# CHAPTER 3

## EAST COAST OF INDIA—THE ORISSA COAST, GODAVARI POINT TO BALISAHI POINT

Part A. Godavari Point to Ganjam
Part B. Ganjam to Balisahi Point

PLAN.—This chapter continues with the description of the east coast of India from Godavari Point northeastward to Balisahi Point, and includes Cocanada, Vishakhapatnam, Bimlipatam, Kalingapatam, Puri, False Point, Shortt Island, Dhamra River, and Chandbali.

### GENERAL REMARKS

3-1 THE ORISSA COAST commences northward of Cocanada and extends to the entrance of the Hooghly River, or from 17° 00'N. to 21°45'N. The south part of the Orissa Coast, from Cocanada to Ganjam in 19°23'N., is generally known as the Northern Circars, while the name Orissa commonly refers to that part of the coast northeastward of Ganjam.

BALISAHI POINT is about 8 miles northwestward of SHORTT ISLAND (20°47'N., 87° 05'E.). From Godavari Point to Shortt Island, a distance of approximately 360 miles, the coast varies in appearance. In some places it is low, barren, and sandy; elsewhere it is relatively high and densely wooded. With the exception of Cocanada Bay and False Bay, there are no indentations of any appreciable size.

The depth curves follow the general contour of the coastline. The 100-fathom curve lies about 15 to 25 miles offshore along this section of the coast from Godavari Point to a position east-southeastward of the mouth of the Devi River (20°00'N., 86°24'E.).

### NAVIGATION

3-2 Navigation offshore of the Orissa Coast between Cocanada and Puri (19°48'N., 85° 50'E.) is safe, there being no off-lying dangers outside the 100-fathom curve. Thence navigation to points and ports northward of Puri is as direct as safety will permit.

### WINDS—WEATHER

3-3 The general characteristics of the winds and weather in the area covered by this chapter have been given in section 2-3.

### CURRENTS—TIDAL CURRENTS

3-4 Currents along the east coast of India have been discussed in section 2-4. See also sections 3A-6 and 3B-5.

### CAUTION—AMMUNITION GROUND

3-5 An ammunition dumping ground lies about 4 miles outside the 100-fathom curve and is centered about 35 miles south-southeastward of the port of Vishakhapatnam (17° 41'N., 83°18'E.); it extends in an east-west direction for approximately 10 miles and is about 5 miles wide.

## PART A. GODAVARI POINT TO GANJAM

3A-1 GODAVARI POINT (16°59'N., 82°20' E.) is the north extremity of a low, sandy spit and narrow sandbank which forms a part of the coastline northward of Hope Island (sec. 2C-9). Godavari Point has been reported (1965) to extend 1/2 mile farther northwestward than charted with depths of 3 to 6 fathoms off the point.

A LIGHT is shown from Godavari Point.

### COAST—GENERAL

3A-2 THE COAST FROM GODAVARI POINT TO GANJAM (19°23'N., 85°04'E.), about 215 miles northeastward is for the most part low and sandy. Many conspicuous hills at various distances inland back the coast. Between Pudimadaka (17°30'N., 83° 00'E.) and Kalingapatam (18°20'N., 84°07'E.) the coast is broken and rocky; in the vicinity of Vishakhapatnam some of the headlands are bold and prominent. From Kalingapatam to Ganjam the coastline is fairly regular with a few slight indentations.

DEPTHS—DANGERS

3A-3 From Godavari Point to Ganjam the 20-fathom curve lies about 2 to 9 miles offshore; the 10-fathom curve lies about 1/2 mile to 6 miles offshore. There are no known or charted dangers between the 10 and 20 fathom curves.

OFF-LYING DANGERS

3A-4 SANTAPILLI ROCKS (18°01'N., 83° 43'E.), with a least depth of 3 feet, lie just within the 10-fathom curve between 5 and 6 miles southeastward of Santapilli Lighthouse. Depths of 6 1/2 to 12 fathoms are charted around these rocks. In fine weather the sea does not break on the rocks and the water over them is not discolored, but with a moderate swell the sea breaks heavily.

Foul ground, the position of which is approximate, exists outside the 20-fathom curve in a depth of 34 fathoms about 13 3/4 miles 101 1/2° from Baruva Light Beacon (18° 53'N., 84°36'E.).

NAVIGATION

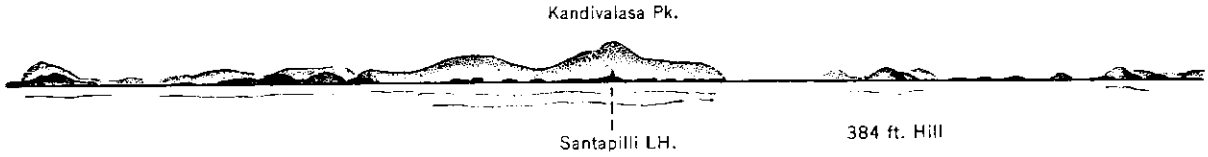
3A-5 The channel between Santapilli Rocks and the mainland is safe only during daylight; at night vessels should keep outside the 20-fathom curve whenever Santapilli Light bears between 322° and 290°.

The summit of an isolated, bare, red, double peaked hill, 384 feet high, about 2 miles northward of Santapilli Lighthouse, in range with Kandivalasa Peak (sec. 3A-29) 304° leads northward of Santapilli Rocks. Santapilli Lighthouse in range with Kandivalasa Peak 322° leads southward of Santapilli Rocks.

CURRENTS—WINDS

3A-6 Between Cocanada and Bimlipatam the current is farther offshore than off Sacramento Shoal (sec. 2C-2 and 2C-4), but its velocity is less. Inshore of this current, slack water is generally found, but sometimes close to the shore tidal currents will be experienced. In July and August the velocity of the offshore current is less than 1 knot.


CLEARING MARK FOR SANTAPILLI ROCKS




KANDIVALASA PEAK IN RANGE WITH SANTAPILLI LH.
Bearing 322°

The currents off the coast from Bimlipatam to Gopalpur between December and June are mainly influenced by the wind, the tidal current, even at springs, having very little effect. In December and January, when northeasterly winds prevail, the current about 1 mile offshore sets steadily southwestward parallel to the coast at a velocity of 1/2 to 3/4 knot.

Toward the end of February the wind hauls around to the southwest, and in March blows steadily from that quarter. In the morning the wind is generally light, but freshens during the afternoon to a force of 5 to 6. The current at this time sets northeastward parallel with the coast; its velocity close inshore is about 1/2 knot. At 10 miles or more off the coast its velocity is frequently 2 to 3 knots.

The greatest velocity of the current observed between Santapilli Rocks (sec. 3A-4) and the mainland was 1 knot.

## COCANADA BAY (17°00'N., 82°19'E.)

3A-7 COCANADA BAY, with its entrance lying between Godavari Point (sec. 3A-1) on the southeast and the coast about 4 miles north-northwestward of the point, is a safe natural harbor. Its shores are low and are subject to inundations during cyclonic storms. In the south part of the bay extensive, drying mud-flats extend from the mouth of the Godavari River, the entrance of which lies between Hope Island and the narrow sandbank and spit which terminates to the northward in Godavari Point. It is reported that the bay has been silting-up for many years and that the mud-flats, formed by the deposited silt, are advancing northward.

NAVIGATION.—Vessels approaching Cocanada Bay, either from the northward or southward, should not approach the coast within depths of less than 10 fathoms by day or 12 fathoms by night.

During the Northeast Monsoon vessels should make a landfall near Pentakota, a town about 25 miles northeastward of Godavari Point, and then navigate along the coast in depths of 12 fathoms or greater.

Vessels should not stand in close to the coast unless sure of their positions; usually a haze over the land reduces visibility during the day to about 8 miles and less.

TIDES—TIDAL CURRENTS.—Tidal current effects are noticeable nearly 1/2 mile off Godavari Point. The current follows the contour of the land with the flood current having a maximum velocity of about 1/2 knot and the ebb current maximum velocities of 1 1/2 to 2 knots.

In Cocanada Bay the flood current sets southwestward and the ebb current sets northeastward. These tidal currents are strong at springs, especially from October to February, and must be taken into consideration when approaching in this vicinity.

Tides at Cocanada are semidiurnal.

TIDAL HEIGHTS ABOVE *CHART DATUM.—MHWS 5.1 feet, MLWS 0.7 feet; MHWN 3.7 feet, MLWN 2.0 feet. *BA Chart 1711-COCANADA Bay (plan).

DEPTHS—DANGERS.—The coastal waters in the approach to Cocanada Bay have shoaled considerable more than shown on the chart. Depths have been reported to be 1 1/2 fathoms less than charted.

A shoal with a depth of 6 1/4 fathoms is charted about 1 1/2 miles northeastward of Godavari Point. A depth of 5 1/4 fathoms lies about 1 1/4 miles northward of the point. Godavari Point is described in section 3A-1. A depth of 7 fathoms was reported about 4 1/2 miles eastward of Vakalapudi Lighthouse. A depth of 4 3/4 fathoms is charted nearly 2 1/4 miles eastward of the same lighthouse.

The bay within or southward of a line drawn from Godavari Point to Vakalapudi Lighthouse is shallow. Depths (1958) southward of this line decrease gradually from 4 fathoms and less to about 1 foot near the mud flats in the south part of the bay. A depth of about 1 foot exists over the bar in the entrance of the Godavari River; only small boats can navigate the river. Near the west shore of the bay depths of 4 1/2 feet (1958) lie close to the entrance of the channel which leads to the port of Cocanada. Controlling depths of 4 to 4 1/2 feet were reported (1962) to exist over the bar at the entrance of the channel.

A WRECK with a depth of 3 1/4 fathoms over it lies about 1 1/2 miles 308° from Godavari Point Lighthouse.

Dangerous WRECKS lie in the following positions, distances and bearings from Vakalapudi Lighthouse: a little more than

2 3/4 miles about 099°, 3 1/2 miles 113°, and 2 2/5 miles 118°. A green conical BUOY is moored close northward of the latter wreck.

A black can BUOY moored about 2 miles southward of the light structure on the outer end of the training wall marks a DUMPING GROUND.

ASPECT—LANDMARKS.—Northward of Cocanada the coast appears bold with high land extending northeastward. Southward of Cocanada the shore is low and sandy interspersed with a few sandy hillocks, palmyra trees, and low jungle.

Conspicuous landmarks in the approach to Cocanada Bay are the old lighthouse on Hope Island (sec. 2C-9), Godavari Point Lighthouse, Vakalapudi Lighthouse, and several oil tanks on the north side of the canal leading to Cocanada.

HARBOR.—The harbor for Cocanada comprises the port area within Cocanada Canal adjacent to the town, Cocanada Bay, and an open anchorage outside the bay that will accommodate ocean vessels. Limits of the harbor extend seaward to depths of about 13 fathoms.

A local REGULATION prohibits the discharge of ballast in depths of less than 12 fathoms.

NAVIGATION AIDS.—Vakalapudi Light is shown from a position on the shore about 4 3/4 miles northward of the entrance of the port of Cocanada.

A light is shown from the outer end of the north training wall which extends northeastward from the north side of the entrance of the port.

A beacon, 40 feet high, stands near the shore about 3 1/4 miles northeastward of Vakalapudi Lighthouse.

A pillar, 25 feet high, stands on the shore about 3/4 mile northeastward of Vakalapudi Lighthouse. A beacon, 38 feet high, stands on the shore about 2 1/2 miles south-southwestward and a similar beacon stands in the bay about 7 1/2 miles south-southeastward, respectively, of the same lighthouse.

CHANNEL—CANAL.—The entrance of the port of Cocanada is marked by a buoyed channel, about 5,000 feet long and 300 feet wide with a least depth of 6 feet, which leads southwestward from the west side of the bay and joins the Cocanada Canal.

The canal entrance lies between two training walls (groynes) which project northeastward from the shore. Cocanada is situated about 2 3/4 miles within the entrance of the canal; the canal has a width of about 250 feet and an average depth of 7 feet.

A channel of sufficient depth to enable cargo boats to communicate at all times with vessels in the anchorage is maintained by dredging.

ANCHORAGE.—Eastward of Vakalapudi Lighthouse anchorage in and outside the bay is subject to a great amount of ground swell from the southeastward, even when there is no wind. This anchorage is open to almost all winds from the northeast and southeast quadrants.

Safe anchorage, draft permitting, can be taken in about 3 fathoms, soft mud, with Vakalapudi Lighthouse bearing about 321°, about 2 3/4 miles distant. Vessels anchor here in all seasons and although about 2 miles from the channel entrance, communication with the port is seldom impeded as the sea in the bay is generally smooth. Another anchorage used by shallow-draft vessels is with Vakalapudi Lighthouse bearing 318° about 1 1/2 miles distant. The depth at this anchorage was about 3 fathoms (1958). Very little tidal current exists at these anchorages; it is usually slack during the rising tide and sets northeastward during the falling tide.

During the Northeast Monsoon anchorage for vessels of suitable draft may be had in depths of about 3 1/4 fathoms southwestward of Godavari Point with Vakalapudi Lighthouse bearing 316° about 3 3/4 miles distant.

In November 1965 a vessel was anchored in depths of about 4 to 5 fathoms in the lee of and about 750 yards westward of the west side of the tip of Godavari Point. In this position Godavari Point Lighthouse bore 110°, Vakalapudi Lighthouse 310°, and the light structure on the outer end of the training wall 235°.

At night vessels can anchor when the depths decrease to 7 or 8 fathoms with Vakalapudi Light bearing 285°.

DIRECTIONS.—The recommended approaches to the anchorage for vessels during the Northeast Monsoon are from the northeastward. By day when Vakalapudi Lighthouse bears about 248° course should be

shaped for the anchorage. At night Vakalapudi Light should be steered for on a course of 248° until the depths decrease to 10 fathoms; thence course should be altered to about 230° and when the light on the outer end of the training wall at the entrance of the port is sighted, this light should be steered for on a course of 230°. On this course vessels can anchor in depths of 7 to 8 fathoms when Vakalapudi Light bears 285°.

Attention is directed to DEPTHS and DANGERS in this section.

STORM SIGNALS.—Storm and weather signals are displayed at Vakalapudi Lighthouse in accordance with the Indian Extended System. See section 1-34.

See Appendix for Cocanada Meteorological Table.

SIGNAL STATION.—A signal station, which is in telephonic communication with the port office, is located at the lighthouse. Morse Code signals can be transmitted to the signal station between the hours of 0400 and 0600 and between 1800 and 2400.

3A-8 COCANADA (Kakinada) (16°56'N., 82° 15'E.), primarily an iron-ore shipping port, had a population of 122,865 in 1961. The town is situated on a sandy plain on both sides of Cocanada Canal, about 2 3/4 miles within its entrance. Cocanada is the headquarters of the district administration. The Port Office, with a flagstaff, is on the north side of the canal.

Total WHARFAGE of 1,500 feet includes the following: Crane Wharf, a wooden wharf 107 feet in length and along the north side of the canal, has depths alongside of about 7 feet. Close westward of Crane Wharf is the Passenger Jetty, 100 feet in length with a depth alongside of about 7 feet. Passenger Jetty is suitable for berthing lighters and launches. About 35 small lighter wharves are farther up the canal; depths alongside these wharves are 4 to 6 feet.

CARGO is transported by lighters between vessels at the anchorage and the port facilities along the canal. It was reported (1965) that stevedores remain aboard the vessel the full time the vessel is in port. About 1,500 tons of iron ore per day are handled, loading one vessel at a time. Harbor craft include one tug, numerous lighters of 25 to 120 tons capacities, and several launches. Several warehouses, petroleum storage tanks, and an ore storage area are along the canal. Crane Wharf is equipped with a mobile 8-ton steam crane and five small manual cranes of from 1/2-ton to 5-tons capacities.

FRESH PROVISIONS in small quantities are obtainable.

WATER and BUNKERS are not available.

MINOR REPAIRS can be made at Cocanada. A graving drydock with a bottom length of 165 feet and a width of 35 feet has a depth of 8 feet (MHWS) over the sill.

There is regular sea COMMUNICATION with Madras, other Indian ports, and with Burma. Cocanada is connected with the railroad and telegraph systems of India.

Two HOSPITALS admit seamen.

## COASTAL FEATURES—LANDMARKS

3A-9 The coast for about 10 miles northeastward of Vakalapudi Lighthouse, just northward of the town of Cocanada, is low and marked with numerous villages and coconut trees. Low sandhills then appear and continue as far as Pentakota, 16 miles farther northeastward.

ROUND HILL, 2,143 feet high, about 22 miles northward of Vakalapudi Lighthouse shows up well in clear weather from positions near Cocanada.

UPADA (17°04'N., 82°20'E.) is a small port for native coasting-craft.

A dangerous WRECK, the position of which is approximate, is charted about 8 1/2 miles 052° from Vakalapudi Lighthouse and a little more than 1 mile offshore.

A masonry BEACON stands on a sandhill close to the coast at Wontimaudi, about 12 miles northeastward of Upada; it is not conspicuous.

PENTAKOTA VILLAGE is situated at the mouth of a river about 9 miles northeastward of Wontimaudi Beacon. At the entrance of the river are two sandhills of moderate height; close to them is a coconut grove. The river is closed during the Southwest Monsoon; a heavy sea rolls in at this time. A LIGHT is shown from the north side of the river entrance at Pentakota.

SUDIKONDA, a cone-shaped hill, 523 feet high, is nearly 3 miles northward of Pentakota Lighthouse. Although it is not the highest hill

in the vicinity, it is the most conspicuous because of its shape and color. Sudikonda Hill shows up well when bearing more than 282°.

A white TEMPLE atop LOKARUP HILL, 310 feet high, provides a good landmark about 4 miles northwestward of Pentakota Lighthouse.

BETWEEN PENTAKOTA AND VISHAKHAPATNAM (17°41'N., 83°18'E.) a succession of rounded hills rise from a low sandy plain. These hills show up well at night.

A prominent white OBELISK stands on rising ground about 4 miles northeastward of Pentakota Lighthouse and about 1/2 mile inland.

POLAREM is a small but very conspicuous rocky hillock, 72 feet high and surmounted with a BEACON, about 13 miles east-northeastward of Pentakota Lighthouse.

SANJIB PEAK, 2,139 feet high and conical in shape with a somewhat flattened, broken summit, is located about 11 miles northwestward of Polarem Beacon.

WATTARA VILLAGE, on tableland at the south side of the common entrance formed by the confluence of three small rivers, is located about 3 miles east-northeastward of Polarem Beacon. The entrance of the rivers is almost obstructed at low water.

Abreast of RAMBHIL, a village about 5 miles east-northeastward of Wattara, is a rounded hill 608 feet high surmounted by a BEACON 16 feet high. This hill presents a steep face to seaward.

3A-10 PUDIMADAKA ANCHORAGE (17° 30'N., 83°01'E.) is located off Pudimadaka, a small village on the shore of a bight in the coast. Some dark cliffs, 42 feet high, on the coast in the vicinity show conspicuously against the white, sandy beach.

PILLAR ROCK, a conspicuous rocky islet 30 feet high, lies south-southeastward of the village and about 1/3 mile offshore. The depth off the seaward side of Pillar Rock is 5 fathoms.

Anchorage during the Southwest Monsoon may be taken in 5 fathoms with Pillar Rock bearing about 214° and a group of godowns on the beach bearing about 282°.

A ledge of rocks lies between Pillar Rock and the coast and serves as a breakwater during the Southwest Monsoon.

A red temple with three towers stands in the village. The village consists mainly of thatched huts.

3A-11 THE COAST FROM PUDIMADAKA TO VISHAKHAPATNAM, about 21 miles northeastward, is broken and rocky. A coastal plain studded with hills backs the coast; some of these hills near the shore have conspicuous patches of drifted sand on their southwest sides.

A rock on the sandy beach about 4 miles northeastward of Pillar Rock appears from the northeastward as a low, black, double rock. The shore on either side of this rock is sandy with a few scattered rocks.

KUTKONDA, a small, rocky, conspicuous promontory, 141 feet high, is located about 10 1/2 miles east-northeastward of Pillar Rock. A BEACON, 15 feet high, stands on Kutkonda.

PIGEON ISLET (17°37'N., 83°14'E.), a small, rocky islet 71 feet high, lies about 1/2 mile offshore in a small bay.

YARADA KONDA rises to an elevation of 1,168 feet about 3 miles north-northeastward of Pigeon Islet. Sloping gradually toward the coast, Yarada Konda terminates abruptly to the eastward in Dolphin's Nose.

DOLPHIN'S NOSE, a bluff headland 536 feet high, is conspicuous when approached along the coast from the northeastward or southwestward. From seaward it is not readily distinguishable from the higher land which rises to the westward. The LIGHTHOUSE, two RADIO MASTS, and a FLAGSTAFF mark the summit of Dolphin's Nose. A LIGHT is shown from Dolphin's Nose. Obstruction LIGHTS are shown from the radio masts which stand near the lighthouse.

A RADIOBEACON transmits from Dolphin's Nose Lighthouse.

VISHAKHAPATNAM (VIZAGAPATAM) (17° 41'N., 83°18'E.)

3A-12 THE PORT OF VISHAKHAPATNAM is entered via a dredged channel from a position about 1 mile northeastward of Dolphin's Nose Lighthouse.

PORT LIMITS.—The northern limit of the port is marked by a pillar at Scandal Point. Dolphin's Nose Lighthouse marks the south-

ern limit and the eastern limit is the 10-fathom curve.

NAVIGATION

3A-13 Vessels approaching Vishakhapatnam from the northward during the Northeast Monsoon should endeavor to sight Rusi (Sugar Loaf) Hill (sec. 3A-26); from southward they should make Pigeon Islet (sec. 3A-11).

A report (1961) states that when approaching Vishakhapatnam from southeastward caution should be used in interpreting the coast outline as shown on the radar screen.

Vessels approaching the port for the purpose of picking up a pilot or for anchoring are cautioned not to approach westward of a line bearing 055° from Dolphin's Nose Lighthouse. See Spoil Ground in section 3A-16. Vessels approaching the port should navigate with caution.

Examination Service and a Port War Signal Station have been activated at the port; see section 1-41 for cautionary information when approaching Indian Ports.

WINDS—WEATHER

3A-14 Southwesterly winds prevail from March to August. From October to December the prevailing winds are northeasterly. During the day the northeasterly winds are fresh; at night they are light and westerly. Heavy wind squalls with rain occur during October and November. Most of the rainfall occurs from June through November.

A considerable swell runs nearly all year. Vessels have remained in the harbor with safety during cyclonic weather.

The climate is subtropical and varies from warm to hot with high humidity throughout the year. Maximum temperatures occur in May while minimum temperatures are usually recorded in December and January. Through May, June, and July temperatures often exceed 100°.

See Appendix for Vishakhapatnam Meteorological Table.

TIDES—TIDAL CURRENTS

3A-15 From about August to November the current sets southwestward and from about the middle of December through June it sets northeastward. Inside the 20-fathom curve the current is much weaker than farther offshore. Close offshore tidal currents will sometimes be experienced.

Tides are semidiurnal.

TIDAL HEIGHTS ABOVE *H.O. CHART DATUM.—MHWS 5.0 feet, MLWS 0.3 feet; MHWN 3.6 feet, MLWN 1.8 feet. *H.O. Chart 3694.

DEPTHS—DANGERS

3A-16 Depths of 6 to 8 fathoms lie within 1 mile of the shore near the entrance of the dredged channel. The depths close eastward of the entrance of the channel are 7 1/2 to 8 fathoms and the seaward end of the entrance channel has been dredged to 38 feet (1963). Depths of 35 feet are charted in the inner end of the entrance channel to and within the turning basin. Off the turning basin depths of 35 feet are charted in the North Arm of the harbor, 25 and 33 feet in the Northwest Arm, and 33 and 35 feet in the Naval Arm. Depths of 31 feet exist along the jetties and quays of the North Arm. All depths are for MLWS tides. Depths are maintained by continuous dredging operations.

A 23-foot spoil ground shoal (patch) lies outside the 6-fathom curve about 1 1/2 miles 050° from Dolphin's Nose Lighthouse.

Less water was reported (1958) in an area northward of the outer light buoy which marks the north side of the entrance channel. Less water was also reported to lie eastward of the spoil ground.

Spoil Ground.—A spoil ground is located in an area north and west of a line extending about 1 1/3 miles east of Signal Station No. 1, thence north to the pillar at Scandal Point which marks the northern limit of the port. A yellow conical buoy, within the spoil ground area, is moored about 3/4 mile south-south-

westward of the pillar at Scandal Point. A similar buoy is moored a little more than a mile southward of the above pillar and marks the 23-foot spoil ground shoal, about 400 yards west-southwestward.

## ASPECT—LANDMARKS

3A-17 A description of Dolphin's Nose and the coastal features and landmarks southward of Vishakhapatnam are given in section 3A-11.

Waltair Point, about 4 1/2 miles northeastward of Dolphin's Nose Lighthouse, is low and sandy with a rocky foreshore backed by red sandhills which, at times, are conspicuous. About 4 1/2 miles northward of the same lighthouse the ruins of two houses on the summit of Kailasa Range, at heights of 1,449 and 1,608 feet, are good landmarks. A white chapel on top of Ross Hill, at a height of 222 feet, is conspicuous between the bearings of 238° and 313°; this hill is on the north side of the entrance of the harbor, nearly 1 mile north-northwestward of Dolphin's Nose Lighthouse. A mosque minaret on the east side of Dargah Hill, about 1/4 mile eastward of the chapel on Ross Hill, and three powerhouse chimneys on the east side of the turning basin and about 1/4 mile northwestward of the chapel are prominent. Other landmarks are a signal station about 1 3/4 miles north-northeastward, a 305-foot high flagstaff about 2 3/4 miles north-northeastward, and a clocktower about 3 1/2 miles northeastward, respectively, of Dolphin's Nose Lighthouse.

Signal Station No. 1 (formerly Vishakhapatnam Lighthouse, (17°41′32″N., 83°17′46″E.) and the lighthouse about 2 miles northeastward of Signal Station No. 1 are difficult to distinguish due to the many buildings in the background.

## HARBOR

3A-18 The entrance of Vishakhapatnam Harbor lies at the mouth of the Meghadri River, close southward of the town. An island breakwater, about 270 yards in length and lying in a northeast-southwest direction on the south side of the channel, shelters the entrance from the southward. The harbor consists of an entrance channel, a turning basin 400 yards in diameter and four arms which radiate from the turning basin. The arms are known as the Lighter Canal, North Arm, Northwest Arm, and the Naval Arm. Inside the entrance channel the area comprising the turning basin, North Arm, Northwest Arm, and the Naval Arm has been dredged from tidal marsh and extensive flats which flank the small, muddy river. Harbor construction projects were still in progress (1962); extension of the North and Northwest Arms is proposed.

CHANNEL.—The entrance channel has a least width of 250 feet on the inner 280°-100° range. Width of the channel on the outer 280° range and in the sharp turn in the approach to the turning basin is 400 feet; on the 263° range the channel is 300 feet wide.

The inner channel is to be widened to 400 feet and the sharp turn to 500 feet.

MOORING BUOYS.—Mooring buoys are moored in the vicinity of the turning basin, in the north end of the North Arm, and in the Northwest Arm.

## NAVIGATIONAL AIDS

3A-19 See section 3A-11 for aids at Dolphin's Nose.

LIGHTS.—A light is shown a little more than a 1/2 mile southwestward of Waltair Point.

A light is shown about 2 3/4 miles north-northeastward of Dolphin's Nose Lighthouse.

LIGHTED BUOYS.—A black conical lighted buoy is moored a little more than a mile northeastward of Dolphin's Nose Lighthouse; a red can lighted buoy is moored about 330 yards southward of the above buoy. These buoys mark the entrance of the dredged channel.

RANGE BEACONS.—Four pairs of range beacons (pylons) mark the axis of the entrance channel. The first and second pairs are red and white and the third pair is black and white. Colors of the fourth pair are not charted. The first pair of beacons is in range 280° and the second pair is in range 263°. The third pair in range 280° ahead and the fourth pair in range 100° astern lead to the approach to the turning basin and inner harbor facilities.

BUOYS.—Black and white checkered conical buoys mark the north side of the channel and red and white checkered can buoys mark the south side of the channel on the 263° and inner 280° ranges, and in the approach to the turning basin.

ANCHORAGES

3A-20 Anchorages in the open roadstead are recommended in the following positions: about 1 3/4 miles 065° in 9 to 10 fathoms and about 1 3/4 miles 082° in 12 fathoms, respectively, from Dolphin's Nose Lighthouse. The holding ground is good with mud and sand bottom. All anchors should be buoyed.

Vessels anchoring in the roadstead must leave sufficient room for vessels to enter or leave the harbor. See also section 3A-13.

Foul ground surrounds Waltair Point; anchorage near the point within depths of 8 fathoms is not recommended.

PILOTAGE—PILOTS

3A-21 Pilotage is compulsory for ocean-going and power-driven vessels over 100 tons. Pilots board arriving vessels about 1/2 to 1 mile off the entrance channel. The pilot vessel PADMINI has a white hull; the word PILOT is painted on both sides amidships. Flag H is displayed when she is carrying a pilot. The signal for a pilot is the G flag.

Pilots are not permitted to take vessels in at night.

The port is open only during daylight hours. To ensure entrance to the harbor the same day, vessels should arrive at the entrance not later than 1600 local time. Inside the harbor vessels are shifted after dark up to 2100 local time.

SIGNAL STATIONS—SIGNALS

3A-22 Signal Station No. 1 is located at the site of the former Vishakhapatnam Lighthouse (17°41'32"N., 83°17'46"E.).

Signal Station No. 2, with a flagstaff, is located on the west side of Ross Hill close eastward of another flagstaff, 228 feet high.

These stations communicate visually with vessels approaching and leaving the port.

SIGNALS.—The system of signals in use in the Port of Vishakhapatnam are contained in "Vishakhapatnam Port Rules and Scales of Rates" issued by the Port Administration. The following signals are listed for the cognizance of entering and departing vessels.

Signal Station No. 1, upon sighting a vessel approaching the port, displays flag P until the pilot answers by the entering signal.

Vessels entering the harbor must display International Code pennant 4 and enter only after Signal Station No. 1 has repeated the signal hoist. A green metal pennant with a white circle hoisted at Signal Stations No. 1 and No. 2 indicates the channel is clear for shipping.

A vessel waiting to enter the harbor should, if International Code pennant 1 is displayed at Signal Station No. 1, keep well clear of the entrance to allow the leaving vessel plenty of room.

Vessels about to leave should display International Code Pennant 1 and proceed only after Signal Station No. 2 has repeated the signal hoist.

A vessel in port and sailing at daybreak displays the signal of a white light over a red light where it can be seen by the signal stations.

STORM SIGNALS.—Storm and weather signals are displayed at Vishakhaptnam in accordance with the Indian General System. See section 1-34.

REGULATIONS

3A-23 The following are from the more important port regulations which are issued by the Port Administration.

Only one vessel at a time may enter or leave the harbor.

Tugs are maintained to assist vessels, as necessary, in entering the harbor or shifting berths. Port regulations require that a pilot be on board a vessel whenever tugs are employed.

Effective April 15, 1964 the Vishakhapatnam Port Trust Authorities have decided to handle vessels drawing 33 feet at high water, length over all 635 feet. Vessels with drafts up to 29 1/2 feet are able to enter or sail, respectively, at all stages of the tide. Ore carriers are limited to 35,000 tons, 623 feet in length, and a draft of 33 feet.

Sailing vessels of 100 tons and greater shall not enter or leave the harbor unless towed by one or more of the port tugs.

No ballast may be thrown or discharged overboard in any portion of the harbor.

RADIO PRATIQUE.—Vessels may obtain radio pratique prior to arrival at Vishak-

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hapatnam by ridgidly following the procedure set forth in section 1-45.

If pratique has already been granted at a major Indian port, radio pratique may be obtained.

QUARANTINE.—Vessels which have not been granted radio pratique remain in quarantine at anchor in the roadstead until cleared by the Port Health Officer.

## DIRECTIONS

3A-24 Vessels enter the dredged channel between the lighted entrance buoys, a position 1 mile 052° from Dolphin's Nose Lighthouse. Approach to the turning basin and inner harbor is made through this channel from its entrance by vessels keeping beacons in range 280°, 263°, and 280°–100° for distances of 3/4, 1/3, and 1/4 mile, respectively; vessels then negotiate the 1/4-mile sharp turn leading to the turning basin on headings of west-northwestward through north-northwestward. The harbor chart should be consulted. See section 3A-19.

MEASURED DISTANCE.—Two pairs of marks, 6,080 feet apart, stand 3/4 mile and 1 3/4 miles, respectively, northeastward of Signal Station No. 1. The southern pair consists of two beacons; at Scandal Point the northern pair consists of a front pillar, which is the northern port limit mark, and a rear beacon. Each pair of marks are in range 312°; the running courses are 042° and 222°. Vessels should not approach the shore on these courses at distances of less than 1 mile.

COMPASS ADJUSTMENT.—A useful bearing for adjusting compasses is the tallest chimney of the powerhouse and Signal Station No. 1 in range about 268 1/2°. Masters of vessels swinging ship and approaching the shore on this bearing are cautioned to keep well clear of the Spoil Ground. See sections 3A-13 and 3A-16.

## FACILITIES

3A-25 VISHAKHAPATNAM, a port of increasing importance and the fourth largest in India, is the site of an oil refinery and has the only shipyard in India capable of constructing oceangoing merchant vessels. Petroleum handling is the principal activity and the shipping of ore ranks second in importance. Principal exports are petroleum products, iron and manganese ores, coke, coal, tobacco, ground nut oil, vegetable oil, molasses in bulk, and raw jute. In 1961 the population was 182,000. An Indian naval base is located at Vishakhapatnam. The port is controlled by the Vishakhapatnam Port Trust under the Ministry of Transport with administration and management vested in the Port Trust Board Authorities.

BERTHING.—A report states all vessels are swung around in the turning basin with the assistance of tugs and backed into quay or mooring buoy berths.

At the berths the bottom is silt; it is reported there is very little danger of vessels touching bottom.

BERTHS—NORTH ARM.—The Main Quay, on the east side of the arm, has a berthing length of 2,300 feet and an alongside depth of 31 feet.

Three berths along the west side of the arm have depths of 29 feet and comprise the following: a 320-foot wharf provides a berthing length of about 460 feet. Three breasting platforms facilitate a 350-foot berth north of the above wharf; a similar 350-foot berth lies south of the same wharf. The platforms are about 25 feet wide along their berthing faces with the two open spaces between the platforms each having a berthing length of about 90 feet.

The north end of the North Arm is being developed; additional berths are under construction.

BERTHS—NAVAL ARM.—Caltex Quay, on the north side of the arm, has a berthing length of 1,200 feet with an alongside depth of 32 feet.

Navy Wharf with its offshore T-head providing 1,000 feet of berthing space along its face has a depth alongside of 22 feet. A shipyard quay, used for fitting out and repair, is 1,150 feet long with a depth alongside of 23 feet. Navy Wharf and the shipyard quay are along the south side of the Naval Arm, west and east ends, respectively.

MOORING BUOY BERTHS.—Three berths around the perimeter of the turning basin have distances between buoys of 580, 600, and 625 feet with depths of 35 feet.

Two berths in the north end of the North Arm

in depths of 35 feet have about 675 feet between buoys.

Four berths in the Northwest Arm, the only facilities in this part of the harbor, have distances between buoys of 350, 460, 570, and 720 feet. The two berths with the least lengths are in depths of 25 feet; the other two are in depths of 33 feet.

TUGS.—Seven harbor tugs, (greatest hp. 1,050) are available. One of the tugs is equipped for fire fighting and can also be used for salvage work. A fire float is also available.

CARGO INFORMATION.—Main Quay is equipped to handle general cargo and the loading of manganese ore. In 1963 thirteen 3-ton electric portal jib cranes and a 25-ton derrick crane were available. Ore was loaded at the rate of about 45 tons per hour over a 12 hour period. Main Quay has covered storage, rail and road clearances.

Ore is loaded at the 320-foot wharf along the west side of the North Arm; coal is loaded at the breasting platform berths north and south of the 320-foot wharf. Petroleum is also discharged at the south breasting platform berth.

Caltex Quay is equipped for the transfer of petroleum.

Facilities for the loading of ore and the handling of general cargo are located at the lighter piers on the north side of the Lighter Canal for a distance of 1/4 mile within its entrance. There are depths of 9 feet alongside.

Thirty-two lighters serve the port. A 60-ton floating crane is available and a 125-ton fixed crane is located on the east end of the shipyard quay.

PROVISIONS.—Fresh provisions are obtainable in limited quantities.

DECK AND ENGINE SUPPLIES.—Limited quantities of deck and engine supplies are available.

FUEL.—Fuel and diesel oils are available at the Caltex Quay and at the three berths on the west side of the North Arm. Fuel oil can be supplied at rates of 100 to 125 tons per hour.

COAL.—Bunker coal can be loaded at the north and south breasting platform berths or from lighters.

WATER.—Water of good quality is piped to the Main Quay berths, Caltex Quay, and the shipyard quay. Three water barges with capacities of 25 to 30 tons deliver water at the rate of 20 tons per hour to vessels at the mooring buoy berths. Drinking water should be treated. Generally, there is an adequate supply of water.

REPAIRS.—The port has two well-equipped work shops, as well as a foundry. Small repairs to hull, boilers, and machinery can be undertaken. There are numerous marine railways; the largest can accommodate a 100-ton vessel. Diving gear and an efficient staff of personnel are maintained.

A graving drydock on the north side of the entrance channel has the following dimensions and depths: LOA 481.8 feet; length on floor 474 feet; length of keel blocks 391.5 feet; breadth of entrance 60.5 feet; depth over sill and blocks 14.3 feet (MLWS).

COMMUNICATIONS.—There is regular sea communication with all parts of the world and air communication with Bombay, Calcutta, and Hyderabad. The port is connected to the general railway, telephone, and telegraph systems. A coastal radio station (VWV) operates at Vishakhapatnam.

MEDICAL.—A port dispensary is available for first aid. In the town, about 1 1/2 miles from the port, there is a government hospital with more than 1,000 beds. There is also a sick bay, equipped with 36 beds, at the naval base.

Deratting Exemption Certificates can be issued.

## COASTAL FEATURES—LANDMARKS (CONTINUED)

3A-26 FROM WALTAIR POINT (17°44'N., 83°21'E.) to Bimlipatam, about 12 miles north-northeastward, the coast is hilly.

Two houses at a height of 570 feet on the side of a small hill about 1 1/2 miles northward of Waltair Point Lighthouse are conspicuous. RUSI (Sugar Loaf) HILL is a conspicuous round-topped hill, 506 feet high and surmounted by a 16-foot BEACON, about 4 1/4 miles northeastward of Waltair Point Lighthouse. OPPADU KONDA (Upada Bluffs), about 3 1/2 miles north-northeastward of Rusi Hill, are about 417 feet high and have the appearance of flat table lands with steep seaward faces. Rocky shoals and shoal water ex-

tends nearly 1/2 mile offshore in this vicinity. The high land terminates about 4 miles northward of Rusi Hill, thence to Bimlipatam there are isolated conical hills. A large sandhill, 314 feet high, about 2 miles southwestward of Bimlipatam Hill is conspicuous.

BIMLIPATAM (BHIMUNIPATNAM) (BHEEMUNIPATNAM) ANCHORAGE (17°54'N., 83° 29'E.)

3A-27 BIMLIPATAM is situated on the south side of the mouth of the Gostani River, a large and very shallow backwater. Vessels anchor in the open roadstead off the town.

TIDAL CURRENT.—The tidal current is scarcely perceptible.

DEPTHS.—The depths decrease gradually in the approach to the anchorage; the 10-fathom curve lies 2 to 3 miles and the 5-fathom curve lies 1/3 to 3/4 mile offshore, respectively.

LANDMARKS.—Bimlipatam Hill, rising to 530 feet just westward of the town, is conspicuous. A pyramidal obelisk, 16 feet high, stands on its summit. A white temple on the east slope of the hill shows up well when the sun shines on it. The tall chimney of a factory about 2 1/2 miles north-northwestward of Bimlipatam is also conspicuous.

LIGHT.—Bimlipatam Light is shown from a position in the northeast end of the town near the port office and close to the shore.

ANCHORAGE.—Anchorage is afforded abreast the town, about 1 mile offshore in depths of 6 to 7 fathoms, sand and mud, good holding ground.

During the Southwest Monsoon it is advisable to anchor with Bimlipatam Lighthouse bearing 264°; during the Northeast Monsoon, a recommended position is with the lighthouse bearing between 249° and 259°.

The anchorage is sheltered more than at adjacent ports.

BOAT ENTRANCE.—The entrance of the backwater is about 1/3 mile northward of the port office. The controlling depth over the bar is 2 feet. Boats can pass through the entrance at certain stages of the tide.

LANDING PLACE.—The landing place is on the beach between the entrance of the backwater and the port office.

Ships' boats are prohibited from communicating through the surf with the shore.

STORM SIGNALS.—Storm and weather signals are displayed at the lighthouse in accordance with the Indian General System. See section 1-34.

3A-28 BIMLIPATAM had a population of 10,000 in 1948. The port is administered by a Port Conservator. Exports include hemp, hides, jute, and seeds.

Two WHARVES, each about 150 feet long, are along the south shore of the backwater.

CARGO is transported between the anchorage and these wharves by lighters (surf boats) which number about 25 with average capacities of about 2 1/2 tons each.

FRESH PROVISIONS are available.

WATER can be supplied in small quantities.

COMMUNICATION via regular steamer with Chittagong is maintained and there is occasional sea communication with other Indian ports.

MEDICAL.—There is a small HOSPITAL.

COASTAL FEATURES—LANDMARKS (CONTINUED)

3A-29 FROM BIMLIPATAM TO KONADA, 10 miles northeastward, the coast is sandy. About midway between these two places some red cliffs, 20 to 40 feet high, are conspicuous when the sun shines on them in the forenoon. Between these cliffs and Konada the beach is fronted by rocks extending about 1/4 mile seaward.

AMANAM HILL, about 3 3/4 miles north-northeastward of Bimlipatam Lighthouse, is 833 feet high and prominent. It is flat-topped, smooth and bare.

KAULVADA, a hill 264 feet high and marked with a BEACON, is located about 2 miles northeastward of Amanam Hill.

KONADA is situated near the mouth of a small river. Several white buildings and some coconut trees stand on low ground on the north side of the river.

ANCHORAGE is afforded at Konada about 1 mile off the entrance of the small river in 5 or 6 fathoms, sand bottom.

The coast from Konada to Kalingapatam, about 37 miles east-northeastward, is a sandy beach backed by sandhills 40 to 60 feet high. KANDIVALASA (Santapilli Peak), the highest and most prominent peak in this locality, rises to 1,762 feet about 7 miles northward of

Konada; it appears nearly conical on all bearings from seaward.

Between Konada and the Nagavali (Langulya) River the hills in many places are close to the coast. Farther northward, between the Nagavali River and Kalingapatam, several isolated hills mark the extensive coastal plain.

SANTAPILLI LIGHT is shown from a position along the coast about 5 miles east-northeastward of Konada.

SANTAPILLI ROCKS, an off-lying danger is discussed in sections 3A-4 and 3A-5.

A BEACON, 15 feet high, stands on RAMACHANDRAPUR, a flat-topped hill 538 feet high about 5 miles northeastward of Santapilli Lighthouse.

AGRA ROCK, over which the depth is 3 fathoms, lies about 1 mile offshore and about 8 miles east-northeastward of Santapilli Lighthouse. The sea is not discolored over this rock and seldom breaks on it. Kandivalasa Peak open southward of Ramachandrapur Beacon and bearing 279° leads 3/4 mile southward of Agra Rock.

The NAGAVALI RIVER enters the sea about 20 miles east-northeastward of Santapilli Lighthouse. The river is broad but shallow and can be navigated only by light-draft native boats. Srikakulam (Chicacole) is situated on the east bank of the river, about 5 1/2 miles within its entrance. POKALAPET BEACON stands on the east side of the entrance of the river.

SANDY POINT (18°19'N., 84°08'E.) is located about 1 1/2 miles southward of the town of Kalingapatam. Sandhills, 20 to 40 feet high, mark the shore southwestward of Sandy Point. KALINGAPATAM LIGHT is shown from Sandy Point.

## KALINGAPATAM (CALINGAPATAM) ROADSTEAD (18°20'N., 84°09'E.)

3A-30 KALINGAPATAM ROADSTEAD, abreast the town of Kalingapatam, is open, but protected somewhat from the southwestward by Sandy Point and some rocks which extend seaward about 100 yards from the point.

Kalingapatam Light is the south limit of the port. The north limit is the south end of Ampalam, a village about 2 1/2 miles northward of the light.

DEPTHS—DANGERS.—The 6-fathom curve is charted about 3/4 mile offshore from a position about 3/4 mile northeastward of Sandy Point thence northward to abreast of the town. Similarly the 3-fathom curve is charted about 1/4 mile offshore. Eastward of the entrance of the Vamsadhara River the 3-fathom curve is charted about 1/2 mile off.

Considerably less depths than charted were reported to exist in the roadstead.

SATARA REEF, a sunken reef which extends about 3/4 mile northeastward from Sandy Point, has patches with depths of 5 fathoms; the least depth of 3 1/2 fathoms is over its outer end. The reef is steep-to on its north and east sides. Depths of 7 fathoms, mud bottom, exist within 100 yards of the reef.

An OBSTRUCTION, position approximate, with a depth of 4 fathoms over it was reported to lie about 1 2/5 miles north-northeastward of Sandy Point Lighthouse.

The entrance of the Vamsadhara River lies close northward of the town. Sandbanks encumber the entrance and the river is not navigable.

ASPECT—LANDMARKS.—In the vicinity of Kalingapatam the land is low and flat. Sahliundam Hill, an isolated ridge running in an east-west direction, has its 409-foot summit near the west end of the ridge and is about 5 1/2 miles west-northwestward of Kalingapatam Lighthouse. It is conspicuous, bare, and wedge-shaped; on its east slope are two white temples. A low range of jagged, rocky hills begins to rise about 4 miles northeastward of Sahliundam Hill.

ANCHORAGE.—It is locally reported that during the Northeast Monsoon vessels can anchor in about 5 fathoms with the port flagstaff bearing about 267° and Kalingapatam Lighthouse bearing about 205°. This position is about 2/3 mile offshore and about 100 yards northeastward of the reported obstruction. During the Southwest Monsoon anchorage may be had with the flagstaff bearing about 273° and the lighthouse bearing about 202°. This position is in charted depths of 4 1/2 to 5 fathoms about 1/2 mile offshore and about 100 yards southwestward of the

obstruction. Caution is advised when anchoring in these positions.

Anchorage is also afforded in 4 to 5 fathoms with the flagstaff bearing 284° and the lighthouse bearing 204°.

The port flagstaff stands about 1 1/3 miles 350° from Sandy Point Lighthouse.

STORM SIGNALS.—Storm and weather signals are displayed from the port flagstaff in accordance with the Indian General System. See section 1-34.

3A-31 KALINGAPATAM, about 1 1/2 miles northward of Sandy Point, had a population of about 5,000 in 1951. The town no longer has any appreciable importance as a trading center; there are no wharves or jetties.

CARGO is transported in flat-bottomed boats between anchored vessels and the shore. About 40 of these boats are available.

FRESH PROVISIONS can be procured in limited quantities.

The town is connected with the main telegraph system.

COASTAL FEATURES—LANDMARKS (CONTINUED)

3A-32 FROM KALINGAPATAM TO PUNDI (18°40'N., 84°27'E.) the coast is sandy; numerous isolated hills back this section of the coast. The land around Bavanapadu, a village about 19 miles northeastward of Kalingapatam, is low and flat. About 1 mile southward of Bavanapadu is a small point; rocks, 12 feet high, extend for about 100 yards from the point. A small river, the entrance shallow and completely closed at low water, flows into the sea about 1/2 mile northward of the rocks.

A tall BEACON with black and white bands stands on the beach at Bavanapadu. Another BEACON is charted on the coast at Jogipad, about 9 miles northeastward of Kalingapatam.

About 7 1/2 miles northeastward of Bavanapadu is a rounded rocky point and about 1 mile farther northward is the entrance of Bendi Creek. The village of PUNDI is about 3/4 mile within the entrance of the creek; a white obelisk, 60 feet high, and a flagstaff close to it mark the village, which has a post office. Pundi is not visible from seaward. The bar at the entrance of Bendi Creek has a depth of about 3 feet; boats can, when the swell is moderate, enter with safety at high water.

ANCHORAGE OFF PUNDI may be had in 7 to 8 fathoms, sand, about 3/4 mile offshore with the white obelisk bearing about 281°.

From Pundi to Baruva, about 15 miles northeastward, the coast continues sandy, and except near Baruva where it is flat, rises gradually and is fairly well wooded. BENDI HILLS, a flat range 576 feet high, rises about 3 miles northwestward of Pundi. KHIRSINGA HILL, small, red, and 169 feet high, is on the coast about 1 1/2 miles north-northeastward of the obelisk at Pundi.

RATI BEACON, a 14-foot high obelisk, stands on a double-peaked hill, 342 feet high, nearly 3/4 mile inland and about 8 miles northeastward of Pundi. The double-peaked hill is the end of a small range of about the same height which slopes down to the coast; it is very prominent from the northeastward or southwestward and at a distance of 4 or 5 miles it has the appearance of a headland.

The MAHENDRAGIRI RANGE, about 14 miles northwestward of Baruva, has elevations of about 5,000 feet and is precipitous.

A ROCKY PATCH, with a depth of 6 1/2 fathoms and with depths of 9 to 10 fathoms around it, lies about 1 1/4 miles offshore about 3 miles east-by-north of Rati Beacon.

BARUVA ANCHORAGE (18°53'N., 84°36'E.)

3A-33 BARUVA is situated on the north bank of a small river which is shallow and not navigable.

ASPECT—LANDMARKS.—From seaward the customhouse and a few trees in the town are visible. A grove of casuarina trees southwestward of the customhouse is conspicuous. The surrounding country is flat and the coast is fringed with coconut trees.

NAVIGATIONAL AIDS.—A light is shown from a beacon at Baruva.

Two beacons, about 70 yards apart, stand about 300 yards northeastward of the light beacon. Each beacon is 15 feet high with an elevation of 65 feet. The northernmost beacon is black and white banded and the southernmost beacon is white.

ANCHORAGE.—The anchorage is off the town, about 1/3 mile offshore in 4 1/2 fath-

oms, sand and mud, with the light beacon bearing between 304° and 315°.

LANDING.—Landing is reported to be possible, except in the heaviest weather. Local reports indicate that often when it would be unsafe to land at Gopalpur there is no danger at Baruva. Native masula boats are always available. International Code flag B is the signal for a boat.

3A-34 BARUVA had a population of about 10,000 in 1951. Formerly a commercial port of some importance, Baruva now has most of its trade carried by the railway. There has been little or no seaborne trade during recent years.

Small amounts of fresh provisions can be obtained.

The town is connected with the general railway and telegraph systems of India.

COASTAL FEATURES—LANDMARKS (CONTINUED)

3A-35 THE COAST FROM BARUVA TO GOPALPUR, about 29 miles northeastward, is sandy. About 5 miles northward of Baruva and 3 to 4 miles inland there is a small range of bare hills, 595 feet high. Near Kowita, 10 miles north-northeastward of Baruva, the land rises gradually from the coast to an elevation of about 300 feet, forming a wooded tableland which is connected with lower ranges of hills farther inland. The higher ranges are so frequently obscured as to be of little use as navigational aids.

KOWITA BEACON, reported to be partially obscured by trees, stands on a tableland at an elevation of 279 feet about 11 miles north-northeastward of Baruva. A masonry BEACON, 21 feet high, stands on a large sandhill near the coast about 10 miles northeastward of Baruva.

INVESTIGATOR ROCK, with a depth of 1 1/4 fathoms, lies 3/4 mile offshore about 8 1/2 miles northeastward of Baruva Light Beacon. The water is not discolored over the rock and it is not marked by breakers.

ICHAPUR, a prominent hill, rises about 4 1/2 miles northward of Kowita Beacon; it is in the form of a sharp cone, 514 feet high, and is surrounded by some lower hills. DANDRASI HILL, 676 feet high, is about 5 3/4 miles northeastward of Ichapur. From the eastward Dandrasi appears round-topped, but from the southward it has a long double summit; the western summit is slightly the higher. RAEGARA, a conspicuous range with four peaks, the highest with a height of 2,914 feet, is about 8 miles northwestward of Dandrasi.

3A-36 SONNAPURAM (Sonapur) (19°07'N., 84°47'E.) is a small port about 1 mile within the entrance of a small river.

A white obelisk and a white column, each about 50 feet high, stand about 20 feet apart on an islet within the entrance. A customhouse with a black flagstaff stands on the beach at Sonnapuram.

GOPALPUR ANCHORAGE (19°15'N., 84°55'E.)

3A-37 GOPALPUR, a port in the Ganjam District, is an open, unsheltered roadstead. The limits of the port are marked by two white pillars; one pillar stands about 1 mile east-northeastward and the other about 1/2 mile southeastward, respectively, of the Gopalpur Light Structure.

WINDS.—The Southwest Monsoon breaks about the middle of June. Winds constantly blow along the coast near Gopalpur in March and April; farther north they are occasional only and the first indication of them is the absence of any lull in the sea breeze at night. These winds make the sea unpleasant for boats; after blowing about three days, they subside quickly.

Strong winds are frequent off the land between Gopalpur and Paluru Bluffs (sec. 3B-7), but cyclones do not appear to pass over Gopalpur Hills.

CURRENTS.—The currents usually set with the prevailing wind. About the middle of January the northeasterly current begins, and by the middle of February it sets steadily east-northeastward with velocities of 1/2 knot close to the shore and increasing to 1 1/2 knots about 12 miles off the coast. At the latter distance its direction is about northeastward, or toward the shore, and it should be guarded against.

The northeasterly current continues to

run until July when the southwesterly current begins and gradually strengthens; sometimes its velocity is over 2 knots.

Between March and August, because of the displacement of sand along this section of coast, all the river entrances have narrow spits trending northeastward.

HARD GROUND.—Two patches of hard ground with depths of 7 fathoms and 8 1/2 fathoms lie about 2/3 mile eastward and about 3/4 mile southeastward, respectively, of the port flagstaff. These patches should be avoided when anchoring.

ASPECT—LANDMARKS.—The town of Gopalpur is situated on rising ground on the south side of a small, shallow stream. White houses stand for about 1/2 mile inland from the coast and are visible about 12 miles seaward. The white port flagstaff stands on the east side of a building near the coast, about 200 yards east-northeastward of the south pillar.

LIGHT.—Gopalpur Light is shown from a position nearly 1/2 mile northwestward of the south pillar.

ANCHORAGE.—Anchorage may be obtained in about 8 fathoms, sand and mud, with the north pillar bearing 358° and the flagstaff bearing 294°. Anchorage is also afforded about 1/4 mile southwestward of the above position in about 7 1/2 fathoms.

During the windy months, April to July, anchorage is recommended in 9 fathoms with a good scope of chain.

REGULATION.—A local regulation prohibits the discharge of ballast in depths of less than 12 fathoms.

STORM SIGNALS.—Storm and weather signals are displayed at Gopalpur in accordance with the Indian General System. See section 1-34.

3A-38 GOPALPUR, like other exposed ports on this coast, is no longer a port of call for shipping. The town with a population in excess of 3,000 has a healthy climate.

Landing and shipping operations are possible, except occasionally when the surf is too high. Ships' boats must not be used for landings; local surf boats are used for all transportation between vessels and the shore.

FRESH PROVISIONS in small quantities can be obtained.

The town is connected to the main railway and telegraph systems.

A dispensary will handle emergency cases.

COASTAL FEATURES—LANDMARKS (CONTINUED)

3A-39 BETWEEN GOPALPUR AND GANJAM several isolated and conspicuous hills are visible over the coastal sandhills. MANUSURUKOTA, rocky and 177 feet high, is about 2 1/4 miles northward of Gopalpur. LANDABAUMS, the easternmost of two hills about 8 miles northward of Gopalpur, is 651 feet high and appears as a conical sugarloaf shape from every direction. Several fishing villages are situated along this section of the coast.

## PART B. GANJAM TO BALISAHI POINT

COAST—GENERAL

3B-1 FROM GANJAM TO FALSE POINT (20°20′N., 86°44′E.), about 112 miles northeastward, the coast is fairly regular, broken only by the many rivers which empty into the bay along this section of the coast. False Bay, a slight indentation, lies between False Point and Shortt Island (20°47′N., 87°05′E.). Westward of Shortt Island and southward of Balisahi Point (20°51′N., 86°58′E.) the coast is broken by the Dhamra River.

Chilka Lake lies inland of the low coast between Ganjam and Puri.

Mountain ranges northward of Ganjam rise to heights of 1,000 feet and greater. Mount Chandikho and Danai, a conspicuous peak, are landmarks farther north-northeastward of Ganjam.

Except for the above elevations, the coast is generally low and sandy and is marked by sandhills, scattered trees, grass and scrub, and in places by jungle growth.

DEPTHS—DANGERS

3B-2 BETWEEN GANJAM AND SHORTT ISLAND the 20-fathom curve is charted about

3 to 30 miles offshore; off Ganjam it lies closest to the shore and eastward of Shortt Island it lies at its maximum distance offshore. Southward of Puri it lies 13 miles off the coast.

From Ganjam to False Point the 10-fathom curve is charted about 3/4 mile to 6 to 7 miles offshore. Farther northeastward, in the vicinity of False Bay, it lies about 14 miles from the shore. The 10-fathom curve lies about 7 1/2 miles eastward of Shortt Island and in this position is the outer limit of Palmyras Shoals.

Six 10-fathom patches are charted between the 10-and 20-fathom curves within a radius of 6 1/2 miles east-southeastward through south by eastward of Puri Light Structure (19°48′N., 85°50′E.).

CENTRAL SAND, a shoal with depths of 1/4 fathom to 5 fathoms, lies off the mouth of the Devi River. The shoal extends about 1 1/2 miles northeastward through eastward, its outer charted limit, and about 1 mile southeastward, respectively, of Devi Point (19° 59′N., 86°24′E.). A 3-fathom patch is charted about 1 1/2 miles southward of Devi Point and about 1 mile offshore. Central Sand is reported to have extended about 1 mile farther southeastward. In fine weather the sea does not always break over the shoal.

PALMYRAS SHOALS, with depths of 1 1/4 to 5 1/2 fathoms, lie within a radius of 8 miles east-northeastward through southeastward of Shortt Island Lighthouse (20°47′N., 87°05′E.).

CAUTIONS.—Caution is necessary when approaching Palmyras Shoals from the eastward as the depths decrease abruptly from 13 to 9 and 4 fathoms.

Caution is also necessary when approaching False Point and vicinity. Because of its light-colored top and lack of background, the lighthouse is difficult to identify if there is a heat haze. During January, February, and March fog may occasionally obscure False Point Light, or cause it to show a deep red color; frequent soundings should be taken and vessels should not proceed in depths of less than 11 fathoms. This depth is charted 4 to 5 miles offshore.

## OFF-LYING DANGER

3B-3 A SHOAL with a least depth of 4 1/2 fathoms was reported (1963) to lie about 24 1/2 miles 165° from False Point Lighthouse.

## NAVIGATION

3B-4 The low coast southwestward of Puri and between Puri and Devi Point should not be approached after dusk or in hazy weather. Vessels may be safely navigated along this section of the coast by sounding continuously and not proceeding in depths of less than 12 fathoms. Because of the effect of a fine sand haze, distances estimated by eye cannot be relied upon; objects appear much more distant than they really are and the land is often actually much nearer to the observer than it appears. At night the sandy beach blends in appearance with the water and the tops of large trees, which show over the hillocks, seem to be very distant on an indefinite horizon. This is especially true on moonlight nights when navigators are tempted to keep vessels near the land in order not to be taken past their destination by the current. There are depths of 8 fathoms very close outside the breakers. During the Southwest Monsoon a heavy surf breaks on the shore, and should a vessel touch bottom she is almost certain to be wrecked.

Balijori Obelisk (20°01′N., 86°25′E.) bearing less than 315° leads northeastward of the reported extension of Central Sand Shoal (sec. 3B-2).

Vessels from the southward, when rounding Palmyras Shoals (sec. 3B-2), should not proceed in depths of less than 15 fathoms until Shortt Island Lighthouse bears less than 237°.

## CURRENT—TIDAL CURRENTS

3B-5 False Point is a lee shore during the Northeast Monsoon or with northeasterly winds; the current is generally westerly in this vicinity at this time.

Tidal currents set over Palmyras Shoals at a velocity of 2 knots at springs. On the

northeast side of the shoals the flood current sets to the northwestward and the ebb current sets to the southeastward. At the south end of the shoals the flood current sets to the northward and the ebb current sets to the southward.

From the end of June to the end of November there is little or no flood or westerly current off False and Palmyras Points except at spring tides; there is often a strong outset from the rivers caused by freshets.

Off False Bay the flood current sets northwestward to northward and the ebb current sets southwestward, each at a velocity of about 1 knot. The velocity is, however, much influenced by the prevailing wind. The tidal current together with the coastal current during the Southwest Monsoon sometimes attains a velocity of 4 knots.

## GANJAM (19°23′N., 85°04′E.)

3B-6 GANJAM is situated on the north bank of the Rushikulya River, close within its mouth. Very little of the town can be seen from seaward. The remains of an old fort stand on rising ground on the south side of the town; northward of the town the country is low.

Ganjam is not used as a port because of a heavy surf and shifting banks.

The town is connected with the main railway system.

## COASTAL FEATURES—LANDMARKS

3B-7 PALURU BLUFF, 580 feet high and about 6 miles northeastward of Ganjam, is the bold northeastern termination of the high ranges of the Ganjam District. KUJIDHEPPO PEAK, saddle-shaped and 1,114 feet high, is located about 6 miles northward of Ganjam; MOUNT CHANDIKHO rises to an elevation of 1,517 feet on the west shore of Chilka Lake; its summit, which is about 16 miles northward of Paluru Bluff, appears as a double peak from the southward. The peak stands out somewhat from the high ranges westward of the lake.

A low beach of sand hills, backed by a little cultivation and grazing ground, stretches 32 1/2 miles northeastward from Paluru Bluff to Chilka Mouth, the entrance of Chilka Lake. On this low coast there are few marks; the most conspicuous is MITA KUA BUNGALOW, a small white house on a sandhill close to the sea, about 20 miles east-northeastward of Paluru Bluff. A BEACON stands on the coast about 13 miles east-northeastward of the above bluff; SANDARI BEACON is charted about 5 miles east-northeastward of Mita Kua Bungalow. BABESWAL TEMPLE, painted black and about 2 1/4 miles northeastward of Sandari Beacon, is sometimes visible among the trees.

DANAI, a conspicuous, sharp PEAK is 1,892 feet high and 22 miles north-northwestward of Mita Kua Bungalow; it is a useful mark on a clear day.

CHILKA LAKE, a large expanse of shallow water, is separated from the sea by a long, narrow, sandy ridge; in good weather CHILKA MOUTH, the entrance of the lake, is navigable by boats drawing up to 3 feet. During the rainy season the surf renders the lake inaccessible from the sea. At the entrance, shoals extend nearly 1/2 mile offshore with depths of 6 to 8 fathoms close outside them; the sea breaks over these shoals.

The coast between Chilka Mouth and Puri continues low and sandy. HARCHANDI TEMPLE stands on a sandhill about 3/4 mile inland and about 4 miles northeastward of Chilka Mouth.

## PURI ANCHORAGE (19°47′N., 85°50′E.)

3B-8 PURI sea front is about 1 mile long; the port boundary pillars are black and white banded with the northeast pillar having a staff and red ball topmark and the southwest pillar being topped by a staff and red triangle.

WINDS—WEATHER.—Cyclonic storms may occur during the latter part of April and in May, June, October, and November. The character of the swells on the beach usually indicates the proximity of a cyclonic storm area.

The fine weather season is from the middle of November to the middle of March; the rainy season is from May to November.

See Appendix for Puri Meteorological Table.

DEPTHS—DANGERS.—The depths decrease gradually from 20 to 7 fathoms toward the beach; inside the 7 fathom curve they decrease sharply.

Vessels approaching the anchorage should sound frequently.

An old ballast ground in a depth of 10 fathoms lies 2 1/2 miles 121° from the Port Office flagstaff and should be avoided.

ASPECT—LANDMARKS.—The government offices, whitewashed and conspicuous, stand on the beach. A sandy ridge separates these offices from the town.

The famous Jagannath Pagodas stand on low ground nearly 3/4 mile northwestward of Puri Lighthouse. They comprise three circular towers decreasing in size eastward and are in range 275°; each tower is crowned with a white dome, the western tower being the highest at 192 feet. The west sides of the towers appear perpendicular while the east sides slope; on northerly bearings they are seen as separate towers. They are conspicuous from seaward in the forenoon.

The Port Office flagstaff, 108 feet high, stands about 250 yards southwestward of Puri Lighthouse.

LIGHT.—Puri Light is shown from a white pedestal on a yellow two-storied building, with "PURI" marked in black letters on its face, which stands about midway between the boundary pillars.

ANCHORAGE.—Anchorage in fine weather is afforded in 7 or 8 fathoms off Puri; the holding ground is good as the bottom is nearly all clay.

The lighthouse bearing 006° and the southwesternmost port pillar bearing 321° mark the recommended anchorage position.

LANDING.—Due to constant heavy surf, ships' boats cannot land even in fine weather; native masula boats are available for communication with the shore. The usual landing place is on the beach near the flagstaff.

STORM SIGNALS.—Storm and weather signals are displayed from the Port Office flagstaff in accordance with the Indian Brief System. See section 1-34.

3B-9 PURI is also known locally as Jagannath. In 1952 the population was 75,544, but this number is greatly increased at times by natives making pilgrimages to the Jagannath Pagodas. Sea trade has declined greatly in recent years.

CARGO is handled by native surf boats between anchored vessels and the shore.

FRESH PROVISIONS in small quantities are obtainable.

COMMUNICATIONS with other Indian ports via steamer is on an occasional basis; the town is connected with the main railway and telegraph systems.

There are two government hospitals, one of which is reserved for infectious diseases. Cholera, small pox, malaria, and dysentary are prevalent.

COASTAL FEATURES—LANDMARKS (CONTINUED)

3B-10 FROM PURI TO DEVI POINT (19° 59'N., 86°24'E.) the coast is sandy with bare sand hills 20 to 70 feet high.

BALESHWAR TEMPLE, a small, black, pagoda-shaped building with trees around it, stands 1/2 mile inland and about 7 miles east-northeastward of Puri Lighthouse. Only the upper part of the temple is visible from seaward.

The Kushbhadra River entrance is located about 13 1/2 miles east-northeastward of Puri Lighthouse. The river is very shallow and of no importance. Ramchand Temple, small in size with two palms near it, marks the entrance.

Eastward of Konarak, a village about 16 miles east-northeastward of Puri Lighthouse and 2 miles inland, groups of trees may be seen between the coastal sand hills. At Konarak a black PAGODA, although in a ruined condition, is quite prominent; it is about 130 feet high and stands on low land with a few trees at its base. From the northeastward it resembles a black pyramid.

TUNDAHA OBELISK, 15 feet high, stands on a coastal sandhill about 9 1/2 miles east-northeastward of Ramchand Temple. A stranded WRECK is reported to lie about 3/4 mile southwestward of Tundaha Obelisk.

The Prachi River entrance is about 1 mile east-northeastward of Tundaha Obelisk; it is shallow and unimportant.

Nulyasai, a fishing village situated on coastal sand hills, is about 4 1/2 miles east-northeastward of Tundaha Obelisk.

3B-11 DEVI RIVER, one of the largest branches of the Mahanadi River, flows into the sea northward of DEVI POINT (19°59'N., 86°24'E.). The country in this vicinity is low and level; Devi Point, the termination of a long, narrow sandspit, can best be identified by BALIJORI OBELISK, 15 feet high, which stands about 2 1/2 miles north-northeastward of the point. Nulyasai village is also conspicuous to approaching vessels in the vicinity of Devi Point; breakers may be seen on the bar across the mouth of the river and from aloft the river is visible over the sandspit. Central Sand, the shoal extending seaward from the mouth of the river, is discussed in section 3B-2.

It is said that a passage with a least depth of 8 feet exists over the entrance bar and that within the entrance there are depths of 3 fathoms. There is little trade on the river and the surrounding country is a dense, swampy jungle with no inhabitants.

A LANDING, in case of necessity, may be made by boats in a bight northward of Central Sand, about 1 1/3 miles northward of Devi Point. This landing is practicable only with southerly winds.

ANCHORAGES.—Vessels with local knowledge can anchor off the mouth of the Devi River, northeastward and eastward of Devi Point. During onshore winds the anchorage is in 8 fathoms with Balijori Obelisk bearing 317°, about 1 1/2 miles distant. When westerly winds prevail the usual anchorage is about 1 mile southward of the above position. Caution should be exercised when using this anchorage because of the reported southeastward extension of Central Sand. Continuous sounding is deemed necessary.

Small vessels with local knowledge and a draft of 10 feet or less can anchor in 3 fathoms inside the mouth of the river with Devi Point bearing 057°, a little more than 1/2 mile distant.

3B-12 The coast from Devi Point to the entrance of the Jatadharmohan (Jotdar) River, about 17 miles northwestward, consists of a low, sandy beach with hillocks 15 to 20 feet high. About 4 miles northeastward of Devi Point is the shallow entrance of the Hurrichpur River, a branch of the Devi River. The entrance is not visible from seaward; Hurrichpur, a small town, is located about 1 1/2 miles up this branch.

There are always breakers across the shallow entrance of the Jatadharmohan River. The entrance of the Patakund River, which is also very shallow, lies about 6 miles east-northeastward of the mouth of the Jatadharmohan River.

The coast from the entrance of the Patakund River northeastward to the vicinity of False Point and thence northwestward around to the Kandrapatia (South Broni) River Entrance (20°29'N., 86°46'E.) is deltaic. False Point Anchorage lies off the northeast side of the delta; the Patakund, Mahanadi, Kharnapi, and Jambu Rivers with tributary creeks flow through this delta. The action of the sea causes constant changes in the shore line and in the depths close off the delta.

The land northeastward of the entrance of the Patakund River is very low; about 4 miles east-northeastward of the river's mouth this low land terminates in LION'S RUMP, the south side of the south entrance of the Mahanadi River. A conspicuous HOUSE stands about 1/2 mile southwestward of Lion's Rump; a structure, formerly a palace, stands near the shore about 2 miles southwestward of the entrance of the Patakund River and is a prominent feature.

A conspicuous monument and a conspicuous water tower stand about 4 3/4 and nearly 5 3/4 miles southwestward, respectively, of False Point Lighthouse.

3B-13 FALSE POINT (20°20'N., 86°44'E.), about 2 1/2 miles north-northeastward of Lion's Rump, lies within the two entrances, north and south, of the Mahanadi River.

A LIGHT is shown from False Point; the lighthouse has a large, white star with ten points centered on its southeast face. See CAUTIONS in section 3B-2.

A RADIOBEACON transmits from False Point Lighthouse.

A low tongue of land extends about 3 3/4 miles northeastward from False Point and nearly meets and sometimes joins the south extremity of NURREA BANGA NASSI, a low and narrow island, about 6 1/2 miles in length and covered with grass and scrub.

A REFUGE HOUSE, a large stone building with a banyan tree close by, stands on the

west side of Nurrea Banga Nassi. At a distance the house with the banyan tree has the appearance of a single object, the tree appearing to form a dome on the roof of the house.

A drying spit extends northward and westward from the north extremity of Nurrea Banga Nassi; the position of the spit is constantly changing.

Two WRECKS lie stranded in the shoal area to the westward of Nurrea Banga Nassi.

3B-14 THE MAHANADI RIVER has two entrances which lie between Lion's Rump and the south extremity of Nurrea Banga Nassi, about 6 miles northeastward. A long and narrow low-lying sand cay, which fronts False Point and covers at very high spring tides, separates the two entrances. This cay, the north end of Lion's Rump, and the south end of Nurrea Banga Nassi are inundated at high water if a heavy surf is running. Both entrances are liable to recurring changes, especially after heavy rains, floods, and seasonal cyclones. A long line of heavy surf has been encountered across and 1 mile seaward of the entrances. The land within the entrances is low and intersected by numerous creeks.

Two narrow channels comprise the south entrance of the Mahanadi River; these channels usually lie between shoals and sandspits with one being close to Lion's Rump and the other close to the south end of the sand cay. Boats can use either channel at most stages of the tide, provided a surf is not running. Tidal currents off the south entrance of the river follow the trend of the coast and attain a velocity of from 1 knot to 1 1/2 knots at spring tides.

The north entrance of the Mahanadi River lies about 3 1/2 miles east-northeastward of False Point Lighthouse and close northward of the north end of the sand cay. This entrance, extremely narrow and with a surf running nearly all of the time, can only be navigated by boats during calm weather; local knowledge is essential.

The city of Cuttack, 55 miles from the mouth of the Mahanadi River, is the headquarters of the Orissa District. A table of meteorlogical data for Cuttack is given in the Appendix.

PARADEEP (PARADIP) (20°19'N., 86°37'E.)

3B-15 PARADEEP, opened as an iron-ore shipping port in 1958, is situated on the right bank of the Mahanadi River. This old port site is reported to be 7 miles below the Paradeep Lock and about 4 miles within the river's mouth. Ore, lightered to anchored vessels, is brough to Paradeep by road and canal; the nearest railroad is at Cuttack, 65 miles from Paradeep.

Construction of the all-weather, deep-sea port of Paradeep at a new site near the mouth of the Mahanadi River was expected to be completed by late 1965. The port was designed as a lagoon with a depth of 50 feet. It was reported in late 1965 that the depth was 42 feet and that vessels with drafts up to 40 feet could enter; only day pilotage was available at that time. Reports indicate the new port of Paradeep will be capable of accommodating 60,000 ton vessels.

Facilities comprising the initial phase of the work consist of a 1 1/4-mile long dredged seaway, 280 feet wide and protected by breakwaters, which leads to a 500-yard turning basin; the iron-ore loading berth, 500 feet long, is reported to have the capacity to load 2,500 tons of ore per hour. Facilities at the loading berth are to include the supplying of water and fuel oil bunkers to vessels calling at the port.

FALSE POINT ANCHORAGE (20°29'N., 86° 49'E.)

3B-16 FALSE POINT ANCHORAGE lies off the north end of and in the bay westward of the north part, respectively, of Nurrea Banga Nassi.

The outer anchorage, about 1 mile northward of the north extremity of Nurrea Banga Nassi, has a depth of about 26 feet; anchorage can be taken in 33 feet about 1 mile farther north-northeastward of the first anchorage position. The holding ground is fairly good, but the anchorage is completely exposed to wind, sea, and swell. Anchorage is not recommended.

Small vessels can anchor in a depression nearly 1 1/2 miles long lying westward of the north part of Nurrea Banga Nassi; local

knowledge is essential. Anchorage in the bay is safe, but the depths are very shallow and the bay is gradually silting up.

DIRECTIONS.—Vessels approaching from the southward and after making False Point Lighthouse, should not proceed in depths of less than 10 fathoms until the lighthouse bears about 244°, distant 10 miles, and the refuge house on Nurrea Banga Nassi bears 270°, thence a course of about 320° should be made good to the anchorage.

CAUTION.—With strong southerly winds the flood current sets toward the coast in the vicinity of Satbaia Sandhill, about 15 miles northeastward of the north extremity of Nurrea Banga Nassi. Vessels from the northward must guard against this current.

With a strong flood current it is best to approach the anchorage on a southerly course; such a current is noticeable by the rapid drift northward it imparts to the vessel. Stemming the current by turning the vessel to port, eastward or northeastward, from its southerly course is then advised before anchoring. Vessels attempting to turn to starboard, or through southwest and northwest, have been swept rapidly westward and have grounded on the shoals extending from Temple Point (20°25′N., 86°44′E.).

TIDES—TIDAL CURRENTS.—The tidal currents within the bay, westward of Nurrea Banga Nassi, set fairly through the channels. The velocity at spring tides averages 2 knots. After heavy rains, when the freshets come down the Kharnasi and Jambu Rivers, the ebb current sometimes attains a velocity of 4 or 5 knots and runs out around the north extremity of Nurrea Banga Nassi.

Tides at False Point are semidiurnal.

TIDAL HEIGHTS ABOVE *H.O. CHART DATUM.—MHWS 8.25 feet, MLWS 1.75 feet; MHWN 6.25 feet, MLWN 3.75 feet. *H.O. Chart 6171.

COASTAL FEATURES—LANDMARKS (CONTINUED)

3B-17 KHARNASI RIVER, with depths of 1 foot to 5 feet, is a short branch of the Mahanadi River. The JAMBU RIVER flows into the bay westward of Nurrea Banga Nassi, as does the Kharnasi. With depths of 6 to 20 feet in mid-channel, the Jambu may be entered by vessels with a 10-foot draft at high water; small craft can enter the Kharnasi at high water. The channels leading to the Kharnasi and Jambu Rivers have a common entrance northward and a common bar, with depths of 1 foot to 5 feet, westward, respectively, of the north extremity of Nurrea Banga Nassi. The channels are subject to change; the depths given have not been checked or confirmed for a number of years. Local knowledge is essential. It is said that, at high water, cargo boats and small steamers enter, without difficulty, the Kharnasi and Jambu channels.

The southern shore and the west side of the bay westward of Nurrea Banga Nassi are principally mangrove swamp and continue as such northward toward Temple Point.

TEMPLE POINT (20°25′N., 86°44′E.) is a projecting point of trees about 1 1/2 miles northward of the Jambu River Entrance. Temple Tree, the tallest tree in the vicinity, stands about 1 mile west-northwestward of Temple Point.

Between Temple Point and the entrance of the Kandrapatia (South Broni) River, about 3 1/4 miles northward, the land is low and covered with grass and scrub with scattered patches of mangrove swamp; the foreshore is sandy and marks the high water line. The entrance of Broni Mohan Creek forms a conspicuous gap between high sandhills about 1 1/2 miles northeastward of the entrance of the Kandrapatia River; farther northeastward the sandhills are more elevated.

3B-18 FALSE BAY lies between Nurrea Banga Nassi and Maipura Point (20°43′N., 87°03′E.), about 20 miles northeastward at the entrance of the Maipura River.

The bottom is soft olive-green mud in the south part of False Bay; in the north part of the bay the bottom changes from soft mud to a mixture of sand and mud, with broken stones and shells towards the south edge of the shoals, which extend seaward from the entrance of the Maipura River and Palmyras Point. Depths in the bay are regular, decreasing gradually towards the shore.

The coast between Broni Mohan Creek and Maipura Point is moderately high and consists of sandhills.

SATBAIA SANDHILL, 60 feet high with an

isolated clump of bushes at its northeast end, is a good mark. It stands about 4 1/2 miles southwestward of Maipura Point.

Northward of Maipura Point the land is quite flat.

LONG SAND, a drying shoal in two parts on which the sea breaks heavily, extends about 3 1/4 miles northeastward from a position about 3/4 mile east-northeastward of Maipura Point. An unmarked CHANNEL, about 600 yards wide with depths of 1 1/4 to 8 fathoms, divides Long Sand into two parts and leads northwestward between the Wheeler Islands joining the buoyed entrance channel of the Dhamra River (sec. 3B-21) westward of Shortt Island.

WHEELER ISLANDS, a group of six small islands, are located on Long Sand; the two largest islands, 15 and 20 feet high, lie on the northeast part of the shoal nearly 3/4 mile southward of Shortt Island. The four remaining islets, the largest of which is 20 feet high, lie on the northwest end of the southwest part of Long Sand.

The north and northeast edges of the northeast part of Long Sand are separated from another shoal northward, on which Shortt Island is located, by another unmarked CHANNEL about 500 yards wide with depths of 1 1/2 to 4 1/2 fathoms which also joins the buoyed entrance channel of the Dhamra River westward of Shortt Island.

MAIPURA RIVER ENTRANCE lies between Maipura Point and the southwest extremity of Long Sand; the Maipura River is deep, but because of flats obstructing its entrance it can be entered only by boats at half tide when the water is smooth.

ANCHORAGE OFF MAIPURA POINT.—Anchorage about 2 3/4 miles southeastward of the north end of the sandhills on Maipura Point in 6 to 7 fathoms, mud and sand, affords shelter from northwesterly winds.

3B-19 SHORTT ISLAND (20°47'N., 87°05'E.), 10 feet high, is the largest of four small islands which are located on the drying shoal northward of Long Sand. The shoal which extends about 1 1/2 miles eastward and 1 mile westward from Shortt Island is continually changing; the island itself is being gradually altered in shape by the action of the sea. In years gone by the north end of the island was being washed away and the south end was extending.

SHORTT ISLAND LIGHT is shown from a tower about 3/4 mile northward of the southwest extremity of the island.

See section 3B-2 for Palmyras Shoals which lie eastward of and adjacent to Shortt Island.

TIDES.—Tides at Shortt Island are semidiurnal.

TIDAL HEIGHTS ABOVE *H.O. CHART DATUM.—MHWS 10.25 feet, MLWS 1.25 feet; MHWN 7.25 feet, MLWN 4.0 feet. *H.O. Chart 6171.

ANCHORAGE OFF DHAMRA RIVER ENTRANCE (20°50'N., 87°08'E.)

3B-20 ANCHORAGE off the entrance of the Dhamra River is afforded about 4 miles northeastward of Shortt Island in 6 to 7 fathoms. During strong southwesterly winds a good position to anchor is in 7 fathoms with Shortt Island Lighthouse bearing 206°.

Anchoring vessels should approach the anchorage with Shortt Island Lighthouse bearing 226°. At night anchorage should be taken in 6 or 7 fathoms. See sections 3B-2 and 3B-4.

A dangerous WRECK, position approximate, lies about 3 miles 056° from Shortt Island Lighthouse.

DHAMRA RIVER

3B-21 THE DHAMRA RIVER, the most important of the navigable rivers of the Orissa District, forms the north outlet of the confluent waters of the Brahmani, Kharsua, and Baitarani Rivers.

The town of CHANDBALI is situated on the north bank of the Baitarani River, about 8 miles above the junction of the Baitarani and Dhamra Rivers and about 18 miles within the latter river's entrance.

DHAMRA RIVER ENTRANCE.—The area off the Dhamra River entrance embraces Shortt and Wheeler Islands, Long Sand, Palmyras Shoals, and extensive drying sand and mud flats.

Dhamra River Entrance, about 6 miles westward of Shortt Island Lighthouse, lies be-

tween Palmyras Point on the south and an unnamed low-mud point about 1 mile northwestward of Palmyras Point.

NAVIGATION.—It is not advisable for a stranger to cross the bar and enter the river without a pilot. Navigation within the river's entrance is tortuous.

TIDES.—Tides at Chandbali are semidiurnal.

TIDAL HEIGHTS ABOVE *CHART DATUM—CHANDBALI.—MHWS 8.9 feet, MLWS 2.1 feet; MHWN 7.0 feet, MLWN 3.4 feet. *B.A. Chart 754.

DEPTHS—DANGERS.—Extensive mud and sand flats, which dry at low water springs, extend about 2 1/2 miles offshore between the entrances of the Maipura and Dhamra Rivers.

Shallow flats extend as much as 6 or 7 miles offshore between the entrance of the Dhamra River and Balisahi Point, about 4 1/4 miles northward of the river's entrance. Kanika Sand is the south extremity of these flats.

KANIKA SAND, an extensive mud and sand flat west-northwestward of Shortt Island, lies on the north side of the entrance channel and dries at low water springs. The southeast extremity of Kanika Sand was reported to be extending to the southeastward.

The outer bar, which had a least depth of 5 feet, lies about 1 1/4 miles north-northwestward of Shortt Island Lighthouse.

The inner bar, southward of Kanika Sand, had a least depth of 8 feet.

The outer bar maintains its position and depths fairly well; the inner bar changes its position with accompanying changes in depths.

Chandnipal Bar lies in the channel northward of Kalibhanja Dian, a long narrow island which divides the river in two channels close within the river's entrance. Chandnipal Bar had a least depth of 17 feet.

Several bars exist in the Baitarani River, one at its junction with the Dhamra River and the others lie between the junction of the rivers and Chandbali; the least depths over these bars was reported to be 8 and 9 feet at certain stages of the tide.

In 1960 the draft available in the river channels leading to Chandbali was reported to be 12 feet at high water and 5 feet at low water.

The Matai Nadi, a river about 200 yards wide, joins the Dhamra River a short distance upriver of Dakshina Dhamra, a village on the north bank of the Dhamra River about 3 3/4 miles within the latter river's entrance. Vessels with a draft of 8 feet are reported to be able to navigate the Matai Nadi at low water.

ASPECT.—PALMYRAS POINT, about 6 miles westward of Shortt Island, is the north extremity of low land which lies between the mouths of the Maipura and Dhamra Rivers. Dark jungle growth covers the point and makes it difficult to distinguish; the adjoining land is low with a few palmyra trees.

The village of Dakshina Dhamra consists of a few scattered houses.

The land on the north side of the entrance of the Dhamra River is low and covered with jungle growth; this low land continues northward for about 4 miles and terminates in Balisahi Point.

BEACONS.—Three beacons, each 80 feet high with a ball topmark, stand in the vicinity of the entrance of the Dhamra River. These beacons, visible from seaward but not easy to identify outside the outer bar, are located as follows:

BUDARA BEACON, a black framework

structure, stands nearly 1 1/2 miles south-southeastward of Palmyras Point.

CHANDNIPAL BEACON, a red and white framework structure, stands on the north side of the entrance of the Dhamra River about 200 yards northward of the unnamed low-mud point.

BALISAHI BEACON, a black framework structure, stands about 1/3 mile inland and about 2 1/2 miles northward of Chandnipal Beacon.

BUOYS.—The entrance channel over the outer and inner bars is buoyed and the channels in the river are marked by buoys in places. The buoys are liable to be moved occasionally to meet changes in the channel and should not be relied upon.

In 1963, a black and white checkered conical buoy marked FWY was moored about 2 1/2 miles east-northeastward of Shortt Island Lighthouse; a red conical buoy and a black can buoy moored 1 mile and 1 1/4 miles northward, respectively, of the same lighthouse marked the entrance of the channel over the outer bar.

CHANNELS.—The buoyed entrance channel passes about 3/4 mile northward of Shortt Island and then leads between the shoal, which comprises Shortt Island and the three islets, and Kanika Sand; it then turns westward and leads between Kanika Sand and the north edge of the flats which extend eastward from Palmyras Point. This westerly stretch of the channel leads to the entrance of the Dhamra River. Close within the river's entrance only the northern channel around Kalibhanja Dian is navigable. See section 3B-18 for the two unmarked channels which join the buoyed entrance channel. The channels are subject to change due to changing conditions.

ANCHORAGES.—Anchorage can be had in the reach off the village of Dakshina Dhamra.

There is an anchorage off the town of Chandbali.

PILOTAGE—PILOTS.—Pilotage for the Dhamra River is not compulsory, but is advisable for strangers.

Pilots are available at Chandbali; by previous arrangement they will meet vessels at Shortt Island.

STORM SIGNALS.—Storm and weather signals are displayed at Chandbali in accordance with the Indian Brief System. See section 1-34.

3B-22 CHANDBALI (20°46'N., 86°45'E.), with a 1948 population of about 5,000, is a river port of increasing importance; most of the sea trade is with Calcutta. There is a Port and Customs Office. Rice is the main export.

A JETTY with a reported 70 feet of berthing space will accommodate small vessels with a maximum draft of 12 feet.

PASSENGERS and CARGO are usually embarked and discharged alongside the jetty.

SUPPLIES in small quantities can be obtained.

COAL up to 20 tons is usually obtainable.

COMMUNICATION by sea with Calcutta and by inland waterway with Cuttack is maintained regularly.

There is a very small hospital.

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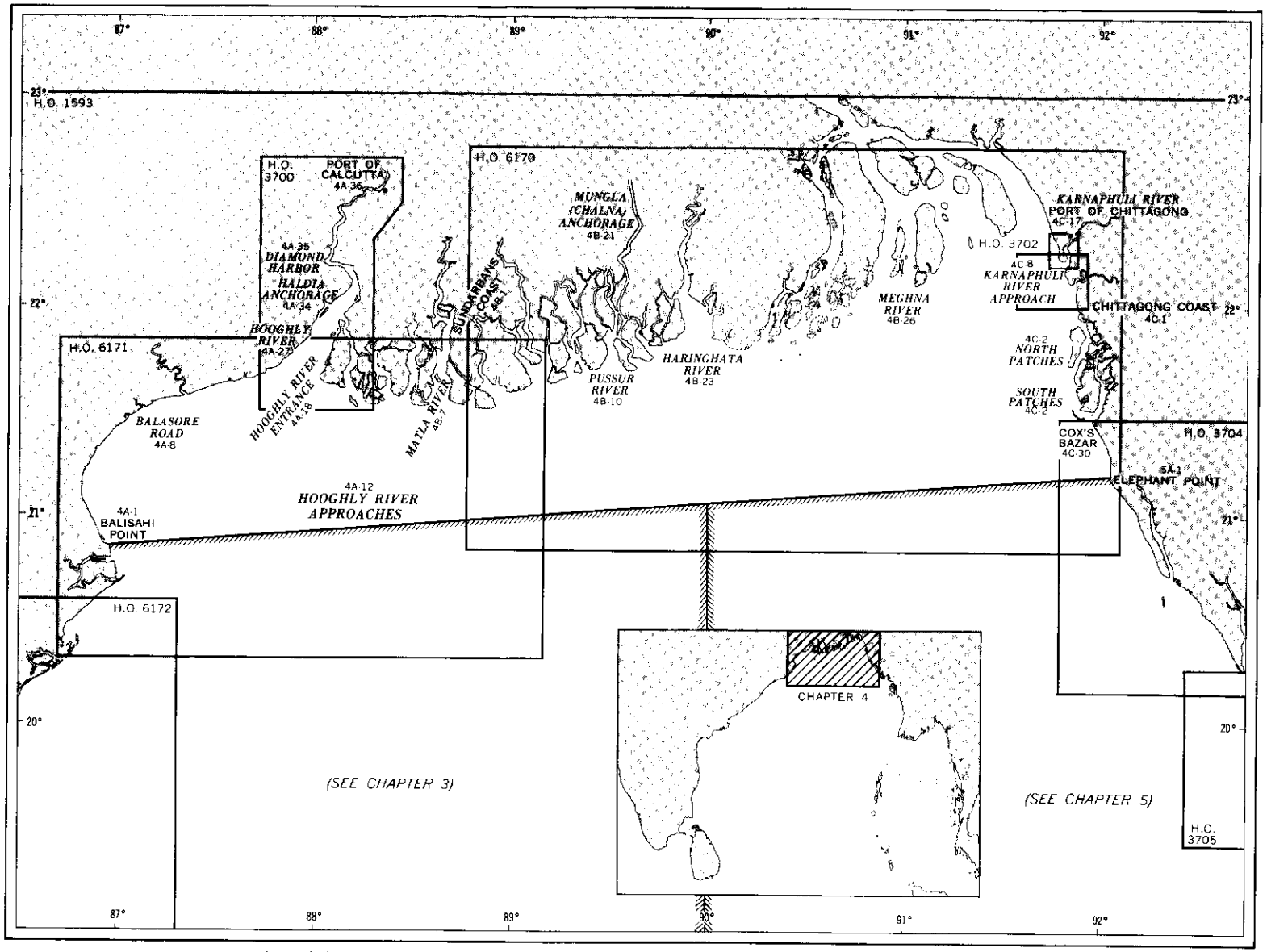


Chart limits shown are of the best scale charts issued to naval vessels by the U. S. Naval Oceanographic Office.
Numbers refer to the section in the text describing a designated locality.

## CHAPTER 4—GRAPHIC INDEX

## CHAPTER 4

## EAST COAST OF INDIA AND THE COAST OF EAST PAKISTAN—BALISAHI POINT TO ELEPHANT POINT

Part A. Balisahi Point to the Sundarbans Coast, including the Hooghly River to Calcutta
Part B. The Sundarbans Coast and the Meghna River to the Chittagong Coast
Part C. The Chittagong Coast to Elephant Point

PLAN.—Description of the east coast of India is continued and concluded in this chapter and embraces the balance of the Orissa Coast, the Hooghly River, the ports of Haldia and Calcutta, and the Sundarbans Coast. Next follows a description of that part of the Sundarbans Coast in East Pakistan and includes the Pussur River along with the port of Chalna (Mungla Anchorage). Finally the Chittagong Coast, including the Karnaphuli River, the port of Chittagong, and Cox's Bazar, is described. The progression is from west to east, thence southward.

### GENERAL REMARKS

4-1 The Hooghly River is the westernmost branch of the Ganges and the means of access for ocean vessels calling at the port of Calcutta. Flowing through the Sundabans, the Pussur River, another branch of the Ganges, is navigable by ocean vessels to the port of Chalna (Mungla Anchorage). Ocean vessels navigate the Karnaphuli River to the port of Chittagong.

The Orissa and Sundarbans Coasts are low; mountain ranges mark the Chittagong Coast.

Across the head of the Bay of Bengal, the 10 and 20-fathom curves are charted in a general east and west direction; off the entrance of the Pussur River, about the center of the head of the bay, the 10 and 20-fathom curves lie nearest to the shore, being about 14 and 15 miles offshore, respectively. In this vicinity depths decrease abruptly from over 100 fathoms to 10 fathoms within a distance of about 2 miles; elsewhere in the head of the bay the decreases in depths between the 20 and 10-fathom curves and within the latter curve are of a more gradual nature. The 100-fathom curve is not well defined in the northern part of the Bay of Bengal.

### NAVIGATION

4-2 Navigation in the Bay of Bengal to the river ports at the head of the bay is as direct as safety will permit. Navigational warnings are broadcast from Calcutta and Chittagong. See H.O. Pub. 117B.

### WINDS—WEATHER

4-3 The areas discussed in this chapter are under the influences of the Northeast and Southwest Monsoons and the transitional periods in between them.

During the Northeast Monsoon, December through February, fine weather with light northerly or northwesterly winds, broken at intervals by disturbances moving eastward with light to moderate rains, are the usual weather features.

The hot-weather season, March through May, is a period of continuous increase of temperature. Land and sea breezes give rise to large contrasts of temperature and relative humidity, and as a result, violent local storms occur, especially in the Ganges Delta Area when they are known as Nor'westers. Approaching from the northwest and driven by winds which may reach hurricane force, these storms, accompanied by downpours of rain, burst suddenly with great fury.

Heavy rainfall and extensive cloudiness with a few clear days are associated with the Southwest Monsoon (wet season), June through September. Temperatures are lower than those during the hot-weather season, but the high humidities combined with the high temperatures create uncomfortable conditions.

The retreating Southwest Monsoon, October through November, is accompanied by clear, dry weather.

Tropical cyclones are experienced mainly from April through December. Severe storms

occur mostly during the transitional months before and after the Southwest Monsoon; tropical storms are most frequent during the Southwest Monsoon.

CURRENTS—TIDAL CURRENTS

4-4 Surface currents across the head of the Bay of Bengal, as elsewhere in the bay, are developed and influenced by the effects of the Monsoon winds. See section 1-70.

At the Sandheads (sec. 4A-15) in August a strong current sets to the westward; in September, after the retreat of the Southwest Monsoon, the current setting to the westward depends on the force and duration of the easterly winds. During October the current sets westward and southwestward.

Seaward of the Sundarbans Coast (sec. 4B-1) there are strong rotary tidal currents. The flood current begins setting westward; at the end of the first quarter its direction is west-northwestward and at half flood about northward. During the last quarter of the flood the current sets east-northeastward. At commencement, the ebb current sets eastward, at half ebb it sets southward and during the last quarter of the ebb westsouthwestward, thus making a complete rotation.

CAUTION—SHOAL DEPTHS

4-5 Reefs, shoals, and sands extend seaward in a general southward direction from the delta shore at the head of the bay. These dangers, with depths of 3 fathoms and less, lie within the 6-fathom curve and in places extend offshore at distances up to nearly 30 miles.

Soundings afford a guide when approaching the shoal waters at the head of the bay; at times when a vessel's position is in doubt or uncertain it is advisable not to proceed in depths of less than 20 fathoms until vessel's position is fixed. Caution is advised.

PART A. BALISAHI POINT TO THE SUNDARBANS COAST, INCLUDING THE HOOGHLY RIVER TO CALCUTTA

4A-1 BALISAHI POINT (20°51'N., 86°58'E.) is an extremity of low land northward of the entrance of the Dhamra River.

COAST—GENERAL

4A-2 BETWEEN BALISAHI POINT AND THE ENTRANCE OF THE HOOGHLY RIVER the coast is indented by a large bay. The Orissa Coast terminates at the entrance of the Hooghly River. Nearly 100 miles of low-lying coast front the bay; the shore fronting the southern part of the bay is low, flat, and covered with scrub and low mangroves. Southwestward of Chandipur the trees are higher; low sandhills mark this section of the coast. The shore fronting the northern part of the bay, east-northeastward of Chandipur to the entrance of the Hooghly River, is low and mostly sandy; several sandhills mark this section of the coast. There are no distinctive landmarks.

DEPTHS—DANGERS

4A-3 Between Balisahi Point and the entrance of the Hooghly River the 20-fathom curve is charted about 36 to 46 miles offshore; the 10-fathom curve lies about 9 miles eastward of Balisahi Point and runs northeastward to a position about 22 miles southward of the entrance of the Subarnarekha River (21°34'N., 87°21'E.), thence east-southeastward to about 40 miles southward of the entrance of the Hooghly River, its most distant position along this section of the coast. The 3-fathom curve and lesser depths and dangers within the 3-fathom curve are discussed along with a description of the coastal features.

In 1959 a shoal with a depth of 8 fathoms was reported in 20°49'N., 88°27'E.

OFF-LYING BANK

4A-4 A bank with depths of 19 fathoms, fine yellow sand, was reported in 20°15'N., 88°03'E.

TIDES—TIDAL CURRENTS

4A-5 At Balramgari, which is just within the Burhabalang River Entrance (sec. 4A-9), springs rise 12 feet and neaps rise 8 feet.

Tidal currents in Balasore Road (sec. 4A-8) set northeastward during the flood stage and southwestward during the ebb stage. The velocity of each current is about 2 knots at springs.

In the Burhabalang River the ebb current lasts 8 or 9 hours with a velocity as high as 4 knots. The flood current is weak, averaging about 1/2 knot.

WINDS—WEATHER

4A-6 See section 4-3.

Balasore Road (sec. 4A-8) is in the track of cyclonic storms; many disasters have been caused by these storms.

COASTAL FEATURES—LANDMARKS

4A-7 BETWEEN BALISAHI POINT AND THE ENTRANCE OF THE BURHABALANG RIVER (21°28'N., 87°04'E.) the shore is fronted by drying sand and mud flats; the 3-fathom curve lies 2 to 5 miles off these flats.

The coast for 13 miles north-northwestward of Balisahi Point to abreast the small village of Bideipur is low, muddy, and covered with scrub growth.

From Bideipur for about 8 miles northward to Kalikoti the coast is flat and lined with dense mangroves. Gamai River, a small stream accessible at low water to small boats only, enters the bay about 3/4 mile southward of Kalikoti.

The village of Nauri is 11 miles north-northeastward of Kalikota; a small stream, similar to the Gamai, flows into the bay about 1 mile southward of Nauri. At Nauri the coast becomes firmer with taller trees and low sandhills marking the shore; these coastal features continue for 10 miles northeastward to the village of Chandipur. A large, double PAGODA, about midway between Nauri and Chandipur and 2 miles inland, is visible among the trees on northwesterly bearings.

At Chandipur there is a sand cliff, 53 feet high; a black FLAGSTAFF stands near a large white bungalow about 3/4 mile northeastward of Chandipur and in this vicinity the sandhills are 55 feet high.

The entrance of the Burhabalang River lies about 2 1/4 miles northeastward of Chandipur; the coast, near the mouth of the river, with its low sandhills appears sandy and barren from seaward.

4A-8 BALASORE ROAD (21°23'N., 87°07'E.) lies off the entrance of the Burhabalang River.

Anchorage is afforded in the roadstead in about 4 fathoms, sand and stiff mud, good holding ground, with the flagstaff northeastward of Chandipur bearing 312°, distant 7 miles. This is the best anchorage for vessels with a draft of about 20 feet. Anchorage may also be found on the same bearing closer to the shore, according to draft.

The anchorage should be approached with the highest part of Nilgiri Mountain, located about 16 miles westward of the Burhabalang River Entrance, bearing about 293°.

When there is doubt as to weathering a storm (sec. 4A-6) in Balasore Road, vessels might anchor farther southwestward off Kalikoti where the bottom is soft mud and the depths decrease gradually.

4A-9 THE BURHABALANG RIVER is tidal for about 23 miles and is navigable for about 4 miles within its entrance by native craft and vessels with drafts up to 9 feet.

The entrance of the river is almost closed by a bar which extends about 2 1/2 miles seaward. A narrow channel leads into the river. The bar is liable to deteriorate during the Southwest Monsoon; with southeasterly winds the sea breaks right across the entrance. The last quarter of the flood is the best time for crossing the bar.

No directions can be given for entering the Burhabalang River; local knowledge is essential. Great caution must be used in crossing the bar as the channel is always subject to change. If the flood current is running, a vessel must guard against being set northward. See section 4A-5.

BALASORE, a town on the south bank of the Burhabalang River, is situated about 16 miles above the river's mouth.

The port of Balasore comprises the waterfront abreast the town at which there is a wharf. Small boats are used for transporting cargo between vessels and the wharf. The river abreast the customhouse is about 100 yards wide; in midstream there are depths of 10 feet. Balasore was formerly a port of some commerical importance, but in recent years there has been no seaborne traffic. There is a hospital in the town which admits seamen.

4A-10 THE PANCHPARA RIVER flows into the bay about 4 1/2 miles northeastward of the entrance of the Burhabalang River; near the

entrance of the Panchpara are sandhills of mottled gray and yellow color. The Panchpara bifurcates just within its entrance; the village of Chanuya is situated about 5 miles up the west branch. Sartha village is about 8 miles up the east branch. A bar across the entrance of the Panchpara has a depth of only 1 foot, but within the entrance the river is deeper; native vessels of 100 tons can enter and ascend as far as Mahadani, about 9 miles inland.

Between the entrances of the Panchpara and Subarnarekha Rivers, a distance of about 13 miles, are several sandhills. PIPPLI SAND, which dries, lies about 2 miles southward of the entrance of the Subarnarekha.

THE SUBARNAREKHA RIVER is reported to have moderate depths within its entrance; it is navigable by native craft for about 16 miles, its tidal length. The former port of Subarnarekha, almost choked with sandbanks, is situated at the mouth of the river and is visited only by fishing boats. A pagoda and a clump of trees stand on the west bank of the river near its entrance.

ANCHORAGE off the entrance of the Subarnarekha River is afforded in 4 1/2 to 5 fathoms, mud, about 8 miles from the shore with the pagoda bearing 327°.

THE DIGWAH MAHAN, a shallow stream, has its entrance about 13 miles east-northeastward of the entrance of the Subarnarekha. About 4 miles eastward of the entrance of the Digwah Mohan is the mouth of the MUNDER MOHAN, another shallow stream; six miles eastward of the Munder Mohan is PICHABONI KHAL (Sola Creek).

4A-11 THE RASULPUR RIVER (21°47'N., 87°54'E.) discharges into the west side of the mouth of the Hooghly River, just within its entrance.

Quoin Sandhill is located on the shore midway between the Subarnarekha and the Digwah Mohan, otherwise the coast from the Subarnarekha to the Rasulpur is low and without any distinguishable features.

The 3-fathom curve lies 3 to 4 miles off the coast from the entrance of the Burhabalang River east-northeastward to a position about 5 miles south-southwestward of the mouth of the Digwah Mohan. Southward of the mouth of the Digwah Mohan the 3-fathom curve is tongue-shaped with the end of the tongue about 10 miles offshore; within this tongue-shaped curve there are least depths of 2 1/2 fathoms and the sea breaks heavily over this area during bad weather.

From the mouth of the Rasulpur River, JENSEN SAND, the inner and outer parts which dry to 15 and 13 feet, respectively, extends about 8 miles to the south-southwestward. SPENCE SAND, which dries from 1 foot to 8 feet in places, extends about 7 miles south-southwestward from the south extremity of Jensen Sand. A shoal with depths varying from 1/4 fathom to 2 3/4 fathoms extends southward from Spence Sand for about 19 miles and terminates in WESTERN SEA REEF.

Small craft approaching the entrance of the Rasulpur River from the westward use a narrow, close inshore channel with depths of a few feet; local knowledge is required.

A LIGHT is shown from the south side of the entrance of the Rasulpur River.

## APPROACHES TO THE ENTRANCE OF THE HOOGHLY RIVER

### NAVIGATION

4A-12 Vessels entering the Hooghly River approach EASTERN CHANNEL LIGHT VESSEL stationed about 45 miles south-southeastward of the entrance of the river.

During the Southwest Monsoon it is best to make the coast near Pundi (18°40'N., 84°27'E.) or between Pundi and Ganjam (19°23'N., 85°04'E.) where higher land backs the coast. When the weather is very hazy the land is obscured until a very near approach to it is made; it is advisable to determine a vessel's position before proceeding northward of Puri (19°48'N., 85°50'E.).

Soundings afford a guide when approaching this coast; the 100-fathom curve lies about 21 and 23 miles southeastward of Pundi and Ganjam, respectively, and about 15 miles southward of Puri. At night vessels should make Kalingapatam, Gopalpur, or Puri Lights. Continuous soundings should be taken while approaching the coast; depths of 20 fathoms lie about 4 miles off Kalingapatam, 3 1/2 miles off Ganjam, and 13 miles southward of Puri.

At night or in bad weather, a vessel's position having been fixed, she should proceed along the coast in depths of about 20 fathoms.

During the day in clear weather the Jagannath Pagodas at Puri (sec. 3B-8) and the black pagoda at Konarak (sec. 3B-10) should be sighted in passing. When about 10 miles beyond the black pagoda at Konarak, course should be shaped for Eastern Channel Light Vessel. Attention should be given to the soundings when passing False Point (sec. 3B-13) as the depths decrease gradually towards the shoal ground around it; at night vessels should keep in depths of not less than 14 or 15 fathoms or even 20 fathoms when the wind is southeasterly.

In September towards the end of the Southwest Monsoon, the current sets strongly to the southwest and if a vessel's position is fixed, landfall should not be made so far to the southward.

During the Northeast Monsoon, if a vessel is on the east side of the Bay of Bengal, course should be shaped directly for Eastern Channel Light Vessel.

See section 1-40 for cautionary information when approaching Indian Ports.

DEPTHS—DANGERS

4A-13 See sections 4-5 and 4A-3.

PILOTS RIDGE, a bank extending off the coast between False and Palmyras Points, is an excellent guide when approaching the entrance of the Hooghly River. The bottom, in depths of less than 20 to 23 fathoms, is shell, sand and gravel of a reddish color; in deeper water to the eastward or seaward, it is sand and mud with shining specks, or olive-colored mud with broken shells. The eastern edge of the ridge is rather steep; depths seaward of it are 28 to 30 fathoms.

The 20-fathom curve follows the northeastward trend of the coast and lies about 24 miles eastward of False Point Lighthouse and 25 miles eastward of Palmyras Shoals.

NAVIGATIONAL AIDS

4A-14 EASTERN CHANNEL LIGHT VESSEL (20°57′N., 88°14′E.) is moored about 45 miles south-southeastward of Sagar Island Lighthouse (21°39′N., 88°03′E.). A fog signal is sounded from the light vessel.

MATLA STATION BUOY, a red and white striped conical buoy with a framework topmark, is moored in the outer eastern approach to the entrance of the Hooghly River in approximately 20°59′N., 88°38′E.

EASTERN CHANNEL STATION BUOY, a black and white striped conical buoy with a framework topmark, is moored in approximately 20°57′N., 88°16′E.

WESTERN CHANNEL STATION BUOY, a red and white striped conical buoy with a framework topmark, is moored in 20°56′30″ N., 88°03′45″E.

SANDHEADS PILOT STATION—PILOT VESSEL—PILOTS—PILOTAGE—ESTIMATED TIME OF ARRIVAL—STANDARD TIME—SIGNAL STATION

4A-15 A pilot vessel, the SAMUDRA, cruises off the entrance of the Hooghly River; the cruising station is known as the SANDHEADS. This station is about 4 miles south-southwestward of Eastern Channel Light Vessel; during heavy weather the pilot vessel cruises about 10 miles southward of the light vessel. Equipped with radio and radio direction finder facilities, the pilot vessel is also in communication with Calcutta.

When sending a pilot to board a vessel, the pilot vessel will lie with the wind on her port side. The master of a vessel intending to pick up a pilot is advised to have a pilot ladder, boat rope, and man ropes rigged on the starboard side and approach the lee side of the pilot vessel with the wind on the port side. This procedure applies in all seasons when the pilot vessel is underway; during the Northeast Monsoon she may be found at anchor in the vicinity of, or up to 5 miles, northward of the light vesse. A motor launch is used to transfer pilots to and from the pilot vessel.

PILOT VESSEL LIGHT.—During the Southwest Monsoon season between sunset and sunrise the pilot vessel on station at the Sandheads, exhibits for 1 minute every 30 minutes, a searchlight beam at an elevation of 30°. The light will be revolved from east to west through south and back again.

PILOT VESSEL SIGNALS.—The pilot vessel, when underway, shows the ordinary signals of a pilot vessel on her station, and in addition a light at the foremast head which is carried in accordance with orders issued by the local port authorities, and also a stern

light. By day the pilot vessel displays the red and white pilot flag. The pilot flag is flown only when there are available pilots on board.

When a vessel arrives at the Sandheads and does not find a vessel showing the above signals, there are no pilots on station; instructions should then be requested by radio from Sandheads Pilot Vessel, call sign VWST.

If circumstances force the pilot vessel to discontinue her usual cruising and anchor, she will display, by day, the International Code Signal indicating that fact; by night she will show the lights for a power-driven vessel at anchor.

Vessels wishing to make any sound signals should do so in accordance with Article 28 of the Rules of the Road.

PILOTAGE.—Pilotage is compulsory for all merchant vessels over 100 tons; navigation on the Hooghly River should not be attempted without a pilot.

ESTIMATED TIME OF ARRIVAL.—Masters of vessels bound for the Sandheads should inform the pilot vessel by radio at least 24 hours in advance of their estimated time of arrival at the pilot station and give the vessel's gross tonnage, length overall, freshwater draft, and speed; whether there are any explosives on board, number of passengers, if any, and livestock, if any, giving details.

An ETA should be sent to the pilot vessel at the Sandheads immediately upon vessel's departure from a port less than 24 hours steaming distance away.

To enable a vessel to get to Calcutta on one tide it is best to arrive at the Sandheads at the time of low water at Sagar (Saugor) Island (21°39'N., 88°03'E.); however, it is necessary to have daylight for the last four hours of the passage.

STANDARD TIME.—Vessels arriving at the Sandheads should have their clocks set to Bengal Time, which is 5 1/2 hours fast of G.m.t.; this time is kept by the pilot vessel and at Calcutta.

SIGNAL STATION.—Lloyd's agents at Calcutta have facilities for delivering communications to vessels at the Sandheads. Signal stations within the Hooghly River are given in section 4A-33.

Although storm and weather signals are not exhibited at the Sandheads, information in accordance with the Indian General System is available to passing vessels.

## ANCHORAGE

4A-16 If, from any cause, it should become necessary to anchor when approaching the pilot vessel, a vessel should do so southward of a line 270° from Matla Station Buoy, in a depth of not less than 15 fathoms, mud, and not too close to the pilot vessel.

A 1964 report stated that anchorage was recommended in the vicinity of the pilot vessel in 8 to 10 fathoms, west to north of Eastern Channel Light Vessel.

At times the tidal current runs strongly at the Sandheads; a vessel should stem the current before letting go an anchor.

## EXAMINATION SERVICE

4A-17 Examination Service and a Port War Signal Station have been activated at the Port of Calcutta; see section 1-41.

## HOOGHLY RIVER ENTRANCE (21°39'N., 88°01'E.)

## NAVIGATION

4A-18 EASTERN CHANNEL LIGHT VESSEL marks the entrance of EASTERN CHANNEL, which in 1961 was the main entrance channel of the Hooghly River. Eastern Channel, open for day and night navigation, leads into Gaspar Channel which leads to Sagar Roads.

Western Channel leads into Beaumont's Gut which also leads to Sagar Roads; in 1961 Western Channel was closed.

SAGAR (Saugor) ROADS (21°39'N., 88°01'E.), the navigable entrance at the mouth of the Hooghly River, lies about 2 miles westward of the southwest extremity of Sagar Island.

The navigable entrance channel leading to

Sagar Roads is subject to change in position and direction to accompany the change in depths, which occur from time to time. Local knowledge and assistance is essential to safe navigation.

## WINDS—WEATHER

4A-19 The wind and weather prevalent at the Sandheads is given in the table below.

See Appendix for Sagar Island Meteorological Table.

STORM SIGNALS.—Storm and weather signals are displayed at Sagar Island Lighthouse in accordance with the Indian Extended System. See section 1-34.

## TIDES—TIDAL CURRENTS

4A-20 Tides at the Sandheads and in Sagar Roads are semidiurnal. Sagar Tidal Semaphore, displaying day and night signals, stands about 1/2 mile south-southwestward of Sagar Island Lighthouse. Dublat Mark stands on Sidney Point, the southeast extremity of Sagar Island.

TIDAL HEIGHTS ABOVE *H.O. CHART DATUM.—The Sandheads: MHWS 11.1 feet, MHWN 8 feet. Sagar Roads: MHWS 17.7 feet, MLWS 3.8 feet; MHWN 13.4 feet, MLWN 7.9 feet. *H.O. Chart 6171.

In Eastern Channel the tidal currents, when not influenced by the wind, set as follows:

| | Flood | Ebb |
|---|---|---|
| First quarter | 306° | 126° |
| Second quarter | 340° | 160° |
| Third quarter | 025° | 194° |
| Last quarter | 070° | 228°,250° |

Maximum velocities are 2 to 3 knots during spring tides and 1 knot to 1 1/2 knots during neap tides in directions 340° and 160°.

## DEPTHS—DANGERS

4A-21 For depths, dangers, and drafts in the Hooghly River see section 4A-32.

Seaward of the Hooghly River entrance, shoals lie parallel to the general direction of the entrance channels.

WESTERN SEA REEF is discussed in section 4A-11.

EASTERN SEA REEF, with depths of 1/4 fathom to 2 3/4 fathoms, has its southern extremity about 29 miles southward of Sagar Island Lighthouse. Eastern Sea Reef extends southward from LOWER LONG SAND, a drying shoal with its north end about 4 1/2 miles south-southwestward of Sagar Island Lighthouse.

| Month | Wind | Force | Weather | Remarks |
|---|---|---|---|---|
| September, after breaking up of southwest monsoon. | Easterly | Light and variable | Showers of rain | Westerly current depending on force and duration of easterly winds. Weather generally clear. |
| October | Easterly and calms | Variable | Stormy, sultry at times | Westerly and southwesterly current; generally a gale or cyclonic storm. |
| November, December, January. | Northerly in morning and evening. | Fresh in morning and evening, calm midday. | Fine weather with cool mornings and evenings. | Cessation of the strong tides of the Hooghly; fogs in January in morning |
| February | Variable, southerly at night; northwesters sometimes. | Light | Warm toward end of month. | Thick fogs in morning; floods strong in Hooghly toward end of month. |
| March, April, May | Variable, until end of March; westerly and southwesterly in April and May. | Light at first, sometimes strong at end. | Northwesters, with rain, thunder, and lightning, frequent. Hazy. | Flood tide occasionally accompanied by bore; sometimes a gale or cyclonic storm in April or May. |
| June | Southwest | Strong at first | Northwesters decreasing in force; heavy thunderstorms. | In June the "chota burast" or small rain, generally lasts a fortnight. |
| July | Southwest; westerly | Strong; gales frequent | Squally, heavy rains | Freshets in the river; much swell in eastern channel. |
| August | Southwest and westerly; westward during day, hauling to southward toward evening. | Lighter | Squally, heavy rains, generally clear. | Strong, westerly current at Sandheads. |

A SHOAL with depths of 1/4 fathom to 2 3/4 fathoms extends about 26 miles south-southeastward from New Island (21°33'N., 88°11' E.). During the Southwest Monsoon the sea breaks heavily over the south end of this shoal.

A MIDDLE GROUND with depths of 3/4 fathom to 3 fathoms lies between Western Sea Reef and Eastern Sea Reef; the least depths over this Middle Ground are charted 15 and 17 miles southwestward of Sagar Island Lighthouse.

Another MIDDLE GROUND lies between Eastern Sea Reef and the shoal which extends south-southeastward from New Island; depths over this danger range from 1/4 fathom to 3 fathoms with the least depths being charted about 12 miles southward of Sagar Island Lighthouse. Heavy breakers during the Southwest Monsoon are noted on the chart over both Middle Grounds; the chart also shows heavy breakers during bad weather southward of the south end of the western Middle Ground, about 27 miles south-southwestward of Sagar Island Lighthouse.

UPPER LONG SAND, a drying shoal about 5 miles in length and 1 1/2 miles in width, lies with the middle of its east edge about 2 miles westward of the north end of Lower Long Sand. The north end of Upper Long Sand is charted about 4 1/2 miles west-southwestward of Sagar Island Lighthouse. A SHOAL with depths of 1/4 fathom to 3 fathoms extends southward from Upper Long Sand; the south extremity of this shoal, about 17 miles south-southwestward of Sagar Island Lighthouse, has a charted depth of 2 1/4 fathoms.

MIZEN SAND, which dries to 9 feet, and several smaller drying sands lie in the middle of the entrance of the Hooghly River westward to northwestward of Sagar Island Lighthouse.

MIDDLETON BAR dries to 3 feet near its center, which lies about 3 miles south-southwestward of Sagar Island Lighthouse. Shoal depths of less than 1 fathom and up to 3 fathoms lie north-northwestward of Middleton Bar for a distance of about 3 miles with the east edge of the north end of the shoal depths lying about 1 1/4 miles westward of Sagar Island Lighthouse.

WRECKS.—Dangerous sunken wrecks are charted approximately 1 1/2 miles 197°, 1 3/4 miles 243°, 5 1/2 miles 189°, in Gaspar Channel 6 1/3 miles 234°, and 8 miles 183°, respectively, from a position of 21°32.3'N., 88°11.2'E. on New Island, which position was that of a tower in ruins no longer charted.

Depths of 2 3/4 and 2 1/2 fathoms are charted over dangerous sunken wrecks which lie 8 1/4 miles 208° and 11 miles 205°, respectively, from Sagar Island Lighthouse.

A dangerous sunken wreck, marked by a green buoy moored on its northeast side, lies in Western Channel about 21 miles 201° from Sagar Island Lighthouse; another dangerous sunken wreck, position approximate, is charted in 9 to 10 fathoms about 35 miles 215° from the same lighthouse.

In Sagar Roads depths of 3 and 5 1/3 fathoms are charted over dangerous sunken wrecks which lie nearly 1 1/2 miles 219° and a little more than 3 miles 283°, respectively, from Sagar Island Lighthouse; another dangerous sunken wreck, marked by a green buoy, lies close to the southwest shore of Sagar Island about 3/4 mile 217° from the lighthouse. Dangerous sunken wrecks are also charted about 1 1/4 miles 265° and 2 miles 308°, respectively, from the lighthouse.

Within the entrance of the river dangerous sunken wrecks are charted nearly 6 1/2 miles 341°, position approximate, and 7 3/4 miles 000°, respectively, from Sagar Island Lighthouse.

CAUTION.—The positions of the wrecks, shoals, and sands with their relative depths and drying heights have been taken from the latest charts. Due to changing conditions, caution is advised; local knowledge is a prerequisite.

## CHANNELS

4A-22 EASTERN CHANNEL lies between Eastern Sea Reef on the west and the shoal on the east which extends about 26 miles south-southeastward from New Island. The deepest water is charted on the east side of the channel where the bottom is generally a soft and sticky clay in which the lead sinks deeply. GASPAR CHANNEL is the continuation northward of Eastern Channel and

leads north-northwestward for about 15 miles to Sagar Roads.

WESTERN CHANNEL lies betweeen Western Sea Reef and Eastern Sea Reef and leads into BEAUMONT'S GUT, which lies between Upper Long Sand and the shoal extending southward from it on the west, and Lower Long Sand on the east. Beaumont's Gut leads northward to Sagar Roads.

## NAVIGATIONAL AIDS

4A-23 SAGAR ISLAND LIGHT (21°39'N., 88°03'E.) is shown from a position about 1/2 mile within the southwest end of Sagar Island.

Although the principal entrance channel and the channel within the Hooghly River to Calcutta are marked by buoys and other aids to navigation, many of them lighted in accordance with the uniform buoyage system of India (sec. 1-19), no detailed description of them is given.

The changes in depths, bars, and in the directions of the channel are particularly rapid and navigational aids are frequently altered to meet these changes.

The chart shows conditions at the time of the last survey, but cannot be expected to remain accurate. Reliance must be placed principally upon the experience of the pilot.

## ASPECT—LANDMARKS

4A-24 SAGAR ISLAND, known locally as Saugor Island, lies on the east side of the mouth of the Hooghly River. The island, about 15 miles long with its greatest width of 7 miles across its southernmost part, is separated from the mainland to the eastward by the Baratala (Baratola) River. Composed of low alluvial soil, except for a fringe of jungle at its south end, Sagar Island is almost entirely cleared for cultivation. Small villages are located throughout the island. Sagar Island Lighthouse, a red and white banded cylindrical tower, stands near the southwest extremity of the island.

The coastal features on the west side of the mouth of the Hooghly River to the Rasulpur River (21°47'N., 87°54'E.) are discussed in section 4A-11.

KAUKHALI TOWER, a disused white brick lighthouse tower 80 feet in height, stands on the west side of the mouth of the Hooghly River about 4 miles northeastward of the entrance of the Rasulpur River.

## ANCHORAGE

4A-25 SAGAR ROADS affords anchorage in 5 to 8 fathoms in ordinary weather. Considerable swell rolls into the roads at high water during heavy gales.

## QUARANTINE REGULATIONS

4A-26 The master of an incoming vessel should report the health condition of his vessel to the pilot when he boards at the Sandheads and act in accordance with his instructions.

A vessel arriving at the Sandheads from an infected port, or one having plague on board, or a vessel on board which one or more cases of plague have developed within twelve days of the date of arrival, shall hoist and keep flying a yellow flag, and the signal indicating the port departed. Permission to haul them down must be obtained in writing from the health officer.

During this period no communication shall be held with the shore, or with any other boat or vessel, with the exception of the pilot boat.

In the case of a vessel with sickness on board which the pilot has reason to believe is plague, he shall telegraph to the health officer from Sagar and shall not proceed beyond Diamond Harbor (sec. 4A-35) without permission of the health officer. If the pilot has no reason to believe that there is anyone suffering from plague on board he shall bring the vessel up the river to Garden Reach and anchor her off Matia Bruz until visited by the health officer.

Vessels with cases of smallpox, cholera, measles, or other epidemic diseases common in India, or of diphtheria or scarlatina on board, or those on which two or more deaths from suspicious causes have occurred during the voyage, must report the facts to the pilot immediately after he boards the vessel; the pilot will give instructions as to the signals to be hoisted.

A vessel that has called at any yellow fever infected port within one month of arrival in Calcutta, even though it may have entered

another Indian port during that period, will not be granted free pratique. Health officials will board such a vessel at her berth.

Radio pratique may be obtained prior to arrival at Calcutta in accordance with instructions given in section 1-45.

The quarantine station is located at Diamond Harbor (sec. 4A-35).

## HOOGHLY RIVER TO CALCUTTA, INCLUDING HALDIA AND DIAMOND HARBOR

4A-27 THE HOOGHLY RIVER, about 11 miles wide at its mouth, is the westernmost, and commercially, the most important branch by which the Ganges River enters the Bay of Bengal. The east bank of the Hooghly is intersected by tidal channels which connect the various tributaries by which the Ganges enters the sea; some of these form inland waterways for boat and steamer traffic from Calcutta through the Sundarbans to Eastern Bengal and Assam. Kantabaria Beacon and Kantabaria Obelisk, about 30 miles north-northeastward of Sagar Island Lighthouse and 3 1/2 miles below Diamond Harbor, stand abreast the upper end of the estuary of the Hooghly River. Calcutta is about 83 miles upriver from Sagar Roads.

### NAVIGATION

4A-28 Navigation on the Hooghly River is reported to be diffioult. The 39-mile stretch from Hooghly Point (22°13'N., 88°04'E.) to Calcutta is the most treacherous.

The navigable channel in the river is subject to annual variations; these are caused by the scour of the freshets and the flood current, as the season is wet or dry, respectively. The channel through the estuary is subject, from time to time, to such changes as occur in all wide, sandy, tidal estuaries.

Vessels take advantage of the rise in tide and cross the shallowest bars at high water; this results in bunching of vessels. A vessel inbound can generally go up the river with the tide without any stops, but sometimes it might take about 24 hours with an anchorage stop along the way. An outbound vessel cannot cover the total distance of the river during the same high tide; the transit down the river is made in stages. According to the speed and type of vessel, sailing down the river takes about 36 to 48 hours with stops at Ulubaria (abreast of Achipur Point), Diamond Harbor or Kalpi Roads, and Sagar Roads Anchorages.

Sharp bends in the river upstream of Diamond Harbor limit the length of a vessel to 530 feet under ordinary circumstances and to 550 feet under special circumstances when extraordinary precautions are taken to negotiate these sharp bends.

Vessels up to 515 feet in length will be accommodated in the Kidderpore Docks; King George's Dock will accommodate vessels up to 555 feet in length if they sail on a deep draft (tankers on a light draft). See section 4A-41.

During times of predicted tidal bores, the overall length of vessels will be regulated by the harbor master.

The navigable channels of the Hooghly River leading to Calcutta northward of the parallel of latitude 21°01'N. are under the jurisdiction of the Port Commissioners of Calcutta.

Vessels proceeding against the current should slow down or stop if it appears that other vessels will be met with at difficult parts of the river, or on bars where the deep-water channels are narrow. The usual rule of the road is adhered to in the river and estuary. A prolonged blast of the whistle, quickly followed by three short blasts, is an optional signal that the vessel making the signal is obliged to stop and cannot get out of the way.

COMPASS ADJUSTMENT BEACON.—A swinging mark (black mast with a black basket topmark) stands on the west bank of the river abreast Kalpi Roads, about 33 miles above Sagar Roads; the mark is in range 281° with Jigerkhali Obelisk, about 800 yards distant.

### WINDS—WEATHER

4A-29 See sections 4-3, 4A-19, and the Appendix for Calcutta Meteorological Table.

STORM SIGNALS.—Storm and weather signals, in accordance with the Indian General System (sec. 1-34), are displayed at the following points when the weather in the Bay of Bengal is disturbed: Diamond Harbor, near the telegraph office; Budge Budge, near the telegraph office; Kidderpore Docks, from the

clock tower near the entrance; and from the flagstaff on the Port Commissioner's Office in Calcutta.

The following signals and instructions from the General System have been approved by the Deputy Conservator of the Port of Calcutta for the security of shipping and are described in greater detail so as to have local significance.

DANGER SIGNAL V indicates that a storm of slight or moderate severity will probably cross the coast to the eastward of Sagar Island and westward of Chittagong. Vessels may proceed to sea if the height of the barometer, state of the sea, and weather are such as to lead masters and pilots to infer that there is no danger. The wind at the mouth of the Hooghly will probably haul from northeast through north to northwest or west.

DANGER SIGNAL VI indicates that a storm of slight or moderate severity will probably cross the coast to the westward of Sagar Island and northward of False Point. The wind at the mouth of the Hooghly will probably veer from northeast through east to southeast or south. As these easterly winds will raise a heavy swell and produce a strong westerly set in the channel at the Sandheads, it is advisable that none but fast steamers in light trim should put to sea, and those only if the weather appearances and state of the sea are not too unfavorable.

DANGER SIGNAL VII indicates the approach toward Sagar Roads of a storm of slight or moderate intensity. It is advisable that no vessels, except fast vessels in light trim, should put to sea until the wind direction and force, the state of weather and sea, and the rise of the barometer indicate that the storm has either broken up or passed inland. It should be remembered that cyclonic storms of small extent in the Bay of Bengal sometimes blow with hurricane force, and raise a high sea near their centers.

GREAT DANGER SIGNAL VIII indicates that a storm of great intensity will cross the coast to the eastward of Sagar Island and westward of Chittagong. It is advisable that sailing vessels, with or without steam, and deep-draft or slow vessels should not proceed to sea. The wind at the mouth of the Hooghly will probably haul from the northeast through north to northwest or west.

GREAT DANGER SIGNAL IX indicates that a storm of great intensity will cross the coast to the westward of Sagar Island and northward of False Point. Vessels should not go to sea; masters and pilots of vessels outward bound should be guided by the appearance of the weather and height of the barometer in deciding whether it is advisable to proceed below Diamond Harbor or Mud Point. The wind at the mouth of the Hooghly will probably veer from northeast through east to southeast or south.

GREAT DANGER SIGNAL X indicates the approach of a storm of great intensity toward the mouth of the Hooghly and Calcutta. Vessels should not go to sea from Sagar Island, or proceed down the river from Diamond Harbor; all vessels should be properly secured.

The masters of vessels in the port should take the special precautions for safety laid down in the port rules.

STORM WAVE.—A cyclonic storm of severe intensity is frequently accompanied by a storm wave, which is not often the case with a small cyclonic storm. The height and destructive effect of a storm depend almost as much on the state and character of the tide when the cyclonic center reaches the coast, as upon the depression at the center, or the intensity and extent of the storm.

## TIDES—TIDAL CURRENTS

4A-30 Tides in the Hooghly River are semidiurnal.

TIDAL HEIGHT ABOVE *H.O. CHART DATUM.—Diamond Harbor: MHWS 17.25 feet, MLWS 1.75 feet; MHWN 12.5 feet, MLWN 4.75 feet. *H.O. Chart 3700.

TIDAL SIGNALS.—Tidal semaphores (day) indicating the rise of the tide in the Hooghly River are located about 1/2 mile south-southwestward of Sagar Island Lighthouse; at Gangra, on the west bank about 7 1/2 miles northwestward of the north point of Sagar Island; at Balari, on the west bank about 12 miles northeastward of the tidal semaphore at Gangra; on Hooghly Point, about 12 miles up the river from the semaphore at Balari; at Moyapur, Akra, and Rajabagan, about 17 miles, 6 1/2 miles, and 3 miles down the river, respectively, from Kidderpore Docks.

The semaphores have 3 arms; the uppermost arm indicates fathoms, the center arm indicates feet, and the lower arm indicates inches. The angle each arm makes with the vertical, measuring downward from the top, has the following meaning:

Upper arm
- 45° to the left indicates 1 fathom.
- 90° to the left indicates 2 fathoms.
- 135° to the left indicates 3 fathoms.
- 45° to the right indicates 4 fathoms.

Middle arm
- 45° to the left indicates 1 foot.
- 90° to the left indicates 2 feet.
- 135° to the left indicates 3 feet.
- 45° to the right indicates 4 feet.
- 90° to the right indicates 5 feet.

Lower arm
- 45° to the left indicates 3 inches.
- 90° to the left indicates 6 inches.
- 135° to the left indicates 9 inches.

A ball hoisted alongside the vertical of the tidal semaphore to an upper and lower position indicates the moment of high water and low water, respectively. The upper position is at a height equal to that of the lower semaphore arm.

The moment of high water is denoted by the ball being hoisted to the upper position; it is then lowered to the lower position and kept there until the tide has fallen 3 feet, when it is hauled down. The ball is hoisted to the lower position at the moment of low water, then hoisted to the upper position where it remains until the tide has risen 3 feet, when it is hauled down.

Two acetylene flashing lights, vertically placed with the upper one having a flash of 2 seconds and an eclipse of 6 seconds and the lower one quick flashing, are installed at each of the semaphores at Sagar Island, Gangra, Balari, Hooghly Point, and Moyapur. The lights indicate the rise of tide at night in accordance with the following table:

5 feet and 15 feet—green upper light.
6 feet and 15 1/2 feet—two green lights.
7 feet and 16 feet—green over red.
8 feet and 16 1/2 feet—green over white.
9 feet and 17 feet—green lower light.
10 feet and 17 1/2 feet—red upper light.
10 1/2 feet and 18 feet—red over green.
11 feet and 18 1/2 feet—two red lights.
11 1/2 feet and 19 feet—red over white.
12 feet and 19 1/2 feet—red lower light.
12 1/2 feet and 20 feet—white upper light.
13 feet and 20 1/2 feet—white over green.
13 1/2 feet and 21 feet—white over red.
14 feet and 21 1/2 feet—two white lights.
14 1/2 feet and 22 feet—white lower light.
The light for 22 feet will be shown for all heights above 22 feet.
Should a signal break down, a fixed red light will be shown.

At Sagar Island and Gangra Semaphores the tidal rise between 5 feet and 22 feet, flood and ebb, is indicated. The semaphores are closed down when the height of the tide is less than 5 feet.

At Balari Semaphore, the rise between 7 feet and 22 feet on the night flood tide is indicated. The semaphore is closed down when the height of the falling tide immediately thereafter is less than 17 feet. The level of the ebb tide above 7 feet will be shown between sunset and 3 hours after sunset.

At Hooghly Point Semaphore the rise of tide will be shown from 1 hour before to 1 hour after high water.

At Moyapur Semaphore at the instant of low water the white upper light which normally indicates a rise of 12 1/2 feet will be shown until the rise of tide has reached 5

feet; thereafter the lights for the correct rise of tide will be shown. If low water is 5 feet or more the white upper light will be shown for 2 minutes after which the lights for the correct rise of tide will be shown. The night semaphore will close down 1 1/2 hours before high water Moyapur or approximately 1 hour before high water at Hooghly Point.

TIDAL CURRENTS.—The strength of the tidal current varies in different parts of the Hooghly River at different times of the year; its velocity is least during the Northeast Monsoon from November to February, when it is 3 to 3 1/2 knots at springs and 1 1/2 to 2 knots at neaps.

During the latter part of the dry season, March to June, the Southwest Monsoon blowing in the direction of the flood current increases its velocity so that it flows up the river at 4 to 6 knots during spring tides.

The descent of the freshets from July to October causes the ebb current to predominate and it reaches a maximum velocity of 7 knots during spring tides; at this time the flood current is imperceptible, except in the estuary.

There are, therefore, three distinct periods in the year, lasting approximately four months each. During the cold season, the flood current has a slight preponderance over that of the ebb because of its shorter period of flow. The flood current, during the second half of the dry season, is made considerably stronger than the ebb by the Southwest Monsoon. During the rainy season, the flood current is overpowered by the descent of freshets and the ebb current predominates accordingly.

The great body of the tidal current flows in the direction of the channels at velocities of 2 to 3 knots at springs and 1 knot to 1 1/2 knots at neaps.

## TIDAL BORE

4A-31 At low water during spring tides, the flow of the flood current is checked by the shallow and restricted bed of the river and by the seaward flow of water from the upper reaches. These conditions can lead to the creation of a tidal bore.

Bores in the Hooghly River occur only with a greater than average spring tide and usually when the seaward flow is augmented by freshets.

There is a considerable diurnal inequality in the tides of the Hooghly River, the higher high water of spring tides occurring at night between October and March and during the day between May and September. A bore is more likely to occur preceding the higher high water than preceding the lower high water. There is, therefore, a seasonal variation in the probability of the occurrence of a bore. Extreme tidal bores are most prevalent in March and September and reach heights of 8 to 10 feet.

During the Northeast Monsoon, from November to February, freshets do not occur and for this reason, bores are a rarity. When they do occur during this particular season it is likely to be at night. They are, therefore, dangerous because they are unexpected. It is advisable to anticipate their occurrence during this season whenever greater than average spring tides are predicted.

With the Southwest Monsoon, the occurence of freshets during greater than average spring tides will always cause bores, those preceding the daylight high water being higher than those at night.

The first appearance of the bore is on Diamond Sand (22°10′N., 88°10′E.), on the west side of the river abreast Diamond Harbor, where the ascending wave runs on as a breaking roller. It is not of much consequence, however, until it enters the contracted reaches above Hooghly Point, when, besides swamping boats it affects vessels at anchor by causing them to run upstream, especially if there is a strong southerly breeze. The bore reaches a maximum at Chinsura, about 26 miles above Kidderpore Docks, and disappears about 14 miles farther up the river above Naya Serai.

Vessels at moorings surge and roll during the passage of the bore as there is a sudden lift of 4 to 6 feet; when bores are expected, springs must be put on the flood moorings close down to the buoys to relieve the jerk on the cable and bitts. Vessels at anchor have been known to break their anchor chains during extreme tidal bores.

## DEPTHS—DANGERS—DRAFTS

4A-32 BARS, BENDS, and BORES, known as the three Bs, constitute the main dangers to shipping in the Hooghly River. Numerous bars encumber the winding channel of the river;

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there are continuous fluctuations in the depths over these bars.

Since 1963 the controlling depth for the passage to Calcutta is the depth over Hooghly Bar, just above Hooghly Point.

Previously the controlling depth was over Balari Bar, about 27 miles above Sagar Roads. The location and position of the controlling depth may shift from year to year, or even month to month, and is determined by continuous surveys of the channel.

A 1964 report states that shoaling had necessitated dredging a new channel over Balari Bar. In use, the new channel had depths of 9 to 10 feet over the bar at mean low water.

DRAFTS.—The river is high from June to October and during this period vessels drawing 28 feet can reach Calcutta at high water springs; vessels drawing 26 feet can reach the port at high water neaps. From October to June the river is low and the maximum draft is 24 feet. It was reported 26 feet was the maximum draft vessel to enter Calcutta the first six months of 1961. Therefore, maximum drafts may vary from year to year for each season. Vessels drawing over 29 feet can be taken up the river, but special arrangements have to be made and the date selected by the Port Pilotage Office. A vessel with a draft of 29 feet has been lightened to 25 1/2 feet at Haldia Anchorage (sec. 4A-34); she then proceeded upriver to Diamond Harbor (sec. 4A-35).

WRECKS.—See section 4A-21 for wrecks in the entrance of the river.

Dangerous sunken wrecks with depths of 4, 3 1/4, and 2 3/4 fathoms are charted about 1 1/2 miles 039°, 3 3/4 miles 171°, and 4 1/2 miles 182°, respectively, from Gangra Tidal Semaphore (sec. 4A-30).

A dangerous wreck with mast showing lies about 1/2 mile eastward of Balari Lighted Tower, in a position 10 1/3 miles northward of the north end of Sagar Island.

A wreck with a depth of 5 1/4 fathoms lies about 1/4 mile west-southwestward of Kantabaria Obelisk (sec. 4A-27).

A dangerous sunken wreck with a depth of 1/4 fathom lies about 2 1/4 miles 100° from Hooghly Point Semaphore (sec. 4A-30). Five sunken wrecks, some of which are buoyed, lie in the vicinity of Hooghly Point.

Two stranded wrecks lie close southward of Achipur Point, about 17 miles above Hooghly Point.

Many additional wrecks are charted in the Hooghly River from Hooghly Point to Calcutta; the chart should be referred to for the position of these wrecks.

## SIGNAL STATIONS

4A-33 Signal stations are located near the lighthouse on Sagar Island (sec. 4A-23); on the east bank at Diamond Harbor (sec. 4A-35); and at Hooghly Point, about 6 miles above Diamond Harbor. Diamond Harbor Signal Station is connected by telegraph and the other stations are connected by telephone with Calcutta.

## HALDIA ANCHORAGE (22°01′N., 88°05′E.)

4A-34 HALDIA, an anchorage and port, has been established on the west side of the Hooghly River at the mouth of the Haldia River, about 23 miles above Sagar Roads. Haldia was developed to permit food grain vessels to lighten to a draft that would enable them to proceed upriver and enter the port of Calcutta. Topping-off a vessel with sugar was carried out during one season.

The port is in use during the fine weather season, which is generally from the beginning of November to the end of February or early March.

HARBOR LIMITS.—The north limit of the anchorage is Balari Tower bearing 330°; old Mud Point Telegraph Office bearing 136° is the south limit. The 2-fathom curve on the east side of Haldia Channel marks the east limit and the west bank of the Hooghly River is the west limit.

NAVIGATION.—Vessels can arrive or depart the anchorage at night; vessels at anchor may be passed on either side.

NAVIGATIONAL AIDS.—Identification lights, range lights, and buoys are established during the season the port is open.

ANCHORAGE.—Vessels anchor on the range in mid-channel about 570 yards from the edge of the sands, in about 6 fathoms, medium to hard mud and sand, good holding ground.

A vessel has anchored in 7 fathoms, mud, with the anchorage range lights, which were in approximately 22°00'N., 88°03'E., bearing 244°; Bagnapara Mark, reported lighted, bore 350° on the ebb current and 339° on the flood.

Because of the strong current, a good anchor watch is required to be maintained.

MOORINGS.—During the 1964/1965 season two mooring buoys provided two swinging berths.

Mooring is accomplished by hanging off either anchor at the first shackle and making fast the anchor cable to the buoy. To this end it is necessary that the first shackle on both anchor cables be overhauled and that a spare shackle be available in the event it is needed. One anchor is to be held in readiness for emergencies. Mooring instructions are furnished by the pilot or the Assistant Harbor Master in charge; a mooring crew is provided.

TIDAL CURRENTS.—The maximum velocity of the flood and ebb currents at the height of spring tides is about 5 knots.

PILOT—CUSTOMS OFFICER.—The pilot and customs officer remain on board during vessel's stay at Haldia; accommodations must be provided for these officers.

Main engines and steering gear are to be maintained in full readiness to meet any emergency.

CARGO INFORMATION.—Vessels, using their own gear, discharge cargo into lighters while moored or anchored. Cargo is worked 24 hours a day in two shifts.

Vessels bound for Haldia shoul ensure that a good supply of water is on board as all stevedores must be supplied, and with the number involved a large amount of water is consumed.

FACILITIES.—Other than an ample supply of stevedores and lighters and small quantities of fresh water, additional facilities and supplies are not available at Haldia. Vessel's personnel are not permitted to disembark. Communication with the shore is maintained via vessel's radio. During the Haldia season of operations, a ferry service plys between Diamond Harbor and Haldia. The nearest medical assistance is at Diamond Harbor.

Excavation has commenced (1964) for the construction of facilities at the subsidiary port of Haldia. Planned for completion by the end of 1967, the first phase of the project constitutes an oil jetty and docks providing five cargo berths for general cargo, coal, and iron ore.

DIAMOND HARBOR ANCHORAGE (22°11'N., 88°11'E.)

4A-35 DIAMOND HARBOR, about 38 miles above Sagar Roads, affords anchorage for large vessels in 6 to 13 fathoms of water. Because of the strong current at the anchorage, at least 5 shackles of chain must be out and a good anchor watch kept. Mooring buoys are in service (1960).

CARGO is loaded from and discharged into canoes. EXPLOSIVES for Calcutta are usually unloaded into special barges at Diamond Harbor. Other vessel facilities are not available.

A SIGNAL AND TELEGRAPH STATION and a CUSTOMS HOUSE stand on the left bank of the river which forms the north shore of the harbor.

COMMUNICATION with Calcutta by rail and auto transport is maintained.

MEDICAL.—There is a hospital.

QUARANTINE AND IMMIGRATION SERVICES are provided at Diamond Harbor.

PORT OF CALCUTTA (22°33'N., 88°19'E.)

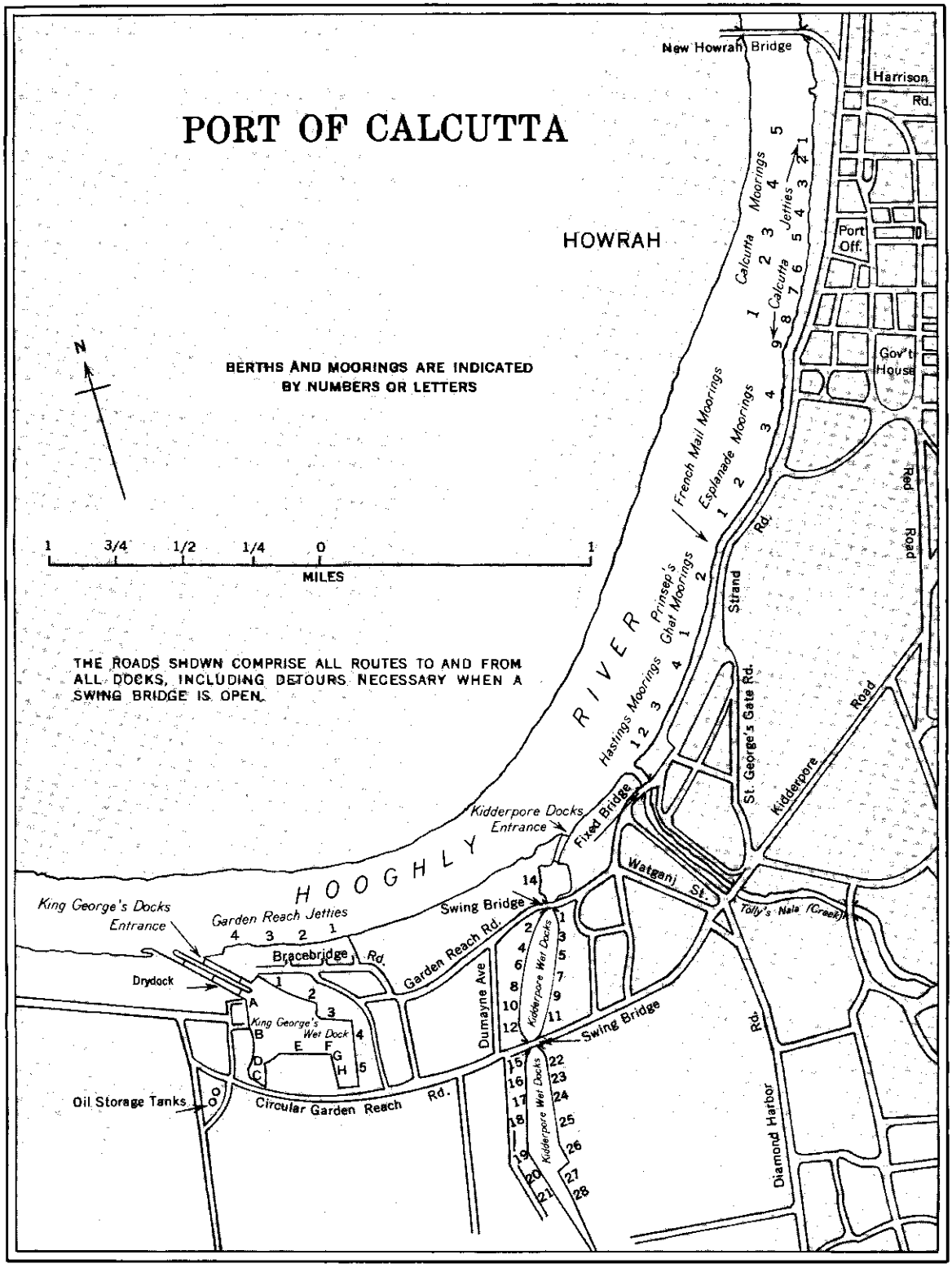
4A-36 THE PORT OF CALCUTTA extends from Budge Budge, about 21 miles above Hooghly Point, to Konnagar about 21 miles farther upriver from Budge Budge. The limits of the port are marked by pillars.

The port is administered by the Commissioners for the Port of Calcutta. In 1964 consideration was being given to placing the various marine services under one wing, to be called the Directorate of Marine Services.

Calcutta is only 18 to 21 feet above sea level. Moist winds blow over the city from the head of the bay for the greater part of the year; as a result the climate is humid.

NAVIGATION

4A-37 HOWRAH BRIDGE, about 2 3/4 miles above Kidderpore Docks, is the upper limit of navigation for ocean vessels; the bridge has a controlling height of 30 feet above mean high water springs.


PORT OF CALCUTTA
HOWRAH
RIVER HOOGHLY
New Howrah Bridge
Harrison Rd.
Port Off.
Gov't House
Calcutta Moorings
Calcutta Jetties
French Mail Moorings
Esplanade Moorings
Prinsep's Ghat Moorings
Hastings Moorings
Strand Rd.
Red Road
St. George's Gate Rd.
Kidderpore Road
Kidderpore Docks Entrance
Fixed Bridge
Watgani St.
Tolly's Nala (Creek)
Swing Bridge
Garden Reach Rd.
Garden Reach Jetties
King George's Docks Entrance
Bracebridge Rd.
Drydock
King George's Wet Dock
Kidderpore Wet Docks
Dumayne Ave
Oil Storage Tanks
Circular Garden Reach Rd.
Diamond Harbor Rd.
N
BERTHS AND MOORINGS ARE INDICATED BY NUMBERS OR LETTERS
1 3/4 1/2 1/4 0 1
MILES
THE ROADS SHOWN COMPRISE ALL ROUTES TO AND FROM ALL DOCKS, INCLUDING DETOURS NECESSARY WHEN A SWING BRIDGE IS OPEN.

R.D.F. STATION.—A radio direction-finder station is located about 5 miles southward of Calcutta. See H.O. Pub. 117B.

TIDES—TIDAL CURRENTS

4A-38 Tides in the Hooghly River at Calcutta are semidiurnal.

TIDAL HEIGHTS ABOVE *H.O. CHART DATUM—Kidderpore Docks.—MHWS 17.0 feet, MLWS 5.25 feet; MHWN 12.25 feet, MLWN 7.25 feet. *H.O. Chart 3700.

TIDAL CURRENTS.—When regular, the flood current runs 5 hours and the ebb current 7 hours. During the Northeast Monsoon, the velocity of the currents is 3 to 3 1/2 knots at springs and 1 1/2 to 2 knots at neaps. Between March and July the velocity of the flood current is increased and reaches a maximum velocity of from 4 to 7 knots at springs. During the freshets, July to October, the flood current is weak and of short duration and at neaps may be nearly imperceptible; the ebb current during freshets has a maximum velocity of 7 knots at springs. Anchors are then quickly buried by the silt, so that sometimes it is necessary to slip the cable and leave the anchor to be picked up by the Port Commissioners. The tidal currents set fair up and down Calcutta Reach.

DEPTHS—DRAFTS

4A-39 Mooring berths in the river have sufficient depths to accommodate any vessel that can enter the river. Depths at the moorings, ranging from 18 to 50 feet, vary according to their location in the river. See sections 4A-32 and 4A-41.

A report indicates that vessels berthed at Garden Reach Jetties are limited to drafts of 18 feet during bore periods.

REGULATIONS

4A-40 Port Regulations are supplied to vessels on arrival; the harbor master boards vessels in Garden Reach.

Rules regulating the handling of explosives are issued by port authorities. Masters of vessels with explosives on board are required to give notice 72 hours in advance of arrival.

FACILITIES

4A-41 CALCUTTA, the second largest port in India, ranks next to Bombay in volume of sea trade. The city is situated on the east bank of the Hooghly; its frontage on the river is about 6 miles. Calcutta is noted for its fine municipal and commercial buildings and its street railway, water supply, and sewerage systems. In 1961 the population of the city, the largest in India, was about 5,500,000. Exports include bones and bonemeal, coal, gunnies, hemp and jute, hides and skins, manufactured articles, mica, ores, scrap iron, seeds, and tea. Calcutta is a first port of entry. The United States is represented by a consul-general and a consul.

BERTHING AND MOORING.—Large numbers of vessels can be accommodated at jetties and in the wet docks.

Double-buoy fixed moorings are maintained in the river for approximately thirty-two ocean vessels. These moorings are laid parallel to the river banks; each berth has two buoys for bow lines and two buoys for stern lines. Vessels at the mooring berths are required to moor bow and stern with two bow and two stern cables shackled to the buoys. During the passage of a tidal bore (sec. 4A-31) vessels moored in the river surge and roll. Good mooring lines are required in this port.

MOORING BUOY BERTHS.—The name of the moorings and the number of berths with their lengths between buoys are as follows:

MATIA BRUZ GHAT MOORINGS (in Garden Reach), 1 berth 640 feet; 2 berths 800 feet.

HASTINGS MOORINGS, 5 berths 500 feet.

PRINSEP'S GHAT MOORINGS, 3 berths 550 feet; 1 berth 700 feet.

ESPLANADE MOORINGS, 3 berths 500 feet; 1 berth 550 feet; 3 berths 630 feet; 3 berths 640 feet; 1 berth 650 feet.

CALCUTTA MOORINGS, 9 berths 500 feet.

KING GEORGE'S WET DOCK, 2 berths 600 feet.

KIDDERPORE WET DOCKS, 5 berths 620 feet.

BERTHS ALONGSIDE.—KING GEORGE'S WET DOCK is entered via a lock which is 700 feet long and 90 feet wide with a depth of 33 feet (MHWN) over the sill. The wet basin,

irregular in shape, has a length of about 3,000 feet and a width of about 2,000 feet with central depths of 30 feet. Nine berths, each with a length of about 600 feet and a depth alongside of 28 feet, comprise the following: one heavy-lift berth for import and export, 3 import berths, 2 export berths, 2 general cargo berths, and 1 tanker berth for the discharging of oil. The following facilities are also available: one laying-up berth, 700 feet long, with a depth of 17 feet alongside; two lighter berths with a total length of 600 feet and a depth of 8 feet alongside; and 1 heavy-lift berth for lighters, 300 feet long with a depth of 7 feet alongside.

KIDDERPORE WET DOCKS, long, narrow, and dogleg shaped, consists of an entrance lock, a turning basin, Dock No. 1, and Dock No. 2. The entrance lock is 580 feet long and 80 feet wide with a depth of 31 feet (MHWN) over the sill. Adjacent to the entrance lock, the turning basin, nearly square, is about 750 feet long and 700 feet wide. A berth on the west side of the turning basin has a length of 510 feet and an alongside depth of 28 feet. The entrances of Dock No. 1 and Dock No. 2 are 80 feet wide; a swing bridge crosses each entrance. Dock No. 1 is about 2,775 feet long and 600 feet wide; twelve berths, 6 at East Quay and 6 at West Quay, have alongside depths of 28 feet. Dock No. 2 is about 4,500 feet long and 300 to 500 feet wide; eight general berths and 6 coal berths have depths alongside of 28 feet. Central depths in the basin are 30 feet. Due to silting when the lock is opened, depths within the basin may be less; depths of 26 feet were reported in 1961.

CALCUTTA JETTIES are located on the riverside below Howrah Bridge. Nine jetties have a total length of 4,735 feet, but only 5 with a total length of 2,500 feet can accommodate ocean vessels. Depths alongside these jetties are presently controlled by the Outram Bar which will not permit any vessel with a draft of over 19 feet to cross; depths alongside the jetties are 19 to 22 feet.

GARDEN REACH JETTIES consist of a coaling jetty for vessels up to 460 feet in length and 4 jetties for vessels up to 530 feet in length; depths alongside are 19 to 27 feet.

BUDGE BUDGE PETROLEUM WHARVES, about 11 miles below the entrance of the wet docks, cover a 1-mile stretch along the east side of the river. Eight pontoon jetties for ocean vessels have alongside depths of 26 feet; six of the jetties can accommodate tankers up to 600 feet in length. Two of the jetties are reserved for dangerous petroleum. The pumping rate is 80 tons per hour.

HARBOR CRAFT.—The port has 18 tugs, 13 dredges, 3 salvage vessels, 3 water barges, and a fireboat. Most of the fuel barges are owned by the various oil companies; an ample supply of lighters is maintained.

CARGO INFORMATION.—All vessels must have a current certificate on either a British or an international form showing that all cargo gear has been tested to the appropriate standards. Failure to produce such a certificate means that the vessel will not be worked until the gear has been tested and this will involve a delay of at least 10 days.

Cargo to and from vessels moored in the river is transported by lighters.

Facilities include transit sheds, some of them three stories high, fitted with cranes, elevators, and trolleys. Docks and jetties have rail clearance.

CRANAGE available at the wet docks and jetties is as follows:

King George's Dock.—Fifteen 2-ton, fifteen 3-ton, and six 5-ton cranes; one 200-ton hammer-head crane. In addition, the heavy-lift yard has four 10-ton cranes, one 15-ton and one 25-ton crane.

Kidderpore Docks.—Dock No. 1 is equipped with 47 cranes with capacities ranging from 3 to 5 tons, and a 100-ton shearlegs. Dock No. 2 has 65 cranes of various capacities, and the heavy-lift yard has one 5-ton, one 15-ton, one 25-ton, and six 6-ton cranes; three mechanical coal loading plants are also among the facilities at Dock No. 2

Calcutta Jetties.—Fifty-three cranes of various capacities, including one 30-ton electric gantry crane, are available.

Garden Reach Jetties.—Twenty-two cranes, each with a capacity of 2 tons, are available.

Floating Cranes.—Six floating cranes, one of 16 tons, three of 30-tons, and two of 60 tons capacity are available. One of the 30-ton and one of the 60-ton cranes are self-propelled and can be used in the river.

PROVISIONS.—Fresh provisions are obtainable in quantity; staple provisions are obtainable in limited quantities.

DECK AND ENGINE SUPPLIES.—Most deck supplies are obtainable; engine supplies are difficult to obtain.

FUEL.—Fuel and diesel oils are supplied from barges in the stream and from pipelines on the wharves at Budge Budge. Delivery rates are 60 tons per hour by barge and 100 tons per hour alongside the wharves.

COAL.—Coal is supplied from dockside at 3 berths on the west side of Kidderpore Dock No. 2; coal is delivered by lighters to vessels in the stream.

WATER.—Drinking and boiler water is supplied by water barges and by pipelines on the wharves at King George's Dock, Kidderpore Docks, and Budge Budge. All drinking water should be boiled. The maximum rate of delivery from either pipeline or barge is 15 tons per hour.

REQUESTS.—Requests for bonded stores, fuel, and water should be made about 3 days in advance of expected need.

REPAIRS.—Major repairs to a vessel's hull and machinery can be effected. The capability for electronic and ordnance repair is very limited.

Five graving docks just within the entrance of the wet docks can accommodate ocean vessels and have the following dimensions and depths:

| | Floor Length | Entrance Width | Depth over Keel Blocks |
|---|---|---|---|
| King George's Dock No. 1 | 574 feet | 80 feet | 32 feet |
| King George's Dock No. 2 | 589 feet | 80 feet | 32 feet |
| Kidderpore Docks No. 1 | 538 3/4 feet | 67 feet | 22 feet |
| Kidderpore Docks No. 2 | 488 1/2 feet | 67 feet | 22 feet |
| Kidderpore Docks No. 3 | 337 1/2 feet | 57 feet | 22 1/2 feet |

The two King George's graving docks are in tandem and provide a total length of 1,163 feet.

Seven graving docks at various shipyards along the river accommodate shallow-draft river and harbor craft. There are numerous marine railways at facilities along the river; the largest has a hauling capacity of 1,200 long tons.

A salvage tug, equipped also with fire-fighting equipment and towing gear, is maintained in the port, but may be used also for outside work. The operating radius is 1,150 miles.

COMMUNICATIONS.—Calcutta is a port of call for a large number of steamship companies and has sea communication with all parts of the world. Regular communication is maintained by steamer with ports in the Bay of Bengal, and with Colombo, Penang, and Singapore.

Air communication with Europe, the Far East, Southeast Asia, and Australia is available at Dum Dum Airport, about 7 miles eastward of Calcutta.

Calcutta is connected with the main railroad and telegraph systems.

A radio station (VWC) handles public correspondence; quarantine reports are handled and medical advice is given. Navigational warnings are also broadcast. See H.O. Pub. 117B.

MEDICAL.—Several hospitals, large and fully equipped, are located in Calcutta. The ambulance service of the Presidency General Hospital is available to seamen.

Sanitary regulations are enforced and largely successful efforts are made to control the tropical diseases, including cholera, dysentery, typhoid, and smallpox to which the city is exposed.

Deratting can be carried out; Deratting and

Deratting Exemption Certificates can be issued.

## PART B. THE SUNDARBANS COAST AND THE MEGHNA RIVER TO THE CHITTAGONG COAST

### COAST—GENERAL

4B-1 THE SUNDARBANS COAST, broken by the many outlets of the Ganges, extends eastward from the entrance of the Hooghly River for about 165 miles to the entrance of the Tetulia River, the western mouth of the Meghna River.

The Sundarbans, an extensive, heavily-wooded swamp area in the south part of the Ganges Delta, is intersected by many creeks and rivers. The more important rivers are the Matla, Raimangal, Malancha, Pussur, Haringhata, and Rabnabad. An intricate series of branches connect these rivers whose courses are continually shifting their positions. Boats can be tracked through the Calcutta canals towards Khulna, about 65 miles eastward of Calcutta. Khulna is the most important center located in the Sundarbans. The Meghna River, the easternmost branch of the Ganges, discharges the main volume of the Ganges waters.

### DEPTHS—DANGERS

4B-2 SWATCH OF NO GROUND is a remarkable tongue-shaped depression lying southward of the entrance of the Pussur River. The end of the tongue, being the northeast side of the depression, is centered in about 21°24′N., 89°36′E. Depths drop steeply from 20 to over 100 fathoms within a distance of 1 mile to 2 miles along the north and northwest sides of the depression. Swatch of No Ground is from 6 to 12 miles in width within the 100-fathom curves on either side for a length of about 50 miles orientated northeast and southwest.

The 6-fathom curve, like the 10- and 20-fathom curves, is charted in a general east and west direction between a position about 25 miles southward of the entrance of the Matla River and a position in 21°13′N., 91° 20′E., about 60 miles southward of the mouth of the Hatia River. The 6-fathom curve lies nearest to the coast southward of the entrance of he Pussur River, being about 11 miles offshore. Distances between the 6 and 10-fathom curves range from 1 mile to 10 miles.

Six-fathom patches are charted outside the 6-fathom curve in 21°15′N., 90°58′E.; 21°14′N., 91°10′E.; and 21°11′N., 91°15′E. A 5 3/4-fathom shoal, about 2 1/2 miles in extent, is centered about 2 1/2 miles northward of the latter 6-fathom patch.

A dangerous WRECK (reported 1960) is charted outside the 6-fathom curve in 21° 12′N., 91°10′E.

Depths and dangers within the 6-fathom curve are discussed along with a description of the coastal features.

See also sections 4-1 and 4-5.

### NAVIGATION

4B-3 Vessels from the westward proceeding to Chittagong are advised to keep well to the southward after passing the meridian of longitude 88°35′E. and until reaching the meridian of longitude 91°30′E.; the course can then be altered to the northeastward and a landfall made in the vicinity of the conspicuous white cliffs about 4 miles south-southeastward of Cox's Bazar (sec. 4C-31).

### TIDAL CURRENTS

4B-4 See section 4-4.

### WINDS—WEATHER

4B-5 See section 4-3.

STORM SIGNALS.—Special signals, used on the rivers of the Sundarbans, are shown at Namkhana, Barisal, Goalunda, Noakhali, Narayanganja, Chandpur, Khulna, Char-Mugria, and at a varying number of river and police stations in Bengal. The signals are as follows:

Signal I.—Warning, a storm may be expected shortly. By day: A black ball. By night: A red light.

Signal II.—Danger, a storm will soon strike. By day: A cone, point upwards. By night: Two red lights, vertically disposed.

Signal III.—Great Danger, a violent storm will soon strike. By day: A cylinder, hoisted vertically. By night: Three red lights, vertically disposed.

COASTAL FEATURES

4B-6 Eastward of Sagar Island is a series of low, alluvial, jungle-covered islands intersected by numerous creeks and rivers. SAPTAMUKHI SAND and BULCHERRY SAND, with depths of 3 fathoms and less, are charted as extending about 28 and 20 miles, respectively, southward from the shore. Reliable information about this section of the coast cannot be given; the chart must be used with caution. Changes on the southwest part of the Sundarbans have been particularly rapid in recent years.

LACAMS CHANNEL, between Saptamukhi Sand on the east and the shoal on the west which extends south-southeastward from New Island (21°33'N., 88°11'E.), leads into the Baratala River on the east side of Sagar Island. SAPTAMUKHI CHANNEL, between Bulcherry and Saptamukhi Sands, is the common entrance for the Jamira River on the east and Saptamukhi River on the west. Ocean vessels cannot use these channels.

MATLA RIVER

4B-7 MATLA RIVER empties into the sea about 34 miles eastward of Sagar Island Lighthouse; the river mouth lies between Dalhousie Island and Bulcherry Island. RAIMATLA SAND, which dries in some parts about 10 miles southward of Dalhousie Point (21°33'N., 88°42'E.), divides the entrance of Matla River into Eastern and Western Channels. Shoals at the entrance are subject to change and since pilot service for the Matla River is not available, caution is necessary in navigating Eastern and Western Channels.

EASTERN CHANNEL, between Dalhousie and Raimatla Sands, has least charted depths of 4 1/4 to 7 fathoms. Western Channel, between Rimatla and Bulcherry Sands, has charted depths of 3 1/4 to 6 fathoms; least charted depths lie in the vicinity of West Spit, the northwest extremity of Raimatla Sand.

WESTERN CHANNEL is preferred to Eastern Channel, but navigation is dangerous because the depths in the approach to Dalhousie Point are fairly regular; the lead gives no indication of the proximity of the steep-to sands on either side. This danger is also true in the river.

4B-8 TIDAL CURRENTS.—The tidal currents below Dalhousie Sand appear to rotate; the flood current sets west-northwestward at its commencement and works through north around to east-northeast. The ebb current sets east-southeastward through south to west-southwest. Velocities of the flood and ebb currents are 2 to 3 knots at springs and 1 knot to 1 1/2 knots at neaps.

In the channel the flood current runs toward the east shore until abreast of Dalhousie River at the north end of Dalhousie Island, thence it crosses southward of Grappler Sand and runs toward Peel Point, forming eddies. It then runs northward for about 8 miles to Roger Point (21°55'N., 88°40'N.) where it bifurcates, the greater portion going up Bidda River and the balance running around Roger Point into Katalli Bight, leaving slack water in the vicinity of Bidda River Point. The velocity of the flood current varies in different parts of the river, but 5 knots is the maximum velocity recorded.

The ebb current sets fairly down the river; off Roger Point it forms numerous eddies. At the last of the ebb the current sets from abreast the north end of Dalhousie Island across the river toward Halliday Island. The maximum recorded velocity of the ebb current is 2 1/2 knots.

ASPECT.—Clumps of trees stand on Dalhousie Point. This point and Halliday Island (21°39'N., 88°37'E.) to the westward of Dalhousie Island may be seen from a distance of about 10 miles when the height of eye is about 24 feet. When close-to, Dalhousie Point, conspicuous when the sun is shining, appears as a high, white sandy beach.

Below Kattali, which is 12 miles northward of the north point of Dalhousie Island, the land is so low that at high water springs the water runs some distance inland. From the sea to Eedoo Reach, about 23 miles above Kattali, dense jungle covers the land. Thence for the remaining 8 miles to Port Canning, villages situated on clearings mark this stretch of the river.

PORT CANNING (22°19'N., 88°39'E.), about 60 miles from the entrance of the Matla River, is connected with Calcutta by railroad.

Anchorage is afforded off Port Canning in depths of 4 to 8 fathoms; local knowledge is essential.

COASTAL FEATURES (CONTINUED)

4B-9 BETWEEN THE ENTRANCES OF THE MATLA AND PUSSUR RIVERS, a distance of about 50 miles, are the entrances of the Bangaduni, Guasuba, Raimangal, and Malancha Rivers. Sands and shoals with depths of 3 fathoms and less are charted as extending up to about 17 miles from shore along this section of the coast.

DALHOUSIE SAND extends about 14 miles southeastward from Dalhousie Island. BREAKERS are charted on this danger about 4 miles from shore.

BANGADUNI ISLAND (21°33'N., 88°52'E.) lies between the mouths of the Bangaduni and Guasuba Rivers; BANGADUNI SAND extends about 17 miles southeastward from Bangaduni Island. The entrance of the Bangaduni River, with a least charted depth over the bar of 3 feet, lies between Bangaduni Island and Sand on the east and Dalhousie Island and Sand on the west. Guasuba River entrance, encumbered with shoals, lies eastward of Bangaduni Island and Sand.

SHOALS are charted as extending about 17 miles south-southeastward from the shore on either side of the mouth of the Raimangal River (21°38'N., 89°09'E.). BREAKERS are noted on the chart for two areas with the least depth on the shoal on the west side of the river entrance. The entrance of the Raimangal has a least charted depth of 3 1/4 fathoms.

PUTNEY ISLAND (21°43'N., 89°20'E.) lies in the mouth of the Malancha River dividing the entrance into two channels. A least depth of 3 1/4 fathoms is charted in the approach to the channel on the east side of the island; the channel on the west side of the island is foul. SHOALS extend 11 miles southward and about 13 1/2 miles south-southeastward from Putney Island. The sea BREAKS over the south part of the latter shoal in heavy weather.

Local knowledge is necessary for entering the Raimangal and Malancha Rivers.

PUSSUR RIVER (PASSAR RIVER) TO KHULNA, INCLUDING MUNGLA (MONGLA) (CHALNA) ANCHORAGE

4B-10 PUSSUR RIVER is entered between JEFFORD POINT (21°44'N., 89°32'E.) and WEST POINT, located about 8 miles westward of Jefford Point. ZULFIQUAR CHANNEL leads from the north side of the bar between shoals off Jefford Point and West Point, and continues northward joining the deep channel through the estuary to AKRAM (Sipsah) POINT at the junction of the Sipsah and Pussur Rivers, about 15 miles northward of Jefford Point. BOAR POINT, on the east side of Zulfiquar Channel, is about 5 miles northward of Jefford Point. HIRAN POINT is on the west side of Zulfiquar Channel and about 6 1/2 miles northeastward of West Point.

NAVIGATION

4B-11 The coast must be approached with caution at all times; soundings should be taken continuously. SWATCH OF NO GROUND (sec. 4B-2) is a good aid for vessels coming from the westward. The change in the color of the water from blue or blue-green to a muddy-yellow color normally indicates the approach to shallow water. During the ebb current at spring tides, yellow water is found as far seaward as Swatch of No Ground.

The PUSSUR RIVER between Akram Point and the anchorage off Mungla is moderately broad and navigable. The river is navigated only during daylight hours; night navigation is hazardous due to the absence of lights.

Vessels with speeds of less than 8 1/2 knots shall not be permitted to transit the river during spring tides. Under special circumstances, if permission is granted, a suitable tug will have to be hired from the port to escort the vessel within the port limits. Request for a tug must be made at least 24 hours in advance. For reasons of safety Mungla Anchorage is normally departed only on the flood tide; deep-draft vessels leave the anchorage with the first of the flood.

WINDS—WEATHER

4B-12 Hazy visibility generally prevails in