end. The main channel leads north of Governors Island.

Buttermilk Channel leads from New York Upper Bay into East River, between Governors Island and Brooklyn, and forms the access to Atlantic Docks. The channel follows the piers of Brooklyn; the general depth is 30 feet (9.1 m.), but there are several spots with as little as 20 feet (6.1 m.) over them. The channel is broad and unobstructed and about 800 feet wide at its narrowest part from Atlantic Avenue Ferry to the Atlantic Docks.

East River Channel between The Battery and Governors Island.—This channel is being improved to a depth of 40 feet (12.2 m.) for a width of 1,000 feet. In 1925 there was a channel of navigable width and 34 feet (10.3 m.) deep. **Battery Reef** has been removed to a depth of 26 feet (7.9 m.) and **South Ferry Reef** to a depth of 18 feet (5.5 m.). **Coenties Reef** is being removed to a depth of 40 feet (12.2 m.), and in 1925 had a least depth of 30½ feet (9.3 m.). **Diamond Reef** is being removed to a depth of 25 feet (7.6 m.) and that portion of the reef extending into the 40-foot channel to a depth of 40 feet (12.2 m.). **Regulations** governing the navigation of East River in the vicinity of the Battery during the improvement operations on Coenties and Diamond Reefs have been prescribed by the Secretary of War, and copies of these regulations may be obtained from the Army Engineers, 39 Whitehall Street, New York City.

Pilotage is compulsory for foreign vessels and vessels under register navigating the channel of Hell Gate who shall be spoken. A number of the Hell Gate pilots have their headquarters at City Island. Pilots come off in small boats from Sands Point, City Island, and The Battery in response to signal.

The rates of pilotage for sloops, schooners, and barges are $1.75 per foot of draft from eastward of Sands Point or Execution Rocks to the port of New York, or the reverse; and for motor, steamer, or square-rigged vessels the rates are $3 per foot.

From November 1 to April 1, $4 additional for every motor, steamer, or square-rigged vessel, and $2 additional for a schooner, sloop, or barge.

Towboats will be found in the vicinity of City Island and in East River. Vessels intending to take a towboat should do so before going westward of Rikers Island.

Reporting station.—Vessels are reported at the Maritime Exchange, New York City, from City Island.

Currents, see page 122.

Storm warnings are displayed at Throgs Neck, Brooklyn Navy Yard at Wallabout Bay, Whitehall Building (New York), and Maritime Exchange (New York).

Anchorages in East River.—For the defined limits of the anchorages see the appendix.

Hammond Flats, between Throgs Neck and Old Ferry Point, is an anchorage for all classes of vessels in 5 fathoms (9 m.) or more,

with good holding ground. Toward Old Ferry Point the water deepens abruptly to 16 and 18 fathoms (29 and 33 m.). There are no dangers, but the water shoals abruptly close inshore from 18 to 4 or 5 feet (5.5 to 1.2 or 1.5 m.).

Off Whitestone good anchorage in 18 feet to 8 fathoms (5.5 to 15 m.) is found eastward of the point. There are no dangers, but the water shoals abruptly close inshore. Avoid Whitestone Point, which makes off rocky northward and is shoal on its western side.

The stretch between Whitestone Point and College Point is not much used as an anchorage.

Flushing Bay is available for light-draft vessels. The flats in Flushing Bay are soft mud, and afford excellent anchorage for vessels of light draft.

Westward of Rikers Island the channel is narrow, the water deep, the holding ground poor, and tidal currents have great velocity, making it unsafe for vessels to anchor before reaching the wharf at the foot of East Thirty-first Street, New York City.

A good anchorage in 4 to 10 fathoms (7 to 18 m.) is found between East Thirty-second Street and East Twenty-fourth Street Wharves, on the New York side of the river.

DIRECTIONS, EAST RIVER

The rocks and reefs in East River are being removed to the project depths for the channel. (See "Depths," on p. 252.) Care should be taken to avoid fouling the vessels and equipment engaged in this work. Mariners should obtain copies of the regulations governing the navigation of East River in the vicinity of the improvement operations, from the Army Engineers, 39 Whitehall Street, New York City.

With the aid of a pilot, vessels of as much as 30-foot (9.1 m.) draft are taken to some of the piers in East River from Upper New York Bay. The strong tidal currents and the crowded traffic in the river between Rikers Island and Governors Island makes great caution necessary. Strangers in low-powered vessels should not attempt to pass through Hell Gate except at slack water, and then only during the daytime, and all strangers are advised to take a pilot.

Throgs Neck to Hell Gate Bridge.—Passing about 300 yards southward of Throgs Neck, steer 277° true (WNW. ½ W. mag.) for 1¼ miles until Whitestone Point Light is abeam distant nearly ¼ mile; then steer 260° true (W. mag.) for 2½ miles, passing about 250 yards southward of Old Ferry Point, 150 yards northward of the black bell buoy off College Point, and to a position with Hunts Point Light bearing 317° true (NNW. ⅞ W. mag.) distant ¼ mile.

Then steer 286° true (NW. by W. ⅝ W. mag.) to a mid-channel position between Barretto Point and the north end of Rikers Island, and with Rikers Island Light abeam; then steer 295° true (NW. ⅞ W. mag.) and round the north end of North Brother Island in mid-channel. When rounding North Brother Island extra caution is necessary to avoid collision with passing vessels and tows off Port Morris.

Pass 100 yards off the wharves at Port Morris and steer 219° true (SW. ⅝ W. mag.) to a position 75 yards southeastward of Sunken Meadow Light, passing midway between the light and Mid-

dle Ground spar buoy No. 9, and then head for the center of Hell Gate Bridge.

Hell Gate Bridge to Blackwells Island Reef.—Pass under the center of Hell Gate Bridge and keep near mid-channel, giving Negro Point a berth of over 100 yards. Avoid the ledges in the bight on the south side of Wards Island and round Hallet Point at a distance of 50 to 175 yards. Vessels proceeding westward against the current here must exercise great caution in rounding Hallet Point to avoid being set across the channel on the shoals off Mill Rock. Follow a mid-channel course westward of Blackwells Island and then follow the wharves on the New York side until abreast East Thirty-third Street, at a distance of less than 250 yards, to avoid Blackwells Island Reef.

The **tidal currents** have great velocity between Sunken Meadow and the north end of Blackwells Island; the greatest velocity is between Negro Point and Hallet Point, where extra caution is necessary to avoid collision with passing vessels. The west shore of Blackwells Island should be given a berth of 70 yards, and when abreast of East Sixty-fifth Street the west shore of the island should not be approached closer than 100 yards.

Blackwells Island Reef to Governors Island.—Passing about 100 yards off the Manhattan wharves to the wharf at the foot of East Thirty-third Street steer about 164° true (S. ½ E. mag.) and keep in the eastern half of the river until past Third Street Reef about ¼ mile northward of Williamsburg Bridge. Then follow a mid-river course under the Williamsburg, Manhattan, and Brooklyn Bridges. Vessels can pass on either side of Governors Island into New York Upper Bay, taking care not to pass too close to the Battery and Governors Island.

To pass northward of Governors Island, from a mid-river position off Pier 7 or 8, New York, steer 259° true (W. mag.), which leads about 350 yards northward of Governors Island; see the description of the channel in the description of East River preceding.

To pass through Buttermilk Channel, follow the wharves of Brooklyn at a distance of less than 300 yards until abreast Red Hook and the south end of Governors Island. Vessels can then continue to follow the wharves of Brooklyn southward, passing through Red Hook and Bay Ridge Channels, or can steer 237° true (WSW. mag.) to the channel of New York Upper Bay, passing between the shoal extending southwestward from Governors Island and the north end of the shoal lying westward of Red Hook Channel. Approaching Buttermilk Channel from New York Upper Bay, St. Margarets Hotel, in range with the southeasterly end of Governors Island, is a good guide until past the anchorage buoys lying ⅜ to ½ mile south-southwestward of Governors Island, and then follow the Brooklyn wharves.

HARLEM RIVER AND SPUYTEN DUYVIL CREEK

These waters form a through passage from Hudson River, 11¾ miles above the Battery, to East River westward of Wards Island (chart 274). The channel is narrow and crooked and is navigable only for steamers or powered vessels. The piers at High Bridge cause eddies which, together with the strong currents, make naviga-

tion dangerous for even the smallest class of vessels, so that vessels trading to points southward of High Bridge usually enter and leave by way of East River, and those northward by way of Hudson River. The traffic is extensive. Vessels of too great height to pass under the bridges should preferably make the passage against the current.

Channel.—The project for the improvement of Harlem River and Spuyten Duyvil Creek provides for securing a channel 400 feet wide and 15 feet (4.6 m.) deep, except at Washington Bridge, where a width of 354 feet is provided, and at the rock cut at **Dyckmans Meadow** (between Harlem River and Spuyten Duyvil Creek), where the projected width is 350 feet and the depth 18 feet (5.5 m.). It also provides for straightening the channel at Johnson's iron works, Spuyten Duyvil Creek, by making a cut 400 feet wide and 15 feet (4.6 m.) deep.

The channel has been deepened to 15 feet (4.6 m.) for a width varying from 150 to 400 feet, except in the westerly draw opening of Central (Macombs Dam) Bridge, where the depth is 12 feet (3.7 m.); the easterly draw opening of this bridge is not navigable.

Bridges.—The least height of the bridges above mean high water is 25.5 feet (7.7 m.) except Spuyten Duyvil Bridge, which is 7 feet (2.1 m.). All of the bridges have wide openings except High Bridge, which has a clear width of 44 feet between the piers at a depth of 5 feet (1.5 m.) below low water. The bridges are center-pier draws, with the exception of High Bridge and Washington Bridge. The following are details relating to the bridges, with the height above mean high water and the least width on either side unless otherwise stated:

Willis Avenue Bridge, height 25.5 feet (7.7 m.), openings 109 feet.

Second Avenue Bridge, height 29 feet (8.8 m.), openings 98 feet.

Third Avenue Bridge, height 26.5 feet (8.0 m.), openings 100 feet.

Fourth Avenue Bridge, height 25.5 feet (7.7 m.), openings 103 feet.

Madison Avenue Bridge, height 25.5 feet (7.7 m.), openings 104.5 feet.

One hundred and forty-fifth Street Bridge, height 26 feet (7.9 m.), openings 104 feet.

Central (Macombs Dam) Bridge, height 29.5 feet (9 m.), openings 164 feet. The west opening only is navigable, the east opening being blocked by a ledge, bare at low water.

Putnam railroad bridge, height 29 feet (8.8 m.), openings 123 feet.

High Bridge is an arched structure, with a clear height of 100 feet (30 m.) above mean high water to the middle of the arches, and a clear width of 44 feet between the piers at a depth of 5 feet (1.5 m.), below mean low water.

Washington Bridge is a single-span arch for the full width of the river, with a clear height of 129 feet (39 m.), above mean high water to the middle of the arch.

Two hundred and seventh Street Bridge, height 27 feet (8.2 m.), openings 101 feet.

Broadway Bridge, height 26.5 feet (8 m.), openings 103 feet.

Spuyten Duyvil Bridge, height 7 feet (2.1 m.) openings 100 feet.

Tides.—The mean rise and fall of the tides at Willis Avenue Bridge is 5 feet; Central Bridge, 4.7 feet; Broadway Bridge, 3.8 feet; Spuyten Duyvil Bridge, 3.6 feet.

Currents.—The local rule for the tidal currents is that the current in Harlem River runs from the Hudson River toward East River (south current), while the easterly current is running in East River (Hell Gate) and the reverse. In Harlem River the southerly stream is considered the flood.

The time of slack water is subject to some variations, depending on the freshet conditions in Hudson River, but may be taken approximately the same time as the slacks at Hell Gate (about 1½ hours after low and high water at Governors Island). The times of the strength of the southerly and northerly currents occur about 3 hours after the current turns eastward and westward at Hell Gate (about 1½ hours before high and low water, respectively, at Governors Island). The velocity of the current is 2 knots or more in the narrower parts of the channel. Strong currents with swirls occur between the piers of High Bridge.

Bridge regulations.—The following are the regulations prescribed by the Secretary of War for the opening and operation of the draws in the bridges crossing Harlem River:

1. The drawbridges spanning the Harlem River which have a clear space of 24 feet between the undersides thereof and the high water of spring tides shall not be required to open, except for vessels propelled by steam, with or without vessels in tow, nor to open at any time other than between 10 a. m. and 5 p. m., except as hereinafter prescribed in section 7.

2. The clear space prescribed by river and harbor act of September 19, 1890, between the undersides of the bridges and the high water of spring tides is 24 feet, and in order that the draws may not be required to be opened or operated oftener than necessary between 10 a. m. and 5 p. m. from and after the completion of the bridges at Third and Fourth Avenues, the pilot houses, flagpoles, and smokestacks of all tugs propelled by steam, with or without vessels in tow, habitually using said river are not to exceed 24 feet high above the water line, and if now exceeding that height will be reduced in height or hinged, so that they can conveniently pass underneath the draws when closed.

3. Any tug passing the draw of any of the said bridges as often as once a day for 10 days of any month will be regarded as using aid river "habitually," and shall conform to the regulation as to height of pilot house, flagpole, and smokestack which is prescribed in section 2 above.

A failure to comply with this regulation by any tug after one warning by the persons owning or controlling any of said bridges shall be sufficient cause for a refusal to open the draw for the accommodation of said tug until such later time as may be convenient to the persons controlling the bridge.

4. When a steam vessel wishes to pass the bridge within the time prescribed for opening the draws the master thereof shall signify his intention by three blasts of the whistle. If the draw is ready to be opened, the signal shall be answered by three blasts of the whistle from the bridge; if the draw is not ready for opening, by two blasts from the bridge.

5. The draw shall be opened with the least possible delay upon receiving the prescribed signal, except when said signal is given to a railroad bridge five minutes or less before the scheduled arrival of an express passenger train. In this case the draw need not be opened until after the passage of said train unless the bridge tender has information that said train is delayed as much as five minutes.

6. The bridge at the mouth of Spuyten Duyvil Creek, being a low bridge, shall be opened at all times during the day and night when approached by vessels desiring to pass it upon receiving the signals prescribed in section 4.

7. The foregoing regulations apply only to commercial or pleasure vessels, tugs, and steamers. Steam vessels owned, controlled, or employed by the United States Government or by the departments of the city of New York shall be passed without delay through the draws of said bridges at any hour of the day or night after giving a signal of four blasts of the whistle.

SOUTH COAST OF LONG ISLAND

The south coast of Long Island has a general 247° true (W. by S. mag.) trend for 68½ miles from Montauk Point to Fire Island Inlet, and thence trends about 263° true (W. ¼ N. mag.) for a little over 35 miles to the western end of Coney Island and the northern point at the entrance to the Lower Bay of New York. It is a clean shore, and may be safely approached as close as 1 mile, with not less than 5 fathoms (9 m.) anywhere between Montauk Point and Rockaway Inlet, except off Fire Island Inlet and the inlets westward, where the shore should be given a berth of at least 1½ miles. When viewed from seaward it presents but few characteristic features. It is composed of a series of sand hillocks backed by low, dark woods. Montauk Point and lighthouse are described on page 131.

About 14 miles westward of Montauk Point and ½ mile back from the beach is the village of **Amagansett**, and westward of this, along the whole line of the Long Island Railroad and some distance back from the beach, are a number of towns and villages. **Southampton** is 27 miles westward of Montauk and 1½ miles eastward of Shinnecock Bay.

Shinnecock, Moriches, Great South, and Hempstead Bays lie inside of the beach along the south coast of Long Island and form an inside route for boats of 5-foot (1.5 m.) draft. (See the description following.) In 1925 there were three inlets from sea to these bays used by boats—Fire Island Inlet, Jones Inlet, and East Rockaway Inlet. These inlets are subject to frequent and extensive changes, and although buoyed should not be used in the absence of local knowledge.

Amagansett Radiocompass Station is located in latitude 40° 58′ 10″ N., longitude 72° 07′ 27″ W. The arc of calibration is from 70° to 230°. Call letters NBM.

Fire Island Radiocompass Station is located in latitude 40° 38′ 07″ N., longitude 73° 12′ 32″ W. The arc of calibration is from 83° to 262°. Call letters NJY. (See "Radio service" on p. 10.)

Shinnecock Bay Lighthouse is a red brick tower on Ponquogue Point, about the middle of the north side of Shinnecock Bay and 1 mile back from the beach. The light is flashing white (three flashes every 7.5 seconds), 160 feet (49 m.) above the water, and visible 19 miles.

Fire Island Lighthouse is a black and white horizontally banded tower. The light is flashing white (flash 5 seconds, eclipse 55 seconds), 167 feet (51 m.) above the water, and visible 19 miles. Near the lighthouse are a radio station and a reporting station, from which vessels are reported to the Maritime Exchange, New York.

Fire Island Lightship, moored in a depth of 16 fathoms (29 m.) 9⅜ miles 172° true (S. ⅛ W. mag.) of Fire Island Lighthouse, has a red hull with "Fire Island" on each side, two masts, and a black, circular gallery under the lens lantern at head of each. The light (on fore masthead) is occulting white (light 25 seconds, eclipse 5 seconds), 57 feet (17.4 m.) above the water and visible 12 miles. If the occulting light is inoperative, a similar light will be shown from the main masthead. The fog signal is a steam chime whistle, blast 3 seconds, silent intervals 4 and 20 seconds. If the whistle be dis-

abled, a bell will be struck by hand a group of 7 strokes every minute. The submarine bell strikes "6–8" every 38 seconds. The radio fog signal sounds groups of 2 dashes for 50 seconds, silent 15 seconds. (See "Radio service" on p. 10.) The radio station receives and transmits *emergency messages only*. Call letters WWAN.

The following summer resorts are on the beach and are prominent from offshore: Point of Woods and Ocean Beach, lying 4 and 3 miles, respectively, eastward of Fire Island Lighthouse; Oakbeach, Long Beach, Far Rockaway, and Rockaway Beach, lying 3½, 21, 25, and 27 miles, respectively, westward of Fire Island Lighthouse; and Coney Island.

DIRECTIONS, SOUTH COAST OF LONG ISLAND

Vineyard Sound Lightship to Montauk Point gas and whistling buoy.—From Vineyard Sound Lightship, a 240° true (WSW. ½ W. mag.) course for 41½ miles, passing 1 mile southeastward of Block Island Southeast Lighthouse, will lead to Montauk Point gas and whistling buoy. This course leads across shoals with a least found depth of 34 feet (10.3 m.). Deep-draft vessels should steer 239° true (WSW. ⅜ W. mag.) for 28¼ miles until Block Island Southeast Lighthouse is abeam, distant 1½ miles; then steer 242° true (WSW. ¾ W. mag.) for 13¼ miles to Montauk Point gas and whistling buoy. Vessels on the above courses should make allowance for currents to avoid being set on the shoals southwestward of Block Island.

Montauk Point gas and whistling buoy to Ambrose Channel Lightship.—From Montauk Point gas and whistling buoy, a 243° true (WSW. ⅝ W. mag.) course for 72 miles, will lead to Fire Island Lightship. From Fire Island Lightship, a 269° true (W. ⅞ N. mag.) course for 29½ miles will lead to Ambrose Channel Lightship.

INLAND WATERS, SOUTH COAST OF LONG ISLAND (CHARTS 578 AND 1215)

Shinnecock, Moriches, Great South, and Hempstead Bays form an inside route for boats of 5-foot (1.5 m.) draft from Peconic Bay to East Rockaway Inlet. Masted boats are limited to a height of less than 20 feet (6 m.) above the water by the fixed bridges over Shinnecock Canal. Westward of East Rockaway Inlet, boats must at present pass outside to reach Jamaica Bay or New York Harbor. The private stakes and other aids mentioned were in place in 1925.

Shinnecock Canal connects Great Peconic Bay and Shinnecock Bay. It is partly a dredged cut and is protected at the northern entrance by two short jetties. The canal and dredged cuts through the bays to Great South Bay are owned and maintained by the State of New York. In 1925 the canal was dredged where necessary to a depth of 8 feet (2.4 m.) and a width of 60 feet. The cuts between the bays leading to Great South Bay were dredged to a depth of 6 feet (1.8 m.) and a width of 60 feet. Shoaling has occurred in some of these cuts and at the Great Peconic Bay entrance to the canal, and in the fall of 1925 the controlling depth from Great Peconic Bay to Great South Bay was 5 feet (1.5 m.). The canal is crossed by two fixed bridges, with spans for the full width of the canal and an

overhead clearance of 20 feet (6 m.). A lock is maintained north of the two bridges crossing the canal. The gates are opened to allow the current to set south through the canal and are closed to prevent the water from Shinnecock Bay flowing back into Great Peconic Bay. Water from Shinnecock Bay flows out through a cut in the beach ½ mile east of Shinnecock Coast Guard Station, also through Quogue Canal.

Slack water in the pond near the northern end of the canal occurs at about half tide in Great Peconic Bay. The currents have considerable velocity, with swirls in the contracted part of the channel, at the lock.

Good Ground, a station on the Long Island Railroad, just west of the canal, is the nearest post office. **Canoe Place,** the settlement at the canal, has gasoline and some supplies.

Shinnecock Bay (chart 578), about 8 miles long, can be entered by boats of 5-foot (1.5 m.) draft, and this depth can be taken into the coves on the north side. The south side of the bay is shoal.

Weesuck Creek, on the north side near the western end of Shinnecock Bay, has a depth of 2 feet (0.6 m.) along the west bank to a bridge at the head. There are two boat yards where motor-boat supplies and repairs can be had. The post office is **East Quogue.** During the summer a ferry runs to **Tiana Beach,** a small summer resort on the south side of Shinnecock Bay.

Quogue Canal, connecting Shinnecock Bay with Quantuck Bay, has been dredged to a depth of 6 feet (1.8 m.) for a width of 60 feet. The canal is crossed by two drawbridges with a least width of 32 feet and each having a vertical clearance of 9 feet (2.7 m.) above mean high water when closed.

Quantuck Bay is crossed by the dredged channel marked by stakes, 6 feet (1.8 m.) deep and 60 feet wide, joining Quoque Canal and Quantuck Canal. **Quantuck Creek,** at the head of the bay, is crossed by a center-pier drawbridge with openings 30 feet wide and with a vertical clearance of 7 feet (2.1 m.) at mean high water when closed.

Quantuck Canal, connecting Quantuck Bay and Moriches Bay, has been dredged to a depth of 6 feet (1.8 m.) for a width of 60 feet. The canal is crossed by two drawbridges having a least width of 32 feet and a least clearance of 6 feet (1.8 m.) above mean high water when closed.

Moriches Bay (chart 578), about 8 miles long, is crossed by the inside waterway leading from Shinnecock Canal to Great South Bay. The eastern and western entrances to the bay have been dredged where necessary to a depth of 6 feet (1.8 m.) and a width of 60 feet, and these dredged cuts are marked by stakes. The general depths in the bay range from 5 to 7 feet (1.5 to 2.1 m.), but the southern part of the bay is shoal.

Seatuck Cove, north side of Moriches Bay, has a depth of 3½ feet (1.1 m.) to the landing at **Eastport,** on the point which separates the two creeks at its head. About ¼ mile southward of the landing a shoal extends from the east side and is sometimes marked by a stake with box.

Tuthill Cove, north side of Moriches Bay, 1 mile westward of Seatuck Cove, has depths of 3 to 5 feet (0.9 to 1.5 m.). **East Moriches** is on its northwest side, and gasoline and small repairs can be had.

Hart Cove has considerable grass and is little used.

Senix Creek, north side of the west end of Moriches Bay eastward of Forge River, has a narrow entrance, with a depth of 3 feet (0.9 m.) between bulkheads, and the depth throughout the creek is about 2 feet (0.6 m.). A stake with flag marks a shoal on the east side at the entrance. The post office is **Center Moriches.**

Forge River has a channel depth of about 4 feet (1.2 m.) in the lower half and 3 feet (0.9 m.) nearly to the railroad bridge at the head of navigation. The channel is indicated by the grass on the shoals.

The channel between Moriches Bay and Bellport Bay has been dredged where necessary to obtain a depth of 6 feet (1.8 m.) for a width of 60 feet. The controlling depth in 1925 was 5 feet (1.5 m.). The channel is crossed by a drawbridge at **Smith Point,** 36 feet wide and with a vertical clearance of 10 feet (3 m.) at mean high water when closed.

Bellport Bay is shoal in its southern part, but has depths of 5 to 7 feet (1.5 to 2.1 m.) in the northern part. The channel on the eastern side of the bay leading to Moriches Bay is marked by stakes in summer.

Carman River has a depth of 3 feet (0.9 m.) for nearly 1 mile above the entrance to the landing at **Brook Haven,** above which the river is shoal and crooked. Sometimes there is a bush stake on each of the shoals making off from the points at the entrance. Entering in midriver between these stakes, favor the west side for a distance of ½ mile and then follow midriver.

Bellport, a town on the north side of **Bellport Bay,** has a wharf with 5 feet (1.5 m.) at its end. The deepest draft taken to the wharf is about 5½ feet (1.7 m.) at high water. The approach is clear. Coal, provisions, and motor-boat supplies can be obtained, and repairs to gas engines can be made. A ferry runs across the bay in a southeasterly direction and through a slough between the shoals to **Old Inlet,** on Fire Island Beach.

Great South Bay (chart 578), about 28 miles long, can be entered at high water by boats of about 8-foot (2.4 m.) draft through Fire Island Inlet, 5-foot (1.5 m.) draft from Great Peconic Bay, and 5-foot (1.5 m.) draft from westward through Hemstead Bay.

Fire Island Inlet was formerly under improvement to secure a channel 10 feet (3 m.) deep and 200 feet wide from deep water outside the inlet to the deep water in Great South Bay. Due to the frequent changes in the inlet this improvement has been abandoned. The inlet and Fire Island Beach have been moving westward at a fairly uniform rate for many years. The channel across the bar is subject to great change, sometimes leading between the point of Fire Island Beach and the shoal westward, and at other times leading westward along Oak Beach northward of that shoal. A gas buoy and a whistling buoy are located off the inlet in a depth of about 9 fathoms (16 m.). The channel across the bar and into the inlet is marked by many buoys, but due to the frequent changes in their location they are not charted.

Fire Island Inlet is used extensively by fishermen and pleasure craft during the summer months. Strangers should proceed with

caution and take a pilot. A pilot may be obtained by hailing a fishing boat or signaling the Coast Guard station. A draft of 12 feet (3.7 m.) may be carried up the main channel in smooth weather, but to do this the buoyed channel can not be followed too closely. Eight feet (2.4 m.) is a safe draft in ordinary weather, but in heavy weather the entrance should not be attempted, as breakers form entirely across the bar. Strangers should keep outside the fish traps until entering the channel.

The **currents** in Fire Island Inlet after crossing the bar have a velocity at strength of about 3 knots on the flood and 2 knots on the ebb and are influenced greatly by the force and direction of the wind. In the bay the currents have little velocity except in the narrow channels between the shoals and within a radius of 3 miles from the lighthouse, where at times their estimated velocity is 1 to 1½ knots.

Inside of Fire Island Beach the channels are fairly stable, and the chart can be used with more confidence. From the inlet the channel with good depth leads eastward inside the beach past Fire Island Lighthouse, from which several channels lead between the shoals to the north side of Great South Bay.

East Channel is buoyed and is good for a depth of 8½ feet (2.6 m.). From between Fire Island Lighthouse and Fire Islands the channel trends northeastward to Fire Islands, then eastward along the beach to Point of Woods, then 6° true (N. by E. ½ E. mag.) nearly 1¾ miles, and then northeastward.

Range Channel, lying close to westward of East Channel, is marked by buoys and beacons and is good for a depth of about 7 feet (2.1 m.).

West Channel is buoyed and is good for a depth of 7 or 8 feet (2.1 or 2.4 m.), which is found in Great South Bay at the north end of the channel. From close westward of Fire Islands the channel trends about 338° true (N. by W. mag.) for 1 mile, and then about 321° true (NNW. ½ W. mag.).

Snakehill Channel is a natural channel marked by bush stakes during the summer. About 4-foot (1.2 m.) draft can be carried through, but a stranger should not attempt it without a pilot. **Oak Island Channel** is a dredged channel marked by bush stakes in the summer and is good for 4-foot (1.2 m.) draft. **Fox Creek Channel** and **New Inlet** are used only by a few fishermen with very shallow-draft boats.

Point of Woods, Ocean Beach, and **Saltaire** are summer resorts 4, 3, and 1 miles, respectively, eastward of Fire Island Lighthouse. Landings extend from them to deep water on East Channel, Great South Bay, and boats make regular trips to Bay Shore. Gasoline and provisions can be obtained.

Cherrygrove is a summer resort on Fire Island Beach 6½ miles eastward of Fire Island Lighthouse. A boat landing extends to a depth of 4½ feet (1.3 m.) in Great South Bay, and to it boats make regular trips from Patchogue and Sayville through the slough which extends in a south-southwesterly direction to it.

Patchogue River is on the north side of the eastern end of Great South Bay. The entrance is protected on the west side by a jetty (marked by a light) and on the east side by a sandspit with a riprap extension. A channel 100 feet wide and 8 feet (2.4 m.) deep extends

for nearly 1 mile to the head of navigation. **To enter,** follow the jetty at a distance of 85 feet until through the narrow entrance, then about 100 feet off the bulkhead on the east side for 300 yards until past the entrance to a small slough on that side, then cross gradually to the west side and favor that side until the harbor narrows, then keep in mid-channel. For a distance of 500 feet from the head, nearly the entire harbor is clear.

Patchogue, the principal town on Great South Bay, has several marine railways and facilities for repairing and supplying small craft. There are depths of 6 to 9 feet (1.8 to 2.7 m.) at the bulkhead on the east side near the head of the river; elsewhere there are little depths in places. There is a depth of 3 feet (0.9 m.) at the end of the wharf on the bay side of the town. From Patchogue boats run southward and southwestward across Great South Bay to **Long Cove** and **Walter Island,** bathing places on Fire Island Beach.

Brown Creek, on the north side of Great South Bay, 3 miles westward of Patchogue, has been improved by building two short jetties at the entrance out to a depth of about 4 feet (1.2 m.) and by dredging a channel 100 feet wide and 4 feet (1.2 m.) deep to the sharp bend ⅝ mile above the entrance. This channel had shoaled to a depth of 3 feet (0.9 m.) or less in 1925. Enter midway between the jetties on a 349° true (N. mag.) course and keep in mid creek. Two electric lights on the bulkhead on the west side of the mouth of the river form a range for the entrance.

Sayville, a town on Brown Creek, has marine railways 50 feet long and facilities for repairing and supplying small craft. There are nine prominent, high radio masts at Sayville.

Conetquo River, on the north side of Great South Bay, 3 miles westward of Browns Creek, has a depth of 3 feet (0.9 m.) for 2 miles above the entrance to the railroad. **Great River** is a post office on its west side. There is a prominent residence, with clock tower, on the north side of the entrance.

On the north shore of Great South Bay, westward of Nicoll Point, there are several small creeks which have been dredged to various depths by private interests.

Great Cove is on the north side of Great South Bay 354° true (N. ⅜ E. mag.) of Fire Island Lighthouse. A dredged channel with a depth of 5 feet (1.5 m.) leads in a north-northeasterly direction into the eastern creek of the cove to the town of **Islip.** This channel is sometimes marked by private buoys and a stake with red keg at the outer end, which also mark the edge of the shoal on the east side of Great Cove.

Bayshore is a town on the northwest shore of Great Cove. The wharf has a depth of about 4 feet (1.2 m.) at its end, and from it boats run to **Ocean Beach.** There is a marine railway at Bayshore and facilities for repairs and supplies for small craft. A yacht basin with a depth of about 6 feet (1.8 m.) has been dredged at **Bright Waters,** on the southwest side of the town.

Babylon is a town near the north shore of Great South Bay 305° true (NW. mag.) of Fire Island Lighthouse. The public landing is ¼ mile northward of Sampawam Point and at the mouth of Sampawam Creek, and has 4 feet (1.2 m.) at its end. Approaching around **Sampawam Point** give the point a berth of over ¼ mile

when southeastward of it and head for the wharf on a northwesterly course. Provisions, coal, supplies of all kinds, and engine repairs are obtainable. Water can be had at the landing. There are marine railways for small craft on Sampawam and Carll Creeks. A cable crosses the bay in a southeasterly direction from Sampawam Point, and anchorage should be avoided in its locality.

Sampawam Creek, just northward of the wharf, has been dredged to reclaim adjacent lands, and is bulkheaded on its west side. It is used as an anchorage by small craft and has a depth of about 3 feet (0.9 m.) through the entrance and greater depths inside. Boats also anchor between the public landing and Sampawam Point.

Carll Creek, westward of Sampawam Point, has been dredged to reclaim land near it; and a channel with a depth of about 3 feet (0.9 m.), which has been cleared of grass, leads in a northwesterly direction to the entrance and into the creek.

Oakbeach is a summer resort on **Oak Island Beach** 3½ miles westward of Fire Island Lighthouse. Boats make regular trips from Babylon through a channel which has a depth of 3½ feet (1.1 m.) and is marked on its west side by stakes and buoys. This channel has approximately a 141° true (SSE. ½ E. mag.) direction, with the public landing at Babylon astern, then southward for ¼ mile, then southwestward to the east side of Oak Island, and then follows the east and south shores of Oak Island. Gasoline and provisions can be obtained, and there is a marine railway for small craft.

Amityville Creek, on the north side of the west end of Great South Bay, has a depth of about 3 feet (0.9 m.). **Warasketuck Creek,** between Amityville Creek and Carmen Creek, has been dredged to a depth of 4 feet (1.2 m.). **Carmen Creek** is used by boats of 3-foot (0.9 m.) draft or less on a favorable tide.

Amityville is a small town on the north shore of Great South Bay at its western end. There is a marine railway for small craft and gasoline and other supplies can be obtained. A ferry operates to **Gilgo Beach** during the summer, and there is regular bus communication with Patchogue and the intervening towns.

South Oyster Bay, lying between Great South Bay and the broken body of water known as Nassau (Hempstead) Bay, is shoal over its greater part. A channel marked by stakes, and good for a draft of about 5 feet (1.5 m.) at high water, extends through the bay.

Hempstead Bay (chart 1215) is the name applied to the numerous sloughs which lie inside the beach from the west end of Great South Bay to Far Rockaway. Boats of 5-foot (1.5 m.) draft can be taken through from Great South Bay to East Rockaway Inlet, westward of which they have to pass outside for a short stretch to reach Rockaway Inlet or New York. Jones Inlet is the other entrance to Hempstead Bay. The sloughs of Hempstead Bay are subject to large changes in the vicinity of the inlets and where dredging is done to reclaim land.

Jones Inlet usually has a depth of about 6 feet (1.8 m.) in the buoyed channel but is subject to frequent extensive changes. It is used by boats up to 5-foot (1.5 m.) draft, which go eastward by the inside route to Great South Bay and northward through Long Creek and a dredged channel to Baldwin and Freeport. A gas buoy and a

bell buoy are located in about 5 fathoms (9 m.) of water off the entrance. Five channel buoys mark the best water over the bar and into the entrance, but due to frequent changes in location they are not charted. These buoys often tow under with the strong current and can not be depended on. Strangers should employ local fishermen or a man from the Coast Guard station to act as pilot.

Freeport and **Baldwin** are towns on the north shore of Hempstead Bay. There are many small marine railways here, the largest being capable of hauling out vessels up to 100 feet in length and 6-foot draft. Gasoline and supplies of all kinds can be obtained. A ferry operates from Freeport to **Point Lookout** and **Short Beach** during the summer. The latter towns are summer resorts on the west and east side, respectively, of Jones Inlet.

A depth of 6 feet (1.8 m.) can be carried at high water to Freeport through **Long Creek** and **Freeport Creek.** There is a depth of 6 feet (1.8 m.) in the dredged slip on the east side of **Baldwin Bay. Milburn Creek,** leading to Baldwin from the northwest side of Baldwin Bay, it being dredged to a depth of 8 feet (2.4 m.). These channels are marked by stakes during the summer.

East Rockaway can be reached by vessels of less than 5-foot (1.5 m.) draft at high water through **Broad Channel** and **East Rockaway Channel.** These channels are marked by stakes during the summer. Gasoline and other supplies can be obtained here and there is a marine railway for small vessels.

Long Beach Channel, extending eastward along the north shore of Long Beach from East Rockaway Inlet to Jones Inlet, is crossed by two drawbridges. The railroad bridge is a center-pier draw with openings 41 feet wide. The highway bridge has a lift span 100 feet wide and with a vertical clearance of 7½ feet (2.3 m.) above mean high water when closed.

East Rockaway Inlet had a depth of about 8 feet (2.4 m.) in 1925. A bell buoy is located in about 4½ fathoms (8.2 m.) of water off the entrance. The entrance is marked by three channel buoys, but due to the frequent changes in position they are not charted.

Long Beach is an important settlement and seaside resort on the outer beach east of East Rockaway Inlet.

Lawrence is a settlement and resort on the mainland, at the entrance of East Rockaway Inlet, and has communication with Long Beach by ferry.

Communication.—The Long Island Railroad affords communication to all of the towns on the north side of Shinnecock, Moriches, Great South, and Hempstead Bays, and to Long Beach, Far Rockaway, and Rockaway Beach. There are telegraph and telephone facilities at these places and at Fire Island Beach near the lighthouse.

Supplies and gasoline can be obtained at all of the towns and at many of the smaller places, as mentioned in the description preceding or the directions following.

Repairs.—There are marine railways for small craft at Patchogue Sayville, Bay Shore, Babylon, Amityville, Freeport, and East Rockaway. There are small machine shops or garages at many places, in addition to the towns, where repairs to gas engines can be made.

Tides.—At the north entrance to Shinnecock Canal, in Great Peconic Bay, the tide has a mean range of about 2.5 feet; in Shinnecock Bay, 0.2 foot; Moriches Bay, 0.3 foot; Bellport Bay and Great South Bay as far west as Amityville, except at the inlets, about 1 foot; Fire Island Inlet, on bar, about 3.5 feet; in the inlet near Fire Island Lighthouse, about 2 feet; in Hempstead Bay, at the inlets, about 4 feet, diminishing toward points in the bay remote from the inlets.

High water at Babylon is about 2½ hours, at Bellport 3½ hours, after high water on the bar at Fire Island Inlet, or 2¼ and 3¼ hours, respectively, after high water at Sandy Hook.

Winds affect the water level to a marked degree, and may amount to as much as 2 feet above or below the normal in some localities. In Moriches Bay storm tides of 3 feet are reported. Easterly winds increase the depth in Shinnecock Bay and decrease it in Moriches Bay.

The currents have considerable velocity in the vicinity of the inlets, in the sloughs in Hempstead Bay, and in Shinnecock Canal; elsewhere they are generally weak.

The tidal currents in Great South Bay are reported to meet in the vicinity of Strong Point, about 4 miles westward of Babylon.

Between Jones and East Rockaway Inlets the currents meet at the east entrance of the canal leading west from Cinder Creek.

Ice.—These waters are generally closed to navigation by ice during January and February, and at times from December to March.

DIRECTIONS, INSIDE ROUTE, SOUTH COAST OF LONG ISLAND

The route leads from Great Peconic Bay to East Rockaway Inlet through Shinnecock Canal, Shinnecock, Quantuck, Moriches, Great South, South Oyster, and Hempstead Bays and the natural channels and dredged canals connecting them.

The channel has a least depth of 5 feet (1.5 m.), and boats of this draft can be taken through. Masted boats are limited to a height of less than 20 feet (6 m.) above the water by the fixed bridges over Shinnecock Canal. In the dredged cuts between Shinnecock and Bellport Bays lumps are encountered which have been formed by the propellers of grounded boats.

The channel is marked by private aids, consisting of stakes, bushes, stakes with cans or pointers, and buoys. They are established and maintained by local yacht clubs generally. The principal marks which were found in place in 1925 are mentioned in the directions following.

The underwater extensions of many of the points on the north shore are composed of gravel, and such localities should be approached with caution.

From Babylon to Amityville there is heavy growth of grass on the bottom. In this section the channel is cleared of grass to a considerable extent by the propellers of boats, and the channel is indicated by the grass on each side at all stages of the tide. Special propellers which free themselves of the grass are used by local boats, and are necessary for this locality.

During heavy weather there is a short, choppy sea in Great South Bay which is uncomfortable to small craft, and even dangerous to open boats.

Great Peconic Bay to Moriches Bay.—Keep in deep water until the jetties are open and then steer midway between them, passing to eastward of two stakes. Favor the eastern bank of the dredged cut and pass through the tide lock; the course then leads in mid-channel under the bridges. When past the highway bridge favor the west bank through the dredged cut and for 300 yards beyond to avoid the shoal extending southward from the east point at the south entrance to the canal. Then steer 107° true (SE. by E. ½ E. mag.) so as to go nothing southward of the middle of this part of the bay, in order to avoid a shoal extending nearly ¼ mile northward from Cormorant Point. When Shinnecock Lighthouse is visible follow the west shore at a distance not less than 250 yards to the entrance of a channel, sometimes marked by stakes, southeastward of Shinnecock Lighthouse, on Ponquogue Point. On the west shore about ¼ mile southward of Cormorant Point is a prominent casino. **Ponquogue Point** is low and sandy.

The channel is about 150 yards eastward and 300 yards southward of Ponquogue Point, and is sometimes marked by stakes on its west and north sides, which should be followed at a distance of 25 yards. When up with a stake lying southwestward of Ponquogue Point, steer northward and westward, following the north shore at a distance of about 300 yards. There is a white frame launch garage on the north shore about ½ miles northwest of Ponquogue Point; a channel marked by stakes and cans leads to the garage and basin.

Pass 100 yards off **Rampasture Point,** which is very low and nearly awash at its outer end, and steer 247° true (W. by S. mag.) with Shinnecock Lighthouse astern and pass ¼ mile southward of **Pine Neck** (low, flat, and sandy). The shoal extending southward from Pine Neck Point was marked by a bush stake in 1925. About ½ mile east of Pine Neck, a 3-foot (0.9 m.) channel, marked by stakes, leads to **Tiana Beach** (a small summer resort). Continue the course and pass 200 yards southward of **Phillips Point;** there was a stake with flag on the end of the shoal extending off the point. When past Phillips Point haul gradually southwestward and follow the west shore, or east side of **Penniman Point,** at a distance of 200 yards. Follow a mid-channel course south of Penniman Point, and give the south shore a berth of over 200 yards in crossing the mouth of Penniman Creek.

Approaching the canal favor the south shore, and favor the north side of the cut after entering the canal. From the canal cross the pond heading for **Quogue drawbridge;** bound east from Quogue drawbridge, the entrance to the canal is the northern one of two openings in the marsh, and from the draw it shows just south of Shinnecock Lighthouse.

The channel through the dredged cuts and ponds connecting Shinnecock Bay and Moriches Bay has a depth of about 6 feet (1.8 m.). Spoil banks mark both sides of the dredged cuts. On the south side of the canal is a launch garage and basin. Follow the cut, favoring the north side, to the pivot drawbridge at Quogue Coast Guard Station. Gasoline, some supplies, and repairs may be had here.

From the bridge favor the north side of the dredged cut which leads westerly through the marsh to **Quantuck Bay.** Entering Quantuck Bay the channel is marked on the south side by a low sand spit, and thence by stakes on both sides. When past the last stake, head for the West Hampton pivot drawbridge. Favor the north bank in the cut as the bridge is approached. A pipe line crosses the canal at the bridge, and anchorage is forbidden. There is a hotel at **West Hampton Beach.**

West from West Hampton bridge favor the north side of the cut and avoid a 2-foot (0.6 m.) shoal in mid-channel, sometimes marked by a black buoy, about 300 yards west of the bridge. Entering **Moneybogs Bay,** favor the north side of the canal and head for Jessup Bridge. Pass 10 yards south of an island and 15 yards north of a small islet, then steer westward and follow the north shore at a distance of 50 yards until 200 yards from the bridge, and then head for the pivot draw. The channel is marked on the south side by stakes.

Moriches Bay to Great South Bay.—Entering Moriches Bay from Jessup bridge, the course is westerly for 100 yards, then follow the north shore at a distance of 100 to 150 yards. At the point where the north shore turns northwestward, about ⅜ mile westward of the bridge and just southward of the narrow entrance of a pond, a shoal makes off 150 yards. Pass southward of the shoal and steer west-northwestward for the left tangent of **Tanner Neck,** which will lead about midway between the diverging north and south shores of the bay. Pass 350 yards southward of Tanner Neck on a westerly course and pass 250 yards off **Speonk Point,** low and grassy.

Then steer 254° true (W. ½ S. mag.), pass ¾ mile off **Haven Point** (marked by a large white hotel), and pass ¼ mile off **Tuthill Point** and the point westward; then steer 265° true (W. ½ N. mag.) for a prominent white flagstaff on the west side of the entrance to **Forge River;** or the north shore can be followed at a distance of ¼ mile. Pass ¼ mile off **Hallet Point,** low and grassy, on the east side of the entrance to Forge River, and steer southward and westward, following the north shore of the bay at a distance of 200 to 250 yards until approaching **Stony Point,** which lies 1 mile northwestward of Forge River Coast Guard station. Follow the southwest side of Stony Point at a distance of 75 yards on a west-northwesterly course. The channel off Stony Point is contracted by a gravel shoal which extends northeastward from the south shore of the bay, the end of the shoal being marked off Stony Point by stakes along the south side of the channel.

From the head of the bight westward of Stony Point follow the north shore southwestward at a distance of 125 yards, pass 150 yards southward of the point just westward of the bulkhead landing, and then steer westward and pass 75 yards southward of the point on the north shore abreast the northeast point of **Pattersquash Island.**

Pass about 125 yards off the north end of Pattersquash Island, then midway between its west end and the north shore, and pass 200 yards off the points on the north shore until ½ mile west of Pattersquash Island; then draw closer to the north shore and pass 50 yards off the point on the east side of the entrance to the cove on the north side, ⅞ mile westward of Pattersquash Island. The channel is nar-

row at this point, and in 1925 there were some stakes marking the south edge of the channel; then steer west-southwestward with this point astern and **Smith Point** in range with the point at the north end of Smith Point bridge ahead, which will lead in the best water across the entrance of the cove. When 200 yards from the bridge head for the draw opening (width 36 feet, overhead clearance when closed 10 feet) passing about 100 yards off the north end of the bridge. From the bridge steer west-southwestward and pass 150 yards south and 100 yards west of Smith Point.

Great South Bay to South Oyster Bay.—From the channel along the east shore of **Bellport Bay** two sloughs, with depths of 4 to 5 feet (1.2 to 1.5 m.) and sometimes marked by stakes, lead northwesterly through the shoals to the deeper water along the north side of the bay. Either of these channels may be used if the stakes are in place, but the following directions are given in case these sloughs are not marked, as local knowledge is then necessary to follow them.

Follow the east shore of Bellport Bay at a distance of 150 yards until up with a small bight about 1¼ miles northward of Smith Point and abreast a prominent skeleton flagpole and yellow building with red roof, lying ½ mile southward of **Sandy Point.** When the flagpole bears southward of east, steer west-northwestward and pass ¼ mile southward of Long Point. Then follow the north shore westward at a distance of about ⅜ mile, and pass ⅜ mile southward and southwestward of Howell Point.

Along the north shore of Bellport Bay shoals of less than 3 feet (0.9 m.) depth extend 300 yards offshore, and shoals with 3 feet (0.9 m.) and less extend from the south shore to within ½ to ¾ mile of the north shore. The sailing line indicated leads in depths of 4½ to 7 feet (1.4 to 2.1 m.) through Bellport Bay. In the open and deeper water of Great South Bay the chart is a good guide.

From **Howell Point** to Patchogue and Blue Point the north shore may be followed at a distance of not less than ½ mile; or passing ⅜ mile southwestward of Howell Point steer for Blue Point until halfway across, and then haul out to pass ⅝ mile southward of it. Westward of Howell Point shoals with 3 feet (0.9 m.) or less extend nearly 1½ miles from the south shore of the bay.

An oyster reef, with depths less than 6 feet (1.8 m.) and which shoals abruptly, extends about ½ mile off **Blue Point** and is marked at its south end by a black buoy. Passing close to this buoy keep ½ mile off the north shore past **Brown** and **Green Points,** and then steer westward across **Nicoll Bay** heading for Nicoll Point. Pass ⅜ mile south of Nicoll Point and then westward about ½ mile off the points of the north shore. Cross Great Cove and follow the north shore at a distance of about ½ mile until approaching **Conklin Point** and then draw in to ⅜ mile. Then steer westward and pass ¼ mile southward of **Sampawam Point** and Fleet Point.

The channel from Fleet Point westward to the shoal area (locally known as the Bulkhead) north of Townsend Island is marked by stakes and bushes which are passed close to. From ¼ mile off **Fleet Point** head to pass ⅜ mile off the point on the west side of the entrance to Neguntatogue Creek, then to pass 200 yards off **Strong Point,** the same distance off the point at the east side of the entrance

to Great Creek, 150 yards off the west point, and then 100 yards off the point east of Wood Creek. Thence westward past the yacht club on the point at the west side of the entrance to Amityville Creek, head for the point on the west side of entrance to Carman Creek until 300 yards from it, and pass 100 yards south of the point. Here the channel carries about 3 to 3½ feet (0.9 to 1.1 m.) at low water through the "Bulkhead."

South Oyster Bay to East Rockaway Inlet.—Follow the S-shaped channel with 3 feet (0.9 m.) at low water, which is marked on its westerly side by stakes and bushes and extends in a general southerly direction across the bay toward the north end of **Townsend Island.** From a point 150 yards north of Townsend Island the channel passes north of a cluster of islets and trends westward nearly for the north end of **West Islands;** along this reach the channel is deep with steep banks, and is marked on its north side by stakes and bushes. When 200 yards off the north end of West Islands turn southward along the east side of West Islands, about 100 yards offshore. The channel is deep with steep banks, and is marked on its west side by stakes and bushes along the east side of West Islands.

The channel then passes around the end of a flat which extends ¼ mile southwestward from West Island and is marked at its end by a stake; then past a shoal on the south side of the channel, sometimes marked by a bush; thence westerly past flag stakes marking the north side of the channel and passing ¼ mile south of **Squaw Island.** There are also bush stakes on the flats surrounding Squaw Island. From a position ¼ mile south of Squaw Island head for the east end of South Line Island and follow the channel northward and westward, as marked by stakes on its east and north sides, past the east end of **South Line** and **Middle Line Islands** and toward the first stake on the south shore of **North Line Island** and enter Bulkhead Drain.

In **Bulkhead Drain** follow the north bank, sometimes marked by stakes, at a distance of 50 yards. From the west end of North Line Island the channel leads west-southwestward to pass 50 yards off the south side of **Low Island** (southward of Great Island), and is marked on the north side by stakes; then steer for the north side of **Egg Island** till past a black and white striped barrel buoy in the channel northeastward of Egg Island; then steer south-southwestward and pass 125 yards off the southeast side of Egg Island. In 1925 a buoyed channel led along the north side of Egg Island. Then steer westward, about 50 yards off the north shore of **Snipe Island** and **Deep Creek Meadow. Brant Point** and landing are at the north end of Deep Creek Meadow. Gasoline, provisions, and some launch supplies can be obtained here. In 1925, buoyed channels led eastward to **High Hill Beach,** northward to **Merrick** and northeastward to Seaford.

Round Brant Point about 50 yards off and thence along and the same distance off the west shore of Deep Creek Meadow, which is marked by stakes; then pass 100 yards north of Deep Creek Island, marked by **Short Beach Coast Guard station;** then steer west-southwestward and follow the southeast and south shores of Jones Island at a distance of 100 yards to the mouth of **Swift Creek.** Head northwestward into the mouth of Swift Creek and follow the

buoyed channel about 50 yards off the west side of **Jones Island** and the island northward. The run along the south side of Jones Island is exposed to sea through Jones Inlet and the channel is subject to change.

Round the shoal extending northward from the northeast end of **Meadow Island** and follow the buoys marking the channel to the clubhouse on the south point of Sand Creek Meadow, then southward in the buoyed channel through Long Creek until about 50 yards eastward of the clubhouse on the southwest point of Meadow Island, then westward through the buoyed channel in **Long Beach Thoroughfare** to the yacht club on the north side of the eastern entrance. The channel through Long Beach Thoroughfare is difficult, but in 1925 was well marked by private buoys. From the yacht club the channel leads diagonally across the passage, and from ¼ to ⅝ mile westward of the yacht club follows the south side at a distance of 50 yards. It then trends northwestward, passes close to the southwest side of Long Meadow, and then follows the north side of the eastern half of **Middle Island** at a distance of about 100 yards until the west end of Long Meadow bears about north. The channel then heads north-northwestward and westward around the shoal extending 200 yards off the north side of Middle Island. In the passage westward of Middle Island follow the west bank at a distance of 75 yards until down to the next bend in **Cinder Creek;** then steer westward to the entrance of the canal.

The channel leads 271° true (W. by N. mag.) through the first canal, across East Channel, and through the second canal into the waterway along the north side of Long Beach at the entrance to Garrett Lead; the west end of the second canal is sometimes marked on the north side by a stake and target. From the canal steer for the standpipe on the north shore of Long Beach, just west of the bridges, and when ½ mile east of the bridge steer for the draw.

The east bridge (highway) has a lift draw, with opening 100 feet wide and 7½ feet overhead clearance at high water when closed. The whistle signal for the draw is three long and one short blasts. The trestle approach on each side of the draw has about 6 feet overhead clearance at high water.

The west or railroad bridge has a draw with one opening 41 feet wide, and no overhead clearance at high water when closed. The trestle approach on each side of the draw has about 3 feet overhead clearance at high water. The whistle signal for the draw is three long blasts. At **Wreck Lead,** the settlement on Barnum Island at the north end of the bridges, supplies and provisions may be obtained. West of the bridges the channel favors the south shore.

Along **Hicks Beach,** on the north side west of **Broad Channel,** a shoal flat extends off about 300 yards. The north side of the inlet off Lawrence is used as a small boat anchorage.

JAMAICA BAY (CHART 542)

Rockaway Inlet, the entrance of Jamaica Bay, lies between Rockaway Beach on the east and south, and **Plumb** and **Barren Islands** on the north. The inlet is obstructed by a shifting bar over which there are two buoyed channels with depths of 16 to 24 feet (4.9 and 7.3 m.).

The project provides for an entrance channel 30 feet (9.1 m.) deep and 1,500 feet wide; a main channel extending from the entrance channel to the mouth of **Cornell Creek,** to be 30 feet (9.1 m.) deep and 1,000 feet wide, with widening at the bends; and for the protection of the entrance channel by the construction of one or two riprap jetties, as may be necessary. In June 1925, this project was only about 6 per cent completed.

The **Entrance Channel** extends southwestward from Rockaway Point and is marked by buoys. When last examined in 1925, it had a depth of 22 feet (6.7 m.) for a width of 600 feet. This channel extends north-northeastward from the perpendicularly striped whistle buoy lying 1¼ miles southwestward of Rockaway Point. An emergency channel has been dredged around the shoal on the north side of the entrance channel and is marked by buoys. When last examined (1919) it has a controlling depth of 16 feet (4.9 m.). On account of the proximity of the channel to the shifting shoals of Rockaway Inlet, strangers, even in small vessels, should not attempt it except under the safest condition of a rising tide and a smooth sea. The deepest draft of vessels entering is about 14 feet (4.3 m.). The tidal **currents** of Rockaway Inlet set northeastward and southwestward across the easterly entrance of the dredged channel.

Jamaica Bay is formed by numerous marshy islands and shoals with narrow channels between. The shoals and channels, especially those nearest Rockaway Inlet, are subject to change, and the shoaling is generally abrupt on the sides of the channel. The principal traffic is to the large refuse factories on Barren Island and through Beach Channel to the summer resort of Rockaway Beach and those farther eastward. These channels are well marked, and with the aid of the chart vessels should have no difficulty, when inside the dredged channel of Rockaway Inlet, in proceeding to an anchorage in Beach Channel below the horizontally striped buoy marking the lower end of Long Bar. Otherwise the channels of Jamaica Bay require local knowledge.

Main Channel has been dredged to a depth of 18 feet (5.5 m.) and a width of 500 feet from deep water at Barren Island to Canarsie and is well marked by buoys. This channel is under improvement to obtain the project dimensions as outlined above, which will extend it about 4 miles farther eastward to the mouth of Cornell Creek. Extensive improvements are in progress along this channel.

Mill Basin, westward of Mill Island, on the west side of Jamaica Bay, has been improved by dredging a channel 18 feet (5.5 m.) deep from the main channel to the wharves on the northwest side of Mill Basin.

Canarsie, a town and summer resort on the northwest shore of the bay, is a part of New York City, with which it has communication by electric roads. Coal, gasoline, and water are obtainable. There is a railway for small craft. Ferry launches run to **Ruffle Bar,** Barren Island, and Rockaway Point, and there is a large fleet of launches and small craft owned in the vicinity. Numerous boats run to the fishing grounds off the inlet.

Bergen Beach is a summer resort lying 1 mile southwestward of Canarsie. It has communication by electric road, and gasoline can be obtained.

Beach Channel has a least depth of 17 feet (5.2 m.) from the entrance channel to the highway bridge, and 12 feet (3.7) to the wharves above the railroad bridge. The channel is well marked by buoys.

Rockaway Beach is a popular summer resort on the beach forming the south side of Jamaica Bay. It has communication with New York by electric and steam trains and excursion steamers. Coal, gasoline, provisions, and some boat supplies can be obtained here, and there is a marine railway capable of hauling out vessels up to 120 feet in length and a draft of 10 feet aft and 5 feet forward.

Bridges.—The highway bridge across Beach Channel has a double-lift opening 102 feet wide and with a vertical clearance of 26 feet (7.9 m.) at mean high water when closed. The railroad bridges across Beach and Broad Channels have center-pier openings 50 feet wide and a vertical clearance of 3 feet (0.9 m.) above mean high water when closed. The highway bridge across Grassy Bay has a lift opening 52 feet wide and a vertical clearance of 25 feet (7.6 m.) at mean high water when closed. The highway fill across Jamaica Bay has caused very large currents in the vicinity of the bridge openings and vessels should proceed with caution.

Sheepshead Bay, on the north side of the eastern end of Coney Island, is frequented by small craft and launches. A dredged channel 100 feet wide and 7 feet (2.1 m.) deep has been dredged into the bay, and is marked on its east side by two lights. The channel is subject to change. Anchorage regulations are given in those for the port of New York. (See Appendix.) Gasoline and small boat supplies of all kinds can be obtained here, and there is a marine railway for small craft. There is communication with New York by electric train and with Rockaway Beach by ferry.

Ice generally closes navigation during January and February.

Tides.—The mean rise and fall of tides is about 4.8 feet.

NEW YORK BAY AND HARBOR

New York Bay is the principal entrance by water to New York City and surrounding ports. It is divided by The Narrows, a passage 1 mile wide, into an upper and lower bay. The harbor and surrounding ports are shown on charts, as indicated on the index map facing page 1.

LOWER BAY

The Lower Bay extends to The Narrows. That part of it lying westward of Sandy Hook and the main channels extending up the bay is described under the heading "New York Lower Bay, western part." The entrance between Sandy Hook on the south and Coney Island on the north is about 6 miles wide. An extensive bar through which several channels lead extends across the entrance. By the best of these channels the deepest draft vessels can go up to the city.

Ambrose Channel, the principal entrance to New York Harbor, has been dredged 2,000 feet wide and 40 feet (12.2 m.) deep, and is easy of access both day and night in clear weather. The channel is navigable at mean low water for vessels of 37-foot (11.3 m.) draft going at a moderate speed and is used by nearly all steamers. The

channel is well marked by lighted buoys and the lower portion by a range of West Bank and Staten Island lights. The following are extracts from the **regulations** prescribed by the Secretary of War for the navigation of Ambrose Channel:

1. The use of Ambrose Channel is hereby restricted to navigation by vessels under efficient control with their own power and not having barges or other vessels or floats in tow. Sailing vessels and vessels carrying tows are not permitted to use this channel, except under permit as provided in paragraph 2 of these regulations.
2. The district engineer in charge of the improvement of Ambrose Channel may, by written permit, authorize vessels under tow to use Ambrose Channel in special cases, when in his judgment the draft of such vessels, or other conditions, may render unsafe the use of other channels.
3. Vessels permitted to use Ambrose Channel under paragraphs 1 and 2 of these regulations must proceed through the channel at a reasonable speed such as not to endanger other vessels and not to interfere with any work which may become necessary in maintaining, surveying, or buoying the channel; and they must not anchor in the channel except in cases of emergency, such as fog or accident, which would render progress unsafe or impossible.
4. These regulations are not to be construed as prohibiting any necessary use of the channel by any Government boats while on Government duty, nor in emergencies by pilot boats whether steam or sail, nor by police boats.

Main Ship—Bayside—Gedney Channel is the former route used by deep-draft vessels leading westward past Sandy Hook and then northward up the bay. By the last examinations the channels had a depth of 25 feet (7.6 m.) but with widths decreased in places to 500 feet.

Directions.—From Gedney Channel gas and whistling buoys the course through Gedney Channel is 282° true (WNW. mag.) heading for Old Orchard Shoal Lighthouse and passing between the gas buoys which mark the sides of the channel. Then 250° true (W. ⅞ S. mag.) on the Main Channel range (Point Comfort and Waackaack beacons). Then 293° true (NW. by W. ⅛ W. mag.) on the Southwest Spit range (South Hook beacon and Sandy Hook Lighthouse); the shoal on the west side of the channel was encroaching on the intersection of the Southwest Spit and Conover and Chapel Hill ranges, the least depth on the range lines being 25 feet (7.6 m.). Then 6° true (N. by E. ⅜ E. mag.) on the Conover and Chapel Hill range up the bay. In addition to the ranges the channels are buoyed.

South Channel is the next channel of importance, and has a least depth of 22 feet (6.7 m.). A straight course leads from its entrance near Scotland Lightship through it and Swash Channel into the bay, on the range of Elm Tree and New Dorp beacon, course 311° true (NW. ½ N. mag.).

Swash Channel leads from the junction of Gedney and South Channels in a northwesterly direction between Romer Shoal and East Knolls, and passes close to the southwesterly edge of Romer Shoal. It is a narrow channel with depths on the range by the last survey of 22 to 26 feet (6.7 to 7.9 m.), but there are several lumps with 19 feet (5.8 m.) over them close by.

False Hook Channel leads along and close to the eastern shore of Sandy Hook and joins the main channel eastward of the point of the Hook. It is buoyed, and by the last survey had a depth of 12 to 14 feet (3.7 to 4.3 m.), but is not safe for strangers.

Coney Island Channel leads nearly parallel with the south shore of Coney Island, about ¼ mile from the beach near its western end.

It is marked by buoys, and is being improved by dredging a channel 600 feet wide and 20 feet (6.1 m.) deep; in 1925 the depth in the channel was 14 feet (4.3 m.), but it is subject to change. The channel is used principally by vessels going to Jamaica Bay and Coney Island.

The **channel between Staten Island and Hoffman and Swinburne Islands** has a project depth of 16 feet (4.9 m.) for a width of 200 feet. This channel extends from bell buoy No. 23 to the wharves at Hoffman and Swinburne Islands and is marked by buoys. In 1925 the project width and depth obtained.

The most prominent landmark southward of the entrance of New York Harbor is the high, wooded ridge forming the **Highlands of Navesink,** on the side of which, in a cleared space, is **Navesink Lighthouse.** The latter is two brownstone towers connected by dwelling. The light, shown from the southerly tower, is flashing white of high power (light 0.3 second, eclipse 4.7 seconds), 246 feet (75 m.) above the water, and visible 22 miles. In case of accidental extinguishment of the flashing light a fixed white light will be shown from the north tower.

Ambrose Channel Lightship has a straw-colored hull, with "Ambrose" on the sides, and two masts with a circular day mark at the head of each. The light is occulting white (light 12 seconds, eclipse 3 seconds), 65 feet (19.8 m.) above the water, and visible 14 miles. If the light can not be shown from the foremast, it will be shown with the same characteristics from the mainmast head. Should the occulting light become inoperative a fixed white light will be shown. The fog signal is a steam whistle, blast 3 seconds, silent 12 seconds; if whistle be disabled a bell will be struck a single stroke every 30 seconds. A submarine bell strikes "2–2" every 12 seconds. The radio fog signal sends single dashes for 65 seconds, silent 25 seconds. The radio station receives and transmits *emergency messages only.* Call letters WWAT.

Scotland Lightship has a red hull with "Scotland" on each side, and two masts with circular gallery under lanterns at each masthead. The deck houses, upper works, and masts are white; the stack, lantern galleries, and upper third of masts are black. The light (on foremast) is occulting white, light 3 seconds, eclipse 3 seconds, 57 feet (17.4 m.) high and visible 12 miles. A fixed red light is exhibited from the mainmast, 45 feet (13.7 m.) high, and visible 11 miles. The fog signal is a bell, 1 stroke every 10 seconds.

Sandy Hook Radiocompass Station is located in latitude 40° 27′ 54″ N., longitude 73° 59′ 50″ W. The arc of calibration is from 0° to 170°. Call letters NJY. This station, together with Fire Island and Manasquan Radiocompass Stations, form a harbor entrance group for the approach to New York Harbor. In foggy weather use should also be made of radio fog signals from Fire Island and Ambrose Lightships and from Sea Girt Lighthouse. (See "Radio service" on p. 10.)

Sandy Hook, the southern point at the entrance of New York Harbor, is low and sandy. On the north end of Sandy Hook is North Hook beacon, and at the northwest end of the Hook is **Sandy Hook Point Light,** a fixed white light with vertical beam, and fog signal (bell, 1 stroke every 10 seconds). Southward of these are a

fort, some houses, Sandy Hook Lighthouse, South Hook beacon, a Coast Guard station, and a **storm-warning** display station. Near North Hook beacon there is a **reporting station,** from which vessels are reported to the Maritime Exchange in New York City.

Sandy Hook Lighthouse is a white stone tower. The light is fixed white, 88 feet (26.8 m.) above the water, and visible 15 miles.

Romer Shoal Lighthouse, located on Romer Shoal, on the northeast side of Swash Channel, is a conical tower, lower part white, upper part brown, on a black pier.

Ambrose Channel range is formed by West Bank and Staten Island Lighthouses, and marks the axis of the outer section of Ambrose Channel.

West Bank Lighthouse, located off the south end of West Bank, is a brown, conical tower on a black pier having a white horizontal band.

Staten Island Lighthouse, located on high land at Richmond, Staten Island, 5⅛ miles 297° true (NW. ¾ W. mag.) from West Bank Lighthouse, is a light-colored octagonal brick tower. The light is fixed white, 231 feet (70 m.) above the water, and visible 21 miles.

West Bank borders the western side of the channel between West Bank Lighthouse and Fort Wadsworth, a distance of 4 miles. The bank is marked on its eastern side by black buoys, which are placed in depths of 18 feet (5.5 m.) or more. **Swinburne** and **Hoffman Islands,** two artificial islands, each having a number of buildings, are located on West Bank.

Craven Shoal, lying ¼ mile eastward of West Bank and 1¼ miles south-southeastward of Fort Wadsworth, has been removed to a least depth of about 30 feet (9.1 m.); it is marked on the east side by a gas and bell buoy painted red and black in horizontal stripes.

Coney Island, on the north side of Lower Bay, is a large summer amusement resort, which is a prominent feature. **Coney Island Lighthouse,** located on **Norton Point,** on the west end of Coney Island, is a white, square, pyramidal, skeleton tower.

Gravesend Bay makes into the Long Island shore between the western end of Coney Island and The Narrows. The bay affords good anchorage in 11 to 16 feet (3.4 to 4.9 m.), but the southeasterly part of the bay southward of a line joining Norton Point and the pier northward of the marine basin is shoal, having depths of 1 to 6 feet (0.3 to 1.8 m.).

A marine basin, marked at its southwest end by a yacht clubhouse, is on the east side of the southerly part of Gravesend Bay. The entrance is on the north side and is reached through a dredged channel. The ruling depth in the bay is 12 feet (3.7 m.); and there is a greater depth in the dredged channel and basin; vessels of 16-foot (4.9 m.) draft enter at high water. To enter, keep northward of the line of the pier, lying northward of the basin, pass 150 feet off the end of the pier, and steer for the east side of the entrance of the basin. The basin is 325 feet by 1,675 feet. There is a marine railway 135 feet long, and with a capacity of 400 tons, which can take out vessels 175 feet long, and there are good facilities for storing and repairing.

Coney Island Creek, emptying into the southeast end of Gravesend Bay, is crossed by four drawbridges with openings 36, 34, 36, and 23 feet wide, respectively. Above the drawbridges are fixed bridges which obstruct further navigation. With local knowledge a draft of 8 feet (2.4 m.) can be carried to the entrance of the creek and a draft of 5 feet (1.5 m.) to the head of navigation.

THE NARROWS

connects the Lower and Upper Bays, and has a clear width of over 5/8 mile at its narrowest part between Fort Wadsworth and Fort Lafayette. **Fort Lafayette** is a brown-stone structure on the edge of the flats, 300 yards from the Long Island shore; on the southwest corner of the sea wall of Fort Lafayette is a fog bell. In 1903 a channel 200 feet or more wide and 13 feet (4 m.) deep was dredged on the east side of Fort Lafayette.

East of Fort Lafayette, on Long Island, is **Fort Hamilton. Bay Ridge,** a part of Brooklyn, is about 1 mile northward of Fort Hamilton.

Fort Wadsworth Lighthouse, on the west side of The Narrows, is a red-brick, semicylindrical tower.

Above Fort Wadsworth, on Staten Island, are **Clifton (Rosebank), Stapleton, Tompkinsville,** and **St. George.** The latter has communication with Manhattan Island by ferry. Just above Fort Wadsworth in The Narrows are the **Quarantine Headquarters** and **Boarding Station.** Vessels subject to visitation by the health officer are boarded when abreast of or a little northward of Fort Wadsworth.

UPPER BAY

The Upper Bay extends from The Narrows to the Battery. The main channel leads between Jersey Flats and Gowanus Flats and has depths of 5 to 15 fathoms (9 to 27 m.) and a width of about 1/2 mile; the shoaler water is found on the eastern side of the channel abreast Gowanus Flats. Bay Ridge and Red Hook Channels follow the wharves of Brooklyn eastward of Gowanus Flats. Kill van Kull connects the bay with Newark Bay and Arthur Kill, and separates the northern shore of Staten Island from Bergen Neck (Bayonne).

The whole of the western part of the bay is occupied by extensive flats, with 1 to 6 feet (0.3 to 1.8 m.) over them, known as **Jersey Flats.** The eastern edge of the flats is marked by Robbins Reef Lighthouse, Bedloes Island, Ellis Island, the black gong buoy southeastward of Robbins Reef Lighthouse, gas buoys at the entrances of Greenville and Black Tom dredged channels, and a number of black buoys.

A dredged channel, 800 feet wide and 21 feet (6.4 m.) deep, leads to the piers of the Pennsylvania Railroad terminal at **Greenville.** The channel is marked by buoys, and its entrance lies 7/8 mile northeastward of Robbins Reef Lighthouse.

A channel 250 feet wide and 35 feet (10.6 m.) deep leads into the Lehigh Valley Railroad pier just northward of the Pennsylvania Railroad terminal. The entrance lies 300 yards northeastward of

the channel described in the preceding paragraph and is marked by buoys and a lighted range. It leads in a 313° true direction.

A channel, 20 feet (6.1 m.) deep and marked by buoys, has been dredged through the flats southward of Bedloes Island to the piers of the Lehigh Valley Railroad terminal on **Black Tom Island.** From the north side of the channel a channel 18 feet (5.5 m.) deep and marked by dolphins has been dredged to the wharf at the west end of **Bedloes Island.** The colossal Statue of Liberty on Bedloes Island is more than 300 feet (91 m.) high.

Gowanus Flats, with a least depth of 9 feet (2.7 m.) lie eastward of the main channel of the Upper Bay and westward of Bay Ridge and Red Hook Channels.

Anchorage Channel, a continuation of Ambrose Channel, has a project depth of 40 feet (12.2 m.) for a width of 2,000 feet and extends northward and north-northeastward from the western side of The Narrows to deep water westward of Governors Island. In 1925 this channel had been dredged and swept clear to a depth of 40 feet (12.2 m.) at mean low water throughout its length and for a width of 1,000 feet measured in an easterly direction from the west channel line. Seagoing dredges are still at work widening the channel to the eastward.

Bay Ridge Channel leads from The Narrows to Gowanus Bay, between the wharves of Brooklyn and Gowanus Flats. It has been improved by dredging a channel 1,200 feet wide and 40 feet (12.2 m.) deep. The piers on the upper part of Bay Ridge Channel southward of Gowanus Bay are used by large foreign shipping interests.

Red Hook Channel leads from Gowanus Bay to Buttermilk Channel between the wharves of Brooklyn and the northerly part of Gowanus Flats. The channel has been dredged 1,000 to 1,200 feet wide and 38 to 40 feet (11.6 to 12.2 m.) deep. It is to be deepened to 40 feet (12.2 m.) for a width of 1,200 feet. In 1925 the controlling depth was 36 feet (11 m.).

Gowanus Bay is the bight in the Brooklyn shore about 1¼ miles southward of Governors Island. It has been partially dredged to a depth of 40 feet (12.2 m.) where it is crossed by Bay Ridge and Red Hook Channels. **Gowanus Creek Channel** has been dredged to a depth of 26 feet (7.9 m.) from its junction with Bay Ridge and Red Hook Channels to the foot of Percival Street, and for a width of 300 feet at its outer end decreasing to 200 feet at its inner end, and thence 18 feet (5.5 m.) deep to Hamilton Avenue Bridge, gradually decreasing in width to 100 feet at the bridge. In 1925 the project depths existed except where shoaling had occurred near the edges of the channel.

The waterway above Percival Street is locally known as **Gowanus Canal.** It is under improvement above Hamilton Avenue Bridge to maintain a depth of 12 feet (3.7 m.) for a width of 100 feet to Ninth Street Bridge; 10 feet (3 m.) to Third Street Bridge; 9 feet (2.7 m.) to Carroll Street Bridge; and 7 feet (2.1 m.) to a point 100 feet northward of the north line of Douglass Street, a total distance of 5,300 feet.

Bridges.—Five drawbridges cross Gowanus Canal, and their width of openings and vertical clearances above mean high water when closed, are as follows: Hamilton Avenue, 46 feet wide, 18 feet

clearance; Ninth Street, 45 feet wide, 7 feet clearance; Third Street, 41 feet wide, 10 feet clearance; Carroll Street, 36 feet wide, 3 feet clearance; and Union Street, 43 feet wide, 9 feet clearance. That part of the canal that extends southeastward along Fifth Street is crossed by a fixed bridge at Third Avenue with a vertical clearance of 20 feet (6.1 m.) above mean high water.

Erie Basin is on the north side of Gowanus Bay, and is entered from Red Hook Channel. It is important on account of its dry docks and facilities for repairing vessels.

Governors Island, lying at the mouth of East River, is occupied at its northeasterly end by Fort Columbus. There is a fixed red light with white vertical beam and foghorn on the southwest end of the island. Castle William, a light, and a fog siren are on the northwest point of the island, and there is a fog bell on the eastern end.

Buttermilk Channel leads from the Upper Bay into East River between Governors Island and Brooklyn. It is described with East River.

Hudson River (see p. 311) flows into the Upper Bay from northward, its mouth being between Manhattan Borough (New York City) on the east and Jersey City and Hoboken on the west. **East River** (see p. 252) flows into the head of the Upper Bay from northeastward, between Brooklyn Borough (city of Brooklyn) and Queens Borough (Long Island City and Flushing) on the south and east, and Manhattan Borough (New York City) and Borough of the Bronx (Port Morris and Westchester) on the north and west. These two rivers, together with Harlem River and Spuyten Duyvil Creek, which connect the Hudson and East Rivers north of the city of New York, form the water front of the city.

GENERAL INFORMATION

New York City, with a population of about 6,000,000, consists of five boroughs, namely: **Manhattan,** at the southern end of Manhattan Island; **Bronx,** the northern end of that island; **Brooklyn** and **Queens,** on Long Island; and **Richmond,** which includes Staten Island.

The port of New York includes the Lower Bay, The Narrows, Upper Bay, Hudson (or North) River, and East River. These waters form the main channels to and through the port as well as for local water traffic. The larger part of the most important of the port terminal facilities front upon these waters (excepting the Lower Bay). Leading off from these main channels are numerous waterways which are tributary to them and which form important elements of the port. On the New York side of the harbor are Gravesend Bay, Bay Ridge, and Red Hook Channels, Gowanus Creek, Buttermilk Channel, Newton Creek, Flushing Bay, Westchester Creek, East Chester Creek, Bronx River, and Harlem River, all within the limits of Greater New York. Also there should be included Jamaica Bay, which is rapidly developing into an important feature of the port. On the New Jersey side are Sandy Hook Bay, Shrewsbury and Navesink Rivers, Raritan Bay, Raritan River, Staten Island Sound (including Arthur Kill and Kill van Kull), and Newark Bay, with tributary streams.

Terminals.—Steamship lines engaged in trans-Atlantic trade berth their vessels principally on the North River along the Manhattan water front and at Hoboken. Some such vessels are also berthed at South Brooklyn. Passenger and large express steamers engaged in this same traffic dock in the North River in Manhattan and at Hoboken. Steamers not pertaining to regular lines but engaged in trade to all parts of the world are berthed generally at South Brooklyn, but with some vessels berthing at Stapleton, Staten Island. Steamers plying to South American ports berth generally at South Brooklyn. Southern coastwise, as well as West India commerce is handled at the Manhattan piers on the North and East Rivers, and on the Buttermilk Channel and at South Brooklyn. New England coastwise traffic is handled mainly along the Manhattan water front in the North and East Rivers. Passenger vessels in this trade dock mainly in the North River. Hudson River passenger and freight steamers use piers in the North River. Steamboat lines engaged in local or intraport freight traffic dock mainly along the East River water front of Manhattan.

Coal terminals are located along the New Jersey front from Edgewater to Jersey City and in Kill van Kull, as well as in Arthur Kill, at Elizabethport, Port Reading, and the Amboys. Terminals of railroads approaching from the west are located on the New Jersey side of the North River and at Greenville, Bayonne, and St. George, Staten Island. The terminals of railroads approaching from the north and east are located in Manhattan and in the Bronx.

Port administration.—The port administration of the port of New York is under separate control of the municipality of New York City, through its department of docks, and of the municipalities of Jersey City, Hoboken, and other towns in New Jersey. In 1917 the States of New York and New Jersey enacted legislation creating a joint harbor development commission, under which it is planned to create a general "port of New York."

The wharves and piers of New York City along the water front of the Hudson and East Rivers are numbered, the numbers beginning at the Battery and following in sequence eastward along the East River and northward along the Hudson River water fronts of the city.

Anchorage.—The anchorage limits are given in the appendix.

Caution—Telegraph cables.—The Compagnie Française des Cables Telegraphique, 25 Broad Street, New York, reports serious interruptions of international telegraphic communication resulting from repeated recent breaking of its cables by vessels anchoring southeastward of Ambrose Lightship. The company will be glad to compensate any vessel which, having fouled the cable, cuts away its anchor and chain in order to save the cable from interruption. Vessels making New York in thick weather and finding it necessary to anchor before entering Ambrose Channel should do so in the area southward of Scotland Lightship and westward of the meridian passing through Ambrose Lightship.

Masters of vessels are cautioned not to anchor on the line of cable running from the west dock, Bedloes Island, to dredged channel, approximately 100 yards east of spar buoy 4, thence approximately 830 yards in the direction 120° along the dredged channel and

fairway to a point just beyond the limits of the adjacent anchorage areas, thence in the direction 60° to a point on the northwest shore of Governors Island, approximately 430 yards from the southwesterly end of Governors Island.

Pilotage is compulsory for foreign vessels, vessels from a foreign port, and all vessels sailing under register. Pilots generally cruise westward of a line drawn from Fire Island to Seagirt. Pilot boats are always found near Scotland and Ambrose Channel Lightships.

The fees for piloting for the port of New York, by the way of Sandy Hook, are as follows:

For every vessel, inward bound and not exempted from pilotage by any law of this State or any regulation thereunder, and drawing less than 14 feet of water, $2.78 per foot.

For every vessel drawing 14 feet, and less than 18 feet, $3.38 per foot.

For every vessel drawing 18 feet, and under 21 feet, $4.13 per foot.

For every vessel drawing 21 feet and upward, $4.88 per foot.

If the master or owner of any vessel shall request the pilot to moor said vessel to any place within Sandy Hook, and not to be taken to the wharf or harbor of New York, or the vessel be detained at quarantine, the same pilotage shall be allowed, and the pilot entitled to his discharge.

When any ship or vessel bound for the port of New York and boarded by any pilot appointed by the Board of Commissioners of Pilots of the City of New York at such distance to the southward or eastward of Sandy Hook Lighthouse as that said lighthouse could not be seen from the deck of such ship or vessel in the daytime, and in fair weather, the addition of one-fourth to the rates of pilotage hereinbefore mentioned shall be allowed to such pilot, provided the commander of such vessel shall have agreed to pay such addition. But such additional rate may be waived by the pilot boarding or offering his services to any vessel, and if waived he shall be taken on board and shall be entitled to pilot such vessel, and to be paid at the ordinary rates established by law. In case of the refusal of the commander of any vessel to take such pilot after such waiver, he and the owner or consignee of the vessel shall be liable to pay such pilot at the ordinary rate, the same as if he had piloted the vessel to the port of New York. In case the same additional rate of pilotage is not waived by the pilot so boarding or speaking any vessel, the commander, owner, or consignee shall not be liable to pay any pilotage, except that in case of failing to take a licensed pilot before such vessel reaches the port of New York, the pilotage shall be paid at the ordinary rate to the pilot who first offers his services. * * *

The pilotage on vessels, outward bound, not exempt from pilotage, shall be as follows:

For every vessel drawing less than 14 feet of water, $2.02 per foot.

For every vessel drawing 14 feet, and less than 18 feet, $2.33 per foot.

For every vessel drawing 18 feet, and less than 21 feet, $3.08 per foot.

For every vessel drawing 21 feet and upward, $3.56 per foot.

Pilotage for taking vessels from the old to the new quarantine, etc.:

(*a*) For vessels having had death or sickness on board, double outward pilotage, etc.

(*b*) For vessels from sickly ports but having had no sickness on board, single outward pilotage.

(*c*) Pilotage of vessels from New York to Perth Amboy or from Perth Amboy to New York, except on the voyage to or from sea, shall be $2.50 per foot of the vessel's draft.

(*d*) Pilotage of vessels from the North River or from the East River to Bayonne or Yonkers, or vice versa, $10 each way.

(*e*) For moving any vessels from the North River, the East River, Atlantic Dock, Erie Basin, Kill van Kull, or any pier or dock in the upper bay of New York Harbor (excepting such places as have a different rate established for them), to an anchorage in the said upper bay, or vice versa, $5 each way, unless such moving is done on the same calendar day as the vessel enters or leaves the port.

(*f*) In case of vessels bound over Sandy Hook Bar to or from points in Newark Bay, Staten Island Sound, the Passaic, Hackensack, or Raritan Rivers, only one full pilotage shall be paid, of which two-thirds shall be paid to the pilot piloting the vessel over Sandy Hook Bar and one-third to the local pilot: *Provided, however*, That if the bar pilot is competent to pilot the vessel the whole way, he shall be entitled to do so and to receive the full pilotage the same as if the vessel was piloted to or from New York, Jersey City, or Brooklyn.

(*g*) Vessels boarded north or west of a line drawn from the lights of the Highlands of Navesink to the Black Buoy No. 1, of the bar, thence to the Red Buoy No. 2, of Gedney Channel, shall pay half pilotage only. If boarded above The Narrows, quarter pilotage.

(*h*) No pilotage, except the regular inward pilotage, shall be allowed when vessels are detained from the nonvisiting of the health officer.

(*i*) Vessels returning from sea in consequence of head winds or stress of weather shall pay full pilotage.

(*j*) For delivering a letter on board a vessel coming to New York ordering her to go instead to another port, without entering the port of New York, the charge shall be a sum equal to one-half the inward and outward pilotage of the said vessel.

Winter pilotage is charged from November 1 to April 1 at the rate of $4 additional for each pilotage.

Quarantine regulations for the port are changed from time to time, as found necessary by the local authorities. The quarantine headquarters and boarding station are just above Fort Wadsworth in The Narrows.

A **Coast and Geodetic Survey field station** is located at the Maritime Exchange, 78 Broad Street, New York City. Complete files of Charts, Coast Pilots, Tide and Current Tables, and other publications relating to navigation may be consulted here, and other information affecting navigation obtained without charge.

A **United States Branch Hydrographic Office** is established at the Maritime Exchange, 78 Broad Street, New York City. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service.

Storm warnings of the United States Weather Bureau are shown in New York City from the Whitehall Building, Maritime

Exchange, and One hundred and thirty-eighth Street, Hudson River; they are also displayed at Brooklyn Navy Yard, Norton Point, and Sandy Hook.

Reporting stations.—Vessels are reported to the Maritime Exchange at New York from City Island, Fire Island, Sandy Hook, Highlands of Navesink, and Quarantine.

Repairs.—For the dimensions of the largest dry docks and marine railways see page 5.

Ice.—The large number of ferryboats, towboats, and steamers navigating the waters of this harbor usually keep the channels open, but in severe winters ice seriously interferes with navigation for short periods.

For **tides** see page 23, also the Tide Tables for the Atlantic Coast of the United States, in which the tides are predicted for every day of the current year for Sandy Hook, Governors Island, and Willet Point.

CURRENTS, NEW YORK BAY AND HARBOR

Approaching New York Bar from seaward the flood current rarely attains a velocity of 1 knot, and sets fair for the entrance, except that it is disposed to press upon the outside shores of Sandy Hook and Coney Island. At the beginning of the flood the current sets in at the bottom, while the surface current is still running out.

The ebb current issuing from the harbor is stronger than the flood, even when the river is low, the excess being never less than 10 per cent, except near Coney Island and the outside shore of Sandy Hook, where the flood and ebb approach equality.

In Ambrose Channel slack water occurs about 1 hour before the corresponding slack at The Narrows (about ¾ hour after high and low water at Governors Island). The mean velocity at strength of the flood current is 1.7 knots and of the ebb current 2.3 knots.

In The Narrows slack water occurs about 1 hour 45 minutes after high and low water at Governors Island. The mean velocity at strength of the flood current is 1.2 knots and of the ebb current 1.9 knots. Daily predictions of slack water are given in the Atlantic Coast Current Tables.

In the path of the Hudson, from the Narrows to the Tappan Sea, it is running flood 15 feet below the surface approximately one hour before the turning from ebb to flood at the surface.

In Hudson River, off the Battery, slack water occurs about 1 hour after the corresponding slack at The Narrows (about 2 hours after low and high water at Governors Island). Off Thirty-ninth Street slack water occurs about 3 hours 10 minutes after high and low water at Governors Island. The mean velocities at strength of the flood and ebb currents are about 1.5 and 2.2 knots, respectively, off the Battery, and 1.5 and 2.5 knots, respectively, off Thirty-ninth Street.

The results of special tidal and current observations in New York Harbor have been published under the title "Tides and Currents in New York Harbor," special publication No. 111, and copies of this publication can be obtained from the Coast and Geodetic Survey Field Station, New York City, or from the Superintendent of Documents, Government Printing Office, Washington, D. C., price 30 cents.

GENERAL REMARKS, APPROACHES TO NEW YORK

Approaching New York from southeastward there is a decided drop in the surface temperature of the sea water, which is most marked in winter and least in summer. The greatest change occurs within a distance of 250 miles southeastward from Sandy Hook, the difference in temperature of the surface sea water in that distance ranging from about 27° F. in February to about 7° F. in August. The following are mean temperatures (Fahrenheit) of surface sea water about 250 miles southeastward of Sandy Hook and at the entrance of New York Harbor, respectively: February, 63° and 36°; May, 70° and 48°; August, 79° and 72°; and November, 72° and 50°.

Radio service.—Vessels equipped with radio transmitters and being in doubt of their position should make frequent use of radio-compass bearings. For the approaches to New York Harbor the radio-compass stations at Amagansett, Fire Island, Sandy Hook, and Manasquan should be used, the last three forming a harbor entrance group. Radio fog signals are transmitted from Fire Island and Ambrose Lightships and from Sea Girt Lighthouse. (See also "Radio service" on p. 10.)

Soundings.—The lead will be found most useful to warn vessels of too close an approach to the shore. Many vessels have been wrecked on the coasts of New Jersey and Long Island through neglect to take frequent soundings when the position was uncertain.

Depth is a better indication of position off this part of the coast than the character of the bottom, as the same characteristics may be found in widely different positions. A frequent use of the lead and close study of the charts will always give sufficient warning of danger.

If not sure of the position, the depth should not be shoaled to less than 15 fathoms (27 m.) on the south coast of Long Island eastward of Fire Island Lighthouse, 12 fathoms (22 m.) between Fire Island Lighthouse and Barnegat, and 10 fathoms (18 m.) southward of Barnegat.

From the position of the two shores relative to each other and to the entrance to New York Bay it follows that a 215° true (SW. mag.) course will deepen the water if the vessel is on the Long Island side of the approach and will shoal it if she is off the New Jersey coast. A 35° true (NE. mag.) course will deepen the water if the vessel is off the New Jersey side of the approach and will shoal it if she is off the Long Island coast.

Eastward of Fire Island Lighthouse the water shoals quite rapidly toward the Long Island shore, but inside of a line drawn from Fire Island Lighthouse to Barnegat Lighthouse there is no marked difference in the soundings, except in the mud gorge, as either shore is approached.

Mud gorge.—The surveys of the sea approaches to New York have developed a continuous narrow channel or ancient river course cut in the sea bed from off Sandy Hook out nearly to the ocean basin. The sea bed, for a distance of nearly 100 miles off Sandy Hook, until a depth of 40 to 60 fathoms (73 to 110 m.) is reached, is composed of sand. In some places the sandy bottom has black specks, in others yellow specks, and again pebbles and broken shells are found in it. The continuous gully cutting southeastward through this bed of sand has a bottom of mud or clay. Near its

outer or seaward end this is a green ooze mixed with sand; farther in it becomes a blue clay mixed with some sand; but whatever the character of the bottom in particular parts of the gully, its general features are so different from those of the sand bed through which it cuts that there is no room for mistake. It must be borne in mind, however, that the deep channel in which a bottom of mud is found is narrow in places, requiring quick work with the lead to pick it up.

The first indications of this remarkable channel are found about 4 miles southeastward of Ambrose Channel Lightship, where the depth is about 19 fathoms (35 m.). For about 10 miles from this point the channel or gully follows a southerly course, with a width of ¾ to 1 mile, and a depth increasing gradually from 19 to 33 fathoms (35 to 60 m.) between banks over which the depth is the same as that of the adjacent sea bed—about 15 to 18 fathoms (27 to 33 m.). The gully then has a general southeasterly direction for nearly 60 miles to a sand bar extending across it. Throughout the second 15 miles the depth remains nearly constant at about 35 fathoms (64 m.), the banks having depths of 22 to 27 fathoms (40 to 50 m.). Thence to the bar, a distance of about 45 miles, the depth in the channel remains about the same—41 to 43 fathoms (75 to 79 m.)—while the banks gradually sink to the same level. The bar, over which the depth is also about 43 fathoms (79 m.), is near the outer limit of the sand bed already mentioned.

Outside the bar, which is about 10 miles wide, the channel is found again as a deep ravine extending eastward about 25 miles farther, with a depth of from 200 to about 475 fathoms (366 to about 870 m.) between banks over which the depth, increasing offshore, is from 45 to 200 fathoms (82 to 366 m.). The average width of this ravine is about 3 miles. Specimens of bottom from it are the same as from its banks and the adjacent flats—a green, sandy mud.

Cholera Bank, lying about 10 miles southeastward of Ambrose Lightship, has a least depth of 10 fathoms (18.3 m.) and is about 2 miles in extent in an east and west direction. This bank is very little raised above the general level of the bottom, but being rocky in character a careful use of the lead will give useful indications in thick or foggy weather. During the summer months numerous fishing vessels may be seen on this bank.

Whistle buoys, three in number, are located in about 10 fathoms (18 m.) off the coast of Long Island, between Jones Inlet and East Rockaway Inlet. These buoys are placed about 4 miles apart in an east and west direction, and are located here to keep vessels off the Long Island shore in thick and foggy weather.

North Atlantic lane routes to and from New York Harbor were revised and adopted by the principal trans-Atlantic steamship companies in October, 1924, as given below. Owing to the frequency of collisions in the approaches to New York Harbor, all trans-Atlantic vessels are urgently recommended to use the following routes:

(*a*) Westbound vessels following the regular trans-Atlantic route should pass close to southward of Nantucket Shoals Lightship; thence 267° true (WNW. ⅞ W. mag.) for 164 miles to Fire Island Lightship; thence 270° true (WNW. ⅝ W. mag.) for 29 miles to Ambrose Lightship.

(*b*) Eastbound vessels to steer 96° true (ESE. ⅛ E. mag.) from Ambrose Lightship for 177 miles to a position, latitude 40° 10′ N., longitude 70° 00′ W.

Attention is called to the fact that the directions given above make no change in the seasonal routes eastward of the seventieth meridian.

Currents.—Observations made between Nantucket and Cape May have developed the existence of weak tidal currents veering around the compass, accompanied by a general drift of the sea southwestward, amounting to about 7 miles in 24 hours.

Approaching from eastward from the vicinity of Nantucket Shoals Lightship, a slight allowance should be made for a southwesterly set of the current. Should the wind be easterly it is customary to allow, in order to make the course good, a set of the current with it of at least 12 miles in every 24 hours.

The effect of the wind on the currents should always be considered. The ordinary maximum velocities caused by strong gales are 2 to 2.5 knots at Nantucket Shoals Lightship, and 1 to 1.5 knots at Fire Island, Ambrose Channel, and Northeast End Lightships. Alongshore winds produce the highest velocities at Fire Island and Northeast End Lightships.

Between Gay Head and Montauk Point the tidal currents have a perceptible set, the flood northward and ebb southward. The estimated velocity in a depth of about 25 fathoms (46 m.) is about 0.5 knot; closer inshore this velocity increases.

At Fire Island Lightship the tidal currents have a mean velocity at strength of about ¼ knot in a west-northwest and east-southeast direction on the flood and ebb, respectively. Slack water occurs about 2½ hours before the time of slacks at The Narrows (about the time of high and low water at Sandy Hook).

The important currents affecting navigation are those due to winds, the maximum velocities of current ranging from 1 to 1.5 knots. A sudden reversal in the direction of the wind produces a corresponding change in the current either diminishing or augmenting the velocity. Sustained winds do not maintain the currents at the maximum velocities, as the angle of the coast between Long Island and New Jersey prevents a free circulation and a long-continued flow.

At Ambrose Channel Lightship the velocity at strength of the tidal current is about 0.3 knot. The maximum velocities noted, due to winds, are 1 to 1.5 knots.

DIRECTIONS, NEW YORK BAY AND HARBOR

The shoals on the bar at the entrance of New York Bay are as follows: **East Bank** lies eastward of Ambrose Channel; **Romer Shoal** lies between Ambrose and Swash Channels; **East Knolls, Flynn Knoll,** and **Southwest Spit** lie between Swash Channel and the Main Ship-Bayside Channel; **Pitch of the Hook** extends northeastward from Sandy Hook; and **False Hook, Oil Spot,** and **Outer Middle Ground** lie off the eastern side of Sandy Hook. For the depths on these shoals reference is made to the chart. They are subject to change in position and depth and should be avoided by strangers.

Ambrose Channel is maintained 2,000 feet wide and 40 feet (12.2 m.) deep, is used by nearly all steamers, and is the best one for

strangers. Regulations respecting the channel are given in the description preceding. For the condition of the other channels reference is made to the chart; they are described starting on page 281. Strangers should not attempt to enter the harbor in thick weather.

Through Ambrose Channel.—Passing 350 yards northward of Ambrose Channel Lightship a 282° true (WNW. mag.) course for 2⅞ miles leads to Gedney Channel gas and whistling buoy, which is at the intersection of the axes of Ambrose and Gedney Channels.

From Scotland Lightship a 350° true (N. mag.) course for 3 miles will lead to the entrance of Ambrose Channel.

From Gedney Channel buoy the course through the outer section of Ambrose Channel is 297° true (NW. ¾ W. mag.) for about 6 miles, with West Bank Lighthouse in range with Staten Island Lighthouse, until between the red gas and bell buoy and black gas and whistling buoy which mark the sides of the channel at the turn; Romer Shoal Lighthouse will then bear about 186° true (S. by W. ⅜ W. mag.).

The course is then 324° true (NNW. ¼ W. mag.) for ⅞ mile until between the red gas and bell buoy and black gas and whistling buoy which mark the sides of the channel at the turn; West Bank Lighthouse will then bear about 271° true (W. by N. mag.).

The course is then 348° true (N. ⅛ W. mag.), with Sandy Hook Lighthouse astern; this course made good for 3 miles will lead to a position ¼ mile eastward of Craven Shoal gas and bell buoy.

A 338° true (N. by W. mag.) course for about 3⅜ miles will then lead through The Narrows and to a position 200 yards westward of a bell buoy at the entrance to Bay Ridge Channel. (See description of Anchorage Channel on p. 280.) On account of the dredging operations in Anchorage Channel, no directions can be given at the present time. Mariners must be guided by the chart and by the latest condition of the channel as published in the Notices to Mariners. Anchorage areas on each side of the channel are shown on chart 541, and are described in the appendix.

Remarks.—In addition to the range lights, Ambrose Channel is marked at short intervals by buoys. The red gas buoys on the northeasterly side of the straight sections of the channel show fixed red lights, those at the entrances and angles being gas and bell buoys (flashing red light). The black gas buoys on the southwesterly side of the straight sections of the channel show fixed white lights; those at the entrances and angles being gas and whistling buoys (flashing white lights) on the southwest side and gas and bell buoys on the northeast side.

NAVESINK RIVER AND SHREWSBURY RIVER

(chart 543) empty through a common entrance into the southern extremity of Sandy Hook Bay eastward of the Highlands of Navesink. The rivers have a navigable length of about 7 miles above the entrance in Sandy Hook Bay. They have been improved by dredging a channel 6 feet (1.8 m.) deep, with a width of 300 feet in the entrance channel to Island Beach, thence 200 feet wide to the junction of the two rivers, and 150 feet wide to Redbank on Navesink River and Branchport on Shrewsbury River. In 1925 the project depths obtained but the channel widths through the bars were narrow in places.

In the absence of local knowledge the chart is the best guide. The following remarks may be of some assistance to small craft using the chart; the bush stakes and other private aids mentioned were in place in 1925.

In approaching through Sandy Hook Bay, bring Navesink Lighthouse to bear 153° true (S. by E. ½ E. mag.) and head for it on this bearing, passing 100 yards westward of the entrance bell buoy. When the outer dike light bears 102° true (ESE. mag.), head for it, avoiding the point of a shoal 200 yards northwestward of the light. The channel then follows the south side of the dike (awash at high water) until 100 yards eastward of the inner light, then leads for Navesink Lighthouse for ½ mile, and then leads for the point on the west side southward of Island Beach; the channel from the dike to this point is marked on its east side by bush stakes. There are shoals bare at low water on both sides.

Passing 150 feet off the point on the west side, southward of Island Beach, the channel leads for the draw in **Highlands Bridge** and through the west opening. The bridge is about 6 feet in the clear above high water, and has two openings, with a least width of 98 feet. The current sets diagonally through the bridge, southeastward on the flood and northwestward on the ebb. The east side of the river northward of the bridge and west side ¼ mile southward of the bridge are used as anchorages for motor boats. From the bridge the channel follows the west side to the junction of the channel leading into Navesink River, and Reeves Channel leading to Shrewsbury River.

To Navesink River.—The channel is marked by several lights and by private stakes or barrel buoys. At the light eastward of Barley Point the channel is narrow and turns sharply from west to northwest, and care is necessary to avoid the shoal on the north side when bound west, and the submerged stone dike on the south side of the channel eastward of the light when bound east. From the light head for the light off Upper Rocky Point, and then follow the channel as marked by lights and bush stakes to the north opening in Oceanic Bridge; the draw opening is 95.5 feet wide. A stake, 300 yards eastward of the bridge, marks the east side of a channel for boats across the shoal middle ground.

Just west of the bridge is the steamboat landing, depth 7 feet (2.1 m.), at **Oceanic,** from which the channel leads northwestward; the west end of the middle ground on the north side of the channel is marked by a bush stake. The landings above Oceanic are **Locust Point,** depth 7 feet (2.1 m.), **Fairhaven,** depth 8 feet (2.4 m.), and Red Bank, depth 7 feet (2.1 m.). The narrow channel leading to Red Bank is marked on both sides of the entrance and on the east side at the turns by bush stakes, and is good for a depth of 6 to 7 feet (1.8 to 2.1 m.). The bottom in Navesink River is hard sand from the entrance to Oceanic Bridge, above which the bottom is soft.

Reeves Channel and the channel in Shrewsbury River are marked by several lights and by bush stakes, and are good for a depth of 6 feet (1.8 m.) at low water to Branchport. The light on the west side of the channel at the entrance is at the north end of a submerged jetty, which shows only at lowest tides. The channel leads through the east opening (width 80 feet) in Seabright Bridge.

There is a short rock jetty on the east side of the channel just northward of the light off the northeast end of **Sedge Island.**

At the light on the south side, 1 mile farther up, the channel turns sharply from west to southwest. From the entrance to this light the bottom is hard sand, and above it the bottom is soft. The channel leads through the east opening (width 40 feet) of the bridge crossing **Pleasure Bay,** and then leads for the steamboat dock at Long Branch. The largest vessel navigating the river to this dock is over 200 feet long and 5 feet (1.5 m.) draft. Above it the channel is good for about 6 feet (1.8 m.) at low water.

Sandy Hook, including **Island Beach,** is a Government reservation down to the north end of Highland Beach, and landing is not permitted. **Highland Beach, Navesink Beach, Normandie, Seabright, Monmouth Beach,** and **Long Branch** are summer resorts, with railroad communication, on the outside beach. Motorboat supplies can be obtained at Seabright and Long Branch. There are marine railways for small craft at Seabright. **Storm warnings** are displayed at long Branch and Sandy Hook.

Highlands is a settlement on the west side of the entrance. The wharf about 150 yards north of the bridge has about 8 feet (2.4 m.) alongside. The wharf south of the bridge is no longer used. Gasoline, water, and supplies can be obtained.

Red Bank is a town at the head of navigation on Navesink River. There are boat-building and repair plants; and railways, with a capacity of about 12 tons, that can take out boats about 60 feet long and 5 feet draft. Water is piped to the steamboat dock, which has a depth of about 7 feet (2.1 m.) alongside.

Branchport, at the head of navigation on Pleasure Bay, Shrewsbury River, has two small marine railways. Supplies and repairs can be had. There is a depth of 6 feet (1.8 m.) in the channel to this point.

Oceanport, at the head of navigation on Shrewsbury River, has a depth of 3 feet (0.9 m.) at low water to it, the channel leading through two drawbridges.

Bridge regulations.—See Raritan Bay following.

Tides.—The mean rise and fall of tides are as follows: Entrance, 5 feet; Highlands Bridge, 3 feet; Seabright Bridge, 1 foot; head of Shrewsbury River, about 1 foot; Oceanic, 2½ feet; Red Bank, about 2½ feet. Strong southerly and westerly winds lower the water about 1 foot, and northerly and easterly winds raise it an equal amount; the greatest variations noted are from 2 to 2½ feet.

High water occurs later than the time of high water at Sandy Hook, as follows: Rocky Point, 1 hour; Red Bank, 2 hours; head of Shrewsbury River, 3½ hours.

Currents.—The tidal currents have considerable velocities in the contracted parts of the channel. The currents generally set fair with the channels and through drawbridges.

At Highlands Bridge the fender pier is at an angle with the axis of the flow, and both ebb and flood currents set across the opening, northwestward on the ebb and southeastward on the flood. The estimated velocity is about 4 knots at strength.

In Navesink River, in the vicinity of the bridge off Oceanic, the currents have a velocity of about 2 knots at strength, and slack water occurs about 1 hour after local high and low waters.

In Shrewsbury River, off Seabright, velocities of 3 to 4 knots are reported. Slack water occurs about 1½ to 2 hours after local high water.

Communication to points on the Shrewsbury and Navesink Rivers is by steamer from the Battery, New York, and by railroad.

Ice.—Navigation in Navesink and Shrewsbury Rivers is generally suspended on account of ice from December to March, inclusive.

NEW YORK LOWER BAY, WESTERN PART

SANDY HOOK BAY

is the southern part of the Lower Bay, lying westward of Sandy Hook and eastward of Point Comfort. The bay is an excellent anchorage for vessels of less than 24-foot (7.3 m.) draft, the depth of water ranging from 5 fathoms (9 in.) just inside the Hook to 15 feet (4.6 m.), near its southern part; the shoaling is gradual and the bottom good holding ground. The best anchorage is in the eastern part of the bay, giving the shore of Sandy Hook a berth of about ½ mile. (See the anchorage map in appendix.) Vessels of over 24-foot (7.3 m.) draft can not find good anchorage out of the channel until above Quarantine. Extensive shoals make off northward and eastward from Point Comfort, but as the depth of water decreases gradually the lead will give sufficient warning of too close an approach to the shore. There are heavy fish traps, extending out to a depth of 20 feet (6 m.) in places, on the shoals on the southwest side of Sandy Hook Bay between Atlantic Highlands and Point Comfort.

Navesink and Shrewsbury Rivers are described above.

Compton Creek (charts 369 and 543) is on the south side of Sandy Hook Bay, 4 miles westward of Sandy Hook Lighthouse; the entrance is called **Shoal Harbor.** A channel 150 feet wide and 4 feet (1.2 m.) deep has been dredged across the flats to the mouth of the creek, and about 75 feet wide and 4 feet (1.2 m.) deep in the entrance of the creek. The entrance channel is sometimes marked by private range targets. The creek is navigable a distance of 1 mile to a railroad bridge without a draw. A highway drawbridge (opening 29 feet wide) crosses the creek ⅜ mile above the entrance. **Port Monmouth,** a village at the mouth of the creek, is the shipping point for garden produce from the adjoining country, and for fish and oysters. The creek is used extensively as a harbor of refuge by small fishing craft.

Staten Island (Richmond Borough of New York City) forms the northwest side of New York Lower Bay. The high wooded ridge of the island has elevations of 100 to over 300 feet (30 to over 91 m.). **South Beach** and **Midland Beach** are summer resorts on the southeast side of the island.

Staten Island Flats are the extensive shoals making off from the southeast side of Staten Island. Parts of these flats are known as Old Orchard Shoal and West Bank, the latter bordering on the main channel up the bay. A channel used by local vessels of less than about 8-foot (2.4 m.) draft leads westward of **West Bank.** From the black bell buoy southeastward of Fort Wadsworth steer southwestward through the dredged channel to black buoy No. 3, and then steer for a perpendicularly striped bell buoy in range with Old

Orchard Shoal Lighthouse. Care should be taken when anchoring not to foul the cable which extends from the southernmost wharf at Fort Wadsworth to the wreck buoy off Point Comfort.

Old Orchard Shoal Lighthouse is a conical tower, lower half brown, upper half white, on a black pier.

Great Kills is a shallow bight on the south side of Staten Island northwestward of Old Orchard Shoal Lighthouse. It is used as an anchorage by small local craft, but is exposed to southerly and southwesterly winds. A narrow channel, with depths of 4 to 6 feet (1.2 to 1.8 m.), leads about in the middle of the entrance; the deeper water, depths 2 to 5 feet (0.6 to 1.5 m.), is in the western half of the bight, as shown on chart 369. Great Kills Light is located ⅞ mile south-southeastward of the entrance.

New York and New Jersey Channels are the channels extending from deep water in the main channel, northwest of Sandy Hook, through Lower New York Bay and Raritan Bay to Perth Amboy, and thence through Arthur Kill, lower Newark Bay, and Kill van Kull, known collectively as **Staten Island Sound,** to deep water in Upper New York Bay. This route is located approximately along the boundary line between the States of New York and New Jersey.

These channels are under improvement to secure a depth of 30 feet (9.1 m.) for a width of 400 feet from deep water in Lower New York Bay through Raritan Bay and Staten Island Sound to deep water in Upper New York Bay, with a branch channel in Raritan Bay to South Amboy, 21 feet (6.4 m.) deep and 300 feet wide, and a branch channel north of Shooters Island, 20 feet (6.1 m.) deep and 400 feet wide, protected by a dike on its northern side. In 1925 the project was about one-third completed. The controlling depth from Lower New York Bay to Upper New York Bay through these channels was 20 feet (6.1 m.) in the channel at the entrance to Arthur Kill with deeper water in the other channels; the controlling depth in the channel to South Amboy was 18 feet (5.5 m.); and the channel north of Shooters Island, 13½ feet (4.2 m.). Descriptions of these channels are given under separate headings below.

RARITAN BAY

(charts 369 and 286) is the part of New York Lower Bay lying westward of Point Comfort and southward of Staten Island. The bay is full of shoals, with depths of 7 to 18 feet (2.1 to 5.5 m.). The channel into Arthur Kill leading from Main Channel, west of Sandy Hook, through the Lower Bay and along the southeastern shore of Staten Island, has a project depth of 30 feet (9.1 m.) for a width of 400 feet (see New York and New Jersey Channels, preceding). In August 1925 this channel had a width of 200 feet and a depth of 28 feet (8.5 m.) to Seguine Point, thence 24 feet (7.3 m.) to the junction of the channels leading to Raritan River and Arthur Kill, thence 20 feet (6.1 m.) in the channel to Arthur Kill. This channel is well marked by beacons and buoys, most of which are lighted. The direct channel over the shoals is good for a depth of about 11 feet (3.4 m.) and is used only by small vessels and towboats.

Point Comfort, on the south side of Raritan Bay, is the location of a summer resort. There are three wharves on the western side of the point, the northern one having a depth of 7 feet (2.1 m.) at its end and the others depths of about 3 feet (0.9 m.). A ferry affords communication with New York City during the summer.

Matawan Creek empties into Raritan Bay from southward, between **Conaskonk Point** and **Matawan Point,** the entrance lying about 3½ miles southward of Princess Bay Lighthouse. A channel, 200 feet wide and 8 feet (2.4 m.) deep, is maintained by dredging to the docks at Keyport and vessels load to from 7 to 9 feet (2.1 to 2.7 m.) there. The entrance is buoyed, and buoys mark the west side of the shoal making northward from Conaskonk Point. The axis of the improved channel trends 190° 30′ true (S. by W. ¾ W. mag.) to the red buoy, and then trends 204° true (SW. by S. mag.) to the wharves. The mean rise and fall of the tides is 4.9 feet.

Keyport is at the entrance of Matawan Creek. Steamers make daily trips to New York and there is railroad communication. Water, coal, gasoline, and other supplies can be obtained. There are several marine railways and facilities for repairing wooden hulls and machinery. The largest railway can take out vessels 160 feet long, draft 5 feet forward and 8 feet aft. Storm warnings are displayed at Keyport.

Matawan Creek, above Keyport, is navigable for a distance of 1.7 miles to the town wharf at Matawan. The channel is a dredged cut, 3 feet (0.9 m.) deep and from 60 to 90 feet wide for a distance of 1.5 miles above Keyport. The channel leads between very shoal flats, and from the Keyport steamboat dock trends west-southwestward and then westward into the creek. The channel in Matawan Creek favors the north bank to **Wilkson Creek,** and then leads in midcreek. A highway drawbridge (opening 48.5 feet wide) crosses the creek about 0.5 miles above Keyport.

Cheesequake Creek is on the south side of Raritan Bay southward of Great Beds Lighthouse. The entrance is between two stone jetties, awash at high water, which are 200 feet apart and are marked at the outer ends by spindles. Between the jetties a channel 100 feet wide and 5 feet (1.5 m.) deep has been dredged close to the west jetty from that depth in Raritan Bay to deeper water in the creek. The best water in the approach is on or just eastward of the line of the west jetty until about 200 yards from it, and then keep between the jetties. The creek is crossed at the inner end of the jetties by a highway lift bridge (opening 51 feet) and a short distance farther up by a railroad lift bridge (opening 50 feet). The channel in the creek is good for a depth of about 4 feet (1.2 m.) at low water for a distance of about 3 miles above the entrance to **Cheesequake.** The mean rise and fall of tides is 5 feet.

Seguine Point is marked by a prominent large factory, with cupola. There is a depth of about 16 feet (4.9 m.) at the wharf. The public dock eastward of Lemon Creek has a depth of about 7 feet (2.1 m.) at its end.

Lemon Creek is a narrow, shallow stream on the south side of Staten Island ¼ mile westward of Seguine Point. A channel 35 to 50 feet wide and 8 feet (2.4 m.) deep at high water was dredged into the creek. the entrance cut having a direction of about north. In

1925 the entrance was good for a depth of about 1½ feet (0.5 m.) at low water. A drawbridge (opening 30 feet) about 4 feet above high water crosses the creek near its mouth. Gasoline and motorboat supplies can be obtained from a station at the entrance. The deepest draft entering is 6 feet (1.8 m.) at high water.

Great Beds Lighthouse is on the shoals at the western end of Raritan Bay. Directions for Raritan Bay are given on page 305.

GENERAL INFORMATION

Pilotage for ports in the States of New York and New Jersey is compulsory for certain vessels (see pilotage under New York Harbor preceding). Pilots for New York Bay have authority and sometimes bring vessels into Perth Amboy and South Amboy. Vessels bound up the Raritan River or Arthur Kill, and desiring a pilot, can get one at Perth Amboy or from a pilot boat cruising off Sandy Hook.

Towboats are used by the larger sailing vessels, and by all but very small craft, bound up the Raritan River and Arthur Kill. They can be had by making signal off the entrance to the dredged channel, and are found cruising in the lower bay inside Sandy Hook.

The **anchorage** limits are given in the appendix.

Quarantine.—The national quarantine boarding station is at a landing near the southern end of Perth Amboy. The quarantine anchorage is westward of the middle ground off the south end of Perth Amboy and is marked by buoys.

Hospital.—At Perth Amboy there is a relief station of the United States Public Health Service.

Storm warnings are displayed at Sandy Hook and Keyport.

Supplies.—Coal and water can be had at the wharves in Perth Amboy and South Amboy. Provisions and ship-chandler's stores can be had at Perth Amboy, South Amboy, Tottenville, and New Brunswick.

Repairs.—See description of Perth Amboy, Tottenville, and New Brunswick following.

Ice.—In ordinary winters ice does not seriously interfere with navigation in Raritan Bay or Arthur Kill, but in severe winters the ice sometimes prevents the movements of vessels for periods of two weeks at a time. In easterly winds the drift ice in New York Lower Bay collects in Raritan Bay and obstructs navigation, but usually only for a short time, as the prevailing westerly winds drive the ice out of the bay. The Delaware and Raritan Canal is closed to navigation in winter.

Tides.—The mean rise and fall of the tides is 5.3 feet.

BRIDGE REGULATIONS

have been prescribed as follows:

1. All drawbridges spanning Raritan Bay, Arthur Kill, and their navigable tributaries, and Shrewsbury River shall be opened promptly upon signal for for the passage of vessels during the day or night, except as prescribed in paragraph 2.

2. During the hours between 7.30 and 10 a. m. and between 5 and 7.30 p. m. drawbridges shall not be required to remain open longer than 10 minutes nor permitted to remain closed longer than 10 minutes to the exclusion

of vessels approaching for passage: *Provided*, That the draw of any bridge used solely for United States mail, passenger, and express trains need not be opened for a vessel reaching said draw less than five minutes before the scheduled arrival of any such train until such train passes, unless the bridge tender has notice that the train is delayed more than five minutes: *Provided further*, That the owners of bridges acting under this rule shall maintain a tug at the drawbridge to control and aid in the passage of vessels.

3. When a vessel approaches within signaling distance of a bridge for passage, the master thereof shall signify his intention by three blasts of a whistle or horn. The signal shall be answered by three blasts of a whistle or horn from the bridge, unless, under paragraph 2, a delay in opening is permitted, when the answer from the bridge will be two blasts of whistle or horn, and the tug stationed at the draw shall immediately go to the assistance of the vessel.

4. Upon hearing or perceiving the signals prescribed the tenders or operators of a drawbridge, except as provided in paragraph 2, shall at once open the draw spans of the bridge for the prompt passage of any vessel or craft: *Provided*, That the bridge may not be opened when there is a train, wagon, or vehicle at the time passing over said draw span, or a train approaching so closely that it can not be safely stopped before reaching the bridge, but it shall be opened as soon as the draw span may be cleared.

5. Wagons, vehicles, and trains shall not be stopped on a drawbridge or on a draw span for the purpose of delaying the operation of the drawbridge, nor shall the water craft or vessels be so manipulated as to hinder or delay the operation of the draw span, but all passage upon, through or under a drawbridge shall be prompt to prevent delay to either land or water communication.

6. The foregoing regulations apply only to commercial or pleasure vessels. Steamers or vessels employed or controlled by the United States Government, or by municipal departments, shall be passed without delay through the draws of said bridges at any hour of the day or night upon giving four blasts of the whistle.

RARITAN RIVER

empties into the western end of Raritan Bay between Perth Amboy and South Amboy (harbor chart 375). It has a length of 10½ miles from South Amboy to New Brunswick, a width varying from ½ mile to 125 yards, and is crooked in places. Dredging has been done to obtain a channel 15 feet (4.6 m.) deep and 200 feet wide from the mouth to Washington Canal, a distance of 6.3 miles; thence 10 feet (3 m.) deep and 150 feet wide for 4.2 miles to the Delaware & Raritan Canal entrance at New Brunswick. In 1925 the project widths and depths existed, except in the channel above Martins Landing, which had shoaled to 9 feet (2.7 m.). A private channel, 10 feet (3 m.) deep (1922), extends from the river west of Martins Creek, a short distance to a factory. Lights have been established in the river as far up as Rocky Reach.

Two center-pier drawbridges cross Raritan River just above South Amboy. The lower or railroad bridge has two openings 132 feet wide each and is 8.6 feet above high water. The upper bridge, ⅝ mile above the railroad bridge, has two openings 109 feet wide each and is 5.4 feet above high water. (See bridge regulations preceding.)

South Amboy Channel has a project depth of 21 feet (6.4 m.) for a width of 300 feet, extending from a junction with the Raritan Bay Channel eastward of Great Beds Light to deep water off the wharves at South Amboy. This channel had a controlling depth of 18 feet (5.5 m.) in 1925.

A narrow channel, good for a depth of 6 feet (1.8 m.) at low water, leads across the shoal southward of Perth Amboy and affords

a short cut for small vessels between South Amboy and Arthur Kill. The channel is marked by bush stakes, and there is a good range for it. The range is the tallest iron stack on the upper coal dock at South Amboy, open a little eastward of the Catholic Church tower; the latter is a square brick tower with four minarets, one at each corner.

South Amboy is an important port for the shipment of coal, petroleum products, and building materials, which are carried in vessels of 5 to 16 foot (1.5 to 4.9 m.) draft. There is a depth of about 19 feet (5.8 m.) at the principal wharves and this is about the deepest draft taken to this port. Coal, fresh water, and supplies of all kinds can be obtained here.

Sayreville is a village with extensive brickyards located on the south bank of the river 6 miles above the entrance. The entrance of the South River Canal is at the western end of Sayreville.

New Brunswick is a city at the entrance of the Delaware and Raritan Canal from Raritan River. There is a marine railway about 100 feet long capable of hauling out small craft of 6½-foot draft.

South River is entered through the **Washington (South River) Canal,** the entrance of which is at the western end of Sayreville, 6 miles above South Amboy. The project for the improvement of the river is to maintain a channel 100 feet wide and 8 feet (2.4 m.) deep through the canal and river to the town of **Washington,** a distance of 1.3 miles; thence 6 feet (1.8 m.) deep to the head of navigation at **Oldbridge,** 5.5 miles above the mouth. Two drawbridges, with openings 34.5 and 39 feet wide, respectively, cross the river 0.6 and 1 mile above Washington; the west and east openings, respectively, are used by vessels. (See bridge regulations preceding.)

The **Delaware and Raritan Canal** is 38 miles (44 statute miles) long from New Brunswick to Bordentown on the Delaware River There are 13 locks in the canal, the dimensions of which are 210 feet long, 23 feet 4 inches wide, and 7 feet (2.1 m.) deep. The deepest draft permitted through the canal is 7 feet (2.1 m.). Masted vessels are limited to masts less than 50 feet (15 m.) above canal level by the arched stone bridge at New Brunswick. The inside route from New York Bay to Delaware and Chesapeake Bays is described in United States Coast Pilot, Section C; and Inside Route Pilot, New York to Key West.

Harbor control.—It is not lawful for any steamer to pass any of the wharves on either side of Raritan River, between New Brunswick and a point 200 yards below French's or Wood's landing, at a greater speed than 4 miles (statute) per hour while any vessel is lying thereto, nor pass up and down the river between said points at a greater speed than 7 miles (statute) per hour.

Tides.—The mean rise and fall of tides is 5.3 feet at South Amboy and 6 feet at New Brunswick; and on South River, about 5½ feet at Raritan Railroad bridge and 4½ feet at Oldbridge. High and low water occur later than at Sandy Hook, as follows: South Amboy, 10 minutes and 15 minutes; New Brunswick, 50 minutes and 1½ hours.

(charts 369, 285, and 286), the narrow body of water separating Staten Island from New Jersey, has an extensive traffic. On its shores are located Perth Amboy, Tottenville, Elizabethport, many large manufactories, and two important coal-shipping points.

Arthur Kill is under improvement to secure a channel 30 feet (9.1 m.) deep and 400 feet wide, connecting with channels of the same depth and width through Kill van Kull at the north end and Raritan Bay at the south end. In 1925 the channel through Arthur Kill had a controlling depth of 23½ feet (7.2 m.) for a width of 200 feet, the entrance through Kill van Kull a depth of 27 feet (8.2 m.), and the entrance from Raritan Bay a controlling depth of 20 feet (6.1 m.). The channel has been widened at Fresh Kills to secure a turning basin of suitable size. The channel requires local knowledge to keep in the best water, and large, deep-draft vessels employ a pilot or towboat. The channels at Shooters Island are described with Kill van Kull.

Perth Amboy is on the point at the junction of Raritan River and Arthur Kill at the western end of Raritan Bay. The principal wharves are situated along the west bank of Arthur Kill. The deepest draft entering is about 23 feet (7 m.) at high water. There is a depth of about 20 feet (6.1 m.) at low water alongside some of the wharves. There is good anchorage abreast the wharves in about 6 fathoms (11 m.). (See the anchorage limits in the appendix.) There are several floating docks at Perth Amboy. The largest is 440 feet long, has a dead-weight capacity of 10,000 tons, and will take a draft of 24 feet. The facilities for repairs to hulls of vessels are excellent.

There is communication by ferry from Perth Amboy to Tottenville, thence by railroad to St. George, and thence by ferry to the Battery.

Tottenville, a small town on the southwestern end of Staten Island, is of little commercial importance, but has a number of shipyards and marine railways for building and repairing vessels. The largest railway is 175 feet long, draft 9 feet forward and 12 feet aft, and capacity 1,000 tons.

Woodbridge Creek enters Arthur Kill from westward about 3 miles above Ward Point. A channel with a depth of 8 feet (2.4 m.) and least bottom width of 50 feet is maintained for a distance of 1⅜ miles above the entrance to **Valentine Dock.** Above this dock the channel shoals gradually from a depth of 3 feet (0.9 m.) to 1 foot (0.3 m.) at the fixed bridge, which forms the head of navigation, about 2 miles above the entrance. Two drawbridges 300 feet apart cross the creek ½ mile above the entrance. The draw opening has a width of 53 feet in the lower or highway bridge and 38 feet in the railroad bridge. The overhead wires at the lower bridge are 125 feet (38 m.) above high water. There is considerable traffic to the various industrial plants on the creek.

Smith Creek enters Arthur Kill from northward about ½ mile northward of Woodbridge Creek. There is a depth of about 2 feet (0.6 m.) on the bar at the entrance and greater depth inside. The channel at the entrance follows the western shore to avoid a shoal which extends southward from the marshy point on the east side

of the creek. The creek is used as an anchorage for small craft, and there are numerous boathouses and private landings. Gasoline and supplies can be obtained at the hotel landing just south of the entrance.

Fresh Kills enters Arthur Kill from eastward southward of **Linoleumville.** There are several brickyards on its banks, but the section is generally agricultural. There are two entrances 3/8 mile apart. The northern one is good for a depth of about 4 feet (1.2 m.) at low water, the channel at the entrance favoring the southerly shore to avoid a shoal which extends in a southwesterly direction from the point on the north side.

The southerly entrance of Fresh Kills, opposite the steel works at **Chrome,** is approached on a northeasterly course, favoring the south shore to avoid a shoal which extends southwestward from the point on the north side. There is a depth of about 10 feet (3 m.) in the channel to the brickyard 3/8 mile inside the entrance, and a least depth of 8 feet (2.4 m.) to the forks in the Kills 1 3/8 miles above the southerly entrance.

The easterly branch of Fresh Kills **(Richmond Creek)** is good for a depth of about 6 feet (1.8 m.) at low water for a distance of 1 mile to a drawbridge. Barges load to 11 1/2 feet (3.5 m.) at high water at the brickyard at the village of Fresh Kills, below the bridge. Above the bridge the channel narrows and gradually shoals to a depth of about 2 feet (0.6 m.) at **Richmond,** a distance of 3/4 mile. The northerly branch is shoal, but barges of 5 feet (1.5 m.) draft are towed by launches at high water to the head of the creek at **Travisville,** a distance of about 1 1/2 miles.

Rahway River enters Arthur Kill from westward 1/2 mile southward of Pralls Island, and extends westward about 4 1/2 miles to the town of **Rahway.** It is frequented only by motor boats and other small craft. The mouth of the river has been dredged along the south side from deep water in Arthur Kill to the railroad bridge. The channel is 500 feet wide at the upper end and has depths of 16 to 25 feet (4.9 to 7.6 m.). A draft of 5 feet (1.5 m.) can be taken to Rahway at high water, and this is about the deepest draft of boats that go above the first bridge. Drawbridges cross the river at the following distances above the entrance: Railroad bridge, 0.1 mile, two openings 50 feet wide each; railroad bridge, 1.6 miles, one opening 47 feet wide, the north opening is closed; railroad bridge, 1.7 miles, lift bridge with opening 65 feet wide, overhead cable 125 feet (38 m.) above high water; Lawrence Street Bridge at Rahway, 3.8 miles, two openings 52 feet wide each; Milton Avenue Bridge at Rahway, 4.2 miles, two openings, 46.5 feet wide each. The mean rise and fall of the tides is about 5 feet at the entrance and 4 feet at Rahway.

The Baltimore & Ohio Railroad bridge, crossing Arthur Kill just southward of Elizabethport, is a center-pier drawbridge, with two openings, east one 202 feet, west one 212 feet wide in the clear. The east opening has the deeper and clearer channel, and is generally used.

Elizabethport, the eastern part of the city of **Elizabeth,** is at the northern end of Arthur Kill at its junction with Newark Bay, There are several shipyards with dry docks and marine railways. There is communication by ferry across Arthur Kill, thence by rail-

road to St. George, and thence by ferry to the Battery. Coal, water, gasoline, and supplies of all kinds are obtainable.

Elizabeth River enters Arthur Kill at Elizabethport. It has a width varying from 50 to 100 feet, a depth at high water of 7 feet (2.1 m.) to Summer Street, 5 feet (1.5 m.) to South Street, 4 feet (1.2 m.) to Bridge Street, and 3 feet (0.9 m.) to Broad Street Bridge, which is the head of navigation, 2⅜ miles above the entrance. Above Summer Street the river is nearly bare at low water. The mean rise and fall of tides is 5 feet at the entrance and about 3½ feet at Bridge Street.

The following are the bridges crossing Elizabeth River, the distance above the entrance, and the width of the draw opening: Front Street, 300 feet, 46.5 feet; South First Street, 0.5 mile, 60 feet; New York & Long Branch Railroad, 0.8 mile, 59.3 feet; Summer Street, 1.4 miles, 38.3 feet; South Street, 1.9 miles, 48.4 feet; Bridge Street 2.2 miles, 31.6 feet.

For general information relating to Arthur Kill see Raritan Bay.

Tides.—The mean rise and fall of the tides is 5.3 feet at Tottenville and 5 feet at the mouth of Rahway River.

Currents.—Throughout Arthur Kill the flood current sets from Raritan Bay to Newark Bay and the ebb the reverse. Slack water occurs at Perth Amboy, at the south end of Arthur Kill, about 1 hour earlier than the corresponding slack at The Narrows (about 45 minutes after low and high water at Governors Island). Proceeding northward slack water occurs later. At Linoleumville slack waters occur about ¼ hour earlier than the corresponding slack at The Narrows (about 1½ hours after low and high water at Governors Island), while at Elizabeth slacks occur about ¼ hour later than at The Narrows (approximately 2¼ hours after low and high water at Governors Island).

The mean velocity of the current at strength is about as follows: Perth Amboy, 0.9 knot; Linoleumville 1 knot; and Elizabeth 1 knot.

DIRECTIONS, RARITAN BAY

The approach to the entrance of the dredged channel in Raritan Bay is easy of access in the daytime with the aid of the chart, and anchorage can be selected below the dredged channel. The anchorage limits are given in the appendix. Local knowledge is required to follow the best water in the dredged channels to South Amboy, Perth Amboy, and through Arthur Kill, and vessels of a greater draft than about 15 feet (4.6 m.) should take a pilot.

Enter the lower bay on courses as given under the description of Main Ship-Bayside-Gedney Channel (p. 281) and proceed to a position 125 yards south of gas and gong buoy No. 12. Then steer 286° true (NW. by W. ⅝ W. mag.), with Seguine Point ahead, through the dredged channel. Pass 25 yards south of beacon No. 1 (flashing white light) and 200 yards northeast of beacon No. 2 (flashing green light). When north of beacon No. 2, steer 267° true (W. ¾ N. mag.) with an unused lighthouse tower a little on the port bow, passing 125 yards off Seguine Point, to a position 275 yards north of beacon No. 3 (flashing white light).

Then steer 224° true (SW. ⅞ W. mag.), passing 200 yards westward of beacon No. 3, 150 yards eastward of beacon No. 4 (flashing

red light), and 30 yards eastward of red buoy No. 8. When abeam of beacon No. 5 (flashing white light), haul westward on an easy port helm (right rudder) and head for Great Beds Lighthouse on course 285° true (NW. by W. ¾ W. mag.), passing 150 yards northward of can buoy No. 7.

To Perth Amboy.—Pass about 200 yards southward and 50 yards westward of buoy No. 10, steer 333° true (N. by W. ½ W. mag.), and pass 100 yards westward of Ward Point, and on approaching the horizontally striped buoy off Perth Amboy haul northward a little so as to pass about 150 yards eastward of it. Anchor on the western side of the channel, northward of this buoy.

To South Amboy.—Steer through the first section of the dredged channel with the Catholic Church tower (square brick tower with four minarets, one at each corner) in South Amboy in range with the end of a wharf on the east side of the town and pass 225 yards southward of Great Beds Lighthouse. When beacon No. 1 (flashing white light) is abeam, distant 50 yards, steer 305° true (NW. mag.), heading for the south end of the draw span in the railroad bridge. Anchorage can be had on the north side of the channel, about 150 yards from the wharves, below the bridge.

Small vessels of less than 9-foot (2.7 m.) draft can use the direct channel over the shoals in Raritan Bay. Passing close to the black bell buoy lying ¾ mile northward of West Bank Lighthouse, steer 232° true (SW. by W. ½ W. mag.), which will lead northward of Old Orchard Shoal Lighthouse; then bring this lighthouse astern on a 246° true (WSW. ¾ W. mag.) course and pass northward of the gas buoy off Conaskonk Point. Continue the course past the buoy until Great Beds Lighthouse bears 276° true (WNW. ⅝ W. mag.), and then steer this course for the lighthouse until up with the buoys marking the channels southward of Ward Point.

For the channel leading from Fort Wadsworth westward of West Bank, see the description of Staten Island Flats, preceding.

KILL VAN KULL AND NEWARK BAY

KILL VAN KULL

Kill van Kull connects New York Upper Bay with Newark Bay and Arthur Kill and separates the southern shore of Bergen Neck (city of Bayonne) from Staten Island. (See chart 285.) There is an extensive through traffic and there are large manufactories on its shores. The Kill is about 3½ miles long, 300 to 500 yards wide, and has general depths of 5 to 7 fathoms (9 to 13 m.). The least depth is about 25 feet (7.6 m.), which is found on spots on **Baxters Ledge,** at the eastern entrance; also about ⅜ mile eastward of the ferry landing at Port Richmond, where the channel is contracted by a ledge with 27 to 29 feet (8.2 to 8.8 m.) over it, nearly in the middle.

The navigation through Kill van Kull and Arthur Kill is not difficult for vessels of less than about 15-foot (4.6 m.) draft with the aid of the charts, and it is used by vessels of deeper draft, with local knowledge.

The main channel from Kill van Kull to Arthur Kill leads southward of **Shooters Island,** and then in a northwesterly and westerly

direction to Arthur Kill, at Elizabethport. It is marked by buoys between Shooters Island and Elizabethport and is easily followed. Improvements are authorized to dredge this channel 400 feet wide and 30 feet (9.1 m.) deep in connection with the improvement of Arthur Kill and Raritan Bay. (See description of New York and New Jersey Channels on p. 298.) In 1925 this channel had a depth of 30 feet (9.1 m.) from Upper New York Bay to West New Brighton, thence 27 feet (8.2 m.) to the westerly line of Shooters Island, and thence 23½ feet (7.2 m.) through Arthur Kill to Perth Amboy. The channel north of Shooters Island had a depth of 13½ feet (4.2 m.), and is protected on its north side by a dike. Shooters Island is occupied by a shipyard.

Constable Point and **Port Johnson,** on the north shore of the Kill, are parts of the city of **Bayonne,** and are commercially important for the shipment of mineral oil and other products in foreign vessels. A dredged channel, 200 feet wide and 35 feet (10.6 m.) deep, marked by buoys and private range targets, leads from southward of Baxters Ledge to the wharf on the north side of Constable Point.

New Brighton, Factoryville, Port Richmond, and **Mariners Harbor** are on the south shore of Kill van Kull. Several shipyards and floating dry docks are located on this shore. (See descriptions on p. 5.) There is railroad communication from these to other parts of Staten Island, and ferry communication with Bayonne, and with New York City from **St. George** at the eastern end of New Brighton.

Currents.—In Kill van Kull the flood current sets westward and ebb eastward, and slack water occurs about 1¼ hours earlier than the corresponding slack at The Narrows (about 30 minutes after high and low water at Governors Island). The mean velocity at strength of the currents is about 2 knots.

The direct currents favor the Bergen Point side of the channel between West New Brighton and Port Richmond; between these points, in the bight on the south shore of the Kill, there is more or less of an eddy when the current is at strength.

NEWARK BAY

(charts 369, 285, and 287) has a length of about 4 miles from Kill van Kull to the junction of the two channels leading to Passaic and Hackensack Rivers. The greater part of the bay is very shoal, but a channel, obtained by dredging, leads through the bay to the rivers. (See descriptions of Passaic and Hackensack Rivers following.)

Newark Bay Channel has a project depth of 30 feet (9.1 m.) for a width of 1,800 feet at the entrance, southwestward of Bergen Point, decreasing to a width of 400 feet at the Central Railroad bridge, and continuing with the same width to the junction of the Passaic and Hackensack River Channels. In 1925 this channel had a depth of 30 feet (9.1 m.) to the Port Newark Terminal Channel, and thence 20 feet (6.1 m.) to the junction of the river channels. Shoals with depths of 14 to 18 feet (4.3 to 5.5 m.) lie in the eastern half of the entrance, but there was a depth of 30 feet (9.1 m.) for a width of over 400 feet in the channel to the westward of these shoals. These shoals will eventually be removed. The channel is well

marked by lights and buoys, and strangers in small vessels should have no difficulty when using the chart as a guide. Deep-draft vessels should employ a pilot.

Port Newark terminal is located on the western side of Newark Bay, just southward of the second drawbridge. A channel 30 feet (9.1 m.) deep and 200 feet wide leads from a widened section of the Newark Bay Channel to a turning basin of the same depth at the upper end of the terminal wharf. A lighted beacon marks the entrance to the channel, and should be left 175 yards to the northward in entering.

Bridges.—Two railroad drawbridges cross the bay; the flood current sets in a northeasterly and the ebb in a southwesterly direction diagonally through the openings in the southern bridge. The Central Railroad bridge is being replaced by a new bridge (to be completed in 1926) which will have a vertical lift opening 200 feet wide on the west side and 125 feet wide on the east side, and with a vertical clearance of 35 feet above mean high water when closed and 135 feet when open. The Lehigh Valley Railroad bridge has center-pier openings with a least width of 97 feet and a vertical clearance of 8½ feet above mean high water when closed.

See **bridge regulations** following Hackensack River.

For **anchorage** limits see the appendix.

For **pilotage** see New York Harbor.

Ice generally closes navigation during a part of January and February.

Tides.—The mean rise and fall of tides is about 4.7 feet.

PASSAIC RIVER

(chart 287) is under improvement to secure a channel 300 feet wide and 20 feet (6.1 m.) deep from the upper end of Newark Bay Channel to Nairn Linoleum Works, which are 9.2 miles above the Central Railroad of New Jersey bridge in Newark Bay; thence 200 feet wide and 16 feet (4.9 m.) deep a distance of 1 mile to the Erie Railroad (Montclair and Greenwood Lake) bridge at **Arlington**; and thence a channel about 100 feet wide and 6 feet (1.8 m.) deep a distance of 5.4 miles to Gregory Avenue Bridge, **Passaic.** In 1925 there was a controlling depth of 20 feet (6.1 m.) to Jackson Street Bridge, thence 17 feet (5.2 m.) to Bridge Street, thence 15 feet (4.6 m.) to Nairn Linoleum Works, thence 13 feet (4 m.) to the Erie Railroad bridge, then 6 feet (1.8 m.) to Third River Bay, and thence 5 feet (1.5 m.) to the head of the improvement at Gregory Avenue bridge. Small boats can proceed for a further distance of about 1½ miles to Wall Street, above which the river is obstructed by bowlders.

Bridges.—The following are the drawbridges crossing Passaic River, the distance in nautical miles above the Central Railroad of New Jersey bridge crossing Newark Bay, the least width of the two draw openings, and the clear height above mean high water:

Central Railroad of New Jersey, 4.4 miles, 100 feet, 25 feet (7.6 m.).

Newark Plank Road, 5 miles, 100 feet, 11 feet (3.3 m.).

Pennsylvania Railroad (freight at Point No Point), 5.6 miles, 100 feet, 15.6 feet (4.7 m.).

Jackson Street (highway), 7.2 miles, 75 feet, 16 feet (4.9 m.).

Pennsylvania Railroad (passenger, at Market Street), 7.6 miles, 74 feet, 21.3 feet (6.5 m.).

Pennsylvania Railroad (Center Street), 7.9 miles, 80 feet, 10 feet (3 m.).

Bridge Street (highway), 8.2 miles, 80 feet, 9 feet (2.7 m.).

Delaware, Lackawanna & Western Railroad (Morris and Essex), 8.3 miles, 75 feet, 15.8 feet (4.8 m.).

Clay Street (highway), 8.5 miles, 76 feet, 7 feet (2.1 m.).

Erie Railroad (Fourth Avenue, Newark), 8.7 miles, 100 feet, 12.7 feet (3.9 m.).

Erie Railroad (Montclair and Greenwood Lake, at Arlington), 10.2 miles, 47.3 feet, 45.5 feet (13.8 m.).

Belleville (highway), 10.9 miles, 100.4 feet, 8.5 feet (2.5 m.).

Avondale (highway), 12.5 miles, 66.9 feet, 7.8 feet (2.4 m.).

Delaware, Lackawanna & Western Railroad (at Lyndhurst), 13.4 miles, 47.3 feet, 26.1 feet (7.9 m.)

Rutherford Avenue (highway, at Rutherford), 13.6 miles, 67.8 feet, 9.3 feet (5.8 m.).

Union Avenue (highway, at Rutherford and Passaic), 14.8 miles, 65 feet, 13 feet (4 m.).

Erie Railroad (Passaic), 15.1 miles, 62 feet (west opening), 18.6 feet (5.6 m.).

Gregory Avenue (Passaic and Wallington), 15.6 miles, 58.8 feet (east), 78 feet (west), 12.5 feet (3.8 m.).

Second Street (Passaic), 16.1 miles, 50.1 feet, 10.4 feet (3.1 m.).

Above Second Street (Passaic) the bridges are closed and have a least height of 5.6 feet (1.7 m.) above mean high water. Above the head of navigation, about 1 mile above Second Street, the river is obstructed by bowlders partly showing above water. Dundee Dam, the first one above Passaic, is 2.5 miles above Second Street Bridge.

See **Bridge regulations** following the description of Hackensack River.

The city of **Newark** extends along the Passaic River for a distance of nearly 5 miles above its mouth. The towns of **Belleville, Rutherford, Nutley, Garfield,** and several villages are located on the river between Newark and Passaic. The latter is a manufacturing city at the head of navigation.

Tides.—The mean rise and fall of tides is 4.7 feet at the mouth of the river, 5 feet at Newark, and 3.3 feet at Passaic. High water at these points occurs about 40 minutes, 1 hour, and 1 hour and 40 minutes, respectively, later than at Governors Island. Ordinarily the flood current extends above Second Street Bridge, Passaic.

Freshets overcome the flood current down as far as Newark, and sometimes to the mouth of the river. Ordinary freshets cause a rise of about 2 feet and a current velocity of about 3 knots at Newark and are of a few hours' duration. Destructive freshets occasionally occur at intervals of years, generally in the spring and fall.

HACKENSACK RIVER

(chart 287) empties at the northeast end of Newark Bay and is navigable a distance of about 17.6 miles to dams at New Milford. The principal navigable tributaries are **Berry Creek Canal** (en-

trance to **Berry Creek)** and **Overpeck Creek,** 6.8 and 11.1 miles, respectively, above the entrance, which are crossed by drawbridges and are navigable for distances of about 3 miles from Hackensack River. Berry Creek Canal, which is 1 mile long, 150 feet wide, has a least channel depth of about 11 feet (3.4 m.) and leads to Berry Creek above the Erie Railroad.

The project for the improvement of the river is to obtain a channel 30 feet (9.1 m.) deep and 400 feet wide from the upper end of Newark Bay Channel for about 1 mile to the Central Railroad bridge; thence 20 feet (6.1 m.) deep and 300 feet wide for about 2 miles to the Delaware, Lackawanna & Western Railroad bridge at Marion; thence 12 feet (3.7 m.) deep and 200 feet wide for about 9 miles to Little Ferry; and thence the same depth and 150 feet wide for about 2 miles to the New York, Susquehanna & Western Railroad bridge at Hackensack. In 1925 the controlling depth was 16 feet (4.9 m.) to the Delaware, Lackawanna & Western Railroad bridge at Marion; thence 12 feet (3.7 m.) to Little Ferry; and thence 9 feet (2.7 m.) to the head of the improvement at Hackensack. Navigation above Hackensack is limited to small craft.

Bridges.—The following are the drawbridges crossing Hackensack River, the distance in nautical miles above the entrance, the least width of the two draw openings, and the clear height above mean high water:

Central Railroad of New Jersey, 0.5 mile, 94 feet, 25 feet (7.6 m.).

Lincoln Highway, 1 mile, 68 feet, 10.7 feet (3.3 m.).

Pennsylvania Railroad (passenger), 2.2 miles, 56.3 feet, 6 feet (1.8 m.).

Pennsylvania Railroad (freight), 2.2 miles, 60 feet, 5.5 feet (1.6 m.).

Newark Turnpike, 2.3 miles, 80.6 feet, 8.9 feet (2.7 m.).

Delaware, Lackawanna & Western Railroad (at Marion), 2.5 miles, 71.6 feet, 14 feet (4.3 m.).

Pennsylvania Railroad (near Snake Hill), 4 miles, 99.6 feet, 23.5 feet (7.1 m.).

Erie Railroad (near Snake Hill), 4.3 miles, 99 feet, 7.5 feet (2.2 m.).

Delaware, Lackawanna & Western Railroad (near Kingsland Creek), 5.5 miles, 60 feet, 5.5 feet (1.6 m.).

Erie Terminals Railroad, 6.1 miles, 99 feet, 4.4 feet (1.3 m.).

Paterson Plank Road, 7.7 miles, 59.5 feet, 5.8 feet (1.7 m.).

Bergen Turnpike (at Little Ferry), 11.1 miles, 59.5 feet, 4.5 feet (1.3 m.).

Court Street (at Hackensack), 13 miles, 59.6 feet, 4 feet (1.2 m.).

New York, Susquehanna & Western Railroad (at Hackensack), 13.4 miles, 43 feet (east only), 2.2 feet (0.7 m.).

Bergen County Traction Co. (at Hackensack), 13.6 miles, 58 feet, 7.5 feet (2.3 m.).

Anderson Street (at Hackensack), 13.9 miles, 45 feet, 3.5 feet (1 m.).

New Bridge (highway), 15.5 miles, 39.6 feet, 2.7 feet (0.8 m.).

River Edge (highway), 16.8 miles, 39 feet, 5.5 feet (1.6 m.).

Tides.—The mean rise and fall of the tides is 4.7 feet at the mouth of the river and 5.2 feet at Little Ferry and Hackensack. High

water at these points occurs about 40 m., 1 h. 25 m., and 1 h. 35 m., respectively, later than at Governors Island. The river has little freshet flow, and the tidal currents are rarely affected by it.

BRIDGE REGULATIONS

have been prescribed as follows:

1. All drawbridges spanning Newark Bay and the Passaic and Hackensack Rivers and their navigable tributaries shall be opened promptly, upon signal, for the passage of vessels during the day or night, except as prescribed in paragraphs 2, 3, 4, and 5.

2. During the hours between 7.30 and 10 a. m. and between 5 and 7.30 p. m. drawbridges shall not be required to remain open longer than 10 minutes nor be permitted to remain closed longer than 10 minutes to the exclusion of vessels approaching for passage.

3. The draw of any bridge used solely for the United States mail, passenger and express trains need not be opened for a vessel reaching said draw less than five minutes before the scheduled arrival of any such train until such train passes, unless the bridge tender has notice that the train is delayed more than five minutes. The owners of bridges acting under this rule shall maintain a tug at the drawbridge to control and aid in the passage of vessels.

4. When a vessel approaches within signaling distance of a bridge for passage, the master thereof shall signify his intention by three blasts of a whistle or horn. For those bascule bridges that have two separate and distinct draw spans the approaching vessel shall signal for an opening of the bridge in the customary manner by three blasts of a whistle or horn, and this shall be followed after a short interval with one blast, if it is desired that the draw span on the starboard hand as the vessel approaches be opened, or by two blasts if it is desired that the one on the port hand be opened. The signal of the craft shall be immediately answered by the tender or operator of the bridge. If the draw is ready to be immediately opened, the answer shall be three blasts of a whistle or horn from the bridge. In case of delay in opening the draw, as is provided for in these regulations, or as may be necessary by accident to the machinery or other contingency, the signal from the vessel shall be answered by two long blasts of a whistle or horn from the bridge. In all cases when delay signals have been given, a signal of three blasts of a whistle or horn shall be given as soon as it is possible to open the draw.

5. Upon hearing or perceiving the signals prescribed, the tenders or operators of a drawbridge, except as provided in paragraphs 2 and 3, shall at once open the draw signaled for so as to allow the prompt passage of any vessel or craft: *Provided*, That the bridge may not be opened when there is a train, wagon, or vehicle at the time passing over said draw span, or a train approaching so closely that it can not be safely stopped before reaching the bridge, but it shall be opened as soon as the draw span can be cleared. In case the opening of the draw will be delayed under the provisions of paragraph 3, the tug stationed at the draw shall immediately go to the assistance of the vessel.

6. Wagons, vehicles, and trains shall not be stopped on a drawbridge or on a draw span for the purpose of delaying the operation of the drawbridge, nor shall water craft or vessels be so manipulated as to hinder or delay the operation of a draw span, but all passage upon, through, or under a drawbridge shall be prompt, to prevent delay to either land or water communication.

7. The foregoing regulations apply only to commercial or pleasure vessels. Steamers or vessels employed or controlled by the United States Government or by municipal departments shall be passed without delay through the draws of said bridges at any hour of the day or night upon giving four blasts of the whistle.

HUDSON RIVER

sometimes called **North River** in the vicinity of New York, takes its rise in one of the lakes in Essex County, in the northeastern part of the State of New York, and flows in a southerly direction for about 260 miles to its junction with East River at the southern

end of Manhattan Island, where both enter New York Upper Bay. For a distance of 79 miles above the Battery (or as far up as Rondout) it has a deep and unobstructed channel navigable for large vessels, the least depths in the channel being some spots with 21 feet (6.4 m.) over them lying 3½ miles above Tarrytown. Above Rondout the channel, although it has a depth of about 24 feet (7.3 m.) as far up as Hudson, is rendered more difficult for navigation by reason of numerous middle grounds and flats which rise abruptly from deep water. Hudson is 22 miles above Rondout and about 30 miles below Troy, which is at the head of navigation, about 131 miles above the Battery.

HUDSON RIVER BELOW YONKERS

(charts 369,[4] 369,[8] and 281) includes that portion of the river extending from the Upper New York Bay to the northern limits of New York City, a distance of about 14½ miles. The deepest portion of the river in this section is sometimes called **Hudson River Channel** and is a continuation of Ambrose and Anchorage Channels. It has a least depth of 40 feet (12.2 m.) and a least width of 2,000 feet from Upper New York Bay to Sixty-first Street, and thence a least width of 1,000 feet to the northern limits of New York City. The river along the Manhattan water front has been cleared of shoals to a least depth of 40 feet (12.2 m.) from the Battery to Sixty-first Street. A channel 30 feet (9.1 m.) deep and 800 feet wide has been dredged along the Jersey City water front. The Hoboken water front has been dredged to a depth of 40 feet (12.2 m.). A channel 26 feet (7.9 m.) deep and 550 feet wide has been dredged along the Weehawken-Edgewater water front, and this channel will soon be increased to a depth of 30 feet (9.1 m.) and a width of 750 feet.

Navigation regulations, prescribed by the Secretary of War, provide that vessels drawing 25 feet (7.6 m.) or more shall have the right of way in the 40-foot channel between Piers 31 and 39, Manhattan (in the vicinity of the Canal Street vehicular tubes).

The western bank of the river opposite Manhattan Borough (New York City) is occupied by **Jersey City, Hoboken, Weehawken, Guttenberg, Shady Side,** and **Edgewater.**

On the eastern bank, nearly opposite Edgewater, is **Grant's Tomb.** Just above the tomb is **Fort Washington Point** (marked by Jeffreys Hook Light), and a little more than 1¼ miles above it is **Tubby Hook,** about ½ mile below the mouth of Spuyten Duyvil Creek. The latter is marked by the drawbridge at the entrance; the creek is described with Harlem River.

Fort Lee is on the west bank of the river opposite Fort Washington Point. From Fort Lee to Piermont, 12½ miles farther up the river, on the same side, the western bank is rocky cliffs (in places thickly wooded with scrub), 300 to 500 feet (91 to 152 m.) high, known as **The Palisades.**

Terminal facilities.—Along the lower Hudson water front there are about 17 miles of continuous water terminals, consisting of piers, bulkheads, warehouses equipped with modern appliances for handling freight, modern coal piers, bridges for the transfer of cars to and from floats, marine railways, dry docks, and ferry racks.

The Manhattan water front has about 7 miles of continuous water terminals, of which 77 per cent are owned by the city of New York, 18 per cent by the railroads, and one terminal is owned by the State of New York as a barge canal terminal. Most of the city-owned terminals are leased for commercial purposes; a few are open to the public and some are used by city departments. Privately owned and leased terminals are used exclusively for commercial purposes and are not open to the public. Many of the city terminals are designed to accommodate trans-Atlantic steamships up to 1,000 feet in length and 40-foot (12.2 m.) draft.

The New Jersey water front has a total of 301 water terminals, of which 294 are either privately or corporately owned, 1 is publicly owned, and the remaining 6 (at Hoboken) are under the control of the United States Shipping Board. These latter terminals accommodate steamships of all classes up to the largest trans-Atlantic steamships afloat. About 55 per cent of all terminals along this front are owned or controlled by railroad companies and are so used. The privately owned terminals accommodate vessels of all classes up to 30-foot (9.1 m.) draft. Of the terminals along the New Jersey shore but one in Jersey City is owned by and open to the public so far as known.

Repairs.—There are several floating docks and marine railways along the New Jersey water front, the largest having a capacity of 10,000 tons. (See descriptions on p. 5.)

Pilots.—See "New York Harbor" on page 288.

Anchorage areas and the regulations relating thereto are given in the appendix.

Storm warnings are displayed at New York, as follows: One hundred and thirty-eighth Street (Hudson River), Whitehall Building, and Maritime Exchange.

Tides.—Daily predictions for Governors Island are given in the tide tables. The mean rise and fall of tides at the Battery is 4.5 feet, and at the mouth of Spuyten Duyvil Creek, 3.6 feet; the mean range of spring tides, 5.3 feet and 4.8 feet, respectively.

Currents.—Along the axis of the channel the velocity of the current at strength of flood is approximately 1½ knots and the ebb 2¼ knots, the greatest velocity being found in midstream. The period of the ebb is generally about 2 hours greater than the period of the flood, the duration of the ebb being 7.2 hours and the duration of the flood 5.2 hours. The time of slack water, the duration of the flood and ebb and the velocity of the current are greatly affected by freshet conditions in the river. The strength of the current at Fort Washington usually occurs about 1¼ hours earlier than slack water at The Narrows (approximately ½ hour after high and low water at Governors Island).

The results of special tidal and current observations in New York Harbor have been published under the title "Tides and Currents in New York Harbor," and copies of this publication can be obtained from the Coast and Geodetic Survey Field Station, 78 Broad Street, New York City, or from the Superintendent of Documents, Government Printing Office, Washington, D. C., price 30 cents.

Freshets.—See after the description of upper Hudson River following:

(charts 281, 282, 283, and 284) has a navigable channel with a controlling depth of about 24 feet (7.3 m.) to Hudson, 101 miles above the Battery. The channel is well marked by lights and buoys. About 3½ miles above Tarrytown there are some shoal spots in the channel with 21 feet (6.4 m.) over them, but eastward of these spots is a clear width of channel 800 feet wide marked on the eastern side by a gas buoy. Below Rondout, which is 79 miles above the Battery, the river is easy to navigate; above Rondout navigation is made difficult by numerous shoals and middle grounds which rise abruptly from deep water.

Between Hudson and Troy the river has been improved to secure a channel 400 feet wide and 12 feet (3.7 m.) deep, and had a least depth of about 13 feet (4 m.) in 1925. The present project for the improvement of this part of the river provides for the excavation of a channel 12 feet (3.7 m.) deep at all stages (see tides following), to be 200 feet wide from Waterford down to the dam with a general width below the dam of 400 feet, except in front of Troy and Albany, where it is to be widened so as to form a harbor at these localities.

The most important ports on the Hudson River above New York are Yonkers, Newburgh, Poughkeepsie, Kingston and Rondout, Hudson, Albany, and Troy. There are also the towns of Tarrytown, Nyack, Ossining, Haverstraw, Peekskill, Catskill, New Baltimore, Rensselaer, and Watervliet, and a number of villages. These ports support a considerable business in the manufacture of cement, brick, and miscellaneous merchandise, the quarrying of rock, and the cutting of ice. The rural district is largely devoted to fruit raising, truck farming, and dairying.

The river also forms a waterway for the traffic of the Erie Canal (New York State Barge Canal), which extends to the Great Lakes at the foot of Lake Erie, and of the Champlain Canal, which extends to the head of Lake Champlain. The latter is connected with the St. Lawrence River by the Richelieu River.

The New York Central Railroad, with its main line on the east bank and its west shore division on the west bank, follows the Hudson from New York to Albany and on the east bank to Troy. Albany and Troy are important railroad centers. Several lines of large steamers, carrying passengers and freight, operate on the river between New York and Albany.

Yonkers, on the east bank of the river, 15 miles above the Battery, has a number of wharves and considerable trade. Opposite, on the west bank, are two landings—the lower, **Huylers;** the upper, **Closter.** About 4 miles above Yonkers, on the same side of the river, is **Hastings upon Hudson,** about 1 mile farther up is **Dobbs Ferry,** and opposite it, on the western bank, is **Sneden Landing.**

Piermont is on the west bank, 22 miles above the Battery. Here is a long, grassy, earthen embankment, formerly a pier of the New York & Erie Railroad. The end of the submerged pier is marked by a black buoy. **Irvington** is a village opposite Piermont; the depth at the wharf is about 7 feet (2.1 m.). **Tappan Sea** is the name given to the stretch of the river, about 2 miles wide, extending from abreast Piermont to Croton Point, a distance of 7½ miles.

Tarrytown is on the east bank of the river, 24 miles above the Battery. A channel dredged about 100 feet wide and 10 feet (3 m.) deep and marked by buoys, leads to the steamboat dock, at the south end of the water front, and then leads in a northerly direction and 150 feet wide to the coal pier, passing about 75 feet off the wharf northward of the ferry landing. From northward a depth of about 5 feet (1.5 m.) can be taken through the dredged channel to the wharves, on a 123° true (SE. 1/8 E. mag.) course, passing close to northward of the red buoy at the entrance, and about 175 yards southwestward of Tarrytown Lighthouse. There is little depth at most of the wharves, and local knowledge is needed for the best water. Fresh water can be had at the steamboat wharf. A ferry operates between Tarrytown and Nyack unless prevented by ice.

Tarrytown Lighthouse lies southwestward of Kingsland Point, just above Tarrytown, and 400 yards eastward of the main channel of Hudson River. A red buoy marks the edge of the main channel abreast the lighthouse.

Nyack, opposite Tarrytown, has a depth of about 8 feet (2.4 m.) at the principal wharves. There are a shipyard, with good facilities for repairing wooden hulls, and a launch building and storing yard at Nyack, and ferries run to Tarrytown. Fresh water and launch supplies can be obtained. The largest marine railway is 110 feet long, and can take out a vessel 125 feet long.

For a distance of 3/4 mile in the vicinity of **Rockland Lake Landing** the shore is occupied by quarry wharves. **Rockland Lake Lighthouse** is in a depth of about 12 feet (3.7 m.) on the shoal off the landing, and is on the west edge of the main channel of Hudson River. **Verdrietege Hook,** extending about 1 3/4 miles southward from Rockland Lake Landing, is 600 to 730 feet (183 to 223 m.) high and wooded with scrub, but in places shows bare, precipitous cliffs. Near the southern part of the Hook it has a height of 730 feet (223 m.), and is called **Hook Mountain.** The west bank of the river between Rockland Lake Landing and Haverstraw rises precipitously to heights varying from 400 to 820 feet (122 to 250 m.), the highest part, **High Tor,** lying about 1/2 mile southward of Haverstraw.

Ossining is on the east bank, 28 miles above the Battery. The controlling depth is 7 feet (2.1 m.) on the flats off Ossining and 5 to 7 feet (1.2 to 2.1 m.) at the wharves, except that a bar with little depth extends a short distance off the mouth of **Sing Sing Creek,** at the foot of Quimby Street. Sing Sing prison, the State penitentiary, is located on the flat shore at the south end of Ossining.

Croton Point is the long peninsula just above Ossining. Haverstraw Bay is the wide stretch of the river extending from Croton Point to Stony Point, a distance of 5 miles. The extensive flats on the east side of **Haverstraw Bay** have ruling depths of 7 to 9 feet (2.1 to 2.7 m.), as shown on the chart. There are brickyards on the west side of Croton Point, also at **Cruger** and **Georges Island,** at the north end of Haverstraw Bay. **Croton** is on the east bank, northward of Croton Point. There is a depth of about 6 feet (1.8 m.) at the principal wharves.

Haverstraw is on the west bank of the river, 32 miles above the Battery, and is remarkable for the number of its brickyards extend-

ing along the water front. **Grassy Point,** at the north end of Haverstraw, has a shipyard for building and repairing wooden hulls and a railway with a capacity of about 225 tons.

Minisceongo Creek has its entrance at the head of the shoal bight westward of Grassy Point. A channel, with a least depth of about 5 feet (1.5 m.) and marked on its south side by stakes, follows the shore through the flat westward of Grassy Point and through the west opening (clear width 45 feet, height above high water 9 feet) in the drawbridge at the entrance of the creek. Barges loaded to 7½-foot (2.3 m.) draft are taken to and from the brickyards on the creek. The drawbridge will be opened during daylight; the signal for it is three blasts.

Stony Point is on the west bank 3 miles above Haverstraw. A light with fog bell is located on this point. Opposite Stony Point is a shoal bight called **Greens Cove,** on the north side of which is Verplanck Point and the village of **Verplanck,** which has a number of brickyards. There are also stone works at Verplanck and **Tomkins Cove.** Gasoline and oil can be obtained at Verplanck.

Peekskill is a village in the shoal bight on the east bank of the river 38 miles above the Battery. A dredged channel 100 feet wide and 9 to 10 feet (2.7 to 3 m.) deep leads to and along the wharves from northward and southward, as shown on the chart. The southern channel is marked by buoys. A chimney on the west gable of the house on the end of the wharf in line with a white church spire on the crest of the first hill is a range for the channel. The outer section of the northern channel is buoyed; the coal hoist at the north end of the wharves in line with the north end of a large white building forms a range for the north edge of the inner section of the northern channel, and vessels must keep southward of the range to follow the channel.

Peekskill (Annsville) Creek, just northward of Peekskill, has been improved by dredging a channel 100 feet wide and 7 to 8 feet (2.1 to 2.4 m.) deep to the sand plant about ⅞ mile above the drawbridge at the entrance. Follow the northern channel leading to Peekskill until abreast the drawbridge opening (lift opening 50 feet wide). The channel then leads through the drawbridge, follows the wharves on the east bank (keeping out of the bights) for ½ mile, then leads for the next point on the west bank, and then curves northeastward to the sand plant. The channel is marked on the west side by stakes and by flats and grass which show on both sides at low water.

Bridge regulations, prescribed by the Secretary of War, require that the draw over Annsville Creek shall be opened promptly for vessels from 8 a. m. to 4 p. m., and shall not be required to open at other times, except for vessels owned, controlled, or employed by the United States Government or by the State of New York.

Opposite Peekskill is **Donderberg,** a high, densely wooded hill terminating eastward in a low, flat point called **Kidds Humbug (Jones Point).** About 1½ miles above Kidds Humbug is **Iona Island.** Government vessels only are permitted to land here.

Just above Peekskill the river becomes much narrower, and for a distance of 8 miles has a width of about ¼ mile. The river here flows along the base of very high hills (some over 1,000 feet (305 m.)

in height) known as the **Highlands.** The river scenery between Peekskill and Newburgh, about 14 miles above, is scarcely excelled anywhere in the world. **Anthonys Nose** is the high, steep, thickly wooded hill on the eastern bank about 2 miles above Kidds Humbug.

Anthonys Nose Bridge is a suspension bridge with a vertical clearance of 153 feet (46 m.) at mean high water under the center of the span, and crosses the river between Anthonys Nose and Bear Mountain. A light is located on the end of the point at Anthonys Nose. **Popolopen Creek,** on the west side of the river above the bridge, is crossed by two bridges, the first having a draw opening 34 feet wide, and the second a fixed span 118 feet (36 m.) above mean high water. On the west bank, 2 miles above Anthonys Nose, is **Con Hook** (marked by a light), and 1½ miles farther up the river is **Highland Falls.**

West Point, 45 miles above the Battery, is the site of the United States Military Academy, and can be easily recognized from the prominence of the buildings and the road leading up the hillside from the ferry wharf and station of the West Shore Railroad. Opposite this station is the village of **Garrison** and a station of the Hudson River Railroad; a ferry is run between Garrison and West Point. The northeastern extremity of West Point descends to a rocky point, upon the extremity of which is West Point Lighthouse. On the opposite side of the river and north of West Point is **Constitution Island;** the bend between the two is locally known as **Worlds End,** and has very deep water, 36 fathoms (66 m.) being found in the channel.

A little above Constitution Island, on the west bank of the river, is a steep, rocky wooded hill 1,396 feet (425 m.) high, known as **Crow's Nest,** and just above it an equally steep and prominent hill 1,340 feet (408 m.) high known as **Storm King.** About 4 miles above West Point and on the west bank is **Cornwall on the Hudson,** just above which is **Moodna Creek.** There is a depth of about 20 feet (6.1 m.) at the coal docks at Cornwall, which is a railroad shipping point for coal. **Polopel Island** is a small island lying near the edge of the shoal on the eastern side of the river opposite Moodna Creek.

Newburgh, a city on the west bank of the river, 52 miles above the Battery, has large manufacturing interests and considerable river trade in farm produce. There is a shipyard with good facilities for the construction and repair of hulls and machinery and a railway with a capacity of about 1,000 tons. There are numerous brickyards on both sides of the river for a distance of about 2 miles southward from Newburgh. Opposite the city is **Fishkill,** which is connected by ferry and submarine cable.

There are numerous brickyards on the west bank of the river between **Roseton** and **Danskammer Point** (marked by a light). **New Hamburg** is a village on the east bank, 58 miles above the Battery and on the north side of the shoal bight at the entrance of Wappinger Creek. Opposite New Hamburg, on the west bank, are the villages of **Hampton** and **Marlboro.**

Wappinger Creek has been improved by dredging a channel 8 feet (2.4 m.) deep and 80 feet wide for a distance of 11,000 feet from the channel of Hudson River to a point 200 feet below a bridge at the lower falls where are large bleaching works. Two bridges

cross the creek. The railroad bridge at the entrance is a lift bridge with a clear opening 40 feet wide; the highway bridge, 1,100 feet above the railroad bridge, has two openings, 48 feet wide each, and is about 8 feet in the clear above high water. The mean rise and fall of tides is 3 feet.

The entrance from Hudson River to the railroad bridge is usually marked by private buoys, the cut having a 59° true (ENE. ¼ E. mag.) direction until in line with the draw opening, bearing southward of 90° true (E. by S. mag.). From the upper end of the fender piers the channel leads for the south end of the highway bridge, above which the south bank should be followed about 100 feet off and pass close to the foundry bulkhead; then head across to pass about 80 feet off the next point on the west bank and follow this bank and the dike above it at a distance of about 60 feet. The channel then leads close to the coal dock, and then follows the south bank at a distance of about 70 feet (a little more in the bight) to the upper end of a bulkhead, from which a narrow channel, with a depth of about 6 feet (1.8 m.) leads to the lumber sheds on the south bank. The main channel, however, from the upper end of the bulkhead follows the north bank at a distance of about 100 feet, drawing in to about 50 feet when passing the steep part of the bank near the bend at the north end of the creek. Then keep near mid creek.

Poughkeepsie, about 7 miles above New Hamburg and 65 miles above the mouth of the river, has about 1 mile of wharf front and is the center of an important trade in manufactured goods. At Poughkeepsie the river is crossed by a bridge with spans over 500 feet in length, the spans having clear heights of 130 and 167 feet (39 and 51 m.) above high water. There is a fog bell on the pier nearest Poughkeepsie. There is a ferry to the post village of **Highland,** opposite Poughkeepsie. Submarine cables cross the river southward of the bridge.

From Poughkeepsie to Rondout, 13½ miles farther up, the river has a deep and unobstructed channel, and on its banks between these two places are a number of villages and landings. **Greer Point,** on the east side of the river, is marked by a light.

Esopus Island, small and narrow, with a light at its south end, is 72½ miles above the Battery and 7 miles above Poughkeepsie. A ledge, partly bare at low water and marked by a horizontally striped buoy, extends 300 yards northward in prolongation of the island. The better channel is westward of the island. **Esopus** is a village on the west bank of the river abreast Esopus Island. About 2½ miles above Esopus Island, on the west bank, is **Esopus Point,** on the eastern extremity of which is Esopus Meadows Lighthouse.

Rondout Creek enters the western side of Hudson River 79 miles above the Battery. It is the harbor for Rondout and Kingston. The entrance is between two long dikes, marked by lights, and is under improvement to maintain a channel 100 feet wide and 14 feet (4.3 m.) deep. The channel leads close to the north dike and the bulkhead at Rondout. Above Rondout there is a depth of about 7 feet (2.1 m.) in the channel to **Eddyville,** where vessels load to a draft of 8 to 9 feet (2.4 to 2.7 m.) at high water. The head of navigation is at the lock of the abandoned **Delaware and Hudson Canal** above Eddyville landing, 3¼ miles from the entrance. Two

fixed bridges, with clear heights of 86 and 148 feet, respectively, above mean low water, cross Rondout Creek about 1½ and 2 miles above the entrance. The mean rise and fall of tides is 3½ feet.

Rondout and **Kingston,** 79 miles above the Battery, have considerable trade, and are the home port of the principal fleet of towboats operating on Hudson River. At **South Rondout** there are facilities for building and repairing wooden hulls and ordinary repairs to machinery; at high water a draft of 9 to 10 feet (2.7 to 3 m.) can be taken to the floating dock there. Coal, water, gasoline, and other supplies are obtainable. A ferry runs to **Rhinecliff,** opposite the mouth of Rondout Creek. **Kingston Point** is an amusement resort and stopping place for some of the river steamers.

Barrytown is a village on the east bank of the river, 5 miles above the mouth of Rondout Creek. **Magdalen Island** is a small island lying in the eastern part of the river 1¾ miles above Barrytown. Nearly 1 mile above the island, on the east bank, is the village of **Tivoli.**

Esopus Creek enters the western side of Hudson River 88 miles above its mouth. The village of **Saugerties** is on the creek about ¾ mile from its mouth. The creek has been improved by dredging a channel 125 to 200 feet wide and 12 feet (3.7 m.) deep for a distance of 4,000 feet above the lights at the entrance between the dikes to the steamboat landing, which is on the south bank of the creek. At the latest examination (1921) this channel had a controlling depth of 11 feet (3.4 m.). For a distance of about 1,000 feet below the steamboat landing a shoal extends 20 to 35 yards from the north bank. A ferry runs from Saugerties to Tivoli, which is on the east bank of the river ¾ mile southward of Esopus Creek. A landing for Saugerties, used by some of the steamers, is on the west bank ⅜ mile southward of Esopus Creek.

Malden is a village on the west bank about 1¼ miles above the mouth of Esopus Creek. About 2 miles above Malden is the village of **West Camp;** and on the opposite bank of the river is **Cheviot,** which is 92 miles above the Battery. The landing for **North Germantown** is 2 miles above the wharf at Cheviot.

Catskill Creek enters the western side of Hudson River 97 miles above the Battery. **Catskill** is a village, with a number of factories, on the creek. A long dock extends from the village to the channel of Hudson River and forms the north side at the entrance of the creek. Gasoline and motor boat supplies can be obtained. A ferry runs to **Greendale,** opposite Catskill Creek, and to Hudson.

The channel in Catskill Creek has a least width of about 100 feet and least depth about 10 feet (3 m.) to the head of navigation, about 6,500 feet above the entrance, and 1,200 feet above the highway bridge. The north edge of the channel leads close to the end of the wharf at the entrance, then passes 75 feet off the first small pier, lying 200 yards inside the end of the wharf, and then passes close to the next small pier on the north side. The best water is then in midcreek until around the first sharp bend, taking care to avoid a rock with 4 feet (1.2 m.) over it, lying about 50 feet off the western end of the wharf on the north side, abreast the rocky point locally known as **The Hopper Nose.** It then follows the south bank nearly to the highway bridge, then through the north draw opening, and then

follows the north bank. The highway bridge is about 10 feet above high water, and has two openings 65 feet wide; the south opening is shoal.

Hudson, on the east bank, 101 miles above the Battery, is at the head of the deeper navigation in Hudson River, there being a depth of about 24 feet (7.3 m.) in the channel to this point. The deepest draft of vessels loaded at Hudson in 1925 was about 22 feet (6.7 m.). **Athens,** a village opposite Hudson, has a marine railway with a capacity of about 1,000 tons and several smaller ones for motor boats. It is connected by ferry with Hudson. High-voltage transmission lines cross the Hudson River between Hudson and Athens. These wires are about 165 feet (50 m.) above the water at the center of the river.

The following are the principal villages between Hudson and Albany and their distances in nautical miles above the Battery: **Coxsackie,** 107 miles; **Stuyvesant,** 109 miles; **New Baltimore,** 113 miles; **Coeyman,** 115 miles; and **Castleton,** 118 miles. There are also numerous ice houses which ship their product by water. At New Baltimore there is a railway with a capacity of about 400 tons.

A railroad bridge crosses the Hudson River 1.7 miles southward of Castleton. It has two fixed spans over the river with a vertical clearance of 139 feet (42 m.) at mean high water over the main channel.

Albany is on the west bank of the river, 24 miles above Hudson and 125 miles above the Battery. There is a depth of about 13 feet (4 m.) at ordinary low water in the channel to Albany and Troy, and 14 feet (4.3 m.) is the deepest draft that can be taken up at high water.

Rensselaer is a town opposite Albany, and **Troy** is a manufacturing city on the east bank of the river, 6 miles above Albany and 131 miles above the Battery. **Watervliet,** opposite Troy, is the site of the United States Arsenal.

Bridges.—The following are the drawbridges crossing the Hudson River at Albany and Troy, the least width of the two draw openings, and the clear height above the plane of mean high water:

Albany and Greenbush, 179 feet, 22.2 feet (6.7 m.).

New York Central Railroad (passenger) at Albany, 109 feet, 27.7 feet (8.4 m.).

New York Central Railroad (freight) at Albany, 103 feet, about 27.5 feet (8.3 m.).

Congress Street, at Troy, 181 feet, 32 feet (9.7 m.).

Delaware & Hudson Railroad (west span only) 50 feet, 23.3 feet (7.1 m.).

Cohoes and Lansingburg, one opening 200 feet, about 24.4 feet (7.4 m.)

Above the Cohoes and Lansingburg bridge the bridges are all fixed, and have a least vertical clearance of 14.3 feet (4.4 m.) above mean high water.

Canals.—The Federal Dam at Troy, 132 miles above the Battery, is the head of tidewater on the Hudson River. A lock with available length of 492.5 feet, 45 feet wide and a depth of 14 feet (4.3 m.) on sills, enables vessels to go above the dam to the new canal entrances.

A channel 200 feet wide and 12 feet (3.7 m.) deep has been dredged from the lock to the new canal entrances at Waterford. Descriptions of these canals are given following "Directions, Hudson River."

Waterford, 2½ miles above the Federal Dam, is the terminal of the new Erie (New York State Barge) Canal and Champlain Canal. There is a marine railway here capable of hauling out vessels up to 9-foot draft.

Tides.—Daily predictions for Governors Island and Albany are given in the tide tables. High and low water at the points named along the Hudson occur later than at Governors Island. The difference in the times and mean rise and fall of tides for low stages in the upper river are as follows: Yonkers, 1 hour 20 minutes, 3.6 feet; Ossining, 2 hours 5 minutes, 3 feet; Peekskill, 2 hours 45 minutes, 2.7 feet; Newburgh, 4 hours, 2.7 feet; Poughkeepsie, 4 hours 45 minutes, 3 feet; Tivoli, 6 hours 5 minutes, 3.8 feet; Hudson, 7 hours 5 minutes, 4.1 feet; New Baltimore, 9 hours 15 minutes, 3.1 feet; Castleton, 9 hours 45 minutes, 3.1 feet; Albany, 10 hours 15 minutes, 3.4 feet; Troy, 11 hours 45 minutes, 3 feet.

Currents.—The time of slack water, the duration of flood and ebb, and velocity of the current are greatly affected by freshet conditions in the river. The time of the strength of the current is not greatly affected by freshet conditions and occurs as follows: Fort Washington, about 1¼ hours earlier than slack water at The Narrows (approximately ½ hour after high and low water at Governors Island); Dobbs Ferry, about ½ hour earlier than slack water at The Narrows (approximately 1¼ hours after high and low water at Governors Island); Croton Point, about ¼ hour later than slack water at The Narrows (approximately 2 hours after high and low water at Governors Island); Donderberg, about ½ hour later than slack water at The Narrows (approximately 2¼ hours after high and low water at Governors Island); West Point, about ¾ hour later than slack water at The Narrows (approximately 2½ hours after high and low water at Governors Island); Poughkeepsie, about 1¼ hours later than slack water at The Narrows (approximately 3 hours after high and low water at Governors Island).

The observed velocities of the currents range from 1 to 3 knots from the Battery to Dobbs Ferry, and the mean velocity is about 2 knots. Above Dobbs Ferry the ordinary velocity ranges from about 1 to 1.5 knots, the ebb having slightly the greater velocity. In the upper river the mean velocities of the strength of the flood and ebb at low stages of the river are approximately as follows: Poughkeepsie, 0.7 and 0.9; Barrytown, 1.1 and 1.3; Hudson, 0.9 and 1.5. See also the statement relating to freshets following.

Freshets.—During March, April, and May freshets may be expected of from 8 feet upward in height at Albany above the plane of lowest low water and lasting through periods of 10 days and more. During warm months freshets may be expected from 8 to 14 feet in height at Albany above the plane of lowest low water, with from 3 to 5 days' duration. Rain freshets are not, as a rule, very destructive, the main damage being interference with navigation due to wharves being under water. Freshets caused by ice gorges, which occur nearly every year in February or March, usually rise higher,

last longer, cause loss and destruction on shore, and form shoals and bars in the channel.

During low-water stages at Albany there is an ebb current for about 7 hours and a clearly definable flood current for from 2½ to 4 hours. When the freshet low water rises to mean half tide the flood current disappears, and the tidal wave is felt only by small fluctuations in the water level. When the freshet height reaches 10 feet above the plane of lowest low water the tidal action ceases to be apparent. During low stages at Albany the velocity of the flood current at strength is about 0.6 knot and the ebb 0.7 knot. During freshets of not less than 6 feet the flood current disappears and there is an ebb current of about 1.5 knots. After the flood current disappears the average difference in the velocities of the ebb current between flood and ebb tides is about 1.2 knots, and during extreme freshets the current reaches a velocity of nearly 5 knots.

Ice closes navigation on the upper Hudson River from about December 12 to March 24. In recent years the dates of opening navigation ranged from March 14 to April 4, and of closing navigation ranged from December 1 to January 3. In 1913, however, navigation remained open till February 6, which is the latest of record.

Hospital.—There is a relief station of the United States Public Health Service at Albany.

BRIDGE REGULATIONS

The following are the regulations prescribed by the Secretary of War to govern the opening of the drawbridges crossing the Hudson River at Albany:

1. The draw in each of the bridges crossing the Hudson River at Albany, N. Y., shall, upon the signal prescribed in paragraph 9 below being given, be opened promptly at all hours for the passage of any vessel or vessels or other water craft not able to pass underneath it.

2. The draw of a bridge shall not be required to remain open for the passage of vessels longer than 15 minutes consecutively, and upon being closed it shall be authorized to remain closed for a sufficient time to allow delayed land traffic to pass over, and in no case exceeding the period of 10 minutes consecutively, unless at the expiration of such a period a train in motion having passed the derailing point is approaching the draw, which train shall be permitted to pass the draw before opening: *Provided*, That no train shall be stopped on the bridge between the derailing points except in a case of great emergency, after which it shall be opened promptly for any vessels desiring to pass the draw: *Provided*, That this regulation shall not apply to any vessels of more than 500 tons burden, to a tug with a tow on a hawser, or to single tows which require longer than 15 minutes to pass through the draw, or to any vessels down bound during the freshets whose height exceeds 5½ feet above the plane of lowest low water as determined by the War Department.

3. The length of time that a draw has been open shall be computed from the time that the draw span begins to move in opening, and the length of time that a draw has been closed shall be computed from the time that the draw span ceases to move in closing.

4. Vessels with tows shall not so approach a bridge as to attempt to pass the draw in succession without interval. They must arranged their approach so as to cause no delay in closing the draw promptly for the relief of land traffic.

5. The draw of a bridge shall not be required to be opened to permit the passage of vessels habitually using said river, which have stacks, jack staffs, or flagstaffs exceeding 21 feet in height above the water line, and which are otherwise capable of clearing the bridge when closed. If such vessels wish to pass the bridge, the stacks, jack staffs, or flagstaffs must be so erected that they may be lowered to permit the passage under the bridge.

6. Any tug or vessel passing the draw of a bridge at Albany as often as once a day for 10 consecutive days of any month will be regarded as using the river habitually in the meaning of paragraph 5 of these regulations. A failure to comply with that regulation by any tug or vessel after one warning by the persons owning or controlling any of the Albany bridges shall be sufficient cause for a refusal to open the draw for the accommodation of said tug or vessel until such later time as may be convenient to the persons controlling the bridge.

7. These regulations shall not apply to vessels which are owned or controlled by the United States Government or by the police or fire departments of the cities of Albany, Rensselaer, Troy, and Watervliet, such vessels shall be passed without delay through the draws of the bridges on identification.

8. *Signals.*—The signal for boats desiring to use a draw shall be by whistle or horn, as prescribed in paragraph 9. The signals from the bridges shall be by blasts of whistle or horn with an additional visible signal as prescribed below. A long blast of whistle or horn shall continue 5 seconds, a short blast 1 second.

The visible signals, by day, shall be displayed at least 15 feet above the fixed day signal at the middle point of the draw span and visible from both sides of the bridge, and by night at a height of at least 15 feet above the fixed light at the center of the draw, the "fixed" signals referred to being those required by the general "Regulation for lighting bridges over navigable rivers."

By day, if the draw is to be opened, the visible signal shall be a round ball not less than 3 feet in diameter and painted green, or, if the draw is not to be opened, it shall be a latticework barrel-shaped sign 5 feet 6 inches high and 4 feet in diameter painted red.

By night, if the draw is to be opened, the visible signal shall be a green light from a standard marine lamp, or, if the draw is not to be opened, it shall be a red light from a standard marine lamp.

9. *Signal code, vessels bound north.*—A vessel bound north shall, on approaching a bridge, give three long blasts of the whistle or horn.

Vessels bound south.—A vessel bound south shall, on approaching a bridge, give three long blasts followed by one short blast of the whistle or horn.

If a vessel desires to pass through more than one bridge the signal calling for the bridge to be opened will be repeated for each bridge.

If a draw is to be opened, the signal from the vessel shall be answered from the bridge by three long whistle blasts and by displaying the green-ball visible signal. If the draw is not to be opened in time for the vessel to pass through safely, five short blasts of the whistle shall be sounded and the red-barrel visible signal be displayed.

10. Private signals of towing or steamboat companies should not be used if in any way they may be mistaken by the bridge tender for signals of the regular code.

The following are the regulations prescribed by the Secretary of War to govern the opening of the drawbridges crossing the Hudson River at Troy:

1. The draw in each of the bridges crossing the Hudson River at Troy, N. Y., below the head of tidewater shall, upon the signal prescribed in paragraph 9 below being given, be opened promptly at all hours for the passage of any vessel or vessels or other water craft not able to pass underneath it, except that the bridge of the D. & H. Co. need not be opened between the hours of 6 p. m. and 6 a. m., unless notice has been given before 6 p. m. of the time or times when vessels may be expected to pass through.

2. The draw of a bridge shall not be required to remain open for passage of vessels for a period longer, consecutively, than 15 minutes. Upon being closed it may remain closed for a time sufficient to allow delayed land traffic to pass, but in no case exceeding a period of 10 minutes, consecutively, if a vessel desires to pass the draw: *Provided*, That these limitations shall not apply to vessels of more than 500 tons burden, to a tug or tugs with a tow on a hawser, or to any vessels down bound during freshets, when the freshet height exceeds 5½ feet above the plane of mean high tide, as determined by the War Department.

3. The length of time that a draw has been open shall be computed from the time that the draw span begins to move in opening, and the length of time that a draw has been closed shall be computed from the time the draw span ceases to move in closing.

4. Vessels with tows shall not so approach a bridge as to attempt to pass the draw in succession without interval. They must arrange their approach so as cause no delay in closing the draw promptly for the relief of land traffic.

5. The draw of a bridge shall not be required to be opened to permit the passage of vessels habitually using said river which have stacks, jack staffs, or flagstaffs exceeding 21 feet in height above the water line, and which are otherwise capable of clearing the bridge when closed. If such vessels wish to pass the bridge, the stacks, jack staffs, or flagstaffs must be so erected that they may be lowered to permit the passage under the bridge.

6. Any tug or vessel passing the draw of a bridge at Troy as often as once a day for 10 consecutive days of any month will be regarded as using the river habitually in the meaning of paragraph 5 of these regulations. A failure to comply with that regulation by any tug or vessel after one warning by the persons owning or controlling any of the Troy bridges shall be sufficient cause for a refusal to open the draw for the accommodation of said tug or vessel until such later time as may be convenient to the persons controlling the bridge.

7. These regulations shall not apply to vessels which are owned or controlled by the United States Government or by the police or fire departments of the neighboring cities or villages; such vessels shall be passed without delay through the draws of the bridges on identification.

8. *Signals.*—The signals for boats desiring to use a draw shall be by whistle or horn, as prescribed in paragraph 9. The signals from the bridges shall be by blasts of whistle or horn.

9. *Signal code, vessels bound north.*—A vessel bound north shall on approaching a bridge give three long blasts of the whistle or horn.

Vessels bound south.—A vessel bound south shall on approaching a bridge give three long blasts followed by one short blast of the whistle or horn.

If a vessel desires to pass through more than one bridge, the signal calling for the bridge to be opened will be repeated for each bridge.

If a draw is to be opened, the signal from the vessel shall be answered from the bridge by three long blasts of whistle or horn. If the draw is not to be opened in time for vessel to pass through safely, five short blasts of the whistle or horn shall be sounded.

10. Private signals of towing or steamboat companies should not be used if in any way they may be mistaken by the bridge tender for signals of the regular code.

DIRECTIONS, HUDSON RIVER

For the charts covering Hudson River see the index map facing page 1.

The channel of Hudson River is broad and has few obstructions as far as Rondout. It is good for a depth of about 24 feet (7.3 m.) to Hudson and 12 feet (3.7 m.) to Troy.

From the Battery to Irvington, about 22 miles, the deepest water follows the east bank and then leads between the shoals along the east bank and the extensive shoals, fringed by broken ground, making off from the west bank from southward of Piermont to Rockland Lake Lighthouse.

Broken ground, on which the least depths found are 13 to 21 feet (4 to 6.3 m.), extends in a northerly direction across the channel and lies from 2 to 3 miles northward of Tarrytown Lighthouse. Three gas buoys, lying 1¾, 3, and 4 miles, respectively, northward of Tarrytown Lighthouse, mark the east edge of the channel abreast the broken ground and assist in avoiding it, but strangers should proceed with caution in vessels drawing more than about 15 feet (4.6 m.).

A shoal bank, with a least depth of about 23 feet (7 m.), extends southward from the Donderberg, opposite Peekskill, and lies on the west side of the channel.

With the exception of the flats in the bights and along the banks, the obstructions in the channel above the Donderberg are rocky.

A rock with 9 feet (2.7 m.) over it lies on the west side of the channel 400 yards from the west bank and 350 yards north-northwestward of the north end of **Iona Island.** This rock is marked by a horizontally striped can buoy.

Con Hook Rocks, with 8 feet (2.4 m.) over them, lie 300 yards from the west bank and nearly 3/8 mile south-southwestward of the light at Con Hook; the rocks are marked by a black gas buoy.

The Brothers is a ledge, partly bare at extreme low water, which lies on the east side of the channel off the shoal bight northward of Constitution Island, and is marked by a red buoy.

Diamond Reef has 5 feet (1.5 m.) over it, and lies near midriver off the lower end of New Hamburg. It is about 300 feet in diameter, with depths of less than 18 feet (5.5 m.), and is marked near its shoalest part by a horizontally striped gas buoy. The gas buoy is withdrawn from station between December 1 and April 1; spar buoy on station throughout year. There is a clear channel on either side of the reef.

A rocky patch with a least depth of 18 feet (5.5 m.) lies 300 yards from the east bank off a sand dock which lies about 3½ miles northward of New Hamburg. The rock is marked by a horizontally striped buoy.

Another small rocky patch with 18 feet (5.5 m.) over it lies in midriver 1⅞ miles southward of the bridge at Poughkeepsie and is marked by a horizontally striped buoy.

From Rondout to Hudson the channel has a navigable depth of about 24 feet (7.3 m.), but is rendered more difficult than southward of Rondout by reason of numerous middle grounds and flats. With the aid of the chart, however, small vessels should have no difficulty in making the passage. From Kingston Point to Barrytown the channels on both sides of the Flats are used. The principal channel then leads westward of the Hogs Back, eastward of Saddle Bags, westward of Green and Upper Flats, eastward of Upper Coal Beds, and Westward of Rogers Island. The generally used channel follows the west bank, passing Athens, and from Fourmile Point to Coxsackie.

From Coxsackie to Troy the river is being improved to obtain a channel 400 feet wide. The bottom is rocky at many of the bars under improvement, and some local knowledge is required to insure safety for anything but small craft. Strangers are advised to take a pilot; one can be obtained at Hudson and at other cities and towns on the river.

INLAND WATERWAYS

New York State Canal System.—The New York canals afford, in addition to ramiform local intercourse, through communication between Lakes Erie and Ontario on the west and the Hudson River and Lake Champlain on the east. The minimum depth in the channels is 12 feet (3.7 m.) for a width of 75 to 200 feet. The law provides for a clearance at bridges of 15½ feet (4.7 m.) above the maximum navigable elevation of water surface. This system comprises the Erie Canal, Champlain Canal, Oswego Canal, and Cayuga and Seneca Canal. There are 35 locks on the Erie Canal, 11 on the

Champlain Canal, 7 on the Oswego Canal, and 4 on the Cayuga Canal. The usable dimensions of the locks are 300 feet in length by 44½ feet width, with 12 feet (3.7 m.) depth over the miter sills. The waterway is free, no tolls being charged.

The Erie Canal extends from the Hudson River at Troy to Tonawanda on the Niagara River, a total distance of 296 nautical miles. It has a total of 35 locks (including the Federal lock at Troy) and the lock dimensions and available depths are as defined in the paragraph above. This canal pursues somewhat the same general line as the old Erie Canal, but utilizes natural watercourses to a much greater extent.

The Oswego Canal, 20½ miles long, is almost entirely a canalization of Oswego River, and extends from a junction with the Erie Canal to Lake Ontario at Oswego. It descends by 7 locks (described in second paragraph above) 118½ feet to the level of Lake Ontario.

The Cayuga and Seneca Canal follows the Seneca River from a junction with the Erie Canal and extends southerly to **Cayuga Lake** and thence westerly to **Seneca Lake.** At the head of Cayuga Lake a spur extends to the city of **Ithaca,** and at the head of Seneca Lake a spur extends to the village of **Montour Falls.** From the Erie Canal this canal ascends by 1 lock 7½ feet to Lake Cayuga, and thence by 3 locks 63½ feet to Seneca Lake. The canal has a total length of 80½ miles. The canal and lock dimensions are given in the third paragraph above.

The Champlain Canal follows the Hudson River at Waterford northerly to **Fort Edward,** thence a land line (cut channel) crosses the divide and by **Wood Creek** to Lake Champlain at **Whitehall,** a total distance of 54½ miles. The canal ascends 125 feet by means of 8 locks and then descends by 3 locks 43½ feet to the Lake Champlain level at Whitehall. The canal and lock dimensions are given in the fourth paragraph above.

A draft of 6½ feet (2 m.) can be carried from Waterford to the St. Lawrence River through the Champlain Canal, **Lake Champlain,** and the Richelieu River and Chambly Canal. The distances in nautical miles are: Champlain Canal, from Waterford to Whitehall, 54½ miles; Lake Champlain, from Whitehall to the International boundary, 93 miles; Richelieu River and Chambly Canal, from the boundary to the St. Lawrence River at Sorel, 70½ miles.

The Richelieu River extends for 70½ miles from the northern end of Lake Champlain to the St. Lawrence River at **Sorel,** 40 miles below Montreal. The river has been rendered navigable by the construction of the **Chambly Canal,** 10½ miles long, in its upper reach and the **St. Ours lock and dam** in its lower course. There are 9 locks in the Chambly Canal, the smallest having an available length of 110 feet, width 22½ feet, and depth on sills 7 feet (2.1 m.). The St. Ours lock, 12½ miles above Sorel, has an available length of 185 feet, width 45 feet, and depth 6½ feet (2 m.) over sills.

Inland route to Chicago and New Orleans.—A draft of 12 feet (3.7 m.) can be carried from **New York to Chicago** by way of Hudson River, Erie Canal, Lake Erie, Detroit River, Lake St. Clair, St. Clair River, Lake Huron, and Lake Michigan. The limiting dimensions are found in the Erie Canal as described above.

A draft of 3½ feet (1 m.) can be carried from **Chicago to New Orleans,** by way of Chicago River, 6 miles; Sanitary Canal, 28 miles; Illinois & Michigan Canal, 56 miles; Illinois River, 194 miles; and Mississippi River, 1,041 miles. The limiting dimensions are found in the Illinois and Michigan Canal, where vessels are limited to a length of about 100 feet, width 16 feet, draft 3½ feet (1 m.), and headroom under fixed bridges, 11 feet.

Lights and buoys.—All red lights and red beacons and buoys appear on the right or starboard hand, and all white lights and black beacons and buoys appear on the left or port hand when proceeding up or away from the Hudson River, or away from the main line in the branches.

Charts and other publications.—Complete descriptions of the Great Lakes and the adjoining canal systems are published by the United States Lake Survey in Bulletin No. 34, Survey of Northern and Northwestern Lakes, and this publication can be obtained free of charge from their office in Detroit, Mich. Charts of the lakes embraced in the canal system of Lake Champlain and of the Great Lakes are published by the United States Lake Survey Office, Detroit, Mich. Charts of the Erie (New York State Barge) Canal from Waterford to the Cayuga and Seneca Canal junction, of the Cayuga and Seneca Canal, and of the Champlain Canal, are published by the superintendent of public works, Albany, N. Y.

APPENDIX

COAST PILOTS AND FIELD STATIONS OF THE COAST AND GEODETIC SURVEY

COAST PILOTS

	Price
U. S. Coast Pilot, Atlantic Coast, Section A, from St. Croix River to Cape Cod	$0.75
U. S. Coast Pilot, Atlantic Coast, Section B, from Cape Cod to Sandy Hook, including Long Island Sound (this volume)	.75
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.75
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.75
U. S. Coast Pilot, Gulf Coast, from Key West to the Rio Grande	.75
U. S. Coast Pilot, West Indies, Porto Rico, and Virgin Islands	.75
Inside Route Pilot, coast of New Jersey	.30
Inside Route Pilot, New York to Key West	.30
Inside Route Pilot, Key West to the Rio Grande	.50
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.75
U. S. Coast Pilot, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.75
U. S. Coast Pilot, Alaska, Part II, Yakutat Bay to Arctic Ocean	.75
U. S. Coast Pilot, Hawaiian Islands	.50
U. S. Coast Pilot, Philippine Islands, Part I, Luzon, Mindoro, and Visayas	.75
U. S. Coast Pilot, Philippine Islands, Part II, Palawan, Mindanao, and Sulu Archipelago	.75

FIELD STATIONS

Boston, Mass., Appraisers Building, 408 Atlantic Avenue.
New York, N. Y., 311–312, Maritime Exchange Building, 78 Broad Street.
New Orleans, La., room 314, Customhouse.
San Francisco, Calif., room 305–306, Customhouse.
Seattle, Wash., room 202, Burke Building.
Manila, P. I., Intendencia Building.

At these stations complete files of the United States Coast and Geodetic Survey charts, Coast Pilots, Tide Tables, Current Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge. Light Lists, Buoy Lists, and Notices to Mariners are kept for sale or for free distribution to mariners. The field stations are also sales agencies for the Coast and Geodetic Survey publications. A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

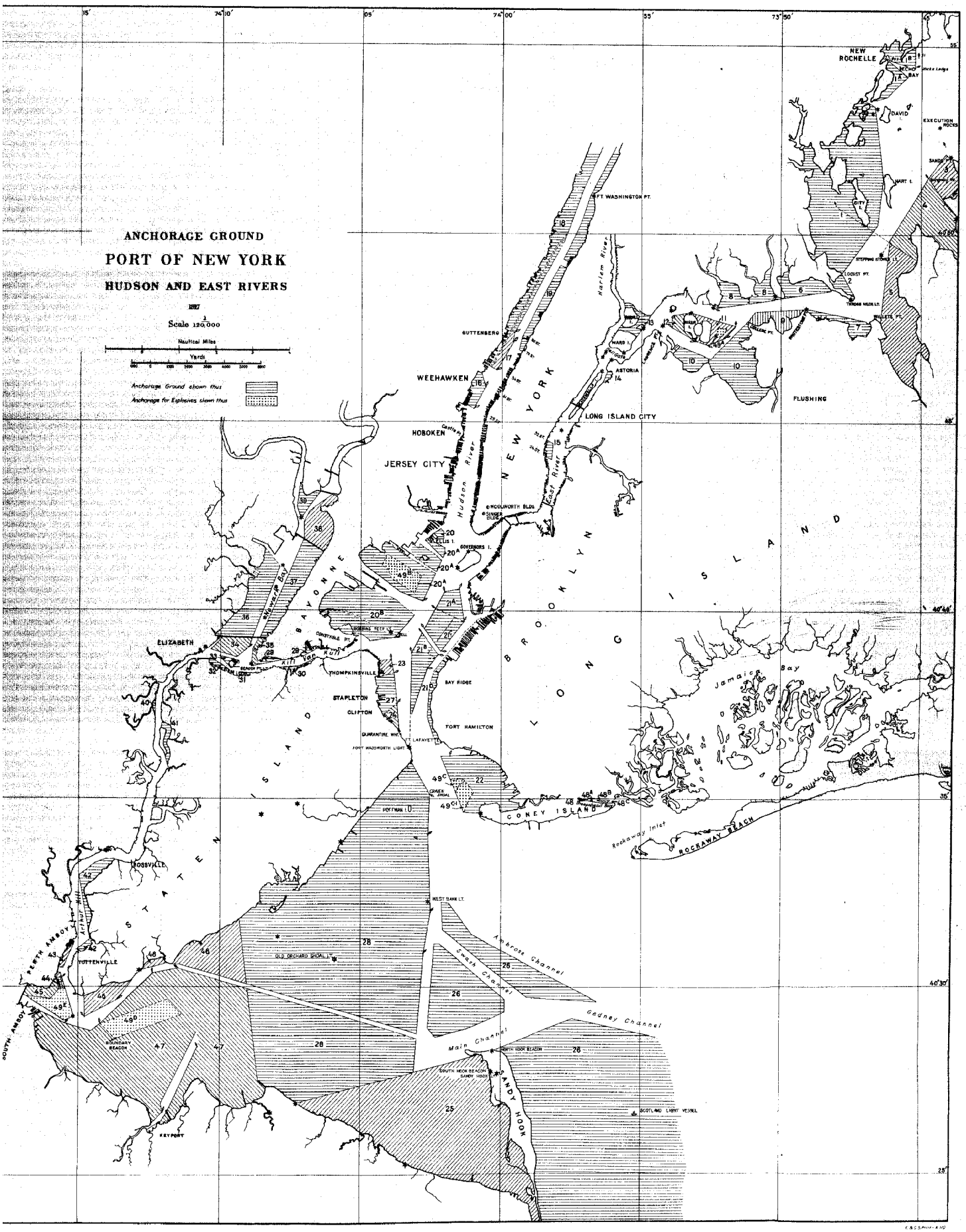
ANCHORAGE GROUNDS FOR THE PORT OF NEW YORK AND RULES AND REGULATIONS RELATING THERETO

WAR DEPARTMENT, *December 22, 1916.*

Attention is invited to the following provisions of law:

River and harbor act approved March 4, 1915—

"SEC. 7. That the Secretary of War is hereby authorized, empowered, and directed to define and establish anchorage grounds for vessels in all harbors, rivers, bays, and other navigable waters of the United States whenever it is manifest to the said Secretary that the maritime or commercial interests of the United States require such anchorage grounds for safe navigation and the estab-


ANCHORAGE GROUND
PORT OF NEW YORK
HUDSON AND EAST RIVERS
1927
Scale 1/120,000
Nautical Miles
Yards
Anchorage Ground shown thus
Anchorage for Explosives shown thus
NEW ROCHELLE
EXECUTION ROCKS
DAVID I.
HART I.
FT WASHINGTON PT.
Harlem River
GUTTENBERG
WEEHAWKEN
HOBOKEN
JERSEY CITY
Hudson River
NEW YORK
WARD I.
ASTORIA
LONG ISLAND CITY
FLUSHING
LOCUST PT.
THROGS NECK LT.
WILLETS PT.
BELLE PT.
ROOSEVELT I.
RIKERS I.
ROCKEFELLER INSTITUTE
LAWRENCE
East River
ROOSEVELT BLDG.
SINGER BLDG.
GOVERNORS I.
ELLIS I.
BROOKLYN
LONG ISLAND
Jamaica Bay
ELIZABETH
Newark Bay
Kill Van Kull
CONSTABLE PT.
ROBBINS REEF
THOMPKINSVILLE
STAPLETON
CLIFTON
BAY RIDGE
FORT HAMILTON
QUARANTINE WHF.
LAFAYETTE
FORT WADSWORTH LIGHT
CRAKEN SHOAL
HOFFMAN I.
CONEY ISLAND
Rockaway Inlet
ROCKAWAY BEACH
STATEN ISLAND
HOSSVILLE
PERTH AMBOY
SOUTH AMBOY
TOTTENVILLE
BOUNDARY BEACON
KEYPORT
WEST BANK LT.
OLD ORCHARD SHOAL LT.
Ambrose Channel
Swash Channel
Gedney Channel
Main Channel
NORTH HOOK BEACON
SOUTH HOOK BEACON
SANDY HOOK
SCOTLAND LIGHT VESSEL

lishment of such anchorage grounds shall have been recommended by the Chief of Engineers, and to adopt suitable rules and regulations in relation thereto; and such rules and regulations shall be enforced by the Revenue Cutter Service under the direction of the Secretary of the Treasury: *Provided*, That at ports or places where there is no revenue cutter available such rules and regulations may be enforced by the Chief of Engineers under the direction of the Secretary of War. In the event of the violation of any such rules and regulations by the owner, master, or person in charge of any vessel, such owner, master, or person in charge of such vessel shall be liable to a penalty of $100; and the said vessel may be holden for the payment of such penalty, and may be seized and proceeded against summarily by libel for the recovery of the same in any United States district court for the district within which such vessel may be and in the name of the officer designated by the Secretary of War."

THE ANCHORAGE GROUNDS

[All azimuths are referred to a true meridian]

Under authority of the provisions of section 7 of the river and harbor act approved March 4, 1915, quoted above, the following anchorage grounds for vessels in the navigable waters of the port of New York are hereby defined and established, and the following rules and regulations relating thereto are adopted:

EAST RIVER AND LONG ISLAND ANCHORAGES

1. Southwestward of a line from the southerly side of the ferries at Neptune Point, ranging to the light on Aunt Phebe Rock; westward of a line drawn from said line tangent to the east edge of the breakwater around Goose Islands and ranging to the west side of the north end of Hart Island; thence ranging toward the light on the outer end of Willets Point Wharf to a point off the south end of City Island, and thence northwest of a line ranging from the south end of Hart Island to Locust Point. Boats must be so anchored in this area as to leave at all times an open, usable channel, at least 50 feet wide, west and south of Glen Island.

1A. Southwestward of a line ranging from black spar buoy No. 1 off Duck Point, Echo Bay, through Buoy "1Br." off Baileys Rock; northwestward of a line ranging from Hicks Ledge Buoy to black spar buoy No. 1 off Middle Shoal, thence through Emerald Rock Buoy to a point 500 yards southwest and from thence ranging to the southerly point of Davenport Neck.

1B. Westward of a line ranging from the shore southward through the spindle at Table Rock to the Hicks Ledge Buoy, thence northward of a line to red spar buoy No. 2 off Premium Point and in Echo Bay north and west of the channel.

2. To the westward of a line from Locust Point to Throgs Neck.

3. To the northeastward of a line from the south side of Barkers Point to the buoy off Gangway Rock, southeastward of a line from thence to the buoy off Sands Point and southwestward of a line from thence to Sands Point Lighthouse.

4. To the northeastward of a line ranging through the southwest point of shore on City Island and a striped buoy in Eastchester Bay, south of Rodman Neck; southeastward of a line ranging from Stepping Stones Lighthouse to the buoy off Gangway Rock, and southwestward of anchorage No. 3.

5. In Little Neck Bay and to the eastward of a line ranging from Fort Totten flagstaff to the east point of shore of Hart Island and southward of anchorage No. 4.

6. On Hammond Flats to the northward of a line bearing 262° from the head of Engineers Wharf, Throgs Neck, to Old Ferry Point.

7. To the southward of a line from Whitesone Point to Willet Point.

8. On the north side of the channel, north of a line between Old Ferry Point and the red channel buoy No. 2 off Hunts Point.

9. On the south side of the channel to the eastward of a line from College Point to buoy (No. 1) off College Point and south of a line from said buoy to Whitestone Point.

10. In Flushing and Bowery Bays, to the southward of lines ranging from the north end of the Astoria Veneer Mills Pier at Steinway to the north end of the pier at Sanford Point and from the south end of the latter pier to College Point Pier.

11. To the eastward of Rikers Island and southward of a line from the north pier of Rikers Island to the striped buoy off College Point; to the westward of a line from thence to red channel buoy No. 2 and northward of a line from thence to red buoy No. 4, and from thence to red buoy No. 6, excluding explosive anchorage 49A.

12. To the westward of Rikers Island, northward of a line from red channel buoy No. 6 to red buoy No. 8, to the eastward of a line from thence to the west side of South Brother Island, and southward of a line from the north side of the latter island to the north pier of Rikers Island.

13. To the westward of a line from Stony Point to northeast end of Wards Island, and between Wards Island and Randalls Island, and between Randalls Island and Port Morris.

14. To the eastward of a line from Hatters Dock to Gibbs Point, Hallets Cove, Astoria.

15. To the southward of a line bearing 119° from the axis of Thirty-second Street, westward of a line through the horizontal striped buoy off Nineteenth Street, ranging 184° from the center of the Forty-second Street ferry slip and northward of a line bearing 119° from the axis of Twenty-fourth Street.

SOUTH ANCHORAGE, HUDSON RIVER

16. To the southwestward of a line ranging from the southeast corner of Gokey's dry dock just below the Weehawken treminal of the West Shore ferries to the northwest corner of the Thirty-fourth Street Pier, New York, and westward of a line 100 yards west of the center line of Hudson River, and northward of a line in range with the northwest corner of Pier 65, near West Twenty-fifth Street, New York, and mooring rack of the Erie Railroad Co. north of Weehawken Cove.

MIDDLE ANCHORAGE, HUDSON RIVER

17. To the southward of a line in range with the south side of West Seventy-ninth Street, New York; westward of a line from a white anchorage buoy off Seventy-ninth Street, and about 125 yards west of the center of the river, ranging to the buoy off Seventy-second Street, thence westward of the center line of said river ranging 209½° toward Castle Point, Hoboken, through two white anchorage buoys off Seventy-second Street and Fifty-fourth Street, respectively; northward of the range 119° of the north side of West Fifty-fourth Street, New York. No vessel shall anchor in the channel dredged by the United States, passing along and through the westerly side of said anchorage.

UPPER ANCHORAGE, HUDSON RIVER

18. Northerly of Fort Washington Point and westward of the 24-foot curve of depth at low water; southerly of Fort Washington Point and westward of a line ranging from a point off said point, and 100 yards west of the middle of the river, to a point on the range of the north side of West One hundred and forty-first Street, New York; thence southerly, to the westward of a line 125 yards west of the middle of the river marked by two white anchorage buoys off West One hundred and twenty-fourth and West Seventy-ninth Streets, New York, respectively; northward of the range of the south side of West Seventy-ninth Street. No vessel shall anchor in channel dredged by the United States, passing through said anchorage.

NAVAL ANCHORAGE, HUDSON RIVER

19. An anchorage is set aside for naval vessels to moor in a single line on the east side of Hudson River, north of West Seventy-second Street, and thence to Fort Washington Point, and above that point if necessary. Anchors shall be let go to the eastward of a line running from a point 300 yards from the shore bulkhead of West Seventy-second Street to a point 250 yards from the end of the pier at Seventy-ninth street, thence to a point 250 yards from the end of the pier at One hundred and twenty-ninth Street, thence to a point 330 yards from the pier at One hundred and fifty-eighth Street, thence northeasterly to a point 125 yards west of the light on Fort Washington Point, and thence northeasterly to a point 250 yards from the end of the wharf at

Dyckman Street, New York. No ships shall anchor within a limit of 300 yards of the prolongation of One hundred and thirtieth Street, in order to give free passage for the Fort Lee ferryboat. Destroyers and other light-draft naval vessels may anchor on the west side of the river west of the 18-foot curve, as shown on Coast Survey Chart No. 369 (8), but not so as to obstruct navigation in the channel dredged by the United States.

NOTE 1.—Small vessels may anchor inside of the pierhead lines, as established by the Secretary of War, along the east bank of the Hudson River between Eighty-first Street and One hundred and twenty-first Street, and between One hundred and thirty-second Street and One hundred and fifty-eighth Street, in the discretion of the captain of the port.

NOTE 2.—The established anchorages for naval vessels having been found inadequate at times when an especially large number of vessels are gathered for parade or other purpose, and the Navy Department having requested the establishment of a numbered series of anchorages for such occasions in order that a naval vessel may be ordered to proceed to a designated point in the harbor, the following arrangements have been made so that naval vessels may anchor at designated points in the Hudson River outside of naval anchorage No. 19. These designated anchorages will be serially numbered from 1 to 40 for capital ships, from 100 to 199 for intermediate ships, and from 200 to 399 for destroyers and small craft. An alternate arrangement of anchorages numbered serially from 500 to 612 will be provided so that destroyers and small craft may anchor on the east side of the river when the space is not required to provide for capital or intermediate ships. These designated anchorages which are outside of naval anchorage No. 19 are not set aside for the exclusive use of naval vessels, but permission will be given for naval vessels to use them when available. When the captain of the port receives notification from the proper naval authorities that it is desired to utilize certain of these specially numbered anchorages, he will authorize the use by naval vessels of the requested numbers, if they can be made available, the commercial conditions at the time being given proper consideration. If, in the opinion of the captain of the port, there are sufficient reasons why the numbers first asked for should not be used, he will confer with the naval officers making the request, and if other numbers can be agreed upon he will authorize their use; otherwise he will communicate the request to the Secretary of War with a statement of the circumstances and with the recommendation.

WESTERN ANCHORAGE, UPPER BAY

20. Within an area lying northeast of Ellis Island to the southward of a line bearing 58° from the northwest corner of the island; to the westward of a line bearing 124° from Communipaw Pier; to the westward of a line bearing 178° from the end of the Central Railroad of New Jersey Pier No. 5; and to the northward of a line ranging from the south side of the main island of Ellis Island station to the outer end of the Staten Island Ferry racks, on the New York shore.

20A. *Temporary anchorage.*—To the southward of a line passing through the southeast corner of middle wharf and the northwest corner (inner) of south wharf, Ellis Island; to the westward of two lines, one line in extension of the line marking the eastern limits of anchorage 20 and passing through buoy S "A," and the other line ranging from buoy S "A" 205° to the north end of the United States marine hospital at Stapleton, Staten Island; and to the northward of a line bearing 294° from the red nun buoy No. 14 on the east side of the main channel, to the light on the east end of the breakwater of the Greenville terminal of the Pennsylvania Railroad. This anchorage is set aside as a temporary anchorage for vessels arriving and leaving port, the word "temporary" to mean the time necessary for a vessel to obtain a permanent berth in another anchorage or at a wharf, which will in no case exceed 72 hours unless a permit is obtained from the captain of the port to remain for a longer period. Area 49B in this anchorage is reserved for explosives and is excluded from use as a general anchorage. (See par. 49.)

20B. To the southward of Greenville Channel and of a line from the southerly corner of the main pier of the Pennsylvania Railroad Co's Greenville terminal to the westerly corner of Morses Basin, Brooklyn; to the westward of a line from the Governors Island Extension Light to the westerly lantern of the St. George Ferry terminal, to the northward of a line ranging from Rob-

bins Reef bell buoy to the southeasterly tall chimney of the International Nickel Corporation at Constable Hook, and northeast of the channel approach to the Lehigh Valley ore piers at Constable Point.

NOTE.—No vessel shall anchor between Ellis Island and the piers of the Central Railroad of New Jersey, or in the dredged channel approaches to this space, or the piers and wharves of the railroad, or in the dredged channel approaches to the National Docks at Black Tom Island, to Bedloes Island, to the Greenville terminal, or to Packards Basin, or near the entrance to said channels so as to obstruct the approaches or interfere in any way with the free navigation of the same.

EASTERN ANCHORAGE, UPPER BAY

21. To the southward of a line passing through the bell buoy at the entrance to Greenville Channel, the easterly white buoy marking the north limit of anchorage ground and the middle point of the front of the New York Dock Co.'s pier No. 41 (Merchant Stores); to the westward of Bay Ridge and Red Hook Channels marked by anchorage and channel buoys along the western edge of the dredged channel; to the northward of a line ranging 279° to the southeast corner of new city pier No. 16 at Stapleton, Staten Island; to the eastward of a line bearing 2° ranging from Fort Wadsworth Light to a point of intersection with a line ranging 88° between the flagstaff on dome of the Pavilion Hotel, New Brighton, Staten Island, and the brick chimney at Fifty-second Street, South Brooklyn; northerly therefrom to the eastward of a line ranging 208° from the southeast corner of city pier No. 16, Staten Island, to the light at southwest end of Governors Island. This anchorage shall be subdivided as follows:

21A. *Sailing vessels, including schooners, ships, barks, etc.*—All that portion of anchorage No. 21 to the northward of a line ranging from the end of the Thirty-ninth Street Ferry rack (northeast rack), Brooklyn, through the white anchorage buoy at the entrance to Gowanus Bay, to buoy No. 14. This anchorage to be used for sailing vessels, including schooners, ships, barks, etc., deep-laden vessels to use the western half of the anchorage and light-draft vessels to use the eastern half.

21B. *Steamers.*—That portion of anchorage No. 21 south of anchorage 21A, as described above, and west and south of anchorage 21C, described below. This anchorage shall be used by steamers; those deep laden to use the western side and southern end of the anchorage ground and light-draft steamers to use the eastern side, excluding the fairway described below.

21C. *Barges.*—That portion of anchorage No. 21 south of anchorage 21A, as described above, northerly of a line ranging from Robbins Reef Light to two tall chimneys of the Brooklyn-Edison Co.'s power house at Sixty-sixth Street, Brooklyn, and easterly of a line ranging from the entrance at Erie Basin to the large gas tank at Clifton, Staten Island. Barges are required to use this anchorage to the exclusions of anchorages Nos. 21A and 21B, excluding the fairway described below.

NOTE.—Vessels of the various types required to use the anchorages Nos. 21A, 21B, and 21C may be anchored in areas other than those set aside for them after first obtaining a permit from the captain of the port.

A fairway 600 feet wide, crossing anchorages 21B and 21C, marked by buoys at each entrance, shall be excluded from the anchorage grounds. Its northerly side is on range with bell buoy "2G" at the entrance to Greenville Channel and the center of the head of the north pier of the Long Island Railroad terminal at the foot of Sixty-fourth Street, Bay Ridge.

21D. Small vessels may, in the discretion of the captain of the port, anchor to the eastward of a line ranging 338½° from the west edge of Port Lafayette and southward of Ninety-second Street; between Seventy-ninth Street and Ninety-second Street, eastward of a line ranging from Craven Shoal bell buoy to the Statue of Liberty, and eastward of Bay Ridge Channel, northward of Seventy-ninth Street to a point off Sixty-sixth Street, but not within 100 yards of the piers at Owls Head.

EASTERN ANCHORAGE, LOWER BAY

22. To the northward of a line ranging from Coney Island Lighthouse, on Norton Point, to Hoffman Island, 274°, and to the eastward of a line having a bearing of 338½° and tangent to the west edge of Fort Lafayette and south

of red spar buoy No. 12A, excluding anchorages 49C and 49C–1. (See par. No. 49.)

MAN-OF-WAR ANCHORAGE

23. To the southward of a line ranging 85° from the north end of the east rack of St. George Ferry to the white buoy off St. George Landing; to the westward of a line ranging from a point 160 yards west of Robbins Reef Light 171° 45′ to a white buoy off Tompkinsville Landing; and to the northward of a line ranging from said white buoy 252° to the south end of Tompkinsville Landing.

NOTE.—The captain of the port may permit commercial vessels to anchor, temporarily, ordinarily for a period not greater than 24 hours in this anchorage, when he knows that it is not going to be needed for naval vessels, but two berths for capital ships of the Navy shall be reserved in the eastern portion of the anchorage and two berths reserved for Coast Guard vessels near shore. Commercial vessels so anchored shall be moved at their own expense whenever the anchorage ground is needed for naval vessels.

24. (See "Quarantine anchorage," on p. 337.)

SANDY HOOK ANCHORAGE

25. In Sandy Hook Bay to the southward of a line extending from North Hook Beacon Lighthouse to Point Comfort Beacon Lighthouse.

26. Vessels may anchor on Romer Shoal and Flynn Knoll and south of Gedney Channel.

STATEN ISLAND ANCHORAGE

27. *Temporary anchorage.*—South of a line ranging from a white buoy 252° to the south end of Tompkinsville Landing; to the westward of a line ranging from this white buoy 174° to the southerly end of Quarantine Wharf, said line being also in range with a point 70 yards west of Robbins Reef Light; and to the northward of a line bearing 226° to the center of a large gas tank at Clifton, Staten Island.

28. To the westward of a line running 154½° from Fort Wadsworth Light to the buoy on Craven Shoal; thence to buoys Nos. 11, 9, 7, 5, 3, 1; thence 182° to a line extending from North Hook Beacon Lighthouse to Point Comfort Lighthouse, to the northward of the latter line, and the New Jersey shore and to the eastward of a line bearing 353° from the head of the Keansburg Steamboat Dock at Point Comfort, through white spar buoy "FG" and red spar buoy No. 4 to the Staten Island shore.

KILL VAN KULL ANCHORAGES

29. To the northward of a line ranging from the Pacific Coast Borax Works chimney to the south face of the city wharf at the foot of Ingham Avenue, Bayonne, between said wharf and the Tidewater Oil Co.'s piers, and to the northward of a line ranging from the Sound end of the rack of the Bergen Point Ferry at Bayonne, N. J., to a point 100 yards south of Bergen Point Lighthouse.

30. To the southward of lines joining the ends of the long piers between pier of the National Lead Co., at Port Richmond, and the power station at Livingston Point.

31. To the southward of a line bearing 85½° from the north end of the Milling Dock to the wharf of the Standard Varnish Works, Port Richmond.

32. To the southward of a line from the northeast corner of Milliken Bros.'s wharf to black spar buoy No. 1, and a line from thence to the northwest corner of the docks of the Staten Island Shipbuilding Co. at Mariners Harbor.

NEWARK BAY ANCHORAGES

33. To the west of Shooters Island between a line ranging from the northeast corner of the Central Railroad of New Jersey coal dock at the foot of Port Avenue, Elizabethport, to the northwest corner of Shooters Island, and a line ranging from the northwest corner of Hecker, Jones-Jewell Co.'s pier tangent to the southwest corner of Shooters Island.

34. South of the trestle bridge of the Central Railroad of New Jersey, to the westward of a line from a point on the trestle bridge, 100 yards west of the west pier of the west lift bridge to black spar buoy No. 1, and a line from thence to red spar buoy No. 2, north of Shooters Island; to the northward of a line ranging from the southerly end of Bergen Point to the southeast corner of the Singer Manufacturing Co.'s bulkhead at Elizabethport and to the eastward of a line ranging from the northerly chimney of Procter & Gamble's Soap Works, on Staten Island, to the east end of the filling of the Central Railroad of New Jersey on the west side of the bay.

35. To the eastward of a line from the center of Bergen Point Light ranging to the west pier of west lift bridge of the Central Railroad of New Jersey to a point off the north side of the pier of the Texas Co., and of a line from thence to a point 100 yards east of the east pier of the east lift bridge of the railroad and south of the railroad trestle.

36. To the southward of the new channel dredged by the city of Newark from Peddie Ditch to just below the stake light just south of the bend in the dredged channel, and to the westward of a line ranging from a point 200 yards west of said stake light to a point 100 yards west of the west pier of the west lift bridge of the Central Railroad of New Jersey, and north of said railroad.

37. To the northward of the Central Railroad of New Jersey's trestle bridge and to the eastward of a line ranging from a point 200 yards east of the east pier of the east lift bridge to a point 200 yards east of the east end of the draw of the Lehigh Valley Railroad bridge and south of the latter bridge.

38. North of the Lehigh Valley Railroad bridge and to the eastward of a line ranging from said point 200 yards from the Lehigh Valley Railroad draw, toward the round brick chimney on the factory of the American Splint Corporation, on the point between the Hackensack and Passaic Rivers to a point southeast of the stake light; eastward of a line from thence northerly in range with the southerly end of the Government dike and the abutment at end of the fill of the Newark & New York Railroad bridge on the west side of the Hackensack River to a point off Droyers Point south of red spar buoy No. 2, and southeast of a line from thence to the abutment at the end of the fill of the Newark & New York Railroad on the east side of the Hackensack River, and south of said river.

39. In the area between the entrance channels of the Hackensack and Passaic Rivers to the eastward of a line from the stake light north of the Lehigh Valley Railroad bridge, ranging toward the northeast corner of Balbach's wharf to a point about one-fifth of a mile north of Gross's wharf and a line from thence ranging from the southeast corner of Gross's wharf to the abutment and end of filling of the Newark & New York Railroad bridge on the east side of the Passaic River, and to the westward of a line from the abutment of the said railroad bridge on the west side of the Hackensack River to said stake light.

ARTHUR KILL ANCHORAGES

40. To the westward of a line from the south end of the southerly wharf of the Standard Oil Co. to the center of Buckwheat Island and a line from thence to the northerly wharf of the Grasselli Chemical Co.

41. The passage between Pralls Island and Staten Island included between a line running 29° from the extreme northwest point of Pralls Island to a point on Staten Island and a line from the southern point of Pralls Island to the north side of the mouth of Neck Creek at Linoleumville, Staten Island.

42. To the southward and eastward of lines from red spar buoy No. 2 at Tottenville, Staten Island, to the south point of the salient of shore line at Richmond Valley; thence to red spar buoy No. 4; thence 53° to a white anchorage buoy off the Ultramarine Works; thence 66° to the white anchorage buoy off Smoking Point; and thence to Smoking Point.

43. To the southward of the northerly pier of the Lehigh Valley Railroad coal terminals, to the westward of a line ranging from the southeast corner of said northerly pier toward the outer end of the ferry rack at Perth Amboy to a point off Washington Street, and a line from thence ranging from the north end of the coal wharf of the Public Service Corporation to the red-and-black buoy off Gordon Street, Perth Amboy, and northerly of the extension of the southerly line of Fayette Street, Perth Amboy.

44. (See "Quarantine anchorage," on p. 337.)

RARITAN BAY ANCHORAGES

45. Near Perth Amboy, to the southward of the extension of the northerly line of Market Street, Perth Amboy, and to the westward of a line ranging through the red-and-black buoy off Gordon Street to the center of Great Beds Lighthouse; to the northward of a line from thence to the white anchorage buoy placed 23½° 175 yards from buoy No. 9 and northeast of a line from thence through a second white anchorage buoy 302° to the center of a pier on north side of draw of the New York and Long Branch Railroad bridge, and east of said bridge, excluding quarantine anchorage 44 and explosive anchorage 49 (*e*). (See par. No. 44 under heading "Quarantine anchorage" and par. No. 49 (*e*).)

46. Near Staten Island, to the westward of Lower Bay anchorage No. 28, and to the northward of the dredged channel from the deep water of the Lower Bay to Seguine Point; in Princess Bay to the northward of a line from the southeast corner of the three-story brick machine shop of the S. S. White Dental Works, on Seguine Point, to Princess Bay Lighthouse; northwest of a line from the lighthouse to buoy No. 6, and a line thence to buoy No. 10, and eastward of a line thence 350° to Wards Point.

47. To the southward of the South Amboy and Raritan Bay Channels in ranges running from the north end of the Wyoming coal piers at South Amboy to buoy No. 9; thence in the direction of the boundary beacon to a point south of buoy No. 7; thence through the white anchorage buoy south of buoy No. 8 to buoy No. 5; thence to buoy No. 3; thence southeasterly through the buoys marking the dredged channel off Seguine Point to the west boundary of Lower Bay anchorage No. 28; to the westward of said anchorage No. 28, excluding explosive anchorage No. 49 (*d*) (see par. 49) and excluding also a channel at Keyport Harbor, bounded as follows: Eastward, by a line ranging from black spar buoy No. 1 to a point 200 yards east of red spar buoy No. 2; thence to the northeast corner of the easterly steamboat wharf, and thence by a line from the west corner of the old steamboat wharf to a point on the shore midway between Matawan and Oyster Creeks; westward, by lines ranging from lighted buoy No. 3 toward the west shore line at the mouth of Matawan Creek, to a point opposite black spar buoy No. 9; thence to red spar buoy No. 2, and thence to the west shore line at the mouth of Matawan Creek.

SHEEPSHEAD BAY ANCHORAGE

48. Within an area at the western end of the bay to the westward of a line in range with the alley in the middle of the block between Coleridge and Dover Street, Manhattan Beach Estates; to the northward of a line 75 feet north of the south bulkhead; to the eastward of a line 150 feet east of the west bulkhead; and to the northward of a line 150 feet long at right angles to the west bulkhead, at a point 75 feet south of the north corner thereof.

48A. Within an area to the westward of the prolonged center line of Ocean Avenue; to the northward of a line ranging from a point on said center line 70 feet north of the south bulkhead toward the southeast corner of Domenicks's bulkhead (near the foot of Sheepshead Bay Road); to the eastward of the new footbridge crossing the bay, and to the southward of a line ranging westward at right angles to said center line of Ocean Avenue at a point 380 feet north of its intersection with the bulkhead along the south shore of the bay.

48B. Within an area to the eastward of the northerly prolongation of the west side of Hastings Street, Manhattan Beach; to the southward of a line ranging from a point on Domenicks's bulkhead 50 feet north of its southeast corner to a point 115 feet south of the southeast corner of Fitzgerald's bulkhead (near the foot of Bragg Street); to the westward of the southerly prolongation of the east side of Batchelder Street; to the northward of a line ranging from said southeast corner of Fitzgerald's bulkhead to a point 200 feet north of the south bulkhead and on a line at right angles thereto, at a point 1,585 feet west of its easterly end; and to the northward of a curving line ranging thence westerly parallel to and 200 feet from the south bulkhead.

48C. Within an area to the southward of a line 310 feet north of the south bulkhead, to the westward of the range of the present easterly bulkhead of Manhattan Beach Estates; to the northward of a line 100 feet north of the south bulkhead and to the eastward of a line at right angles to said bulkhead, at a point 530 feet west of its easterly end.

ANCHORAGE FOR EXPLOSIVES AND OTHER DANGEROUS ARTICLES

49. Vessels carrying gunpowder or other explosives may anchor only as follows:

(*a*) On the shoal ground to the eastward of Rikers Island, East River, from 300 to 900 yards from this island: *Provided*, That no vessel using this anchorage shall carry more than 20 tons of high explosives in bulk, and that vessels carrying high explosives in bulk shall not anchor closer than 500 feet to one another, and that no vessel carrying explosives of any kind shall anchor within 500 feet of vessels carrying high explosives in bulk. In so far as practicable in the use of this anchorage, preference shall be given to vessels storing explosives for current consumption.

(*b*) On the New Jersey Flats to the southward of a line drawn parallel to and 500 yards to the south of the Black Tom dredged channel, to the westward of a line ranging from the east end of the east landing pier on Bedloes Island to Greenville Channel entrance buoy "2G" and in range with Robbins Reef bell buoy "13B" and buoy "2G," and to the northward of a line parallel to and 500 yards north of the Greenville dredged channel, provided they do not anchor within 800 yards of Bedloes Island or within 500 yards of any pier, and provided that no vessel using this anchorage shall carry more than 20 tons of high explosives in bulk. Vessels carrying high explosives in bulk shall not anchor closer than 500 feet to one another, except that the captain of the port may authorize the placing of moorings not less than 500 feet apart within this area and the making fast thereto of not to exceed three barges at each mooring, provided the combined load of the barges at a mooring is not more than 20 tons of high explosives. No vessels carrying explosives of any kind shall anchor within 500 feet of vessels carrying high explosives in bulk. In so far as practicable, in the use of this anchorage, preference shall be given to vessels storing explosives for current consumption.

NOTE.—In cases of great emergency and when weather conditions are such that it is impossible for barges, scows, or lighters loaded with more than 20 tons of high explosives to proceed to Gravesend Bay or Raritan Bay, or lie at anchor there, such vessels may anchor temporarily in the Jersey Flats anchorage, but in each case the captain of the port must be immediately notified, and such vessels will not remain so anchored without his special permission.

(*c*) In Gravesend Bay to the eastward of a line bearing 338½° tangent to the west face of Fort Lafayette and ranging to Robbins Reef Light, but not within 1,600 yards of the shore: *Provided*, That not more than three seagoing vessels shall receive or discharge cargoes of high explosives in bulk in this anchorage at any one time. Seagoing vessels carrying high explosives in bulk will not occupy this anchorage for a period of time longer than is necessary to receive or discharge such cargoes, except by special permit from the captain of the port. All vessels carrying high explosives in bulk in this anchorage shall not anchor closer than 400 yards to one another, but this provision is not intended to prohibit lighters from tying up alongside ships for the transfer of cargoes.

(*c*–1) A space of 600 yards wide and not less than 1,000 yards from the shore on the southeast side of anchorage ground, designated as 49(*c*) shall be reserved for barges and lighters loaded with ammunition and smokeless powder, provided such barges and lighters be anchored so as not to approach one another closer than 300 feet. The captain of the port may authorize the placing of moorings within this area and the making fast thereto of not to exceed three barges at each mooring, provided these moorings be so spaced that barges at one mooring shall at all times be not less than 300 feet from barges at an adjacent mooring.

(*d*) An anchorage in Raritan Bay for barges loaded with explosives, as follows: To the southward of a line ranging 70° from the white spar buoy on the south side of the channel leading to Arthur Kill, opposite red channel buoy (No. 8) to West Bank Light; to the westward of a line ranging 137° from Princess Bay Light to Waackaack Light; to the northward of a line ranging 250° from Old Orchard Shoal Light to Boundary beacon; and to the eastward of a line ranging 306° from Boundary beacon.

(*e*) The captain of the port may authorize a mooring to be placed in the vicinity of Great Beds, Raritan Bay, at which may be moored not exceeding three barges loaded with explosives, the mooring to be not closer than 500

yards to any wharf and so located that the barges when moored will not swing into the channel. Barges shall not be permitted to remain at this mooring longer than 12 hours.

QUARANTINE ANCHORAGE

NOTE.—The establishment, regulations, and enforcement of quarantine anchorages are under the Secretary of the Treasury, and under his authority the following quarantine anchorages have been established.

24. To the southward of a line bearing 226° to the center of the gas tank at Clifton, Staten Island, and to the westward of a line ranging from the Northern end of the Quarantine Wharf, Rosebank, Staten Island, to Robbins Reef Lighthouse.

Vessels arriving at quarantine and awaiting inspection may anchor temporarily to the westward of a range passing through Craven Shoal buoy and Robbins Reef Lighthouse, but as soon as cleared by the quarantine officer must vacate this temporary anchorage and, if detained in quarantine, must at once move into the quarantine anchorage. In both anchorages vessels shall not drop anchors south of a line bearing 270° from the north side of Fort Lafayette.

44. A quarantine anchorage for vessels in a single line is established between two red buoys Nos. 1 and 2, off the south end of Perth Amboy.

RULES AND REGULATIONS

1. Except in cases of great emergency, no vessel shall be anchored in the navigable waters of the port of New York, outside of the anchorage areas hereby defined and established, nor be made fast to the exterior end of any pier, nor to any vessel lying at the exterior end of any pier, or along any bulkhead in such manner as to obstruct or endanger the passage of any vessels to or from the adjacent wharf property, or impede the movements of any vessels entering or leaving adjacent slips.

2. Whenever, in the opinion of the captain of the port, such action may be necessary, that officer may require any or all vessels in any designated anchorage area to moor with two or more anchors.

3. Every vessel whose crew may be reduced to such number that it will not have sufficient men on board to weigh anchor at any time shall be anchored with two anchors, with mooring swivel put on before the crew shall be reduced or released.

4. Anchors must not be placed outside the anchorage areas, nor shall any vessel be so anchored that any portion of the hull or rigging shall at any time extend outside the boundaries of the anchorage areas.

5. Any vessel anchoring under circumstances of great emergency outside of the anchorage areas must be placed near the edge of the channel and in such a position as not to interfere with the free navigation of the channel nor obstruct the approach to any pier nor impede the movements of any boat, and shall move away immediately after the emergency ceases, or upon notification by the captain of the port.

6. The captain of the port shall assign berths in the anchorage to all vessels applying. He may grant permits for habitually maintaining and using the same mooring place in an anchorage area, and no vessel shall occupy a permanent berth in an anchorage area except under authority of such permit, which may be revoked at any time.

7. A vessel upon being notified to move into the anchorage limits or to shift its position on anchorage grounds must get under way at once or signal for a tug and must change position as directed with reasonable promptness.

8. Except as provided in rule 10, vessels carrying explosives or other dangerous articles, including inflammable liquids, inflammable solids, oxidizing materials, corrosive liquids, compressed gases, and poisonous substances shall be anchored within the anchorage areas 49 (*a*) to (*e*) only, described above, under the heading "Anchorage grounds." These areas are reserved for this special purpose and are not to be used by vessels carrying other classes of freight except in cases of emergency.

Any vessel carrying explosives and desiring to proceed to the anchorages provided therefor must first obtain a written permit from the captain of the port, and no vessel shall occupy a berth in such anchorages except by authority

of such permit, which may be revoked at any time. All other vessels in anchorage areas must carry written permits from the captain of the port and must show these permits whenever required by the captain of the port or his properly authorized agents.

9. Whenever any water craft not fitted with mechanical power anchors in explosive anchorage 49 (*a*) to (*e*) while carrying explosives, the captain of the port may require the attendance of a tug upon such water craft, when in his judgment such action is deemed necessary.

10. The district engineer in charge of works of river and harbor improvements is empowered to authorize, in writing, the anchoring in or near the vicinity of such a work of a single scow carrying explosives for use on the work, but only in quantities considered by him safe and necessary. The district engineer shall prescribe the conditions under which this explosive shall be stored and handled and shall in each case furnish the captain of the port with a copy of the written permit to anchor explosives on the work and a copy of the rules and regulations for the storage and handling.

11. Municipal ash scows may be anchored in such places as the captain of the port may designate.

12. Whenever the maritime or commercial interests of the United States so require, the captain of the port is hereby empowered to shift the position of any vessel anchored within the anchorage areas, of any vessel anchored outside the anchorage areas, of any vessel which is so moored or anchored as to impede or obstruct vessels movements in any channel or obstruct or interfere with range lights, and of any vessel which, lying at the exterior end of a pier or alongside an open bulkhead, obstructs or endangers the passage of vessels to or from adjacent wharf property or impedes the movements of vessels entering or leaving adjacent slips.

13. Permits to anchor in channels within the limits of the port of New York may be granted by the captain of the port to wrecking plants or other vessels legally engaged in recovering sunken property or in laying pipe or cable lines legally established or in repairing the same, when the application for such anchorage is approved by the district engineer in charge of works of river and harbor improvements and to plant engaged in dredging operations when authorized by the district engineer.

The provisions of this paragraph shall not apply to plants engaged under the supervision of the district engineer of the engineer department, upon works for the improvement of rivers and harbors; but the district engineer will in advance advise the captain of the port of proposed work for such improvement in all cases where plant is to be employed under his supervision.

14. Nothing in these rules and regulations shall be construed as relieving the owner or person in charge of any vessel from the penalties of the law for obstructing navigation, or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights, fog signals, or for otherwise violating law.

REGULATIONS GOVERNING THE USE AND NAVIGATION OF THE WATERS OF THE PORT OF NEW YORK AND THE HANDLING OF EXPLOSIVES THEREIN BY VESSELS OTHER THAN COMMON CARRIERS CARRYING EXPLOSIVES

THE LAW

Section 7 of the river and harbor act approved August 8, 1917, provides as follows:

"That it shall be the duty of the Secretary of War to prescribe such regulations for the use, administration, and navigation of the navigable waters of the United States as, in his judgment, the public necessity may require for the protection of life and property, or of operations of the United States in channel improvement, covering all matters not specifically delegated by law to some other executive department. Such regulations shall be posted, in conspicuous and appropriate places, for the information of the public; and every person and every corporation which shall violate such regulations shall be deemed guilty of a misdemeanor and, on conviction thereof in any district court of the United States within whose territorial jurisdiction such offense may have been committed, shall be punished by a fine not exceeding $500, or by imprisonment (in case of a natural person) not exceeding six months, in the discretion of the court."

NOTE.—The act of Congress approved March 1, 1921, imposes certain restrictions upon the transportation of explosives by common carriers engaged in interstate or foreign commerce, and also provides that "The Interstate Commerce Commission shall formulate regulations for the safe transportation within the limits of the jurisdiction of the United States of explosives and other dangerous articles, including inflammable liquids, inflammable solids, oxidizing materials, corrosive liquids, compressed gases, and poisonous substances, which shall be binding upon all common carriers engaged in interstate or foreign commerce which transport explosives or other dangerous articles by land or water, and upon all shippers making shipments of explosives or other dangerous articles via any common carrier engaged in interstate or foreign commerce by land or water." Other vessels carrying explosives will be governed by the following regulations:

THE REGULATIONS

Under authority of section 7 of the river and harbor act approved August 8, 1917, the following regulations are prescribed to govern the use and navigation of the waters of the port of New York by vessels, other than common carriers, carrying explosives:

1. The officer of the Coast Guard designated "captain of the port" shall have immediate supervision of the enforcement of these regulations, but such supervision shall not be construed to diminish or affect the duties of other Federal officials as prescribed in section 17 of the river and harbor act of March 3, 1899.

2. Vessels carrying explosives shall be at all times in charge of competent persons and must display by day a red flag of at least 16 square feet at the masthead, or at least 10 feet above the upper deck, if the vessel has no mast; at night a red light will be displayed in the same positions specified for the red flag. For use in emergencies each barge must be provided with a suitable anchor, ground tackle, and equipment, to be approved by the captain of the port, with an adequate supply of fire extinguishers, and fire pails filled with water, and with a suitable fog horn and bell.

3. No smoking will be permitted on or near any vessel, barge, or scow carrying explosives, and no person under the influence of liquor will be allowed on board nor to approach such vessels. Every person having business on board vessels which are being loaded with explosives, other than members of the crew, must have a pass from the captain of the port, in such form as the captain of the port shall determine.

4. Vessels carrying explosives shall not carry inflammable liquids, inflammable solids, oxidizing materials, mineral acids, as defined in Interstate Commerce Commission regulations for the transportation of explosives, or articles likely to ignite spontaneously, or to give off inflammable gases, unless the explosives are stored in separate rooms or are otherwise so separated as to effectually prevent danger to the explosives from any of these articles or from the vapor thereof. Where blasting caps, detonating fuses, and fulminate of mercury in bulk are loaded on the same vessel with high explosives, they must be in a different compartment, the distance in a straight line from the compartment containing them to the explosives to be not less than 25 feet.

5. No unnecessary fires shall be permitted on vessels carrying explosives, and those fires which are deemed necessary must be properly safeguarded and must be left in constant charge of some one individual of the crew during the entire period that they are burning. Cabins on barges or lighters in which oil lights or stoves are used, and carrying explosives of any or all descriptions, must be protected by covering the wooden walls, partitions, floors, and ceilings with two thicknesses of ¼-inch asbestos board placed with joints broken and covered with No. 26 gauge metal. This protection must also be applied to doors; and the doors from the cabin into other parts of the boat must be provided with substantial springs, making them self-closing. The stoves must be at least 18 inches from all partitions, and a sheet-metal shield 5½ feet in height, securely fastened to the floor and the wall, must be placed midway between the walls and the stove. The stove must be at least 6 inches from the floor of the cabin, supported either on legs permanently and securely fastened to the stove and the floor, or on 6 inches of hollow tile securely fastened in place. The hole in the roof of the cabin where the stovepipe passes through shall be 18 inches larger in circumference than the stovepipe, and a substantial metal

plate shall be placed in the opening surrounding the pipe to hold it in place. The stovepipe shall also be tied into the walls so that it will not shift. The smokestack must be provided with substantial screens of fine mesh or other satisfactory spark arrester. All oil lamps must be held in marine brackets. Safety matches of wooden-stick type rather than the paper type must be used exclusively and kept in proper receptacles. Oils and lamps must be kept on deck in a metal-lined box and in such position that it can be readily thrown overboard. No artificial light shall be permitted in the holds or compartments of any vessel that contains explosives except electric flash lights or electric lanterns or an approved electric lighting of the vessel. Crews must not have or carry matches, firearms, or cartridges on their persons. Electric flash lights must be provided for the attendants.

6. No explosives will be allowed to be placed aboard a vessel until the rest of the cargo has been placed aboard and the vessel trimmed. All work of construction of floors, partitions, and other conditioning of the vessel, and the removal of any other combustibles from that part of the hold in which the explosives are to be stored, shall be completed before loading of the explosives is commenced. All rubbish, shovelings, old oil, paint cans, oil rags, rope ends, and other litter must be kept cleared out of the holds. Such lumber as is allowed to remain in the holds for use as firewood must be securely piled. Floors must be kept broom clean. All decks, gangways, and holds over which explosives must be passed in loading must be freed from all loose metal or tools and carefully swept before loading is commenced and after loading has ceased.

7. All explosives must be handled carefully. No metal tools shall be used in loading, unloading, or handling explosives. Men engaged in loading, unloading, or handling explosives must not have or carry on their persons metal tools or bale hooks, matches, firearms, or cartridges, and they must not wear boots or shoes shod or strengthened with iron nails or any metal unless such boots or shoes are covered with leather, felt, or some other such material. Packages of explosives must not be thrown, dropped, rolled, dragged, or slid over each other or over the decks. Dynamite boxes must be stowed topside up. Powder kegs should be loaded with seams up.

8. The term "high explosives in bulk" shall be construed to mean high explosives packed in boxes, barrels, or kegs and not loaded in ammunition or shells. The standard definition of the term "high explosives" will be that contained in paragraph 1503 of the regulations of the Interstate Commerce Commission for the transportation of explosives by rail, viz: "High explosives are all explosives more powerful than ordinary black powder, except smokeless powders and fulminates. Their distinguishing characteristic is their susceptibility to detonation by a blasting cap. Examples of high explosives are dynamite, picric acid, picrates, chlorate powders, nitrate of ammonia powders, dry trinitrotoluol, dry nitrocellulose (guncotton), dry tetranitroaniline, dry tetranitromethylaniline and fireworks that can be exploded en masse." Unless they are loaded in the same vessel with articles enumerated in the rule quoted above, picric acid 10 per cent wet, and trinitrotoluol 10 per cent wet, and nitrocellulose (guncotton) 20 per cent wet, will not be classified as high explosives. The term "high explosives in bulk" does not include such articles as benzol, toluol, smokeless powder, black powder, small arms ammunition, ammunition for cannon with explosive projectiles, explosive projectiles or torpedoes, percussion fuses, time fuses, combination fuses, tracer fuses, cordeau detonant, primers for cannon and small arms, blasting caps, detonating fuses, and fulminate of mercury in bulk. Blasting caps, detonating fuses, and fulminate of mercury in bulk will be considered as constituting a distinct class by themselves, and must be stowed and handled with special care.

9. In transferring high explosives in bulk, blasting caps, detonating fuses, or fulminate of mercury from one vessel to another they must be handled by hand or regulation chute and mattress. If difference in elevation between vessels or condition of weather renders it impossible to transfer or load by hand or chute, mechanical hoists and a special crate or basket may be used. Explosives transferred in this manner must not be handled roughly. They must be hoisted and lowered carefully and be deposited or lowered on a mattress.

10. When an inclined chute is employed, such chute shall be constructed of 1-inch planed boards with side boards 4 inches high, extending 3 inches above

top face of bottom of chute and throughout its length fastened with brass screws. D-shaped strips or runners not more than 6 inches apart and running lengthwise of the chute must be fastened to the upper surface of the bottom part by means of glue and wooden pegs extending through the bottom part and runners. Chutes must be occasionally wiped down with waste moistened with machine oil when dynamite packages are being handled. A stuffed mattress 4 feet wide by 6 feet long and not less than 4 inches thick, or a heavy jute or hemp mat of like dimensions, must be placed under the discharging end of the chute. The incline of the chute should be such that the velocity of the packages sliding will not be great enough to cause violent shock when coming in contact with other packages or when reaching the bottom of the slide, or men must be stationed alongside the chutes to retard the velocity of the packages and prevent violent shocks when packages come in contact with each other or reach the bottom of the chute.

11. Broken or seriously damaged packages of explosives may be recoopered when it is practicable and not dangerous. A broken box of dynamite that can not be recoopered should be reinforced by stout wrapping paper and twine, placed in another strong box, and surrounded by dry fine sawdust, or dry, clean cotton waste, or elastic wads made from dry newspaper. A ruptured can or keg should be inclosed in a grain bag of good quality and boxed or crated. Injured packages thus protected and properly marked may be forwarded. Packages too seriously damaged to be recoopered should not be forwarded but set aside and the shipper notified to make disposition of them. In removing broken cases or kegs of explosives from vessels care must be taken to remove any particles of loose explosives.

12. The transportation of high explosives by water and the transfer of high explosives to and from water craft in the harbor of New York and vicinity, other than in the case of naval vessels, shall be made under the direct supervision of such guards as may be assigned for the purpose by the captain of the port, but this is not to be construed as charging the captain of the port with any responsibilty in connection with the navigation of such water craft. No high explosives in bulk shall be transported by water through Arthur Kill or Kill van Kull, except that during stormy weather the captain of the port may permit, in his discretion, shipments of high explosives in bulk in amounts not exceeding 10,000 pounds in any one shipment to be transported through these passages when destined to explosive anchorage 49 (*b*) for local consumption: *Provided*, That no high explosives in bulk shall be transported through these passages at night or during foggy weather: *Provided*, That no other explosives shall be transported by water through Arthur Kill or Kill van Kull except during stormy weather: *And provided further*, That shipments of high explosives in bulk in amounts not exceeding 2,000 pounds in any one shipment may be transported through Arthur Kill or Kill van Kull, at night or during foggy weather, when such explosives are destined for local consumption at places along these two waterways. Owners or agents of water craft transferring or carrying such cargoes will be required to provide subsistence when crews are subsisted on board, and, when necessary, suitable sleeping accommodations for guards placed on board by the captain of the port, and for such period as he may specify. When crews are not subsisted on board, subsistence for inspectors and guards will not be required, but every opportunity will be afforded to them to use such cooking facilities as are provided for the crews.

13. In any case of violation of the regulations in regard to the handling of explosives the captain of the port is empowered to remove any vessel or any man or men from the waters to which these regulations pertain or to stop the loading or unloading of explosives in said waters.

14. Nothing in the foregoing shall be construed as relieving the master of any vessel carrying explosives from the responsibilty of making frequent inspections, both by day and night, to see that these rules are complied with.

NAVIGATIONAL AIDS AND THE USE OF CHARTS

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to navigation: Charts, Coast Pilots, Tide Tables, Current Tables, a catalogue of these publications, and Notices to Mariners, the last named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

CHARTS bear three dates, which should be understood by persons using them: (1) The date (month and year) of the edition, *printed* on the late charts below the border in a central position; (2) the date of the latest correction to the chart plates, *printed* in the lower left-hand corner below the border; (3) the date of issue, *stamped* below the border and just to the left of the subtitle. Charts show all necessary corrections as to lights, beacons, buoys, and dangers, which have been received to the *date of issue*, being hand corrected since the latest date printed in the lower left-hand corner. All small but important corrections occurring subsequent to the *date of issue* of the chart are published in Notice to Mariners and should be applied by hand to the chart immediately after the receipt of the notices. The date of the edition of the chart remains unchanged until an extensive correction is made on the plate from which the chart is printed. The date is then changed and the issue is known as a new edition. When a correction, not of sufficient importance to require a new edition, is made to a chart plate, the year, month, and day are noted in the lower left-hand corner. All the notes on a chart should be read carefully, as in some cases they relate to the aids to navigation or to dangers that can not be clearly charted. The charts are various in character, according to the objects which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately 1 : 1,200,000, which exhibit the approaches to a large extent of coast, give the offshore soundings, and enable the navigator to identify his position as he approaches from the open sea.
2. General charts of the coast, on scales of 1 : 400,000 and 1 : 200,000, intended especially for coastwise navigation.
3. Coast charts, on a scale of 1 : 80,000, by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.
4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

NOTE.—General charts of the Philippine Islands are on scales 1 : 1,600,000, 1 : 800,000, and 1 : 400,000; coast charts are on scales 1 : 100,000 and 1 : 200,000.

COAST PILOTS, relating to surveyed waters of the United States, Porto Rico, Virgin Islands, Alaska, Hawaiian Islands, and the Philippine Islands, contain full nautical descriptions of the coasts, harbors, dangers, and directions for coasting and entering harbors. At intervals of about one year supplements are issued, containing the more important corrections since the publication of the volume. The supplements are printed on one side of the paper only, so that they may be cut and pasted in the appropriate places in the volume. Supplements and other corrections for any volume can be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., or any of its field stations, provided the volume itself has not been superseded by a subsequent edition.

TIDE TABLES.—The Coast and Geodetic Survey Tide Tables are issued annually in advance of the year for which they are made and contain the predicted times and heights of the tide for each day in the year at the principal ports of the world, including the United States and its possessions. A table of tidal differences is given by means of which the tides at about 3,500 intermediate ports may be obtained. Separate reprints from the general Tide Tables are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

CURRENT TABLES, which have heretofore been issued as a part of the Tide Tables, are now published separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States.

AGENCIES for the sale of the Charts, Coast Pilots, Tide Tables, and Current Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C., or any of the field stations. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Coast and Geodetic Survey." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other publications of the Survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey, Washington, D. C.

OTHER PUBLICATIONS.—Lists of Lights, Buoys, and other Day Marks of the United States, its insular possessions, and the Great Lakes are published by the Bureau of Lighthouses and may be purchased from its sale agencies or from the Superintendent of Documents, Washington, D. C. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey; this publication can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

REMARKS ON THE USE OF CHARTS

ACCURACY OF CHARTS.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide. This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean, and part of Bering Sea, and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail. A wide berth should, therefore, be given to every rocky shore or patch, and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

With respect to a well-surveyed coast, only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven, the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made. Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

DREDGED CHANNELS.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is that determined on a certain date which is stated in the channel legend. The actual depth of a completed channel may be greater than the charted depth shortly after dredging and less when shoaling occurs as a result of storms or other causes. These changes are of too frequent occurrence and uncertain duration to chart. Therefore, when a vessel's draft approximates the charted depth of a dredged channel, the latest information should be obtained before entering. The possibility of shoaling along the edges of the channel should always be considered.

DANGER CURVES.—The depth curves will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart and regard this as a "danger curve," which is not to be crossed without precaution. Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

CAUTION IN USING SMALL-SCALE CHARTS.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts

as on those of larger scale; therefore in approaching the land or dangerous banks regard should be had to the scale of the chart, and the largest scale chart available should be used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. For the same reason bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

DISTORTION OF PRINTED CHARTS.—The paper on which charts are printed directly from copper plates has to be dampened. On drying distortion takes place from the inequalities in the paper, which varies with the paper and the amount of the original dampening; but usually it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted upon the chart, especially if the lines to objects be long. The longer the chart the greater the amount of this distortion.

The majority of Coast and Geodetic Survey charts are now printed by lithography on dry paper and have little if any distortion. A lithographed chart may be distinguished from a plate printed chart by the feel of the surface, the former being smooth while the latter is rough. Lithographed charts also are usually tinted in colors while the others are in black and white.

BUOYS.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions. It is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of soundings.

GAS BUOYS and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished or, if intermittent, the apparatus may get out of order.

LIGHTS.—The distances given in the light lists, Coast Pilots, and on the charts for the visibility of lights are computed for a height of 15 feet (4.6 m.) for the observer's eye. The table of distances of visibility due to height, published in the light list, affords a means of ascertaining the effect of a greater or less height of the eye. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances. As the range of visibility increases with the elevation of the observer, it is often possible to obtain a bearing before the light is sighted from the bridge by sighting the light from aloft, noting a star in range with it, and then obtaining a bearing of the star with compass or pelorus.

The actual power of a light should be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen. The power of a light can be estimated by its candlepower as given in the light lists and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

FOG SIGNALS.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the wind, large areas of silence have been found in different directions and at different distances from the origin of the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time. Mariners must not, therefore, judge their distance from a fog signal by the force of the sound and must not assume that a signal is not sounding because they do not hear it. Taken together, these facts should induce the utmost caution when nearing the land or danger in fog. The lead is generally

the only safe guide and should be faithfully used. In regions where the shores are high and rocky the echo of the whistle frequently gives warning of too close an approach to shore. In narrow passages it is often possible to keep in mid-channel by directing course so that the echoes from both shores are heard at approximately the same time.

SUBMARINE BELLS, installed on many lightships and buoys, have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but a bearing of the signal can not then be readily determined.

TIDES.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates to or is less than the draft of the vessel and, wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with a rising or falling tide. In some localities the tide may be at a high or low water stand while the current is at its maximum velocity.

THE TIDE TABLES published by the Coast and Geodetic Survey give the predicted times and heights of high and low waters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports.

PLANE OF REFERENCE FOR SOUNDINGS ON CHARTS.—For the Atlantic coast of the United States and Porto Rico the plane of reference for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the one exception noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Wrangel Strait, Alaska, the plane of reference is 3 feet below mean lower low water. For the Atlantic coast of the Canal Zone, Panama, the plane of reference for soundings is mean low water, and for the Pacific coast of the same it is low-water springs. For foreign charts many different planes of reference are in use, but that most frequently adopted is low-water springs.

It should be remembered that whatever plane of reference is used for a chart there may be times when the tide falls below it. When the plane is mean low water or mean lower low water, there will generally be as many low waters or lower low waters below those planes as above them; also the wind may at times cause the water to fall below the plane of reference.

TIDAL CURRENTS.—In navigating coasts where the tidal range is considerable special caution is necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore, and that the effect of a cross current is greater on a vessel running slowly than when at full speed. The turn of the tidal current offshore is seldom coincident with the time of high and low water on the shore.

At the entrance to most harbors without important tributaries or branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, the ebb and flow will be much more regular in occurrence. A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels. Along most shores not seriously affected by bays, tidal rivers, etc., the current usually turns soon after high and low waters.

The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve. Counter currents and eddies may occur near the shore of straits, especially in bights and near points.

THE CURRENT TABLES published by the Coast and Geodetic Survey give the predicted times of slack water and other current data for a number of places on the Atlantic and Pacific coasts of North America.

TIDE RIPS AND SWIRLS occur in places where strong currents occur, caused by a change in the direction of the current and especially over shoals or in places where the bottom is uneven. Such places should be avoided if exposed also to a heavy sea, especially with the wind opposing the current. When these

conditions are at their worst, the water is broken into heavy, choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the baring of the propeller and rudder.

CURRENT ARROWS on charts show only the usual or mean direction of a tidal stream or current. It must not be assumed that the direction of the current will not vary from that indicated by the arrow. In the same manner the velocity of the current constantly varies with circumstances, and the rate given on the chart is a mean value, corresponding to an average range of tide. At some stations but few observations have been made.

THE CURRENT TABLES published by the Coast and Geodetic Survey give the predicted times of slack water and other current data for a number of places on the Atlantic and Pacific coasts of North America.

FIXING POSITION.—The most accurate method available to the navigator for fixing a position relative to the shore is by plotting with a protractor, sextant angles between well-defined objects on the chart. This method, based on the "three-point problem" of geometry, should be in general use.

In many narrow waters also where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore. For its successful employment it is necessary, first, that the objects be well chosen; and second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice.

Near objects should be used either for bearing or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn. On the other hand, distant objects should be used for direction because less affected by a small error or change of position. The three-arm protractor consists of a graduated circle with one fixed and two movable radial arms. The zero of the graduation is at the fixed arm, and by turning the movable arms each one can be set at any desired angle with reference to the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges in case of a metal instrument, or the radial lines in the case of a transparent or celluloid instrument, pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole. The tracing-paper protractor, consisting of a graduated circle printed on tracing paper, can be used as a substitute for the brass or celluloid instrument. The paper protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of lying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through the three objects, it will be indeterminate, as it will plot all around the circle. An approach to this condition, which is called a "revolver," must be avoided. In case of doubt select from the chart three objects nearly in a straight line or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90°, the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation. A single angle and a range give, in general, an excellent fix, easily obtained and plotted.

THE COMPASS.—It is not intended that the use of the compass to fix the position should be given up. There are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the

more the better; but five objects is a good number, as the four angles thus obtained prevent any errors. When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

DOUBLING THE ANGLE ON THE BOW.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called bow and beam bearing, the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam when the position is obtained. By taking the bearing at two points and four points on the bow a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam. Such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in case of being suddenly shut in by fog. A graphic solution of the problem for any two bearings of the same object is frequently used. The two bearings are drawn on the chart, and the course is then drawn by means of the parallel rulers, so that the distance as measured from the chart between the lines is equal to the distance made good by the vessel between the times of taking the bearings.

DANGER ANGLE.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, charts compiled from early Russian and Spanish sources, referred to in a preceding paragraph, should not be used.

SOUNDINGS.—In thick weather, when near or approaching the land or danger, soundings should be taken continuously and at regular intervals and, with the character of the bottom, systematically recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship and then moving the paper over the chart parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

SUMNER'S METHOD.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method or one of its many modifications should be well understood, and this method should be in constant use. The Sumner line—that is, the line drawn through the two positions obtained by working the chronometer observation for longitude with two assumed latitudes, or by drawing through the position obtained with one latitude a line at right angles to the bearing of the body as obtained from the azimuth tables—gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. If directed toward the coast, it marks the bearing of a definite point; if parallel with the coast, the distance of the latter is shown. Thus, the direction of the line may often be usefully taken as a course. A sounding at the same time with the observation may often give an approximate position on the line. A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The Sumner lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day, and in combination with the sun gives an excellent fix.

POSITION LINE BY MARC SAINT HILAIRE OR CALCULATED ALTITUDE METHOD.—By this method the altitude of the celestial body is calculated for the assumed position, and the difference between the observed and calculated altitudes is laid off toward or away from the assumed position, according to sign, along the azimuth of the observed body. The line of position is then drawn through the new point in a direction normal to the azimuth of the celestial body. This method has certain advantages, the principal one being that the solution is strong even when the body is near the meridian. Full description of this method will be found in any epitome of navigation.

POSITION LINE BY MEANS OF TABLES.—The Sumner line of position furnished ready to lay down on the chart may be derived from the tables of Simultaneous Hour Angle and Azimuth of Celestial Bodies, published by the Hydro-

graphic Office as publication No. 203. By means of these tables all calculations are avoided.

RADIOCOMPASS bearings and positions are especially valuable at night and during fog or thick weather when other observations are not obtainable. For practical navigating purposes radio vibrations may be regarded as traveling in a straight line from the sending station to the receiving station. Instruments for determining the bearing of this line are now available. The necessary observations may be divided into two general classes: First, where the bearing of the ship's radio call is determined by one, two, or more radio stations on shore and the resulting bearing or position is reported to the vessel (see p. 10, "radio service"); secondly, where the bearing of one or more known radio stations is determined on the vessel itself and plotted as a line of position or as cross bearings. Experiments show that these bearings can be determined with a probable error of less than 2°, and the accuracy of the resulting position is largely dependent on the skill and care of the observer. It must be remembered, however, that these lines are parts of great circles, and if plotted as straight lines on a Mercator chart a considerable error may result when the ship and shore station are a long distance apart. The bearings may be corrected for this distortion as explained on page 11.

Radio bearings may be combined with position lines obtained from astronomical observations and used in ways very similar to the well-known Sumuer line when avoiding dangerous shoals or when making the coast.

CHANGE OF VARIATION OF THE COMPASS.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are replotted for every new edition if the error is appreciable. Means for determining the amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

LOCAL MAGNETIC DISTURBANCE.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places. Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together. The law which has hitherto been found to hold good as regards local magnetic disturbances is that north of the magnetic Equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic Equator it is repelled. It is very desirable that whenever an area of local magnetic disturbances is noted the position should be fixed and the facts reported as far as they can be ascertained.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING WAVES

Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple. The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats by modifying the action of breaking seas. The principal facts as to the use of oil are as follows:

1. On free waves—that is, waves in deep water—the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, and generally waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, either when running or lying to or in wearing.

6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.

7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls. The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow; that is, from the cathead and allowed to tow in the water. With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter. Lying to, the weather bow, and another position farther aft seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted. On a bar with the ebb tide running it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling if necessary.

USE OF SOUNDING TUBES

Although of undoubted value as a navigational instrument, the sounding tube is subject to certain defects which, operating singly or in combinations, may give results so misleading as to seriously endanger the vessels whose safety is entirely dependent upon an accurate knowledge of the depths. Efforts have been made from time to time by the Coast and Geodetic Survey to utilize various commercial tubes for surveying operations, but the results obtained have not been satisfactory. A tube recently designed by the bureau, however, has been tested extensively by field parties and, as it gives results exceeding in accuracy any other type of tube, has been adopted for survey work. Even with this tube great care is necessary in order to obtain satisfactory results. There are various types of tubes in common use which are too well known to require detailed description here. They are all based on the general principle that air is elastic and can be compressed, and that if a column of air in a tube be lowered into the water in such a way that the air can not escape, yet at the same time the pressure of the water can be transmitted to it, the amount by which the air is compressed furnishes a measure of the depth to which it was lowered. Theoretically this principle is sound, but when we come to apply the theory to actual practice certain elements enter which result in errors in the depth determination. Actual experiments show that errors of 10 to 12 per cent are not uncommon, and that considerably greater errors may occur. It is important to note that the amount of these

errors depends on the depth—the greater the depth the greater the numerical value of the error.

These errors are due chiefly to uneven bore of tube, variation of barometric pressure from normal, difference in temperature of air and water, uneven thickness of caps used to close one end of the tube, leakage of water, accumulated salt in the tube, and leakage or failure of gaskets and valves used in the construction of some types of tube.

In order to avoid serious errors tubes should therefore be used with greatest care. A type that can be used more than once should be adopted, and the tubes to be used for sounding to make a land fall should be tested beforehand by stopping for an up and down cast, sending them down on the sounding wire to any desired depth, and comparing their readings with the actual depth to which they were submerged. Additional tests of this nature from time to time during the sounding operations are also valuable. Special care should be taken to prevent leakage by making sure that the cap fits tightly or that the valve and gaskets are water-tight and are working properly. In using the valve type of tube it is very important to make sure that the tube does not submerge after it once clears the water.

INSTRUCTIONS TO MARINERS IN CASE OF SHIPWRECK, AS PUBLISHED BY THE UNITED STATES COAST GUARD

GENERAL INFORMATION

Life-saving stations and houses of refuge are located upon the Atlantic and Pacific seaboards of the United States, the Gulf of Mexico, and the Lake coasts.

All stations on the Atlantic coast are manned throughout the year by crews of experienced surfmen; upon the Lake coasts the stations are manned from the opening until the close of navigation, with the exception of the one on Beaver Island, Lake Michigan, which depends on a volunteer crew; and upon the Pacific coast they are open and manned throughout the year.

All life-saving stations are fully supplied with boats, wreck guns, beach apparatus, restoratives, clothing provided by the Women's National Relief Association for the shipwrecked requiring it, etc.

Houses of refuge are supplied with boats, provisions, and restoratives, but not manned by crews; a keeper, however, resides in each, who is required to make extended excursions along the coast after every storm, with a view of ascertaining if any shipwreck has occurred and finding and succoring any persons that may have been cast ashore.

Houses of refuge are located exclusively upon the Florida coast, where the requirements of relief are widely different from those of any other portion of the seaboard.

The life-saving stations are provided with the International Code of Signals, and vessels can, by opening communication, be reported; or obtain the latitude or longitude of the station, where determined; or information as to the weather probabilities in most cases; or, where facilities for the transmission of messages by telephone or telegraph are available, requests for a tug or Coast Guard cutter will be received and promptly forwarded.

All services are performed by the life-saving crews without other compensation than their wages from the Government.

Destitute seafarers are provided with food and lodging at the nearest station by the Government as long as necessarily detained by the circumstances of shipwreck, and, if needed, with clothing provided by the Women's National Relief Association.

The station crews patrol the beach from 2 to 4 miles each side of their stations between sunset and sunrise, and if the weather is foggy the patrol is continued through the day. A continuous lookout is also maintained at every station night and day.

Each patrolman carries Coston signals. Upon discovering a vessel standing into danger he ignites one of these, which emits a brilliant red flame of about two minutes' duration, to warn her off, or, should the vessel be ashore, to let her crew know that they are discovered and assistance is at hand.

If the vessel is not discovered by the patrol immediately after striking, rockets, flare-up lights, or other recognized signals of distress should be used.

If the weather be foggy, some recognized sound signal should be made to attract attention, as the patrolman may be some distance away at the other end of his beat.

Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of the stations, to remain on board until assistance arrives, and under no circumstances should they attempt to land through the surf in their own boats until the last hope of assistance from the shore has vanished. Often when comparatively smooth at sea a dangerous surf is running which is not perceptible 400 yards offshore, and the surf when viewed from a vessel never appears as dangerous as it is. Many lives have been lost unnecessarily by the crews of stranded vessels being thus deceived and attempting to land in the ship's boats.

The difficulties of rescue by operations from the shore are greatly increased in cases where the anchors are let go *after entering the breakers*, as is frequently done, and the chances of saving life correspondingly lessened.

RESCUE WITH THE LIFEBOAT OR SURFBOAT

The patrolman, after discovering your vessel ashore and burning a Coston signal, hastens to his station or the telephone for assistance. If the use of a boat is practicable, either the large lifeboat is launched from its ways in the station and proceeds to the wreck by water, or the lighter surfboat is hauled overland to a point opposite the wreck and launched, as circumstances may require.

Upon the boat reaching your vessel the directions and orders of the keeper (who always commands and steers the boat) should be implicitly obeyed. Any headlong rushing and crowding should be prevented, and the captain of the vessel should remain on board, to preserve order, until every other person has left.

Women, children, helpless persons, and passengers should be passed into the boat first.

Goods or baggage will positively not be taken into the boat until all are landed. If any be passed in against the keeper's remonstrance, he is fully authorized to throw the same overboard.

RESCUE WITH THE BREECHES BUOY OR LIFE CAR

Should it be inexpedient to use either the lifeboat or surfboat, recourse will be had to the wreck gun and beach apparatus for the rescue by the breeches buoy or the life car.

A shot with a small line attached will be fired across your vessel. Get hold of the line as soon as possible, and haul on board until you get a tailblock with a whip or endless line rove through it. The tailblock should be hauled on board as quickly as possible to prevent the whip drifting off with the set or fouling with wreckage, etc. Therefore, if you have been driven into the rigging, where but one or two men can work to advantage, cut the shot line, and run it through some available block, such as the throat or peak-halyards block, or any block which will afford a clear lead, or even between the ratlines, that as many as possible may assist in hauling.

Attached to the tailblock will be a tally board with the following directions in English on one side and French on the other:

"Make the tail of the block fast to the lower mast, well up. If the masts are gone, then to the best place you can find. *Cast off shotline, see that the rope in the block runs free,* and show signal to the shore."

The above instruction being complied with, the result will be as shown in Figure 1.

As soon as your signal is seen a 3-inch hawser will be bent onto the whip and hauled off to your ship by the life-saving crew.

If circumstances permit, you can assist the life-saving crew by manning that part of the whip to which the hawser is bent and hauling with them.

When the end of the hawser is got on board, a tally board will be found attached, bearing the following directions in English on one side and French on the other:

"Make this hawser fast about 2 feet above the tailblock, see all clear and that the rope in the block runs free, and show signal to the shore."

These instructions being obeyed, the result will be as shown in Figure 2.

Take particular care that there are no turns of the whip line round the hawser. To prevent this, take the end of the hawser up between the parts of the whip before making it fast.

When the hawser is made fast, the whip cast off from the hawser, and your signal seen by the life-saving crew, they will haul the hawser taut and by means of the whip will haul off to your vessel a breeches buoy suspended from a traveler block, or a life car, from rings running on the hawser.

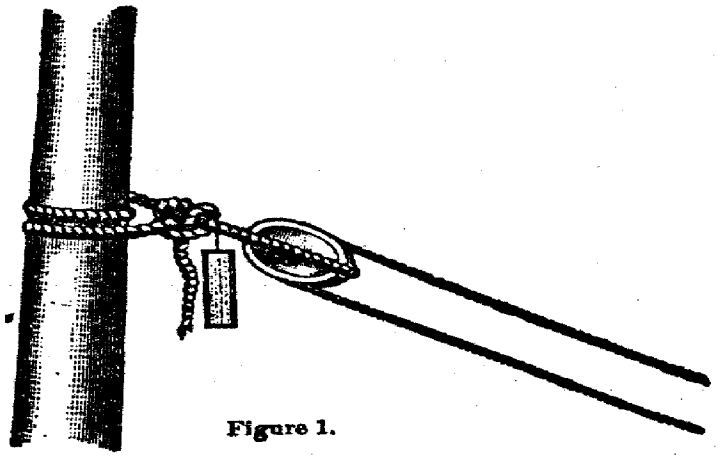


Figure 1.

Figure 3, below, represents the apparatus rigged, with the breeches buoy hauled off to the ship.

If the breeches buoy be sent, let one man immediately get into it, thrusting his legs through the breeches. If the life car, remove the hatch, place as many persons therein as it will hold (four to six), and secure the hatch on the outside by the hatch bar and hook, signal as before, and the buoy or car will be hauled ashore. This will be repeated until all are landed. On the last trip of the life car the hatch must be secured by the inside hatch bar.

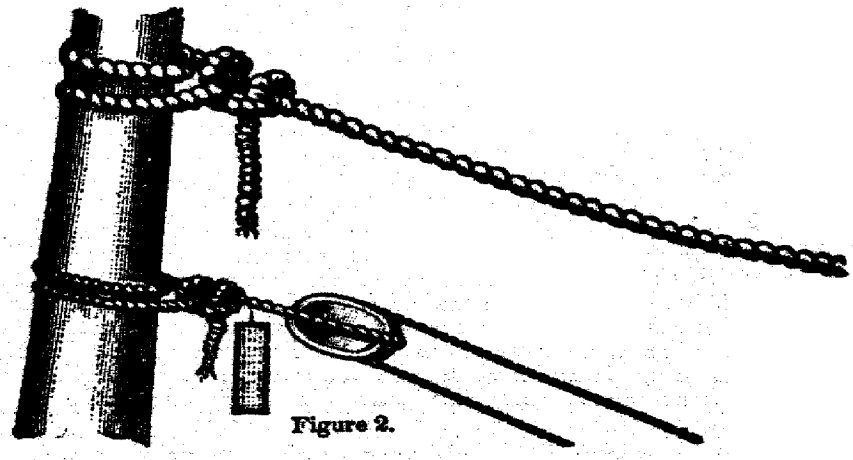


Figure 2.

In many instances two men can be landed in the breeches buoy at the same time by each putting a leg through a leg of the breeches and holding onto the lifts of the buoy.

Children, when brought ashore by the buoy, should be in the arms of older persons or securely lashed to the buoy. Women and children should be landed first.

In signaling as directed in the foregoing instructions, if in the daytime, let one man separate himself from the rest and swing his hat, a handkerchief, or

his hand; if at night, the showing of a light and concealing it once or twice will be understood; and like signals will be made from the shore. (See also, "Signals," below.)

Circumstances may arise, owing to the strength of the current or set or the danger of the wreck breaking up immediately, when it would be impossible to send off the hawser. In such a case a breeches buoy or life car will be hauled off instead by the whip or sent off to you by the shot line, and you will be hauled ashore through the surf.

If your vessel is stranded during the night and discovered by the patrolman—which you will know by his burning a brilliant red light—keep a sharp lookout for signs of the arrival of the life-saving crew abreast of your vessel.

From one to four hours may intervene between the burning of the light and their arrival, as the patrolman may have to return to his station, perhaps 3 or 4 miles distant, and the life-saving crew draw the apparatus or surfboat through the sand or over bad roads to where your vessel is stranded.

Lights on the beach will indicate their arrival ,and the sound of cannon firing from the shore may be taken as evidence that a line has been fired across your vessel. Therefore, upon hearing the cannon, make strict search aloft, fore and aft, for the shot line, for it is almost certain to be there.

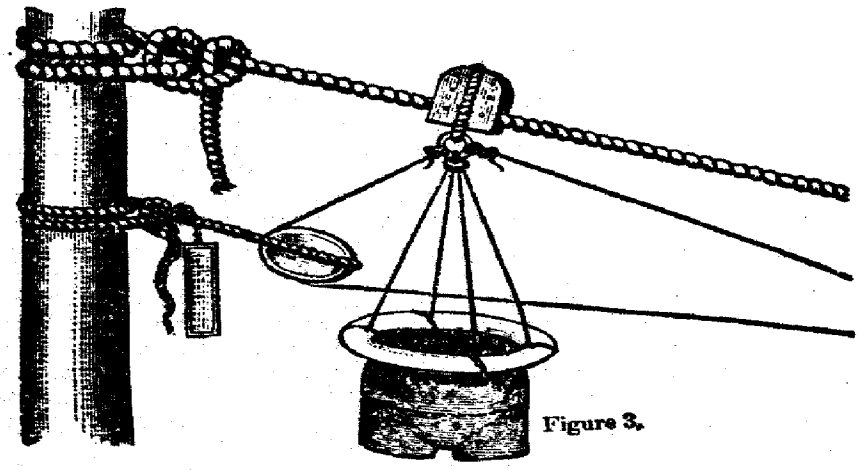


Figure 3.

Though the movements of the life-saving crew may not be perceptible to you, owing to the darkness, your vessel will be a good mark for the men experienced in the use of the wreck gun, and the first shot seldom fails.

IMPORTANT

Remain by the wreck until assistance arrives from the shore, or as long as possible. If driven aloft, the inshore mast is the safest.

If not discovered immediately by the patrol, burn rockets, flareup or other lights, or, if the weather be foggy, fire guns or make other sound signals.

Make the shot line fast on deck or to the rigging to prevent its being washed into the sea and possibly fouling the gear.

Take particular care that there are no turns of the whip line round the hawser before making the hawser fast.

Send the women, children, helpless persons, and passengers ashore first.

Make yourself thoroughly familiar with these instructions, and remember that on your coolness and strict attention to them will greatly depend the chances of success in bringing you and your people safely to land.

WRECK SIGNALS

The following signals, approved by the International Marine Conference convened at Washington in October, 1889, have been adopted by the Coast Guard Service and will be used and recognized by the officers and employees as occasion may require:

"Upon the discovery of a wreck by night, the life-saving force will burn a red pyrotechnic light or a red rocket to signify, '*You are seen; assistance will be given as soon as possible.*'

"A red flag waved on shore by day, or a red light, red rocket, or red Roman candle displayed by night, will signify, '*Haul away.*'

"A white flag waved on shore by day, or a white light slowly swung back and forth, or a white rocket, or white Roman candle fired by night will signify, '*Slack away.*'

"Two flags, a white and red, waved at the same time on shore by day, or two lights, a white and a red, slowly swung at the same time, or a blue pyrotechnic light burned by night, will signify, '*Do not attempt to land in your own boats; it is impossible.*'

"A man on shore beckoning by day, or two torches burning near together by night, will signify, '*This is the best place to land.*'

"Any of these signals may be answered from the vessel, as follows: In the daytime, waving a flag, a handkerchief, a hat, or even the hand; at night, by firing a rocket, a blue light, or a gun, or by showing a light over the ship's gunwale for a short time, and then concealing it."

BOUNDARY LINES OF THE HIGH SEAS

The following lines divide the high seas from rivers, harbors, and inland waters described in this volume. Waters inshore of the lines here laid down are "inland waters," and upon them the inland rules and pilot rules given on page 361 apply. Upon the high seas—viz, waters outside of the lines here laid down—the international rules given below apply.

All harbors in Cape Cod Bay, Mass.—A line drawn from Plymouth (Gurnet) Lighthouses 77½° (E. ⅛ S.), 16¼ miles, to Race Point Lighthouse.

Nantucket Sound, Vineyard Sound, Buzzards Bay, Narragansett Bay, Block Island Sound, and easterly entrance to Long Island Sound.—A line drawn from Chatham Lighthouse, Mass., 146° (S. by E. ¾ E.), 4⅜ miles, to Pollock Rip Slue Lightship; thence 142° (SSE. ⅛ E.), 12¾ miles, to Great Round Shoal entrance gas and whistling buoy (perpendicularly striped); thence 229° (SW. by W. ⅝ W.), 14½ miles, to Sankaty Head Lighthouse; from Smith Point, Nantucket Island, 261° (W. ⅜ N.), 27 miles, to No Mans Land gas and whistling buoy, 2; thence 359° (N. by E. ⅛ E.), 8⅛ miles, to Gay Head Lighthouse; thence 250° (W. ⅝ S.), 34½ miles to Block Island Southeast Lighthouse; thence 250½° (W. ⅝ S.) 14¾ miles, to Montauk Point Lighthouse, on the easterly end of Long Island, N. Y.

New York Harbor.—A line drawn from Rockaway Point Coast Guard Station 159½° (S. by E.), 6¼ miles, to Ambrose Channel Lightship; thence 238½° (WSW. ⅛ W.), 8¼ miles, to Navesink (southerly) Lighthouse.

RULES OF THE ROAD—INTERNATIONAL RULES TO PREVENT COLLISIONS OF VESSELS

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collisions at sea shall be followed by all public and private vessels of the United States upon the high seas in all waters connected therewith navigable by seagoing vessels.

PRELIMINARY

In the following rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The words "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

RULES CONCERNING LIGHTS, AND SO FORTH

The word "visible" in these rules when applied to lights shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

ART. 2. A steam vessel when under way shall carry—(a) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than twenty feet, and if the breadth of the vessel exceeds twenty feet, then at a height above the hull not less than such breadth, so, however, that the light need not be carried at a greater height above the hull than forty feet, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(e) A steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

ART. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than six feet apart, and when towing more than one vessel shall carry an additional bright white light six feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a), excepting the additional light, which may be carried at a height of not less than fourteen feet above the hull.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

ART. 4. (a) A vessel which from any accident is not under command shall carry at the same height as a white light mentioned in article two (a), where they can best be seen, and if a steam vessel in lieu of that light two red lights, in a vertical line one over the other, not less than six feet apart, and of such a character as to be visible all around the horizon at a distance of at least two miles; and shall by day carry in a vertical line one over the other, not less than six feet apart, where they can best be seen, two black balls or shapes, each two feet in diameter.

(b) A vessel employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in article two (a), and if a steam vessel in lieu of that light three lights in a vertical line one over the other not less than six feet apart. The highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least two miles. By day she shall carry in a vertical line, one over the other, not less than six feet apart, where they can best be seen, three shapes not less than two feet in diameter, of which the highest and lowest shall be globular in shape and red in color, and the middle one diamond in shape and white.

(c) The vessels referred to in this article, when not making way through the water shall not carry the side lights, but when making way shall carry them.

(d) The lights and shapes required to be shown by this article are to be taken by other vessels as signals that the vessel showing them is not under command and can not therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in article thirty-one.

ART. 5. A sailing vessel under way and any vessel being towed shall carry the same lights as are prescribed by article two for a steam vessel under way with the exception of the white lights mentioned therein, which they shall never carry.

ART. 6. Whenever, as in the case of small vessels under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Steam vessels of less than forty, and vessels under oars or sails of less than twenty tons gross tonnage, respectively, and rowing boats, when under way, shall not be required to carry the lights mentioned in article two (a), (b), and (c), but if they do not carry them they shall be provided with the following lights:

First. Steam vessels of less than forty tons shall carry—

(a) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than nine feet, a bright white light constructed and fixed as prescribed in article two (a), and of such a character as to be visible at a distance of at least two miles.

(b) Green and red side lights constructed and fixed as prescribed in article two (b) and (c), and of such a character as to be visible at a distance of at least one mile, or a combined lantern showing a green light and a red light from right ahead to two points abaft the beam on their respective sides. Such lanterns shall be carried not less than three feet below the white light.

Second. Small steamboats, such as are carried by seagoing vessels, may carry the white light at a less height than nine feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision one (b).

Third. Vessels under oars or sails of less than twenty tons shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

Fourth. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this article shall not be obliged to carry the lights prescribed by article four (a) and article eleven, last paragraph.

ART. 8. Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with green glass on the one side and red glass on the other, to be used as prescribed above.

Pilot vessels when not engaged on their station on pilotage duty shall carry lights similar to those of other vessels of their tonnage.

A steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights. When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

ART. 9. Fishing vessels and fishing boats, when under way and when not required by this article to carry or show the lights hereinafter specified, shall carry or show the lights prescribed for vessels of their tonnage under way.

(a) Open boats, by which is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night, with outlying tackle extending not more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light.

Open boats, when fishing at night, with outlying tackle extending more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light, and in addition, on approaching or being approached by other vessels, shall show a second white light at least three feet below the first light and at a horizontal distance of at least five feet away from it in the direction in which the outlying tackle is attached.

(b) Vessels and boats, except open boats as defined in subdivision (a), when fishing with drift nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen. Such lights shall be placed so that the vertical distance between them shall be not less than six feet and not more than fifteen feet, and so that the horizontal distance between them, measured in a line with the keel, shall be not less than five feet and not more than ten feet. The lower of these two lights shall be in the direction of the nets, and both of them shall be of such a character as to show all around the horizon, and to be visible at a distance of not less than three miles.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the net or gear) a white light, visible at a distance of not less than one sea mile, on the approach of or to other vessels.

(c) Vessels and boats, except open boats as defined in subdivision (a), when line fishing with their lines out and attached to or hauling their lines, and when not at anchor or stationary within the meaning of subdivision (h), shall carry the same lights as vessels fishing with drift nets. When shooting lines, or fishing with towing lines, they shall carry the lights prescribed for a steam or sailing vessel under way, respectively.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the lines) a white light visible at a distance of not less than one sea mile on the approach of or to other vessels.

(d) Vessels when engaged in trawling, by which is meant the dragging of an apparatus along the bottom of the sea—

First. If steam vessels, shall carry in the same position as the white light mentioned in article two (a) a tricolored lantern so constructed and fixed as to show a white light from right ahead to two points on each bow, and a green light and a red light over an arc of the horizon from two points on each bow to two points abaft the beam on the starboard and port sides, respectively; and not less than six nor more than twelve feet below the tricolored lantern a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon.

Second. If sailing vessels, shall carry a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon, and shall also, on the approach of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision.

All lights mentioned in subdivision (d) first and second shall be visible at a distance of at least two miles.

(e) Oyster dredgers and other vessels fishing with dredge nets shall carry and show the same lights as trawlers.

(f) Fishing vessels and fishing boats may at any time use a flare-up light in addition to the lights which they are by this article required to carry and show, and they may also use working lights.

(g) Every fishing vessel and every fishing boat under one hundred and fifty feet in length, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least 1 mile.

Every fishing vessel of 150 feet in length or upward, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least 1 mile, and shall exhibit a second light as provided for vessels of such length by article 11.

Should any such vessel, whether under 150 feet in length or of 150 feet in length or upward, be attached to a net or other fishing gear, she shall on the approach of other vessels show an additional white light at least three feet below the anchor light, and at a horizontal distance of at least five feet away from it in the direction of the net or gear.

(h) If a vessel or boat when fishing becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall in daytime haul down the day signal required by subdivision (k); at night show the light or lights prescribed for a vessel at anchor; and during fog, mist, falling snow, or heavy rainstorms make the signal prescribed for a vessel at anchor. (See subdivision (d) and the last paragraph of article 15.)

(i) In fog, mist, falling snow, or heavy rainstorms drift-net vessels attached to their nets, and vessels when trawling, dredging, or fishing with any kind of drag net, and vessels line fishing with their lines out, shall, if of twenty tons gross tonnage or upward, respectively, at intervals of not more than one minute make a blast; if steam vessels, with the whistle or siren, and if sailing vessels, with the foghorn, each blast to be followed by ringing the bell. Fishing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals; but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

(k) All vessels or boats fishing with nets or lines or trawls, when under way, shall in daytime indicate their occupation to an approaching vessel by displaying a basket or other efficient signal where is can best be seen. If vessels or boats at anchor have their gear out, they shall, on the approach of other vessels, show the same signal on the side on which those vessels can pass.

The vessels required by this article to carry or show the lights hereinbefore specified shall not be obliged to carry the lights prescribed by article four (a) and the last paragraph of article eleven.

ART. 10. A vessel which is being overtaken by another shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

The white light required to be shown by this article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon of twelve points of the compass, namely, for six points from right aft on each side of the vessel, so as to be visible at a distance of at least one mile. Such light shall be carried as nearly as practicable on the same level as the side lights.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upwards in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall not be less than fifteen feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fairway shall carry the above light or lights and the two red lights prescribed by article four (a).

ART. 12. Every vessel may, if necessary in order to attract attention in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by shipowners, which have been authorized by their respective Governments and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, shall carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH

ART. 15. All signals prescribed by this article for vessels under way shall be given.

First. By "steam vessels" on the whistle or siren.

Second. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds' duration.

A steam vessel shall be provided with an efficient whistle or siren sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn, to be sounded by mechanical means, and also with an efficient bell. In all cases when the rules require a bell to be used a drum may be substituted on board Turkish vessels, or a gong where such articles are used on board small seagoing vessels. A sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar fog horn and bell.

In a fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(*a*) A steam vessel having way upon her shall sound, at intervals of not more than two minutes, a prolonged blast.

(*b*) A steam vessel under way, but stopped, and having no way upon her, shall sound, at intervals of not more than two minutes, two prolonged blasts, with an interval of about one second between.

(*c*) A sailing vessel under way shall sound at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession; and when with the wind abaft the beam, three blasts in succession.

(*d*) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(*e*) A vessel when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through being not under command, or unable to maneuver as required by the rules, shall, instead of the signals prescribed in subdivisions (*a*) and (*c*) of this article, at intervals of not more than two minutes, sound three blasts in succession, namely: One prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

Sailing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals, but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

SPEED OF SHIPS TO BE MODERATE IN FOG, AND SO FORTH

ART. 16. Every vessel shall, in a fog, mist, falling snow, or heavy rain storms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

STEERING AND SAILING RULES

PRELIMINARY—RISK OF COLLISION

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

ART. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, namely:

(a) A vessel which is running free shall keep out of the way of a vessel which is closehauled.

(b) A vessel which is closehauled on the port tack shall keep out of the way of a vessel which is closehauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

ART. 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article also applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on, to the other; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own; and by night, to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one or two vessels is to keep out of the way, the other shall keep her course and speed.

Note.—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision can not be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. [See articles twenty-seven and twenty-nine.]

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam—that is, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side lights—shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and constructing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER

ART. 28. The words "short blast" used in this article shall mean a blast of about one second's duration.

When vessels are in sight of one another, a steam vessel under way, in taking any course authorized or required by these rules, shall indicate that course by the following signals on her whistle or siren, namely:

One short blast to mean, "I am directing my course to starboard."

Two short blasts to mean, "I am directing my course to port."

Three short blasts to mean, "My engines are going at full speed astern."

NO VESSEL UNDER ANY CIRCUMSTANCES, TO NEGLECT PROPER PRECAUTIONS

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

RESERVATION OF RULES FOR HARBORS AND INLAND NAVIGATION

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

DISTRESS SIGNALS

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime: First. A gun or other explosive signal fired at intervals of about a minute.

Second. The international code signal of distress indicated by N C.

Third. The distance signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night: First. A gun or other explosive signal fired at intervals of about a minute.

Second. Flames on the vessel (as from a burning tar barrel, oil barrel, and so forth).

Third. Rockets or shells throwing stars of any color or description, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

RULES OF THE ROAD—INLAND RULES TO PREVENT COLLISION OF VESSELS

AN ACT To adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States

Whereas the provisions of chapter eight hundred and two of the laws of eighteen hundred and ninety, and the amendments thereto, adopting regulations for preventing collisions at sea, apply to all waters of the United States connected with the high seas navigable by seagoing vessels, except so far as the navigation of any harbor, river, or inland waters is regulated by special rules duly made by local authority; and

Whereas it is desirable that the regulations relating to the navigation of all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall be stated in one Act: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collision shall be followed by all vessels navigating all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and are hereby declared special rules duly made by local authority:

PRELIMINARY

In the following rules every steam-vessel which is under sail and not under steam is to be considered a sailing-vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The word "steam-vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

RULES CONCERNING LIGHTS, AND SO FORTH

The word "visible" in these rules, when applied to lights, shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

ART. 2.[2] A steam vessel when under way shall carry—(a) On or in front of the foremast, or, if a vessel without a foremast, then in the fore part of the vessel, a bright white light so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(e) An sea-going steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

(f) All steam vessels (except sea-going vessels and ferry boats) shall carry in addition to green and red lights required by article two (b), (c), and screens as required by article two (d), a central range of two white lights; the afterlight being carried at an elevation at least fifteen feet above the light at the head of the vessel. The headlight shall be so constructed as to show an unbroken light through twenty points of the compass, namely, from right ahead to two points abaft the beam on either side of the vessel, and the afterlight so as to show all around the horizon.

ART. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than three feet apart, and when towing more than one vessel shall carry an additional bright white light three feet above or below such lights, if the length of the tow, measuring from the stern of the towing vessel to the

[2] Article 2 is amended by act of Congress approved June 9, 1910, effective on and after July 9, 1910, in rules for lights required to be carried by every vessel propelled by machinery and not more than 65 feet in length, except tugboats and towboats propelled by steam. See p. 372.

stern of the last vessel towed, exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a) or the after-range light mentioned in article two (f).

Such steam vessel may carry a small white light abaft the funnel or after-mast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

ART. 5. A sailing vessel under way or being towed shall carry the same lights as are prescribed by article two for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

ART. 6. Whenever, as in the case of vessels of less than ten gross tons under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

ART. 8.[3] Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

Pilot vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other vessels of their tonnage.

ART. 9. (a) Fishing vessels of less than ten gross tons, when under way and when not having their nets, trawls, dredges, or lines in the water, shall not be obliged to carry the colored side lights; but every such vessel shall, in lieu thereof, have ready at hand a lantern with a green glass on one side and a red glass on the other side, and on approaching to or being approached by another vessel such lantern shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

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[3] AN ACT Relating to lights on steam pilot vessels

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights.

When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

SEC. 2. That this act shall be construed as supplementary to article eight of the act approved June seventh, eighteen hundred and ninety-seven, entitled "An act to adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States," and to article eight of an act approved August nineteenth, eighteen hundred and ninety, entitled "An act to adopt regulations for preventing collisions at sea."

SEC. 3. That this act shall take effect on June thirtieth, nineteen hundred.

Approved, February 19, 1900.

(b) All fishing vessels and fishing boats of ten gross tons or upward, when under way and when not having their nets, trawls, dredges, or lines in the water, shall carry and show the same lights as other vessels underway.

(c) All vessels, when trawling, dredging, or fishing with any kind of drag-nets or lines, shall exhibit, from some part of the vessel where they can be best seen, two lights. One of these lights shall be red and the other shall be white. The red light shall be above the white light, and shall be at a vertical distance from it of not less than 6 feet and not more than 12 feet; and the horizontal distance between them, if any, shall not be more than 10 feet. These two lights shall be of such a character and contained in lanterns of such construction as to be visible all round the horizon, the white light a distance of not less than 3 miles and the red light of not less than 2 miles.

(d) Rafts, or other water craft not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall carry one or more good white lights, which shall be placed in such manner as shall be prescribed by the board of supervising inspectors of steam vessels.

ART. 10. A vessel which is being overtaken by another, except a steam vessel with an afterrange light showing all around the horizon, shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upwards in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

ART. 12. Every vessel may, if necessary, in order to attract attention, in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by ship-owners, which have been authorized by their respective Governments, and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, may carry in daytime, forward, where it can best be seen, one black ball or shape 2 feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH

ART. 15. All signals prescribed by this article for vessels under way shall be given:

1. By "steam vessels" on the whistle or siren.
2. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds' duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient fog horn; also with an efficient bell. A sailing vessel of 20 tons gross tonnage, or upward shall be provided with a similar fog horn and bell.

In fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(a) A steam vessel under way shall sound, at intervals of not more than one minute, a prolonged blast.

(c) A sailing vessel under way shall sound, at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession, and when with the wind abaft the beam, three blasts in succession.

(d) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(e) A steam vessel when towing, shall, instead of the signals prescribed in subdivision (a) of this article, at intervals of not more than one minute, sound three blasts in succession, namely, one prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

(f) All rafts or other water craft, not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall sound a blast of the foghorn, or equivalent signal, at intervals of not more than one minute.

SPEED OF SHIPS TO BE MODERATE IN FOG, AND SO FORTH

ART. 16. Every vessel shall,, in a fog, mist, falling snow, or heavy rainstorms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

STEERING AND SAILING RULES

Preliminary—risk of collision.—Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

ART. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other as follows, namely:

(a) A vessel which is running free shall keep out of the way of a vessel which is close-hauled.

(b) A vessel which is close-hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

ART. 18. RULE I. When steam vessels are approaching each other head and head—that is, end on, or nearly so—it shall be the duty of each to pass on the port side of the other; and either vessel shall give, as a signal of her intention, one short and distinct blast of her whistle, which the other vessel shall answer promptly by a similar blast of her whistle, and thereupon such vessels shall pass on the port side of each other. But if the courses of such vessels are so far on the starboard of each other as not to be considered as meeting head and head, either vessel shall immediately give two short and distinct blasts of her whistle, which the other vessel shall answer promptly by two similar blasts of her whistle, and they shall pass on the starboard side of each other.

The foregoing only applies to cases where vessels are meeting end on or nearly end on, in such a manner as to involve risk of collision; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own, and by night to cases in which each vessel is in such position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course, or by night to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light or a green light without a red light is seen ahead, or where both green and red lights are seen anywhere but ahead.

RULE III. If, when steam vessels are approaching each other, either vessel fails to understand the course or intention of the other, from any cause, the vessel so in doubt shall immediately signify the same by giving several short and rapid blasts, not less than four, of the steam whistle.

RULE V. Whenever a steam vessel is nearing a short bend or curve in the channel, where, from the height of the banks or other cause, a steam vessel

approaching from the opposite direction can not be seen for a distance of half a mile, such steam vessel, when she shall have arrived within half a mile of such curve or bend, shall give a signal by one long blast of the steam whistle, which signal shall be answered by a similar blast, given by any approaching steam vessel that may be within hearing. Should such signal be so answered by a steam vessel upon the farther side of such bend, then the usual signals for meeting and passing shall immediately be given and answered; but, if the first alarm signal of such vessel be not answered, she is to consider the channel clear and govern herself accordingly.

When steam vessels are moved from their docks or berths, and other boats are liable to pass from any direction toward them, they shall give the same signal as in the case of vessels meeting at a bend, but immediately after clearing the berths so as to be fully in sight they shall be governed by the steering and sailing rules.

RULE. VIII. When steam vessels are running in the same direction, and the vessel which is astern shall desire to pass on the right or starboard hand of the vessel ahead, she shall give one short blast of the steam whistle as a signal of such desire, and if the vessel ahead answers with one blast, she shall put helm to port; or if she shall desire to pass on the left or port side of the vessel ahead, she shall give two short blasts of the steam whistle as a signal or such desire, and if the vessel ahead answers with two blasts, shall put her helm to starboard; or if the vessel ahead does not think it safe for the vessel astern to attempt to pass at that point, she shall immediately signify the same by giving several short and rapid blasts of the steam whistle, not less than four and under no circumstances shall the vessel astern attempt to pass the vessel ahead until such time as they have reached a point where it can be safely done, when said vessel ahead shall signify her willingness by blowing the proper signals. The vessel ahead shall in no case attempt to cross the bow or crowd upon the course of the passing vessel.

RULE. IX. The whistle signals provided in the rules under this article, for steam vessels meeting, passing, or overtaking, are never to be used except when steamers are in sight of each other, and the course and position of each can be determined in the daytime by a sight of the vessel itself, or by night by seeing its signal lights. In fog, mist, falling snow, or heavy rainstorms, when vessels can not so see each other, fog signals only must be given.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one of the two vessels is to keep out of the way, the other shall keep her course and speed.

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam, that is, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side-lights, shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give

to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and construing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER

ART. 28. When vessels are in sight of one another a steam vessel under way whose engines are going at full speed astern shall indicate that fact by three short blasts on the whistle.

NO VESSEL UNDER ANY CIRCUMSTANCES TO NEGLECT PROPER PRECAUTIONS

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner, or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

ART. 30. The exhibition of any light on board of a vessel of war of the United States or a revenue cutter may be suspended whenever, in the opinion of the Secretary of the Navy, the commander in chief of a squadron, or the commander of a vessel acting singly, the special character of the service may require it.

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime.—A continuous sounding with any fog-signal apparatus, or firing gun.

At night.—First. Flames on the vessel as from a burning tar barrel, oil barrel, and so forth.

Second. A continuous sounding with any fog-signal apparatus, or firing a gun.

RULES FOR LIGHTS FOR CERTAIN CLASSES OF VESSELS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL, AND THE RED RIVER OF THE NORTH, AND RIVERS EMPTYING INTO THE GULF OF MEXICO, AND THEIR TRIBUTARIES

The following rules for lights to be carried by ferryboats, rules for lights for barges and canal boats in tow of steam vessels, rules for lights for rafts and other water craft navigating by hand power, horsepower, or by the current of the river, rule relating to use of searchlights, rule prohibiting unnecessary sounding of the steam whistle, rule prohibiting the carrying of unauthorized lights on steam vessels, and rules relating to drawbridges over navigable water of the United States were adopted by the Board of Supervising Inspectors, Steamboat Inspection Service, and approved by the Secretary of Commerce.

These rules concerning lights shall be complied with in all weathers from sunset to sunrise.

RULES FOR LIGHTS TO BE CARRIED BY FERRYBOATS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL, AND THE RED RIVER OF THE NORTH, AND RIVERS EMPTYING INTO THE GULF OF MEXICO, AND THEIR TRIBUTARIES [4]

Ferryboats propelled by machinery and navigating the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal, and the Red River

[4] See act of Congress approved June 9, 1910, effective on and after July 9, 1910, prescribing lights that shall be carried by certain classes of vessels of not more than 65 feet in length, amendatory of these rules, p. 372.

of the North, and rivers emptying into the Gulf of Mexico, and their tributries, shall carry the range lights and the colored side lights required by law to be carried on steam vessels navigating those waters, except that *double-end ferryboats* shall carry a central range of clear, bright, white lights, showing all around the horizon, placed at equal altitudes forward and aft, also on the starboard side a green light, and on the port side a red light, of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on their respective sides.

The green and red lights shall be fitted with inboard screens projecting at least 3 feet forward from the lights, so as to prevent them from being seen across the bow.

Local inspectors in districts having ferryboats shall, whenever the safety of navigation may require, designate for each line of such boats a certain light, white or colored, which shall show all around the horizon, to designate and distinguish such lines from each other, which light shall be carried on a flagstaff amidships, 15 feet above the white range lights.

RULES FOR LIGHTS FOR BARGES AND CANAL BOATS IN TOW OF STEAM VESSELS AND FOR LIGHTS AND DAY SIGNALS FOR DREDGES, VESSELS WORKING ON WRECKS, ETC., NAVIGATING THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

Lights for barges and canal boats in tow of steam vessels on certain inland waters on the seaboard, except the Hudson River and adjacent waters and Lake Champlain.—On the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and except on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, barges (except scows) and canal boats in tow of steam vessels shall carry lights as follows:

Barges and canal boats towing astern of steam vessels, when towing singly, or what is known as tandem towing, shall each carry a green light on the starboard side and a red light on the port side, and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

When two or more boats are abreast, the colored lights shall be carried at the outer sides of the bows of the outside boats. Each of the outside boats in last tier of a hawser tow shall carry a white light on her stern.

The white light required to be carried on stern of a barge or canal boat carrying red and green side lights shall be carried in a lantern so constructed that it shall show an unbroken light over an arc of the horizon of 12 points of the compass, namely, for 6 points from right aft on each side of the vessel, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles.

Barges or canal boats towing alongside a steam vessel shall, if the deck, deck houses, or cargo of the barge or canal boat be so high above water as to obscure the side lights of the towing steamer when being towed on the starboard side of the steamer, carry a green light upon the starboard side; and when towed on the port side of the steamer, a red light on the port side of the barge or canal boat; and if there is more than one barge or canal boat abreast, the colored lights shall be displayed from the outer side of the outside barges or canal boats.

The colored side lights referred to in these rules for barges and canal boats in tow shall be fitted with inboard screens, so as to prevent them from being seen across the bow, and of such a character as to be visible on a dark night,

with a clear atmosphere, at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on either side. The minimum size of glass globes shall not be less than 6 inches in diameter and 5 inches high in the clear.

Scows when being towed by steam vessels on the waters covered by the first paragraph of these rules shall carry a white light at each end of each scow, except that when such scows are massed in tiers, two or more abreast, each of the outside scows shall carry a white light on its outer bow, and the outside scows in the last tier shall each carry, in addition, a white light on the outer part of the stern. The white light shall be carried not less than 8 feet above the surface of the water, and shall be be so placed as to show an unbroken light all around the horizon, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles.

Lights for barges and canal boats in tow of steam vessels on the Hudson River and adjacent waters and Lake Champlain.—All nondescript vessels known as scows, car floats, lighters, and vessels of similar type, navigating the waters referred to in the following rules, shall carry the lights required to be carried by barges and canal boats in tow of steam vessels, as prescribed in such rules.

Barges and canal boats, when being towed by steam vessels on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, shall carry lights as follows:

Barges and canal boats being towed astern of steam vessels, when towing singly or what is known as tandem towing, shall each carry a white light on the bow and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon: *Provided*, That seagoing barges shall not be required to make any change in their seagoing lights (red and green) on waters coming within the scope of these rules, except that the last vessel of the tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

Barges and canal boats, when towed at a hawser two or more abreast, when in one tier, shall carry a white light on the bow and a white light on the stern of each of the outside boats; when in more than one tier, each of the outside boats shall carry a white light on its bow; and the outside boats in the last tier shall each carry, in addition, a white light on the outer afterpart of the stern.

Barges or canal boats towed alongside a steam vessel, if on the starboard side of said steam vessel, shall display a white light on her own starboard bow; and if on the port side of said steam vessel shall display a white light on her own port bow; and if there is more than one barge or canal boat alongside, the white lights shall be displayed from the outboard side of the outside barge or canal boat: *Provided*, That barges known as car floats when towed alongside shall have a white light at each outboard corner of said barge.

When barges or canal boats are massed in tiers and towed at a hawser, as is usual on the Hudson River, there shall be carried on the forward port side of the port boat of each tier a white light, and on the forward starboard side of the starboard boat in each tier a white light, and on the after port side of the port boat in the stern tier a white light, and on the after starboard side of the starboard boat in the stern tier a white light.

The white bow lights for barges and canal boats referred to in the preceding rules shall be carried at least 10 feet and not more than 30 feet abaft the stem or extreme forward end of the vessel. On barges and canal boats required to carry a white bow light, the white light on bow and the white light on stern shall each be so placed above the hull or deck house as to show an unbroken light all around the horizon, and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles. Dump scows utilized for the transportation and disposal of garbage, street sweepings, ashes,

excavated material, dredgings, etc., when navigating on the Hudson River or East River or the waters tributary thereto between loading points on these waters and the dumping grounds established by competent authority outside the line dividing the high seas from the inland waters of New York Harbor, shall, when towing in tandem, carry, instead of the white lights previously required, red and green side lights on the respective and appropriate sides of the scow in addition to the white light required to be shown by an overtaken vessel. The red and green lights herein prescribed shall be carried at an elevation of not less than 8 feet above the highest deck house, upon substantial uprights, the lights properly screened and so arranged as to show through an arc of the horizon of 10 points of the compass; that is, from right ahead to 2 points abaft the beam on either side and visible on a dark night with a clear atmosphere a distance of at least 2 miles: *Provided*, That nothing in these rules shall be construed as compelling barges or canal boats in tow of steam vessels, passing through any waters coming within the scope of these rules where lights for barges or canal boats are different from those of the waters whereon such vessels are usually employed, to change their lights from those required on the waters from which their trip begins or terminates; but should such vessels engage in local employment on waters requiring different lights from those where they are customarily employed they shall comply with the local rules where employed.

RULES FOR LIGHTS AND DAY SIGNALS TO BE CARRIED BY VESSELS, DREDGES OF ALL TYPES, AND VESSELS WORKING ON WRECKS OR OTHER OBSTRUCTIONS TO NAVIGATION, OR MOORED FOR SUBMARINE OPERATIONS, OR MADE FAST TO A SUNKEN OBJECT WHICH MAY DRIFT WITH THE TIDE OR BE TOWED[5]

Rule for signals to be displayed by a towing vessel when towing a submerged or partly submerged object upon a hawser when no signals are displayed upon the object which is towed.—The vessel having the submerged object in tow shall display by day, where they can best be seen, two shapes, one above the other, not less than 6 feet apart, the lower shape to be carried not less than 10 feet above the deck houses. The shapes shall be in the form of a double frustum of a cone, base to base, not less than 2 feet in diameter at the center nor less than 8 inches at the ends of the cones, and to be not less than 4 feet lengthwise from end to end, the upper shape to be painted in alternate horizontal stripes of black and white, 8 inches in width, and the lower shape to be painted a solid bright red.

By night the towing vessel shall display the regular side lights, but in lieu of the regular white towing lights shall display four lights in a vertical position not less than 3 feet nor more than 6 feet apart, the upper and lower of such lights to be white, and the two middle lights to be red, all of such lights to be of the same character as is now prescribed for the regular towing lights.

Rule for steamers, derrick boats, lighters, or other types of vessels made fast alongside a wreck, or moored over a wreck which is on the bottom or partly submerged or which may be drifting.—Steamers, derrick boats, lighters, or other types of vessels made fast alongside a wreck, or moored over a wreck which is on the bottom or partly submerged, or which may be drifting, shall display by day two shapes of the same character and dimensions and displayed in the same manner as required by the foregoing rule, except that both the shapes shall be painted a solid bright red; but where more than one vessel is working under the above conditions, the shapes need be displayed only from one vessel on each side of the wreck from which it can best be seen from all directions.

By night this situation shall be indicated by the display of a white light from the bow and stern of each outside vessel or lighter not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck.

Rule for dredges which are held in stationary position by moorings or spuds.—Dredges which are held in stationary position by moorings or spuds

[5]Adopted by executive committee of Board of Supervising Inspectors on July 22, 1914, and approved by Secretary of Commerce on July 28, 1914. Adopted by Board of Supervising Inspectors on January 20, 1915, and approved by the Secretary of Commerce on April 12, 1915.

shall display by day two red balls not less than 2 feet in diameter and carried in a vertical line not less than 3 feet nor more than 6 feet apart, and at least 15 feet above the deck house and in such a position where they can best be seen from all directions. By night they shall display a white light at each corner, not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck. When scows are moored alongside a dredge in the foregoing situation they shall display a white light on each outboard corner, not less than 6 feet above the deck.

Rule for self-propelling suction dredges under way with their suctions on the bottom.—Self-propelling suction dredges under way with their suction on the bottom shall display by day the same signals as are used to designate any steamer not under control; that is to say, two black balls not less than 2 feet in diameter and carried not less than 15 feet above the deck house, and where they may best be seen from all directions.

By night they shall carry, in addition to the regular running lights, two red lights of the same character as the masthead light, in the same vertical plane and underneath the masthead light, the red lights to be not less than 3 feet nor more than 6 feet apart and the upper red light to be not less than 4 feet and not more than 6 feet below the white masthead light, and on or near the stern two red lights in the same vertical plane not less than 4 feet nor more than 6 feet apart, to show through 4 points of the compass; that is, from right astern to 2 points on each quarter.

Rule for vessels which are moored or anchored and engaged in laying pipe or operating on submarine construction or excavation.—Vessels which are moored or anchored, and engaged in laying pipe or operating on submarine construction or excavation shall display by day, not less than 15 feet above the deck, where they can best be seen from all directions, two balls not less than 2 feet in diameter, in a vertical line not less than 3 feet and not more than 6 feet apart, the upper ball to be painted in alternate black and white vertical stripes 6 inches wide, and the lower ball to be painted a solid bright red. By night they shall display three red lights, carried in a vertical line not less than 3 feet nor more than 6 feet apart and not less than 15 feet above the deck, and in such position as may best be seen from all directions.

All the lights required by these special rules for dredges, wrecking boats, lighters, etc., shall be of such size and character as to be visible on a dark night with a clear atmosphere for a distance of at least 2 miles.

Rule for vessels which are moored or at anchor.—Vessels of more than 300 gross tons propelled by machinery when moored or anchored in a fairway or channel where traffic is liable to congestion or confusion shall display between sunrise and sunset on the forward part of the vessel where it can best be observed from other vessels one black ball or shape not less than 2 feet in diameter.

RULES FOR LIGHTS FOR RAFTS AND OTHER WATER CRAFT NAVIGATING BY HAND POWER, HORSEPOWER, OR BY THE CURRENT OF THE RIVER, ON THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

Any vessel, except rafts and rowing boats under oars, navigating by *hand power, horsepower, or by the current of the river*, shall carry one white light forward, not less than 8 feet above the surface of the water.

Rafts propelled by hand power or by the current of the river, or which shall be anchored or moored in or near a channel or fairway, shall carry white lights, as follows: Rafts of one crib and not more than two in length shall carry one white light. Rafts of three or more cribs in length and one crib in width shall carry one white light at each end of the raft. Rafts of more than one crib abreast shall carry one white light on each outside corner of the raft, making four lights in all.

The *white light* required by these rules for rafts and other water craft shall be carried, from sunset to sunrise, in a lantern so fixed and constructed as to show a clear, uniform, and unbroken light, visible all around the horizon and of such intensity as to be visible on a dark night with a clear atmosphere at a distance of at least 1 mile. The lights for rafts shall be suspended from

poles of such height that the lights shall not be less than 8 feet above the surface of the water.

Rule prohibiting the carrying of unauthorized lights on steam vessels.—Any master or pilot of any steam vessel who shall authorize or permit the carrying of any light, electric or otherwise, not required by law, on the outside structure of the cabin or hull of the vessel that in any way will interfere with distinguishing the signal lights shall, upon conviction thereof before any board of inspectors having jurisdiction, be deemed guilty of misconduct and shall be liable to have his license suspended or revoked.

REGULATION OF MOTOR BOATS

AN ACT To amend laws for preventing collision of vessels and to regulate equipment of certain motor boats on the navigable waters of the United States

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the words "motor boat" where used in this act shall include every vessel propelled by machinery and not more than sixty-five feet in length except tug boats and tow boats propelled by steam. The length shall be measured from end to end over the deck, excluding sheer: *Provided*, That the engine, boiler, or other operating machinery shall be subject to inspection by the local inspectors of steam vessels, and to their approval of the design thereof, on all said motor boats, which are more than forty feet in length, and which are propelled by machinery driven by steam.

SEC. 2. That motor boats subject to the provisions of this act shall be divided into classes as follows:

Class one. Less than twenty-six feet in length.

Class two. Twenty-six feet or over and less than forty feet in length.

Class three. Forty feet or over and not more than sixty-five feet in length.

SEC. 3. That every motor boat in all weathers from sunset to sunrise shall carry the following lights, and during such time no other lights which may be mistaken for those prescribed shall be exhibited.

(*a*) Every motor boat of class one shall carry the following lights:

First. A white light aft to show all around the horizon.

Second. A combined lantern in the fore part of the vessel and lower than the white light aft showing green to starboard and red to port, so fixed as to throw the light from right ahead to two points abaft the beam on their respective sides.

(*b*) Every motor boat of classes two and three shall carry the following lights:

First. A bright white light in the fore part of the vessel as near the stem as practicable, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side. The glass or lens shall be of not less than the following dimensions:

Class two. Nineteen square inches.

Class three. Thirty-one square inches.

Second. A white light aft to show all around the horizon.

Third. On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side. On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side. The glasses or lenses in the said side lights shall be of not less than the following dimensions on motor boats of—

Class two, Sixteen square inches.

Class three, Twenty-five square inches.

On and after July first, nineteen hundred and eleven, all glasses or lenses prescribed by paragraph (b) of section three shall be fresnel or fluted. The said lights shall be fitted with inboard screens of sufficient height and so set as to prevent these lights from being seen across the bow and shall be of not less than the following dimensions on motor boats of—

Class two. Eighteen inches long.

Class three. Twenty-four inches long: *Provided*, That motor boats as defined in this act, when propelled by sail and machinery or under sail alone,

shall carry the colored lights suitably screened but not the white lights prescribed by this section.

SEC. 4. (a) Every motor boat under the provisions of this act shall be provided with a whistle or other sound producing mechanical appliance capable of producing a blast of two seconds or more in duration, and in the case of such boats so provided a blast of at least two seconds shall be deemed a prolonged blast within the meaning of the law.

(b) Every motor boat of class two or three shall carry an efficient fog horn.

(c) Every motor boat of class two or three shall be provided with an efficient bell, which shall be not less than eight inches across the mouth on board of vessels of class three.

SEC. 5. That every motor boat subject to any of the provisions of this act, and also all vessels propelled by machinery other than by steam more than sixty-five feet in length, shall carry either life preservers or life belts or buoyant cushions, or ring buoys, or other device, to be prescribed by the Secretary of Commerce, sufficient to sustain afloat every person on board and so placed as to be readily accessible. All motor boats carrying passengers for hire shall carry one life preserver of the sort prescribed by the regulations of the Board of Supervising Inspectors for every passenger carried, and no such boat while so carrying passengers for hire shall be operated or navigated except in charge of a person duly licensed for such service by the local board of inspectors. No examination shall be required as the condition of obtaining such a license, and any such license shall be revoked or suspended by the local board of inspectors for misconduct, gross negligence, recklessness in navigation, intemperance, or violation of law on the part of the holder, and if revoked the person holding such license shall be incapable of obtaining another such license for one year from the date of revocation: *Provided*, That motor boats shall not be required to carry licensed officers except as required in this act.

SEC. 6. That every motor boat and also every vessel propelled by machinery other than by steam, more than sixty-five feet in length, shall carry ready for immediate use the means of promptly and effectually extinguishing burning gasoline.

SEC. 7. That a fine not exceeding one hundred dollars may be imposed for any violation of this act. The motor boat shall be liable for the said penalty and may be seized and proceeded against, by way of libel in the district court of the United States for any district within which such vessel may be found.

SEC. 8. That the Secretary of Commerce shall make such regulations as may be necessary to secure the proper execution of this act by collectors of customs and other officers of the Government. And the Secretary of the Department of Commerce, may upon application therefor, remit or mitigate any fine, penalty, or forfeiture relating to motor boats except for failure to observe the provisions of section six of this act.

SEC. 9. That all laws and parts of laws only in so far as they are in conflict herewith are hereby repealed: *Provided*, That nothing in this act shall be deemed to alter or amend acts of Congress embodying or revising international rules for preventing collisions at sea.

SEC. 10. That this act shall take effect on and after thirty days after its approval.

Approved, June 9, 1910.

REGULATIONS FOR TOWS OF SEAGOING BARGES WITHIN INLAND WATERS

The following regulations limit the length of hawsers between towing vessels and seagoing barges in tow and the length of such tows within inland waters of the United States, designated and defined from time to time pursuant to section 2 of the act approved February 19, 1895. These regulations have been prepared and are approved by the Secretary of Commerce pursuant to section 14 of the act approved May 28, 1908, entitled "An act to amend the laws relating to navigation, and for other purposes."

The suspension of these regulations on June 4, 1917, "for the duration of the war or until further notice," has expired by limitation, and said regulations are in full force and effect on and after December 21, 1923.

1. Tows of seagoing barges navigating the inland waters of the United States are limited in length to five vessels, including the towing vessel or vessels.

2. Hawsers are limited in length to 75 fathoms, measured from the stern of one vessel to the bow of the following vessel; and should in all cases be as much shorter as the weather or sea will permit.

3. In cases where the prescribed length of hawser is, in the opinion of the master of the towing vessel, dangerous on account of the state of weather or sea, hawsers need not be shortened to that length until reaching the localities named below:

(*a*) Tows bound for Hampton Roads or beyond, before passing Thimble Light.

(*b*) Tows bound up the Chesapeake, to the northward of Baltimore Light.

(*c*) Tows bound up the Deleware, between Fourteen Foot Bank and Cross Ledge lighthouses.

Hawsers may also be lengthened in the same places, under the same circumstances, when tows are bound out.

4. In case of necessity, on account of wind or weather, hawsers of vessels navigating between Race Rock and Gay Head may be lengthened out in the discretion of the master of the towing vessel; but this paragraph shall not apply to Narragansett Bay north of Beavertail Light.

5. In all cases where tows can be bunched it should be done.

(*a*) Tows navigating in the North and East Rivers of New York must be bunched above a line drawn between the Robbins Reef Lighthouse and Owls Head, Brooklyn, but the quarantine anchorage and the north entrance to Ambrose Channel shall be avoided in the process of bunching tows. When tows are entering Long Island Sound from the westward, the lines may be lengthened out to the prescribed length after passing Fort Schuyler; and when bound for New York from Long Island Sound tows must be bunched before passing Whitestone Point.

(b) Tows must be bunched above the mouth of the Schuylkill River, Pa.

6. Section 15 of the act approved May 28, 1908, provides:

> That the master of the towing vessel shall be liable to the suspension or revocation of his license for any willful violation of regulations issued pursuant to section 14 in the manner now prescribed for incompetency, misconduct, or unskillfulness.

7. Any violation of these regulations shall be reported in writing as soon as practicable to the board of local inspectors of steam vessels most convenient to the officer or other person who may witness the violation.

Meteorological table compiled by the United States Weather Bureau

NANTUCKET, MASS.

Month	Barometer at 32° F. and mean sea level				Air temperature, in ° F.							Average relative humidity	Average amount of clouds 0-10	Precipitation			Wind											Number of days with winds of 40 miles or over	Number of days fog
	Mean	Extremes			Mean				Extremes								Statute miles		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month	Highest	Lowest	Range	For month	Mean maximum	Mean minimum	Range	Highest	Lowest	Range			Average fall	Number of days 0.01 inch or more	Maximum fall in 24 hours	Average hourly velocity	Highest velocity	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.04	30.99	28.82	2.17	31.3	37.5	25.1	12.4	57	−4	61	80	7	3.42	14	2.47	16	85	6	6	3	4	5	9	14	15	0	4	4
February	30.04	30.97	28.89	2.08	30.7	36.8	24.7	12.1	59	−6	65	79	6	3.11	12	2.77	16	72	7	5	2	3	3	8	15	13	0	4	3
March	29.98	30.87	28.47	2.40	35.5	41.0	30.0	11.0	68	6	62	82	6	3.98	13	3.22	16	86	7	6	4	6	6	13	9	11	0	4	6
April	29.97	30.68	29.13	1.55	43.4	49.0	37.7	11.3	74	15	59	83	6	2.64	12	2.51	15	79	6	8	2	6	8	14	8	8	0	3	5
May	29.99	30.54	29.38	1.16	52.3	58.3	46.3	12.0	86	34	52	85	6	2.67	11	2.78	14	60	5	8	5	6	7	20	7	4	0	1	8
June	29.98	30.49	29.31	1.18	61.0	67.4	54.5	12.9	90	43	47	86	5	2.41	10	3.74	13	55	5	9	4	5	7	20	7	3	0	1	8
July	29.98	30.51	29.41	1.05	67.8	74.0	61.5	12.5	92	48	44	88	5	2.68	9	3.04	12	65	3	6	2	5	8	27	7	4	0	1	10
August	29.99	30.45	28.71	1.74	67.8	73.7	61.9	11.8	89	51	38	87	5	3.05	9	5.73	11	55	5	11	4	6	8	18	6	4	0	1	8
September	30.08	30.63	29.48	1.15	62.8	68.3	57.3	11.0	87	41	46	84	5	2.73	9	3.15	12	59	6	11	6	5	9	14	5	4	0	1	6
October	30.05	30.61	29.35	1.26	54.2	59.6	48.7	10.9	81	33	48	82	6	3.39	10	3.86	14	60	7	9	6	7	4	11	9	9	0	2	3
November	30.05	30.80	29.15	1.65	44.4	49.8	39.0	10.8	66	15	51	80	6	3.28	12	2.88	15	79	8	5	2	4	4	9	14	11	0	3	2
December	30.05	30.91	28.73	2.18	35.8	41.6	29.9	11.7	60	−1	61	79	6	3.64	13	2.62	16	76	6	6	3	5	3	8	16	15	0	4	2
Mean	30.02				48.9	54.8	43.0	11.8				83	6				14												
Total														37.00	134				71	90	43	62	72	171	117	104	0	29	65

Meteorological table compiled by the United States Weather Bureau

PROVIDENCE, R. I.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in ° F.: Mean: For month	Air temperature: Mean: Mean maxi.	Air temperature: Mean: Mean mini.	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds 0-10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Maximum fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over	Number of days fog
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.06	30.99	28.85	2.14	27.2	36.8	21.1	15.7	64	-9	73	73	6	4.38	13	2.07	14	79	10	4	1	6	3	8	9	16	5	5	2
February	30.05	31.02	29.01	2.01	29.0	35.0	19.0	16.0	62	-10	72	72	5	4.42	11	2.01	15	68	6	4	2	3	3	6	13	19	0	5	1
March	29.98	30.91	28.88	2.03	35.7	45.0	28.4	16.6	84	4	80	70	5	4.62	12	1.60	15	72	7	5	2	8	4	8	10	18	0	5	1
April	29.98	30.72	28.87	1.85	46.6	55.7	37.8	17.9	86	11	75	68	6	3.76	12	2.16	14	67	6	6	3	10	6	5	9	14	1	3	1
May	29.98	30.52	29.32	1.20	58.5	66.5	47.8	18.7	92	32	60	68	5	3.46	12	2.48	13	55	6	8	4	12	7	9	7	9	0	2	1
June	29.97	30.51	29.30	1.21	68.3	75.3	56.4	18.9	96	42	54	71	5	3.14	10	3.03	11	61	8	8	2	8	5	11	10	8	0	1	1
July	29.97	30.47	29.43	1.04	73.4	80.7	62.9	17.9	100	51	49	74	5	3.52	10	3.83	10	53	5	5	3	7	10	15	8	9	0	1	1
August	29.99	30.46	29.18	1.28	71.0	78.4	60.8	17.6	97	46	51	77	5	4.05	9	2.31	10	53	7	9	3	6	8	11	8	10	0	1	(1)
September	30.07	30.64	29.42	1.22	63.2	72.1	54.2	17.9	92	33	59	78	5	3.17	9	3.41	11	62	10	7	2	7	8	8	7	11	0	1	1
October	30.05	30.64	29.22	1.42	52.2	62.6	44.8	17.8	87	27	60	76	5	3.84	9	3.13	12	60	9	7	3	4	5	8	10	16	0	2	1
November	30.07	30.75	28.74	2.01	40.4	49.3	34.2	15.1	75	12	63	72	5	3.90	10	1.66	13	67	6	5	1	3	4	8	15	17	1	4	1
December	30.06	30.82	28.94	1.88	31.6	38.9	24.6	14.3	68	42	80	74	6	3.88	10	2.05	14	82	8	3	1	3	3	9	16	19	0	4	2
Mean	30.02				49.8	58.1	41.0	17.1				73	5				13												
Total														46.14	127				88	71	27	77	66	106	122	166	7	34	13

[1] Less than 1.

Meteorological table compiled by the United States Weather Bureau

BLOCK ISLAND, R. I.

Month	Barometer at 32° F. and mean sea level				Air temperature, in ° F.							Average relative humidity	Average amount of clouds 0-10	Precipitation			Wind											
	Mean	Extremes			Mean				Extremes								Statute miles		Average number of times (observations at 8 a. m. and 8 p. m.) from—									Number of days with winds of 40 miles or over	Number of days fog
	For month	Highest	Lowest	Range	For month	Mean max.	Mean min.	Range	Highest	Lowest	Range			Average fall	Number of days 0.01 inch or more	Maximum fall in 24 hours	Average hourly velocity	Highest velocity	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.07	30.96	28.80	2.16	31.0	37.0	25.0	12.0	59	−4	63	77	6	3.86	13	2.90	20	80	7	5	3	4	5	12	10	16	0	10	3
February	30.06	30.98	28.72	2.26	30.4	36.2	24.6	11.6	58	−6	64	77	5	4.29	11	4.54	20	78	10	4	2	4	2	9	10	15	0	9	2
March	29.98	30.94	28.72	2.22	35.4	40.8	30.0	10.8	68	6	62	80	5	4.37	13	4.29	19	84	5	6	5	5	5	14	9	13	0	8	4
April	29.98	30.75	29.10	1.65	44.0	49.4	38.6	10.8	78	14	64	81	5	3.62	11	3.73	17	72	3	7	5	4	7	13	10	11	0	4	4
May	29.99	30.52	29.32	1.20	52.8	58.5	47.2	11.3	82	31	51	86	5	3.75	11	3.19	15	72	2	7	6	6	7	19	8	7	0	2	7
June	29.97	30.54	29.32	1.22	61.8	67.6	56.0	11.6	88	44	44	87	5	2.87	9	4.93	14	72	3	8	5	5	6	21	8	4	0	1	7
July	29.97	30.52	29.46	1.06	68.4	73.9	62.8	11.1	92	52	40	87	5	3.31	10	6.22	13	60	3	4	4	4	11	21	9	6	0	1	7
August	29.99	30.48	28.96	1.52	68.5	73.6	63.3	10.3	90	49	41	86	5	3.48	9	3.62	12	72	3	8	6	5	7	18	7	8	0	1	4
September	30.08	30.62	29.40	1.22	63.4	68.4	58.3	10.1	86	38	48	84	5	3.00	9	4.88	14	84	6	8	6	6	8	15	4	7	0	2	4
October	30.05	30.64	29.35	1.29	54.9	59.8	49.9	9.9	77	30	47	80	5	4.11	9	3.46	17	84	7	8	4	5	5	14	6	13	0	5	2
November	30.06	30.82	28.51	2.31	44.6	49.7	39.4	10.3	70	14	56	77	6	3.88	10	4.54	19	90	6	6	2	3	3	11	12	17	0	7	1
December	30.06	30.92	28.77	2.15	36.0	41.6	30.3	11.3	60	−6	66	76	6	3.82	11	2.52	20	86	6	4	2	2	4	14	14	16	0	9	2
Mean	30.02				49.3	54.7	43.8	10.9				82	5				17												
Total														44.36	126				61	75	50	53	70	181	107	133	0	59	47

Meteorological table compiled by the United States Weather Bureau

NEW LONDON, CONN.

Month	Barometer at 32° F. and mean sea level				Air temperature, in ° F.							Average relative humidity	Average amount of clouds 0-10	Precipitation			Wind											Number of days with winds of 40 miles or over	Number of days fog
	Mean	Extremes			Mean				Extremes								Statute miles		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month	Highest	Lowest	Range	For month	Mean maxi.	Mean mini.	Range	Highest	Lowest	Range			Average fall	Number of days 0.01 inch or more	Maximum fall in 24 hours	Average hourly velocity	Highest velocity	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
	Ins.	Ins.	Ins.	Ins.								%		Ins.		Ins.													
January	30.08	30.82	28.90	1.92	29.0	36.4	21.7	14.7	65	−10	75	75	5	3.94	14	2.85	7.9	54	12	6	2	2	3	8	1	18	0	1	2
February	30.08	30.86	28.85	2.01	29.7	37.3	23.0	14.3	65	−14	71	74	5	3.77	13	6.66	8.8	80	11	4	3	3	2	6	10	17	0	1	2
March	29.99	30.57	29.07	1.57	35.1	42.4	28.0	14.4	64	4	60	72	5	4.19	14	2.46	9.0	60	12	5	3	3	4	8	7	20	0	0	2
April	29.98	30.74	29.10	1.64	45.6	53.3	38.1	15.2	79	19	60	70	5	3.57	12	2.38	8.1	40	8	6	3	7	8	9	6	13	0	0	2
May	29.98	30.48	29.29	1.19	56.4	64.1	48.3	15.8	93	31	62	73	5	3.37	12	2.05	7.0	44	7	8	5	13	3	12	5	9	0	0	3
June	29.98	30.50	29.57	0.93	65.6	73.1	57.4	15.7	95	43	52	77	5	3.03	10	5.97	6.0	36	6	5	3	9	9	13	8	7	0	0	2
July	29.97	30.49	29.58	0.91	71.0	71.9	63.3	14.6	93	51	42	78	5	3.68	12	1.71	5.8	48	5	2	4	7	11	16	8	9	0	0	1
August	30.00	30.31	29.57	0.74	69.7	76.5	62.4	14.1	92	47	45	79	5	4.27	10	3.71	5.4	57	8	2	3	6	7	12	9	15	0	0	1
September	30.08	30.58	29.43	1.15	63.2	70.8	56.2	14.6	93	35	58	78	5	3.45	11	1.90	6.2	41	9	6	3	4	12	13	3	10	0	0	1
October	30.06	30.58	29.35	1.23	53.1	61.0	45.2	15.8	83	27	56	76	5	3.75	11	2.88	7.1	63	10	9	4	3	4	9	9	14	0	0	1
November	30.07	30.81	29.32	1.49	41.9	49.8	35.5	14.3	72	4	68	73	5	3.67	12	2.54	7.9	63	9	7	2	2	4	8	12	16	0	1	1
December	30.08	30.90	29.36	1.54	32.6	40.7	26.2	14.5	60	−8	68	74	5	3.67	12	2.27	7.8	69	10	5	1	2	3	8	14	19	0	1	1
Mean	30.02				49.5	57.0	42.1	14.9				75	5				7.2												
Total														44.36	143				107	65	36	61	70	122	102	167	0	4	19

Meteorological table compiled by the United States Weather Bureau

HARTFORD, CONN.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in ° F.: Mean: For month	Air temperature: Mean: Mean maximum	Air temperature: Mean: Mean minimum	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds 0-10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Maximum fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over.	Number of days fog.
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.07	31.01	28.67	2.34	27.6	35.4	19.8	15.6	67	−12	79	71	6	3.83	12	1.95	8	58	13	3	1	2	11	12	3	17	0	1	1
February	30.06	31.06	28.89	2.17	26.3	34.1	17.8	16.3	61	−14	75	69	5	3.55	10	3.04	8	54	13	2	1	1	7	11	4	17	0	(1)	1
March	29.99	30.91	28.90	2.01	37.0	45.3	28.2	17.1	82	4	78	67	5	4.32	12	2.66	9	49	12	3	1	2	12	7	7	18	0	(1)	1
April	29.99	30.70	29.02	1.68	47.8	57.2	38.4	18.8	90	11	79	66	6	3.57	12	3.73	9	42	8	5	3	3	12	8	4	17	0	(1)	1
May	29.98	30.51	29.37	1.14	58.7	68.4	48.7	19.7	94	32	62	68	6	3.54	12	3.18	8	40	11	6	2	3	18	8	3	11	0	(1)	(1)
June	29.97	30.51	29.29	1.22	66.9	77.0	57.1	19.9	98	40	58	71	6	3.08	10	2.52	7	37	11	5	2	3	15	12	3	9	0	0	(1)
July	29.97	30.45	29.43	1.02	72.9	82.3	63.2	19.1	100	48	52	74	6	4.11	11	2.62	7	40	9	4	2	2	22	11	3	9	0	(1)	1
August	29.99	30.48	29.46	1.02	70.2	79.7	60.6	19.1	100	43	57	76	5	4.56	10	3.61	6	32	12	5	2	3	20	8	2	10	0	0	1
September	30.07	30.59	29.09	1.50	63.8	73.3	54.1	19.2	95	32	63	78	5	3.50	9	4.60	6	40	15	4	2	4	17	7	3	8	0	(1)	2
October	30.06	30.63	29.25	1.38	53.6	63.3	43.8	19.5	90	25	65	75	5	3.86	8	4.67	7	54	14	3	2	4	12	10	3	14	0	(1)	2
November	30.08	30.62	28.75	1.87	41.3	49.1	33.6	15.5	74	6	68	71	5	3.82	10	2.63	8	48	11	3	2	2	8	13	5	16	0	(1)	1
December	30.07	30.85	29.00	1.85	30.2	37.6	23.6	14.0	67	−18	85	72	6	3.57	10	2.24	7	58	13	2	1	1	9	15	6	15	0	(1)	1
Mean	30.02				49.8	58.6	40.8					71	5																
Total														45.31	126				142	45	21	30	163	122	46	161	0	1	12

[1] Less than 1.

Meteorological table compiled by the United States Weather Bureau

NEW HAVEN, CONN.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in ° F.: Mean: For month	Air temperature: Mean: Mean maximum	Air temperature: Mean: Mean minimum	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds 0–10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Maximum fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over	Number of days fog
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.08	31.00	28.76	2.24	28.2	35.9	20.6	15.3	65	−14	79	73	5	3.91	13	2.74	9	.....	11	10	2	3	6	8	9	13	0	1	2
February	30.07	31.04	28.76	2.28	29.0	36.8	21.3	15.5	67	−11	78	71	4	3.75	11	4.13	10	.....	11	7	2	2	3	9	9	12	0	1	1
March	29.99	30.94	28.27	2.67	35.8	43.7	27.9	15.8	84	0	84	70	5	4.45	12	4.78	10	.....	10	11	2	5	7	7	8	12	0	1	2
April	29.99	30.72	29.04	1.68	47.2	55.7	38.6	17.1	91	13	78	68	5	3.56	12	5.90	9	.....	10	7	5	7	7	6	7	11	0	1	1
May	29.99	30.53	29.22	1.31	57.9	67.0	48.9	18.1	93	30	63	70	5	3.64	12	3.32	8	.....	7	9	3	11	11	8	5	8	0	0	1
June	29.97	30.56	29.30	1.26	66.6	75.6	57.7	17.9	96	41	55	73	4	3.17	10	4.79	7	.....	7	9	3	6	10	11	6	8	0	0	1
July	29.97	30.51	29.45	1.06	71.8	80.2	63.3	16.9	99	49	50	75	4	4.78	11	7.00	7	.....	6	6	2	7	15	10	6	9	1	0	(1)
August	29.99	30.47	29.44	1.03	70.3	78.6	62.0	16.6	98	45	53	78	4	4.99	10	8.73	7	.....	13	8	3	5	11	10	5	7	0	0	(1)
September	30.07	30.64	29.27	1.37	63.5	72.3	54.8	17.5	100	32	68	77	4	3.79	9	6.69	8	.....	13	7	4	5	9	9	4	9	0	0	(1)
October	30.06	30.79	29.24	1.55	53.8	62.5	45.1	17.4	89	24	65	75	4	3.92	9	5.19	8	.....	13	10	2	3	6	9	7	12	0	0	(1)
November	30.07	30.84	28.65	2.19	42.0	49.7	34.3	15.4	73	2	71	74	5	3.58	9	3.13	9	.....	13	6	1	2	4	10	11	13	0	1	1
December	30.07	30.94	28.87	2.07	32.5	39.8	25.1	14.7	68	−12	80	73	5	3.65	11	3.75	9	.....	10	9	1	1	3	15	11	12	0	0	1
Mean	30.02	.....	.....	.....	49.9	58.2	41.6	16.6	.....	.....	.....	73	5	.....	.....	.....	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47.19	129	.....	.....	.....	124	99	30	57	92	112	88	126	1	5	11

[1] Less than 1.

Meteorological table compiled by the United States Weather Bureau

NEW YORK, N. Y.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in ° F.: Mean: For month	Air temperature: Mean: Mean max.	Air temperature: Mean: Mean min.	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds 0-10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Maximum fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over	Number of days fog
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.10	30.97	28.61	2.36	30.9	37.4	24.5	12.9	67	−6	73	72	6	3.79	12	2.48	20	86	4	7	4	3	5	8	14	16	1	12	3
February	30.08	31.00	28.70	2.30	31.3	38.4	24.2	14.2	69	−7	76	69	6	3.74	10	3.25	20	96	5	5	4	2	4	6	13	17	0	10	3
March	30.00	30.95	28.38	2.57	37.7	45.4	30.2	15.2	80	3	77	68	6	4.10	12	3.60	21	92	4	8	7	4	6	6	10	17	0	14	3
April	30.00	30.68	29.14	1.54	49.4	57.2	41.6	15.6	91	12	79	67	6	3.30	11	3.73	18	84	4	7	7	5	7	5	9	16	0	10	2
May	29.99	30.52	29.13	1.39	60.6	68.5	52.6	15.9	95	34	61	69	6	3.18	11	4.17	16	90	3	6	10	7	9	9	7	11	0	6	2
June	29.98	30.56	29.34	1.22	68.8	77.0	60.5	16.5	97	45	52	72	6	3.26	10	3.88	14	75	4	7	5	6	10	8	8	9	3	5	1
July	29.98	30.51	28.46	1.05	73.8	81.7	65.9	15.8	99	50	49	72	6	4.54	12	3.80	14	88	4	5	3	5	12	11	10	12	0	5	1
August	30.00	30.44	29.28	1.16	73.1	80.1	66.2	13.9	102	51	51	74	6	4.53	10	5.05	13	76	4	8	7	6	12	8	7	10	0	3	(1)
September	30.08	30.61	29.19	1.42	66.8	73.7	59.8	13.9	100	39	61	74	5	3.59	9	6.17	14	80	5	7	8	6	10	8	6	10	0	3	1
October	30.06	30.66	29.15	1.51	56.3	63.7	49.0	14.7	88	29	59	72	5	3.71	9	9.40	16	76	6	8	4	6	6	7	12	13	0	6	2
November	30.00	30.80	28.70	2.10	44.2	51.0	37.3	13.7	74	7	67	71	6	3.44	9	0.62	19	77	4	5	3	1	5	6	17	19	0	10	2
December	30.00	30.93	28.96	1.97	35.0	41.2	28.8	12.4	68	−13	81	72	6	3.45	10	2.93	19	90	4	6	3	2	5	9	15	18	0	11	3
Mean	30.04				52.3	59.6	45.0	14.6				71	6				17												
Total														44.63	125				51	79	65	53	91	91	128	168	4	95	24

[1] Less than 1.

Meteorological table compiled by the United States Weather Bureau

ALBANY, N. Y.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in ° F.: Mean: For month	Air temperature: Mean: Mean max.	Air temperature: Mean: Mean min.	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds 0-10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Maximum fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over	Number of days fog
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.07	31.10	28.46	2.64	23.1	31.2	15.0	16.2	64	−24	88	79	6	2.59	13	1.62	8	60	9	6	1	4	15	6	5	16	0	(1)0	2
February	30.07	31.10	28.86	2.24	24.1	32.2	16.1	16.1	63	−20	83	78	6	2.52	11	1.92	8	70	9	7	1	4	12	2	4	17	0	(1)	1
March	30.01	30.92	28.96	1.96	32.7	40.7	24.7	16.0	79	−8	87	75	6	2.74	12	2.29	9	54	8	6	1	5	16	3	5	18	0	(1)	1
April	30.00	30.69	29.12	1.57	46.8	55.9	37.7	18.2	91	9	82	68	6	2.39	12	2.02	8	48	8	6	1	5	13	4	7	16	0	(1)	(1)
May	29.98	30.54	29.29	1.25	59.3	69.1	49.5	19.6	97	29	68	67	6	2.98	12	2.19	8	42	8	4	1	5	21	4	7	12	0	(1)	(1)
June	29.97	30.50	29.22	1.28	68.0	77.7	58.2	19.5	99	40	59	70	5	3.76	12	2.95	7	48	8	4	2	8	18	5	5	10	0	0	(1)
July	29.96	30.55	29.50	1.05	72.6	82.2	63.0	19.2	104	48	56	71	5	3.90	12	3.12	6	70	5	4	2	7	22	6	6	10	0	(1)	1
August	29.98	30.51	29.36	1.15	70.8	80.1	61.4	18.7	102	43	59	74	5	3.96	11	2.90	6	44	8	5	2	7	22	4	4	10	0	(1)	1
September	30.07	30.65	29.23	1.42	63.1	72.4	53.8	18.6	97	32	65	77	5	3.18	10	3.27	6	39	8	7	1	6	20	4	4	10	0	(1)0	3
October	30.06	30.72	29.18	1.54	52.1	60.7	43.5	17.2	90	23	67	78	6	2.99	10	4.75	7	70	8	6	1	6	17	6	5	13	0	(1)	4
November	30.06	30.80	29.00	1.80	39.3	46.4	32.2	14.2	72	−10	82	78	6	2.80	11	2.46	8	52	9	4	1	4	16	5	5	16	0	(1)	2
December	30.06	30.94	29.07	1.87	28.5	35.4	21.6	13.8	66	−19	85	79	7	2.57	11	2.39	8	60	9	5	1	4	18	5	4	16	0	(1)0	1
Mean	30.03				48.4	57.0	39.7	17.3				74	6				7												
Total														36.38	137				97	64	15	65	210	54	61	164	0	1	16

[1] Less than 1.

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