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No 83

# GERMANY: COAST REPORT NORTH SEA

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## PART II

THE COAST, PORTS, AND COAST DEFENSES

### SECTION 1

## OSTFRIESLAND

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JANUARY, 1915

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OFFICE OF NAVAL INTELLIGENCE



DECEMBER, 1917

WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1918

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NAVY DEPARTMENT,  
OFFICE OF NAVAL INTELLIGENCE,  
*Washington, December 15, 1917.*

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ROGER WELLES,  
*Captain, United States Navy,*  
*Director of Naval Intelligence.*

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**GERMANY: COAST REPORT.  
NORTH SEA.**

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**PART II.**

**THE COAST, PORTS, AND COAST DEFENCES.**

**SECTION 1.**

**OSTFRIESLAND.**

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**JANUARY, 1915.**

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**ADMIRALTY WAR STAFF,  
Intelligence Division.  
June, 1915.**

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## CHART, MAP, AND PLANS RELATING TO THIS SECTION.

No.	DESCRIPTION.	Scale.
1.	Map. District from Borkum to Spiekeroog.....	1 : 100,000
2.	Borkum—Chart showing defences.....	1 : 48,000
3.	Borkum—Plan of island showing fortifications.....	1 : 15,000
4.	Emden—Plan of fort.....	1 : 10,000
5.	Canals { Dortmund-Ems ( <i>i. e.</i> , Emden to the Rhine) { Ems-Jade.....	1 : 400,000
6.	Juist-Norderney—Plan of the islands.....	1 : 100,000
7.	{ Baltrum } Plans of the islands..... { Langeoog }	1 : 25,000

For plan of Spiekeroog see No. 10 issued with section 2.

VIII

## THE OSTFRIESLAND DEFENCES.

All bearings, whether in points or degrees are true.  
Distances given in miles are in nautical miles of 2,000 yards.

### Introductory.

A general description of the whole German North Sea coast, followed by a division of that coast into five portions for strategic and tactical consideration, will be found in Part II, section 4, pages 1 to 3, of this report, and illustrated by Chart No. 16.

A tactical appreciation of the known facilities for attack and defence for each of these five portions of the coast is prefaced to the detailed description of their defences, *i. e.*, of the defences of the fortresses situated within them.

The present pamphlet deals with the Ostfriesland section of coast, which is the westernmost and which comprises the mainland coast from Emden to Harle (inclusive) and the off-lying islands from Borkum to Spiekeroog (inclusive).

### The Coastal Alignment.

Both the mainland and the islands are considered from west to east.

The coast of the mainland from Knock, near Emden, as far as Norddeich, runs roughly N. b. E. a distance of some 18 miles.

It then continues almost eastwards from Norddeich to Harle, a distance of about 24 miles. Thus the coast forms a bend at Norddeich.

The islands off the coast do not, however, reproduce this bend, but run from west to east in almost a straight line, only the westernmost, Borkum, being slightly withdrawn landwards.

### TACTICAL FEATURES OF COAST.

(See Map 1.)

The distance occupied by the islands from Borkum to Spiekeroog, inclusive, is about 43 miles.

The fortress of Wangeroog stands immediately east of Spiekeroog, so that between the two fortresses of Borkum and Wangeroog there is a distance of some 38 miles occupied by five islands.

### Defence Pivots and Gaps.

It would seem essential to the defence of this Ostfriesland section of coast for Norderney and Langeoog to be fortified, but no information regarding such defences is available.

This would provide three defended pivots on this coast, Borkum and Wangeroog at the flanks and the Norderney-Langeoog group in the middle.

No permanent foothold could be obtained in Ostfriesland without the reduction of two of these, and the fortifications on these three pivots should prevent the landing of guns on any of the islands lying between them.

The coast of the central pivot is very long.

From the west of Norderney to the east of Langeoog is a direct distance of 17 miles.

What is more important tactically is the width of the undefended gaps on either side of this 17-mile group.

Thus the Ostfriesland coast may be considered in two parts, the western from Borkum to Norderney, the eastern from Langeoog to Wangeroog.

### Borkum.

From about the middle of the mainland coast, between Knock and Norddeich, there is an area of sands and shallows extending N.W. for 20 miles.

The fortress island of Borkum stands on the outer portion of this area, with its northwest coast about 14 miles from the mainland coast, the distance being occupied by sands which mostly dry out at low water.

Northwest of the island are 7 miles of shallows before the shelving bottom reaches a depth of 30 feet at low water, thus keeping battleships at least 14,000 yards from the shore batteries on that side, unless they enter the channels described on page 4.

South of the island is the deep-water channel of the Ems (Randzel Gat) leading up to the commercial port of Emden, some 25 miles steaming distance above Borkum and over 35 from the open sea.

Northeast of the island is another deep-water channel separating Borkum from the next island of Juist. This channel, the Oster Ems, ends in a *cul-de-sac* at low water.

**Juist.**

The next island eastward is Juist. This lies at the seaward margin of drying-out sands, with its straight north coast lying from 10 to 6 miles from the bending mainland coast near Norddeich.

The island is about 8 miles long west to east.

Its west end is within 12,000 yards of some of the heavy guns of Borkum.

Its eastern extremity is 26,000 yards from the same batteries, but only some 5,000 yards from ground in Norderney, which commands it.

A depth of 30 feet at low water is attained at about 5,000 yards off the north shore.

**Norderney.**

This island is nearer than is Juist to the mainland coast owing to the fact that the latter here completes its eastward bend and begins to run parallel to the islands.

The sands dry out for the most part between the island and mainland, and in one part they do so in a continuous line, providing a track for wheeled traffic at low water.

Off the north coast the shelving bottom reaches a depth of 30 feet at about 4,000 yards.

**The Juist Gap.**

From the eastern batteries of Borkum to the western end of Norderney is 15 miles.

Of this distance the island of Juist occupies 8 miles in the middle of the gap, and the only two channels giving navigable access towards the mainland pass close to Borkum or Norderney, respectively, and are obstructed by mine fields and commanded by guns on Borkum or by ground suitable for batteries on Norderney.

A landing on the 8 miles long north coast of Juist would have to be effected through surf. It is true that if Juist is undefended the landing could be undertaken at a distance of 15,000 yards from any guns on Borkum or Norderney, and atmospheric conditions might make the landing invisible from the gun positions. But probably the surf would limit the force landed to infantry alone. It is probable that the defence scheme has been rendered as independent as possible from atmospheric conditions, and that at least the bearings of the transports or ships could be obtained and transmitted either by P.F. stations on Juist or by submarines or aircraft.

After landing infantry as above, guns would have to be landed at Juist pier, the only spot reached by a navigable channel, and this is on the south side of the island, and the only channel to it passes within 7,000 yards of Borkum guns round the west end of Juist, and is suitable only for boats or lighters, as the least depth is 1½ feet at M.L.W.S. and 9 feet at M.H.W.S.

A channel with equal depth reaches the eastern extremity of the island also, passing at 4,000 yard gun range of Norderney, but there is no pier.

Unless the guns of Borkum had been permanently silenced, the island of Juist would soon be rendered untenable.

**Significance of Borkum.**

If Borkum were out of action, Juist would no longer be required, as it would be too far from the mainland to silence field batteries there.

Norderney would be required as a preliminary to getting a footing on the mainland to outflank land forces protecting Emden.

Thus Borkum, though of high importance to Germany—

- (1) as maintaining the open port of Emden,
- (2) as a base for naval operations,

yet, when fallen into the hands of an enemy wishing to land on the mainland, would not assist very materially the further operation of forcing the narrow estuary up to Emden, where alone the landing of an army corps would be free from the most stupendous difficulties.

But the reduction of Borkum is a necessary preliminary.

Emden's port facilities and the proximity of Norderney to the mainland as likely to facilitate a preliminary but subordinate landing on the coast at that part, together form a prominent feature in the consideration of the western half of the Ostfriesland Coast as a landing place.

**The Eastern Part.**

This properly includes Wangeroog, but as this island is more important to the Jade-Weser defences, it is described in the next pamphlet. It is sufficient to say here that it is a fortress nearly equal to Borkum.

Continuing the Ostfriesland coast eastwards, the part between Norderney and Wangeroog is now described.

**Langeoog**

has rather a wider stretch of drying-out sands between it and mainland, owing to a slight recession of the latter southwards abreast the island, and thus the north coast of Langeoog is 5 miles from the mainland shore.

Deep water is found at about the same distance from the island shore as at Norderney, viz. 4,000 yards.

**Spiekeroog.**

This island is separated from the mainland by about 4 miles of drying-out sands, intersected by a few pools.

The mainland coast abreast the island lies between the small harbours of New Harlingersiel and Harle, both dry at low water.

These sands do not, however, offer at any part a continuous track at low water suitable for wheeled traffic.

Off the north shore the shelving bottom attains a depth of about 30 feet at some 4,000 yards distance.

**The Spiekeroog Gap.**

From the eastern hills of Langeoog to the western batteries of Wangeroog is a direct distance of about 9 miles.

Of this distance the island of Spiekeroog occupies about 4½ miles in the middle of the gap.

The only two channels giving navigable access towards the mainland run past either end of the island, and pass within 2,500 yards of Langeoog and Wangeroog, respectively.

The western of these two channels is also the only channel leading to Spiekeroog Pier, which is on the south side of the island.

This channel gives a least depth of about 6½ feet at M.L.W.S. and 15 feet at M.H.W.S. between the open sea and the pier.

It is, therefore, of some tactical importance for a landing on Spiekeroog.

The pier has deep water, about 30 feet, at its extremity at low water.

The pier is from 12,000 to 13,000 yards from the western batteries of Wangeroog, but, as stated above, the approach to it passes within 2,500 yards of defensible ground in Langeoog.

A landing on the north coast of Spiekeroog would have to contend with surf, which is very frequent. The island could be rendered untenable by fire from Wangeroog's 9-inch guns.

**THE DEFENCES.**

These are described in the following order:

1. OPEN-SEA MINE FIELDS.
2. MAINLAND DEFENSIVE POSITIONS.
3. BORKUM DEFENCES (pages 11 to 27)—
  - a. Fortifications.
  - b. Submarine Defences.

**Open-Sea Mine Fields.**

These submarine obstructions, which form the outermost line of defence of the German coast, have been described as a whole in the pamphlet dealing with Helgoland, which is the centre of the system.

They are all, of course, subject to change.

The particular open-sea mine field, off the Ostfriesland portion of the coast, is laid roughly parallel to the line of islands, and probably about 6 or 8 miles off their north coasts, corresponding in parts with the general trend of the 10-fathom line.

This field probably extends from well west of Borkum to abreast Baltrum, and then turns N.E. to Helgoland.

There are gaps giving access to the entrance channels for Borkum and Emden, and possibly a gap N.W. of Baltrum.

Any gap that may exist has probably got a line of mines opposite it, like the parados of a fort.

**Mainland Defensive Positions.**

In addition to the fortification of the islands fringing the Ostfriesland coast, a defensive position has been prepared, extending along rising ground on the line—

Emden—Aurich—Jever.

It has been reported that as many as 24 batteries or redoubts have been prepared along this line as pivots for its defence, and that heavy guns had been mounted in some of them.

The position is strengthened by nature in that the whole fringe of coast extending inland from high-water line for several miles is able to be inundated by the opening of sluices and the breaking of dykes. (The heights of the sea dykes are given from page 45 onwards, under the names of the many small harbours along the coast; see also Map No. 1 and Index.)

### BORKUM.

NOTE.—All bearings, whether given in points or degrees, are true.

#### APPROACHES.

(See Chart 2.)

Borkum may be approached from the open sea by four main channels. Three of these lead into the one deep channel close to the west shore of Borkum. These are the Huibert Gat, the Wester Ems and the Riff Gat. These constitute the western approach to the two Borkum anchorages. The fourth channel is the Oster Ems, which passes north and northeast of Borkum, and gives access to the War anchorage from the east.

#### Western Approach.

The western approach as far as Borkum west anchorage (south of Borkum village and at the outer end of Randzel Gat) has the following least depths in its three entrance channels, viz:

- Huibert Gat, at a point North of the centre of Rottum . . . M.L.W.S. . . . 30 feet.
- Wester Ems, throughout most of its length . . . . . M.L.W.S. . . . 19½ feet (see photograph facing this page).
- Riff Gat, at a point near the seaward end . . . . . M.L.W.S. . . . 19 feet.

The spring rise is 8½ feet in each case.

From the west anchorage there is a channel called the Fischer Balje leading eastward to Borkum Pier and to Borkum War anchorage, which is beyond and northeast of the pier. The least natural depth in the Fischer Balje is about 11 feet M.L.W.S., which is the depth alongside Borkum Pier at M.L.W.S. This channel forms the southern entrance to the War anchorage and is reported to have been dredged to a depth of 30 feet M.L.W.S.

#### Eastern Approach.

This is by the Oster Ems. British and German navigation charts have shown soundings at the inner end of this channel as being much less than they actually are. The Oster Ems is in reality a channel deep enough at M.H.W.S. for battleships to ascend. There is a least depth on the bar north of Brauer Flat of 24 feet at M.L.W.S., and this is the least depth between the open sea and Bants Balje.

Bants Balje is halfway between the west end of Juist Island and Pilsum Light, on the mainland, and lies nearly due east of Borkum Hopp; it is of no importance except as marking the innermost limit of deep water, 24 feet M.L.W.S.

Entering by the Oster Ems and steaming as far as the northeastern extremity of Borkum Island, the entrance to the War anchorage lies on the right hand. It is a dredged channel between Borkum and Lütje Horn, with a reported depth of 30 feet M.L.W.S.

#### The Dutch Approach.

A further possible approach exists for light draught vessels and lighters, the least natural depth being 6½ feet M.H.W.S.

This is between the Dutch islands and the mainland of Holland, and therefore through Dutch territorial waters, but it is considered that it might be used at night, as the Dutch authorities would have to make special arrangements to acquaint themselves of its use, and this they might refrain from doing and so avoid giving somewhat gratuitous offence to Germany.

By this approach light draught vessels, disguised if necessary, could enter the Zuider Zee at the Helder, or the Vlie, and reach the Randzel (Ems River) abreast Fischer Balje. The least natural depth in this approach is 6½ feet at M.H.W.S.; this shallow occurs close to the junction of this channel with the Randzel Gat, and can be avoided by passing through the Pinke Gat into the Huibert Gat, and thus reaching the Randzel.

By this means the more western part only of the Dutch approach is used which has a least depth (natural) of 12 feet at M.H.W.S.

A small subsidy to some firm of Dutch shell dredgers, or to a German owner passing as such, would bring the five shallow spots in this approach to the same depth as the rest of its long devious course, and so afford a secret approach to the Borkum anchorages for T.B. craft with a least depth of 12 feet at M.H.W.S., and having many reaches of 15, 18, and 20 feet at M.H.W.S., where craft could wait between tides if necessary.

#### Anchorages.

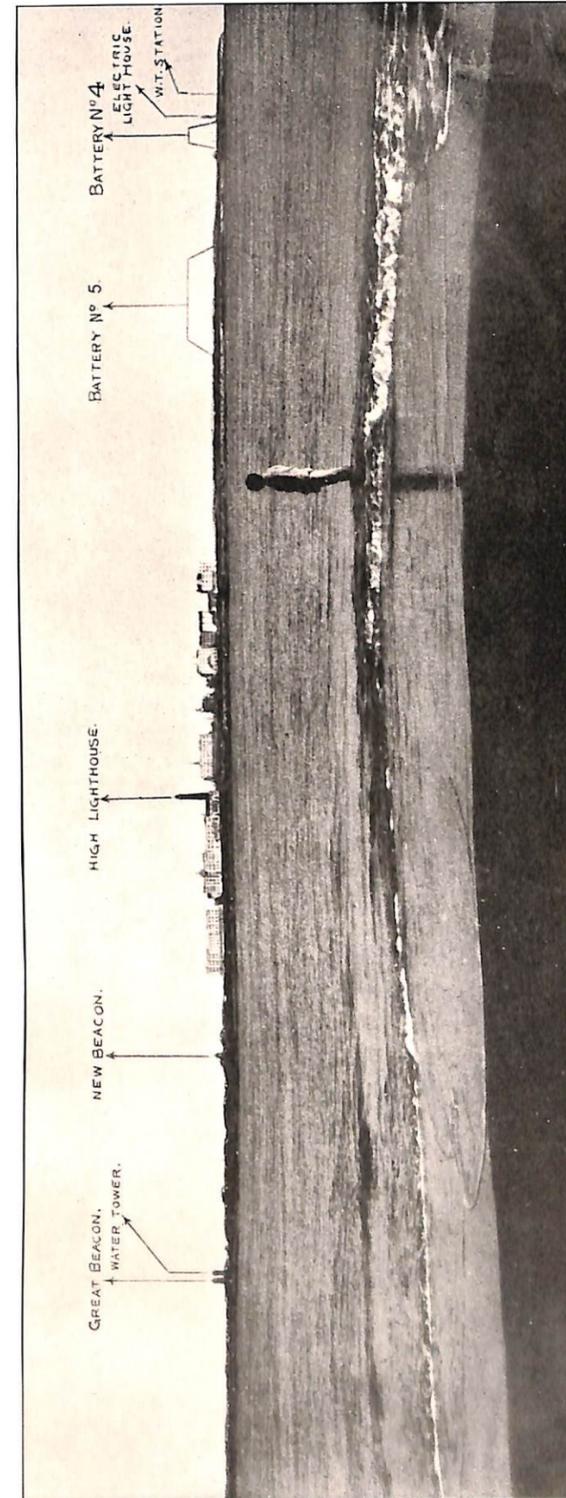
##### WEST ANCHORAGE.

This is at the outer end of the Randzel Gat and off the entrance of the Fischer Balje, in 7 to 15 fathoms.

The holding ground is good and shelter is afforded in northerly, easterly and southerly winds.

I. D. 978, Section 1.  
PLATE 1.  
To face page 4.

VIEW OF BORKUM FROM HOHE RIFF.



Borkum is seen on the same bearing as in the photograph from the narrow part of the Western Ems.

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**EAST ANCHORAGE.**

This is southwest of Memmert Sand, about 5 miles above (east of) the bar of the Oster Ems entrance channel.

**WAR ANCHORAGE.**

This is east of Borkum Hopp and between Borkum Pier and the northeastern extremity of the island.

It thus lies exactly between the west anchorage and the east anchorage at Borkum and can be reached from either of these. From the west anchorage it is reached through the Fischer Balje past Borkum Pier; from the east anchorage it is reached through the Hörne Balje.

It is believed to be dredged to a depth of 32 feet L.W.O.S. and to have been created as secret anchorage for the High Sea Fleet. The dredging was carried out during 1912 and 1913.

**The Pier.**

This is at the eastern extremity of the southern part of the island, and projects into the Fischer Balje.

The shore end near high-water mark is built in continuation of the railway embankment and broadens gradually as it advances into the water. When it has reached a breadth of about 100 yards, that is about 200 yards from high-water mark, it divides into two arms, which diverge from each other, leaving a triangular area of water between them.

The north arm continues for a further length of about 150 yards, and is about 70 yards wide.

Three railway lines run along its whole length.

At its extremity there is a target platform built in 1913, a wooden structure on piles with a launching incline at its end.

The south arm is about the same size as the north arm, about 150 yards by 70 yards. The south side of it has been protected from the action of the sea by 2 miles of piles with fascines between them, the piles being higher than the surface of the pier.

There are two lines of rails along this arm.

At the extremity of the southern arm there is a pontoon, rising and falling with the tide and guided by wheels and vertical rails.

**The Town Jetty.**

A wooden pier, about 6 feet in width and 150 yards in length, extends seaward from No. 5 groin. It is only suitable for small boats and is very difficult of access in the slightest swell; approach to it is always difficult during flood tide.

**Lifting Appliances.**

On the north arm of the pier there are the following:

- Two travelling cranes—lifting 2 tons.
- One tripod fixed crane—lifting 5 tons.

**THE ISLAND.****Physical Features.**—See (Plan 3.)

The island of Borkum is nearly 6 miles in length, rather over  $3\frac{1}{2}$  miles in width at the widest part, and comprises an area of some 14 square miles.

It consists of two almost separate insular formations, known as *Westland* and *Ostland*, which are united by a wide expanse of level sand and a narrow artificial sand embankment some 20 feet in height.

In *Westland* is the town of Borkum, in *Ostland* the small village of Ostland, comprising some six or eight houses and an inn. Borkum is described later under the heading "The Town."

Both portions present a somewhat similar configuration, though *Ostland* is slightly smaller, and consist of horseshoe shaped belts of dunes lying with the concave sides facing southeast and low-lying meadow or arable land in the centre.

In *Westland* this belt consists of three principal groups of dunes, the *Nord*, *West*, and *Süd Dünen*, which attain their maximum elevation on the west shore to the north and south of *Westland-Borkum* village.

The *Nord Dünen* (height 33 to 56 feet) are the largest in extent, and are continued in a southeasterly direction by the *Bandje Dünen* (height 43 feet), which are bordered on both sides by marshy meadow land.

The *West Dünen* (height 43 to 56 feet) form a narrow ridge of dunes separating *Westland-Borkum* village from the shore.

The *Süd Dünen* (height 23 to 50 feet) skirt the south shore from the south or new lighthouse as far as the railway embankment.

The dunes are covered with scrub and bent grass and are intersected by small verdant valleys. The largest of these valleys are the marshy *Kievietsdelle* in the Süd Dünen, and in the Nord Dünen the *Dorndelle*, which is covered with thorny scrub in places over 6 feet in height, and the *Dodemannsdelle*, which is covered partly with scrub and partly with bog grass; together with the *Waterdelle* the latter valley forms in autumn a considerable expanse of fresh water.

Towards the shore the dunes fall steeply and afford excellent cover for infantry and field guns.

Under the shelter of the dune ridges, some meadow land, divided by a dyke into the *Binnen-* and *Aussen-Weide*, extends in a southeasterly direction. The *Binnen-Weide* are intersected by wet ditches, and in the center lie the remains of the *Franzosen Schanze* or French earthwork, a relic of the Napoleonic wars. North of Upholm farm a small tract of enclosed cultivated land is met with. The *Aussen-Weide* are intersected by the *Hopp*, a shallow inlet dry at low water, and are subject to inundation at exceptional spring tides. The soil of the meadow land is soft and easily excavated.

*Ostland* is generally similar to *Westland*, and the dunes (height 30 to 60 feet) present the same features, though, perhaps, not quite so well covered with vegetation. The land inside the dyke is more enclosed, and comprises several ploughed fields. Outside the dyke, the meadow land is intersected by the *Groote Sloop*, a shallow inlet which dries at low water.

To the south of the embankment uniting *Ostland* and *Westland* lies the *Tüskendoor* inlet, which is bordered on both sides by meadows, and is dry at low water.

On the east and west sides of the island the shore is fairly steep-to, but on the northwest and north the Borkum Reef extends some 6½ nautical miles seaward. On the east side of the reef lie the *Brauer Flats*, on which surf is nearly always visible. To the northwest of Borkum high lighthouse is the *Hohe Reef*, which in places dries out at low water, and on which there is heavy surf in the lightest westerly breezes.

To the southeast the *Randzel* sand extends for over 7 nautical miles from the island; it dries out for the most part at low water, but is in places intersected by channels too deep for fording even at low water. Movement is, however, possible across portions of the sand at low water.

The shore is of fine yellow sand and slopes gently from the foot of the dunes to high-water mark. Below high-water mark the sand is level, firm, and suitable for wheeled traffic, but above high-water mark it is soft, and especially so on the Süd Strand and along the edge of the *Ostland* dunes.

Above high-water mark, the *Nord Strand* varies in width from some 500 yards at a point north of the East Beacon (*Ost Bake*) to about 1,100 yards opposite the deep indentation between *Ostland* and *Westland*. The west shore is 150 yards in width at Borkum village, but elsewhere does not exceed about 50 yards. The *Süd Strand* increases in width from a few feet at the west end to a maximum of about 1,500 yards at the point where the railway enters the dunes.

The width between high and low water marks varies considerably. On the eastern portion of the Nord Strand, the average width uncovered at low water is about 250 yards, but north of the Nord Dünen (*Ostland*) it increases to some 600 yards and then quickly contracts to about 50 yards at the point where the *Vooren Tief* approaches the shore. From this point westward the width ranges between 100 and 150 yards, until on the Süd Strand it again increases to some 300 yards.

#### Sea Wall.

Surf is of frequent occurrence and is very heavy during northerly and westerly winds.

For the protection of the west shore a sea wall with an upper and a lower promenade extends along the foot of the dunes from a point southeast of the Electric Lighthouse round the west coast of *Westland* to the most northerly point of the dunes overlooking Nord Strand.

The total length amounts to about 5,500 yards.

Some 27 or 28 stone groins, each about 200 yards long project seaward from the sea wall.

#### Landmarks.

The High Lighthouse is a circular reddish-brown tower 197 feet in height, situated in Borkum village. The Electric Lighthouse is a 16-sided iron tower with green cupola and painted in red and white bands. It is 91 feet in height and lies 1,300 yards to the south of the High Lighthouse on the west side of the island.

The old lighthouse is a square tower, 131 feet in height, situated in the northeast part of Borkum village.

All the lighthouses are closed to the public on account of the new fortifications.

The three Borkum beacons are of brick. The great, and the small or new, beacons are situated on the dunes to the north of Borkum village and are 75 and 39 feet in height respectively. The East Beacon stands on a dune 24½ feet in height near the eastern extremity of *Ostland*, and is 24 feet in height.

The tower of Borkum Church, and the water tower in the Nord Dünen (*Westland*) also form good landmarks.

#### Food Resources.

The island is provisioned for 18 months to stand siege or blockade preventing communication with the main land.

In December, 1913, the live stock in the island was as follows:

386 oxen.  
362 pigs.  
116 sheep.  
77 goats.  
A large number of cows.

#### Transport.

Apart from military transport there are a number of two-wheeled carts which go by the name of "Wippe," some of these are to be found distributed among the farms and the rest in the town of Borkum.

In December, 1913, there were 87 horses in the island in addition to those belonging to the garrison.

#### Coal.

About 1,000 tons of coal were kept in the island in peace time for the use of the railway, waterworks, engine-houses, &c. The war stock is not known.

#### Water.

In addition to the wells in various defensive works, there is also in the island an excellent further supply of good drinking water. The water is pumped up from six wells, 105 to 125 feet in depth, situated at the edge of the Nord Dünen. The engine-house and reservoir lie midway between "Kinderheim" and Upholm Farm, and the water tower is situated in the Nord Dünen.

#### THE TOWN.

(See Plan 3.)

#### GENERAL.

The town of Borkum is situated near the west shore of the western half of the island, *Westland*.

This western shore is protected from the action of the sea by a stone sea wall (see page 6). The town is situated abreast the most westerly point in this west coast. From this point it extends inland a little more than half a mile, its eastern end being built round the old lighthouse.

The town is divided by the passage of the main line of the railway from south to north through it. To the east of this railway is the old town, to the west and seaward is the new town.

The old town may be said roughly to lie between three points, as follows: The old lighthouse to the east of its center, the High Lighthouse to the northwest, and the cemetery to the extreme south.

The new town lies west of the High Lighthouse and between the latter and the sea. It is bounded on its seaward side by the lower promenade and the upper and broad terrace, called Kaiser Strasse, and by the northwestern branch of the railway. The latter also bounds it on the south. On the east the main line railway divides it from the old town.

The new town contains the central railway station, the administrative offices, the post, &c. offices, and the High Lighthouse.

#### THE STREETS AND SEA WALL.

The main streets of the old town and the new town are paved with brick, and are 17 feet 6 inches wide.

From the east center of the old town, the vicinity of the old lighthouse and R. C. Church, two streets run roughly southwards, crossing No. 1 road (see foot of page 8) and the railway, and terminating at the sea wall, level with the upper promenade, under the names of Süd Strasse and Friese Strasse, on either side of Work No. 4.

Following the sea wall from south to north, no other street leading down from the town occurs for about half a mile when Bismarck Strasse is reached.

The northwestern branch of the railway also approaches the sea wall here and crosses Bismarck Strasse close to the junction of the latter with the sea wall on a level with the upper promenade.

Here the upper promenade becomes the broad Kaiser Strasse, a wide metalled open space or "front," which extends northwards for a quarter of a mile. Three streets debouch on to it from the new town, leading down westwards from the vicinity of the High Lighthouse.

At its north end the Kaiser Strasse narrows and the brick-paved upper promenade recommences from it.

This is here 4 feet wide only and continues so past Work No. 6 (the cable house). Here it passes inland of the underground cable house, and continuing to the northeast, broadens out to some 14 feet, continuing to the northern extremity of the sea wall in front of Work No. 8.

**Population.**

	1905.	1913.
Men (civilians) .....	2,260	1,130
Women .....		1,100
Children .....		1,075
Peace garrison .....	Nil.	1,350
Total .....	2,260	4,655
War garrison (additional) .....	—	2,610
War total .....		7,265

In summer time the island has been visited for some years by 20,000 to 25,000 people, there being accommodation in Borkum town in the hotels and boarding houses for some 6,000 or 7,000 people extra to the resident population.

**Buildings.**

The old town lies back from the shore behind the dunes, and the new portion, comprising the principal hotels, crowns the dunes overlooking the beach.

The buildings are of red brick or stone with tiled roofs, and the streets are paved throughout the village.

There are many hotels and pensions.

A large bathing establishment, with swimming bath, steam pump, &c., is situated in the Strand Strasse on the dunes.

**Hospital.**

The hospital, with special isolation ward, lies in the south part of the village between the Süd Strasse and Neu Strasse.

**Barracks.**—(See page 14.)

**Post Office.**

The post, telegraph, and telephone office is situated in the central railway station buildings in the Am Bahnhof Strasse.

**Water.**

Drinking water is laid on, and all houses are connected to a modern system of drainage, the outfall of which is located in the Hopp Inlet.

**Lighting**

The streets, the promenade along the sea wall, as well as most of the hotels and houses, are lighted by gas. Some of the principal hotels are lighted by electricity and have their own generating plant.

There are also three large electric generating stations.

**Steamer Services.**

**COMMUNICATIONS.**

	Company.	Sailings.	Ports of call.
1	Borkum Light Railway Company	Daily in summer.....	Juist and Nordeney.
2	Nord Deutsche Lloyd.....	Daily in summer. Weekly in winter.	Helgoland and Bremerhaven.

For other services see under "Emden."

**Roads.**—(See Plan 3.)

The streets of the town and the sea wall have been described on the previous page. The roads outside the town are as follows:

No. 1.—From the south end of the old town near the cemetery, eastwards between the south end of the Hopp Dyke and the slaughterhouse.

Thence close north of the railway main line as far as defensive Work No. 1—where it turns northeast to the southern shore of Das Hopp, opposite to the end of road No. 5.

This road is metalled and asphalted as far as the Hopp Dyke, but becomes a hard sand track farther east. Some 900 yards east of Hopp Dyke there is a branch road southwards called Weyersgatt.

No. 2.—This runs from near the North Railway Station, where it is a branch from No. 3 road, in a direction north-by-west to the old cable house. It passes inland of the new (siege) cable house which is underground (work No. 6) and then bending north-by-east it passes Great Beacon and ends near defensive work No. 7.

No. 3.—Through the northwestern extremity of the old town a street runs north-by-west alongside the railway main line, throwing off a branch westwards (No. 2 road) when abreast the North Railway Station, and then continuing north by east for about 200 yards.

Here it reaches an almost right-angled bend to the east, and then proceeds as the main road right across the island to the eastern end of Ostland.

From within the old town to a little short of its junction with the north end of the Hopp Dyke, it is a broad brick paved road with a branch also brick paved which diverges northwards to the barracks.

Beyond the Hopp Dyke it continues as a hard sand track between defensive works 9 and 10, across the isthmus, through Ostland village past the north end of Ostland Dyke to the East Beacon and the shore.

No. 4.—From the old lighthouse, east of the town, northeast to Upholm Farm.

This road is paved and has a width of 12 feet. It terminates against the Hopp Dyke, but a path on the top of the Dyke leads on northeast to meet road No. 3

No. 5.—From the second right-angled bend in road No. 3 just east of its junction with the north end of Hopp Dyke a road leads east by south to the north shore of the Hopp, to a spot opposite the end of No. 1 road.

This is a hard sand track.

No. 6.—From the east end of the isthmus a branch road from No. 3 leads east by south and turns due south towards the southern extremity of Ostland.

This is a hard sand track.

No. 7.—There are two unmetalled branches from road No. 5 which lead northeast across the Tuskendoor inlet to Ostland village, crossing No. 6 road.

They are sand tracks.

Another but shorter branch from No. 5 leads round work No. 10 to the western end of the isthmus where it joins No. 3 road. It is not known to what extent this is used in lieu of the part of No. 3 road which passes between works 9 and 10.

It is a hard sand track.

No. 8.—A track runs northeast from Ostland village to the north shore of Ostland peninsula, passing east of work No. 12A.

**Railway.**—(See Plan 3.)

This was built by the Borkum Light Railway Company.

THE MAIN LINE is a double line and extends from the pier northwestward across the low lying sands of this extremity of the island, being twice supported by piles, once for 546 yards and once for 250 yards.

It then enters the Dunes near defensive work No. 1 and continues westwards, roughly parallel to road No. 1, crossing Weyersgatt. At 350 yards west of Weyersgatt a branch leads northward to south of gasworks.

It bends toward the northwest on approaching the south end of the old town and throws out a branch southwards to the Electric Lighthouse and to work No. 3. It then crosses Süd Strasse and Friese Strasse.

At the Friese Strasse crossing a branch diverges into the defensive work No. 5—and some 300 yards further northwest when approaching the new town it throws off the long northwestern branch to the sea walls.

The main line continues to skirt the old town and running in a northerly direction passes through the Central Railway Station and ends at the north Railway Station; which is some 300 yards due north of the High Lighthouse.

The engine-house is situated at the North Railway Station.

In 1910 there were 5 locomotives, 22 passenger coaches, 7 mail vans and over 100 trucks.

In 1913 there were in addition 1 long steel truck on bogies, and 12 hand driven trollies for 12 men each, belonging to the military authorities.

The gauge of the railway (and all branches) is 3 feet.

**NORTHWESTERN BRANCH.**

After leaving the main line this branch runs through part of No. 5 work and then crosses Bismarck Strasse close to sea wall, bends north along Kaiser Strasse and then follows the inner edge of the upper promenade as far as the northeastern extremity of the sea wall.

The gauge is 3 feet. The line is single. There are no branches.

In 1913 the condition of the line was bad. Many sleepers were rotten, and the nails holding down the chairs were loose in their holes.

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GOVERNMENT BRANCH (to Ostland).

This leaves the company's main line close to the North Railway Station. It crosses road No. 2 and follows the alignment of road No. 3 running close to the north side of this road as far as the north end of the Hopp Dyke.

Before reaching this point it throws off two branches, the earlier one southwards to the waterworks, the second one northwards to the barracks.

At the north end of the Hopp Dyke the railway leaves the road and bends to the north-west to enter the enclosure of No. 9 work.

Inside the enclosure it throws off a branch northwards into the interior of work No. 9, and then passes out of the enclosure, crosses No. 3 road and enters the enclosure of work No. 10.

Inside this enclosure it passes between the central ammunition depôt and the howitzer battery No. 10, sending a branch southwards into the latter and itself serving the former, passing close to the magazine doors.

After leaving work No. 10, the Government railway runs northeast to cross No. 3 road again and then passes over the isthmus running close to the north side of the road.

Entering Ostland the railway again leaves the road, this time finally, and following an alignment not definitely known but approximately that shown in Plan 3, it passes some 20 to 30 yards south of works Nos. 12, 12A, and 13, and curving to the north terminates at No. 14.

At a point about north of the north end of the Ostland Dyke a branch rail runs east by south a short distance to work No. 15.

Cables.

Borkum is the landing station for nine ocean cables, in addition to the local cables between the mainland and neighboring islands. The cables are as follows:

Cable.	Number of wires.	Nationality.	Owners.	Remarks.
Greetsiel—Borkum—Vigo.....	1	German.....	Deutsch Atlantische Tel. Co., Cologne.	3 wires (German Government) from Greetsiel to Borkum.
Greetsiel—Borkum—Bacton (3 cables).	4 to each cable.	2 Anglo-German, 1 German.	Government.....	
Greetsiel—Borkum—Fayal—New York.	1	German.....	Deutsch Atlantische Tel. Co., Cologne.	
Greetsiel—Borkum—Fayal—Coney Island (U.S.A.).	2	"	"	
Greetsiel—Borkum—Le Minou (near Brest).	1	"	Government.....	Old cable to Valentia.
Greetsiel—Borkum—Lowestoft..	4	"	"	
Hauen—Borkum—Juist—Norderney.	1	"	"	
Borkum—Juist—Norderney....	4	"	"	
Borkum—Tenerife—Monrovia—Fernambuco.	1	"	Deutsch-Südamerikanische Telegraphen-Gesellschaft.	One wire is telephonic.

Thus:

- 9 cables are landed from the North Sea on the west coast of Borkum.
- 10 cables leave the eastern end of Borkum for the neighborhood of Greetsiel.
- 2 cables leave the eastern end of Borkum for the west end of Juist.

CABLE LANDING PLACES.

These are described in order from south through west and north to the eastern extremity of Ostland.

1. The Tenerife cable is landed on the Süd-Strand and brought in under the sand to some spot between No. 3 defensive work and the life-boat station just east of it. Possibly it is connected to the land line within the large flank traverse of the work.

In any case the alignment passes through the casemates of No. 2 work, in which some cell is used as a cable house and relay for this cable. The land line subsequently leads to road No. 3, and follows it with the other cables to the eastern extremity of the island.

2. The Cable House.

The Brest Cable is landed and brought in south of groin No. III. to the cable house. This is an underground concrete chamber built under the sea wall and partly under the lower promenade at a spot about 600 yards north of the High Lighthouse, abreast groin No. II. It is described under the defences as work No. 6, see page 19.

It is believed to contain the relays for all the nine cables.

3. The older Bacton cable (1891) and the Vigo cable are landed near groins 6 and VII, respectively, and brought in underground and through the sea-wall.

The connection with their land lines is probably made in the small black hut just south of defensive work No. 7.

4. The Lowestoft cable, which was the first cable ever laid to Borkum, the two later Bacton cables, and the Fayal cables are landed near the second groin from the northeast extremity of the sea wall.

They are brought inland under the sea wall abreast defensive work No. 8.

5. The Eastern Landing Place.

Twelve cables are landed at the far eastern extremity of Ostland. Ten of them come from near Greetsiel and pass over the Lutje Horn, two of them from the west end of Juist.

The alignment followed after landing and connection with land lines meets road No. 3 in the neighbourhood of its sharp bend south of East Beacon. It is possible that a switch is situated near the landing, and it is thought that the land lines are led through the spot some 700 yards south-by-east from defensive work No. 15 where some building operation was observed from a distance and where a detached observation station was reported to exist.

LAND LINES.

The alignment of the land lines connecting the cables landed at the east end with those landed on the west coast of Borkum Island, follows the course of road No. 3 from the bend in the road south of the East Beacon to the bend in the same road about 200 yards northeast of the North Railway Station of Borkum town.

From the latter position or near it—

- 9 land lines run straight to the cable house (defensive work No. 6).
- 1 land line runs from here or diverges earlier to work No. 2 to join the Tenerife cable, and
- 2 land lines go straight to the Post Office, being the connection of the Hauen-Borkum-Juist cable and the Borkum Juist cable.

The land lines from the three landings places on the west coast are led to the cable house where the relays are situated, and thus connect up with the lines running alongside road No. 3. All these land lines are laid underground.

Telephones.

These are described under Defences, General, see top of page 15.

W.T. Station.

This is situated as shown on Plan 3, a little south of the Electric Lighthouse.

AERIAL BASE.

It has been reported that hangars have been erected in the Dorn-Delle, west of the barracks and north of the water tower.

DEFENCES.

GENERAL.

(See Chart 2 and Plan 3.)

The defences of the island of Borkum differ very much from those which are usual in older fortresses. Whereas at a port like Pola, or a channel like the Dardanelles, a number of massive and self-contained forts may be found, each having numerous guns of various caliber permanently mounted on its faces or sides, we find in Borkum an example of widely distributed artillery positions, all small and excellently concealed, and while in some of them a small number of heavy howitzers or guns may be permanently mounted, the majority would appear to be intended to receive their armament during times of strained international relationships, or to be utilized by field or siege ordnance as necessity dictates.

Apart from barracks, magazines, &c., there are 16 known works on the island. Some of these may not be intended for artillery positions, while others have guns or howitzers actually mounted in them.

The positions of the works and their armament, when this is known, are shown on Chart 2, from Admiralty Chart 3509. They are severally described below.

Plan 3, on a larger scale than the Chart, gives a comprehensive diagrammatic presentation of the island, its main features, and its defensive works, and the main component parts of the works.

Summary of Works.

The table on page 12 has been made out to facilitate quick reference to the details of any work.

It will be seen that the armament is sometimes partly in rear of a parapet and partly in rear of or built into the flanks of the casemates.

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Summary of Works (Borkum).

No. of work.	Date of construction or completion.	Parapet.		Revetment.	The- vices.	Armament.	Mounting.	Range.	F. C. post.	Magna- zine.	P. F. cells.	S. L. emplacements.	Casemates.				Obstacles.	Communications.	
		Length.	Height of crest.										Above M.H.W.S. form.	Above crest.	Height of crest.	Accommodation.			
1	*End 1912	?	?	Concrete 3'	—	6-9 cm. field guns	—	7,100	—	—	2	1	—	Feet. 40	Feet. 20	Feet. 12	Feet. 9	Entanglement.....	Rail—Main line to old lighthouse.
2	*Early 1912	60	45	Concrete 5'	?	6-15 cm. field howitzers.	—	6,000	—	—	—	Top of lighthouse	—	55	20	13	10	—	Rail—Branch line. Phone—To old lighthouse.
3	*End 1913	300	10	Timber 5'	Eight.	6-10.5 cm. Q. F. (A-Air).	Pedestal.....	?	—	—	1	Top of lighthouse	—	—	—	—	—	Entanglement.....	Phone—To old lighthouse.
4	1912 and 1913	35	30	Concrete 6'	—	—	—	—	—	—	2	2 (mobile).....	—	55	30 to 35	13	10	Front—3' barbed fence and sunk on tankment. Flank and rear an entanglement.	Rail—Branch line.
5	*Early 1912 enlarged 1913.	180	20	Concrete 6'	Nine..	8-18.5 cm. guns.	Disappearing..	714,500	1	1	2	1	—	—	—	—	—	Front—3' barbed fence and sunk on tankment. Flank and rear an entanglement.	Rail—Branch line.
6	1912 and 1913	—	—	—	—	2-21 cm. guns...	Disappearing..	16,400	—	—	—	—	—	45	18	13	10	Entanglement.....	Phone—To old lighthouse.
7	1912 and 1913	—	—	Underground cable house.	—	Also parapet for M. G. and infantry.	Disappearing..	16,400	—	—	—	—	—	40	38	15	12	Entanglement.....	Phone—To bar-rack.
8	*End 1913	25	20	Concrete 9'	—	2-21 cm. howitz-ers.	Coast.....	79,000	—	—	—	—	?	?	?	?	?	Entanglement.....	Rail—Branch line.
9	*Early 1912.	—	—	Howitzer pits.	—	4-28 cm. howitz-ers.	Coast.....	13,800	—	—	1	—	?	?	?	?	?	6' barbed fence.....	Phone—To work No. 10.
10	*Early 1912.	—	—	Howitzer pits.	—	4-28 cm. howitz-ers.	Coast.....	13,800	—	—	—	—	?	?	?	?	?	6' barbed fence.....	Phone—To work No. 9.
11	1912.	—	—	Small earthworks commanding approaches from Ostland.	—	4-9 cm. field guns	—	7,100	—	—	—	—	—	130	—	—	14	Entanglement.....	Rail—Main line.
12	*Early 1912	300	40	Concrete 6'	Five..	2-18.5 cm. guns.	Disappearing..	714,500	—	2	—	—	—	—	—	—	—	The same entan- glement as Nos. 12 and 12A.	Phone—Main cable.
12A	*End 1913	—	—	—	—	2-21 cm. guns...	In cupolas.....	16,400	—	—	—	—	—	55	35	13	10	—	Phone—Main cable.
13	*Early 1913.	—	—	—	—	6-15 cm. field howitzers.	—	6,000	—	—	—	—	—	55	35	13	10	—	Ditto.
14	*Early 1913.	?	30	Concrete 7'	—	2-21 cm. guns...	Disappearing..	16,400	—	—	—	—	—	—	—	—	—	Entanglement.....	Rail—Branch line.
15	*End 1913.	—	—	Concrete 7'	—	—	Disappearing..	16,400	—	—	—	—	—	—	—	—	—	Entanglement.....	Phone—(1) To cell, (2) to main cable.
16	1914.	—	—	—	—	4-30.5 cm. guns.	Disappearing..	16,400	—	—	—	—	—	—	—	—	—	Entanglement.....	Ditto.
17	1915.	—	—	3 projected howitzer pits.	—	3-30.5 cm. how-itzers.	Turret.....	224,000	—	—	—	—	—	—	—	—	—	Entanglement.....	Phone—(1) To cell, (2) to main cable.

Positions not known, but each howitzer in separate pit.

When the height of the crest of parapets and casemates above the gun platform appears to be unsuitable for the armament given in the table, this apparent discrepancy must not be considered as a bar to the correctness of the armament. Other positions may have been prepared for the latter close by, or cupola mountings built in at the flanks of the casemates.

Observation Stations and P.F. Cells.

It is probable that two systems of range finding are installed in Borkum, one by depression, the other by subtension. In the former one of the lighthouses may be used, and in the latter it is possible that a P.F. station may have been established in Juist to obtain a sufficient length of base.

As an alternative in case of the destruction or failing of these main systems, the P.F. cells of certain batteries, offering a fairly long base, may have been selected and fitted for long-range use, while those closer together within some of the batteries would enable these to act independently if cut off from central control.

In addition to the P.F. cells mentioned under the various works, there are other stations used for observation, and the following is a summary of observation and lookout posts:

Nature of station.	Situation.	Height of summit above sea.
2 battery P.F. cells.....	In work No. 1.....	20 feet.
Detached P.F. cell or S.L. emplacement.....	Between works Nos. 1 and 2.....	8 "
Battery P.F. cell.....	In work No. 3.....	10 "
2 battery P.F. cells.....	" No. 4.	
" " " ".....	" No. 5.	
1 fire commander's post (armoured cupola).	" No. 5.	
Possible depression station.....	Top of high lighthouse.....	150 feet.
3 steel-lattice masts, 100 feet high.....	Not known.....	? 120 feet to 150 feet.
Commandant's post.....	At top of old lighthouse.....	? 120 feet to 130 feet.
1 battery P.F. cell.....	In work No. 9.....	35 feet.
Detached P.F. cell or coast watch station.....	About 700 yards south by east from work No. 15.	36 "
2 telescopic ladders on motor lorries.....	As required.....	? 30 feet.

Magazines.

In addition to the magazines belonging to various works there is a central ammunition depôt in the middle of the island.

The magazines in the various works are mentioned in the "summary of works" above.

CENTRAL AMMUNITION DEPÔT.

This is situated on Westland just west by south of the narrow neck of land which gives access to Ostland.

The same wire fence encloses both the ammunition depôt and work No. 10, the ammunition depôt being in the northern part of the enclosure and north of the railway which passes between it and the howitzer pits.

There are nine magazines (one is south of the railway). They are built of concrete and covered with sand and grass, having only one side or end exposed for doors, &c., and this side or end being invariably the one next the railway.

The dimensions of the buildings themselves (they were seen before being covered with sand) is as follows:

Length, 75 feet;  
Breadth, 15 feet;  
Height, 9 feet.

Searchlights.

There are six known positions as well as some searchlights mounted in motor vehicles. The searchlights have alternative electric or hand control, and the latter is mostly used and relied on.

The searchlight equipment was to be improved and extended early in 1914.

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The lights were as follows in 1913:

Situation.	Height above sea.	Remarks.
In work No. 1.....	<i>Feet.</i> 20	Fixed.
1,100 yards east of work No. 2.....	30	Probable prepared position for portable projector.
At top of electric lighthouse (in rear of works 2 and 3).	105	Illuminates the mine fields in Wester Ems. Also signalling apparatus.
2 mobile searchlights travelling on tight lines through works Nos. 4 and 5.	? just above sea wall.	Mobile.
In work No. 5.....	25	Fixed.
125 yards S.W. of North Railway Station.....	?	"
In or near work No. 11.....	?	"
Northeast of work No. 12.....	? 20	Fixed—also has signalling apparatus. Illuminates the mine fields in Oster Ems.

#### Garrison.

The war garrison of Borkum is as follows:

- 8 companies of infantry, war strength.
- 1 fortress machine-gun detachment, 6 officers, 16 N.C.O.s, and 60 men.
- 4 island guard companies, 400 men.
- 4 batteries of foot artillery—total about 20 officers and 500 men, *i.e.*, the 2nd Battalion of the 2nd Regiment.
- \*1 Battery, 1st Reserve Battalion Foot Artillery. (5 officers, 121 men).
- 1 park company.
- 1 pioneer company (mobilized Landwehr), 200 men.
- 2 troops, fortress-lighting, 2 officers and 60 men.
- Railway personnel.
- Naval personnel.

Total, 3,950 men, 146 horses.

The Coast Guard Division serves in connection with the mine fields and is largely increased on mobilization.

#### Barracks.

These are in Westland, north of road No. 3. They were commenced in April, 1913, and designed to accommodate 1,000 men. The hotels in the town are intended for military use in war time and would probably accommodate 2,000 or 3,000 men and the necessary horses and vehicles. (*See under "Population," page 8.*)

#### Intercommunications.

##### RAILWAY.

The main line or branches connect the various works, &c., in following order starting from the pier:

Work No. 1.....	Main line 30 yards from casemates.
" No. 3.....	Branch from main line into the work.
Electric lighthouse.....	" " " " into the work.
Work No. 5.....	" " " " into the work.
" No. 6 (cable house).....	Western branch of Railway 2 yards from entrance.
" No. 7.....	" " " " 4 yards seaward of crest.
" No. 8.....	" " " " 20 " " " "
Barracks.....	Branch north from Government Railway.
Work No. 9.....	" " " " " "
" No. 10.....	Branch south " " " "
Central ammunition depôt.....	Government railway passes doors of magazines.
Work No. 12.....	" " " " 20 yards from casemates.
" No. 13.....	" " " " " "
" No. 14.....	Eastern terminus of Government Railway.
" No. 15.....	Branch south from " " " "

##### TELEPHONE.

Works Nos. 1, 4, and 7 are connected direct with the old lighthouse by separate underground cables:

No. 7 has also another line leading to the barracks.

Work No. 8 is connected to the barracks.

Nos. 9 and 10 are connected to each other as well as to other parts *via* the main trunk.

\*This may be 15 c n. howitzers or 21 cm. mortars.

The main line of telephone wires is laid from west to east of the island as follows:

From the cable house (Work No. 6) to the bend in the railway and Road No. 3, just north of Borkum village, thence along the railway to where the latter enters the enclosure of Work No. 9, thence along the Road No. 3 between Works 9 and 10, past Jagerheim, Ostland village, to the eastern extremity of the island (probably Steerenk Klipp).

This main telephone trunk is in duplicate, one set of wires being an air line, the other set being underground at one side of the road, parallel to the alignment of the land lines connecting the cables.

Works Nos. 9, 10, 12, 13, 14, and 15 have telephone lines running into this alignment and connecting them with the cable house and probably with the Old Lighthouse.

The telegraph land lines joining the cable house (Work No. 6) to the cables landed at the eastern extremity of the island, also follow Road No. 3, and are laid parallel to the alignment of the telephone wires.

#### Power Stations.

There are electric generating stations as follows:

- (1) Just north of the Electric Lighthouse.
- (2) On the south side of Prinz Heinrich Strasse which leads inland from between groin 5 and groin V.
- (3) West of the Old Lighthouse and just east of the Catholic Church.

#### Landing Places.

There would appear to be no part of the coast more accessible or less well guarded than another.

During manœuvres landings have been made, after bombardment, at the middle of the Süd Strand and on the beach between groins IV and V.

At a spot about southeast of Work No. 2, at half an hour after high water it was noticed that a boat was able to land a passenger on hard sand, and that there was a depth of about 6 feet at about 50 yards from the water's edge.

The beach on the *Nord Strand* is very soft in places, and a heavy man is much impeded in walking. Owing to the shallowness of the water and the long reach out of the surf, boats would have considerable difficulty in approaching this shore at low tide.

Before the construction of the pier in the Fischer Balje visitors to the island were landed in fine weather in boats on the Süd Strand, and in bad weather in the Fischer Balje at the point where the present pier stands.

The most suitable point for landing an infantry force appears to be the western portion of the Süd Strand, where a length of beach some 2,000 yards in extent is available in close proximity to the deep-water channel. It must be borne in mind, however, that the sand above high-water mark is very soft, and that this portion of the shore is commanded by Works Nos. 1, 2, and 3.

In unfavourable weather conditions, disembarkation on this shore would probably be impracticable.

#### THE FORTIFICATIONS.

##### Work No. 1—(Chart 2, Plan 3).

DATE OF CONSTRUCTION.—Completed end of 1912(?); enlarged 1913.

SITE.—*See* Plan 3. The sand forms slight undulations between the railway and high-water mark to the south, and the bank covering the casemates has the appearance of being natural when viewed from the sea.

The advanced banks south of this are no longer distinguishable at all.

##### TRACE AND PROFILE.—

CASEMATES.—The main feature is a bank running west by north and east by south. This contains concrete casemates and has a concrete platform in rear of it (north side). The dimensions of these casemates are not known. Height of crest above platform not known.

M.G. TRENCH.—A trench to the east of this bank commands the railway and sands towards the pier.

PARAPETS.—To the south of the main bank and in a line roughly east and west three mounds or short parapets have been reported. They are revetted in concrete and intended for light guns. The dimensions of these mounds are not known.

HEIGHT ABOVE SEA.—The crest of the casemates is about 20 feet above high water, and that of the parapets about 15 feet.

**Work No. 1—Continued.**

**ARMAMENT.—1913.**

In rear of the parapets.  
**6—9-cm. Q.F. Field guns.**  
 Range—7,100 yards.

It is reported that the platform in rear of the main bank is intended for mobile howitzers. It is possibly intended as an alternative position in common with other platforms in the island.

**FIELD OF FIRE.**—The 9 cm. guns in the advanced positions would command the Süd Strand, the northwest end of the Randzel Gat and probably the entrance to the Fischer Balje.

**P.F. CELLS.**—There are two position-finding stations, one on each flank of the main bank and separated from it.

They are built in concrete, covered with sand, and a circular armoured hood with flat top and lookout slot projects 1 foot above the mound so formed.

Height of hood above sill of entrance door in rear, 12 feet.

**SEARCHLIGHT.**—A corrugated iron hut on the west flank of the main bank is reported to contain a searchlight.

**OBSTACLES.**—A barbed wire entanglement 4 yards wide surrounds this work, having one opening on the north side.

The east and west diameter of the space enclosed by the wire is about 100 yards. Its north and south diameter is not known.

**COMMUNICATIONS.**—Telephone wires lead underground from this work. They pass under the railway and then run westwards between the railway and the road for some further distance, then turning toward the OLD LIGHTHOUSE (which is square in plan). At the top of the latter is the main fire control station.

There is no road or path leading from the interior of this work to the railway or road, but the sand is hard enough for wheeled traffic.

**Work No. 1A**—A group of 8 embrasures has been constructed between Works No. 1 and No. 2. The embrasures are at irregular heights along the crest of sand dunes facing roughly SW. Calibre of guns not known.

**Work No. 2**—(Chart 2, Plan 3).

**DATE OF CONSTRUCTION.**—Completed early 1912.

This work comprises a howitzer parapet to the west and living casemates to the east. The distance apart of these is not known.

**SITE.**—The sands here rise a little more steeply than usual from the shore.

The parapet (to the west of the work) is some 225 yards from high-water mark, on the reverse slope (northern) of a high sand dune. North of it is another long sand dune concealing it from view from the railway.

The casemates are nearer the shore and built on the north slope of a sand dune. In rear (north) is another sand dune, and north of this a deep long depression called the Kievietsdelle. Along the northern rim of this hollow runs the railway.

**PARAPET.**—This is straight and faces south by west.

It is revetted in concrete, and there are probably chambers and five traverses flush with the crest and two larger flank traverses.

Height of crest above platform, 5 or 8 feet.

Height of crest above sea, 45 feet.

Length and other details not known.

**CASEMATES.**—Some distance east of the battery and nearer the shore, a straight bank 75 feet long and 24 feet in breadth covers the front and roof of concrete living quarters.

The north wall of these quarters is 55 feet long and 10 feet high. It has windows and doors, ventilators and chimney, and overlooks a concrete yard or platform. It is shown on Plate 2. The width of the platform is not known. Probably there are steel shutters fitted for the window openings.

The sand heaped above the building is covered with coarse grass. The thickness of sand covering is not known, but is probably about 3 feet, and hence the height of crest above platform would be 13 feet.

The crest of this bank is about 20 feet above the sea.

**GARRISON.**—A rough calculation, taking into consideration the probable span of a flat concrete roof in this situation, gives about 36 men as the maximum.

**ARMAMENT.**—In rear of the parapet. 1912.

**6—15-cm. field howitzers.**

Range—6,600 yards.

It is considered that possibly one 21-cm. mobile howitzer might be placed in rear of the casemates, using these as an alternative position to one of the other similar casemates in the island.

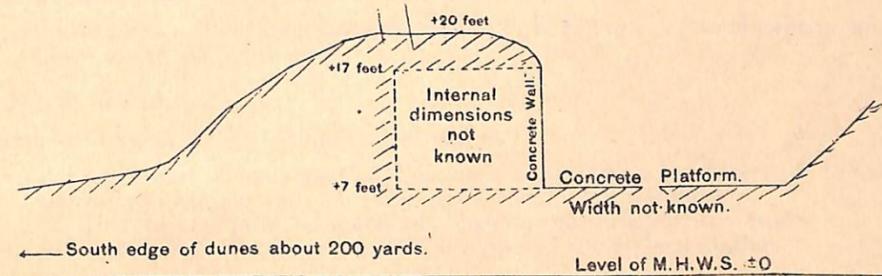
**FIELD OF FIRE.**—Roughly southwest.—It commands the deep channel and anchorage and the entrance to the Randzel Gat.

I. D. 978, Section 1.  
 PLATE 2.  
 To face page 16.

**BORKUM.**

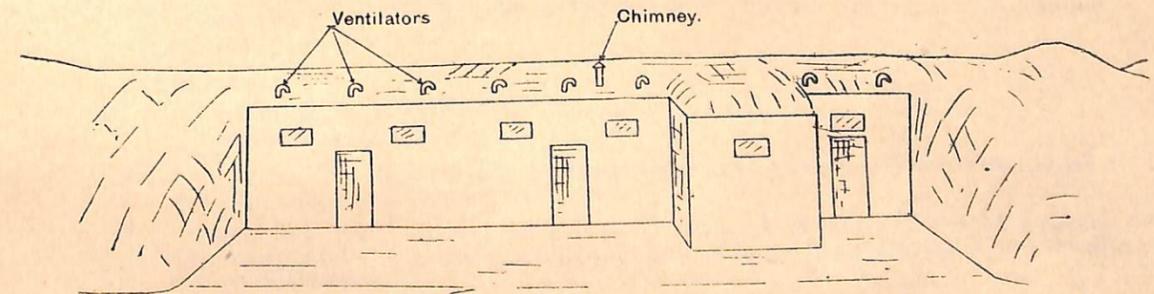
**WORK NO. 2.**

Section through center of casemates.



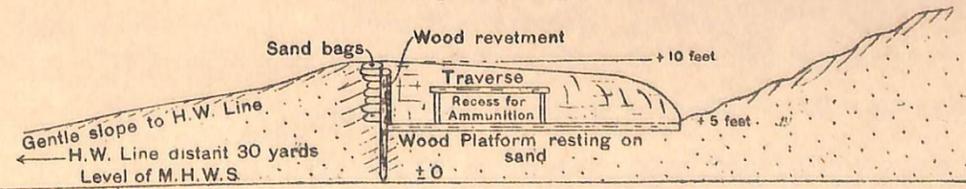
**WORK NO. 2.**

Appearance of casemates from the rear.



**WORK NO. 3.**

Section through Gun Emplacement.



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Work No. 2—*continued*.

P. F. CELL. } Between this work and work No. 1, but nearer the shore, there is  
S. L. EMBLACEMENT. } a small sand dune having a door in its northern slope.

A telephone line on light poles or staves led to the top of this sand dune in 1912, and later a heavier electric cable in a trench led to the door. It is believed that there are several alternative positions in Borkum for one or two portable search-lights.

LIGHTING.—No information.

WATER.—There is an artesian well in rear of the casemates, and a pump (uncovered) stands in the middle of the concrete platform.

OBSTACLES.—There was no fence or entanglement at the end of 1913.

COMMUNICATIONS.—Telephone probably *via* the P. F. cell or S. L. emplacement mentioned above to the old lighthouse.

## Work No. 3—(Chart 2, Plan 3).

DATE OF CONSTRUCTION.—Completed at end of 1913.

SITE.—At the time of construction this work was beyond (southeast of) the southern extremity of the sea wall. It is 30 yards from high-water mark.

There is high ground immediately behind (northeast of) this work.  
The work lies between the W/T station and the lifeboat station.

PARAPET.—This is in two parts, but the crest is continuous. The trace of each part appears to be a curve, convex seawards.

The eastern part has its right flank roughly northwest of its left flank, and is about 240 feet long.

The western part is 20 yards long, and its west flank is roughly west-northwest of its east flank.

Both parts are revetted 5 feet high in timber and sand bags, and have timber gun platforms in rear, six in all.

The eastern part has five traverses and the western has three. All the eight traverses have recesses for ammunition.

The crest is 5 feet above the platforms, and only about 10 feet above high water. As the shore is shelving, gales would not drive the sea far inside its ordinary margins. (*See Plate 2.*)

ARMAMENT (1914).

6—10-cm. Q. F. antiaircraft guns.  
Pedestal mountings.

FIELD OF FIRE.—The deep channel leading to Randzel Gat as antitorpedo craft battery, and all-round fire as antiaircraft battery.

P. F. CELL.—This is on the west flank of the parapet. It is built of concrete, covered with sand, and has a circular steel lookout hood with flat top projecting 1 foot above the top of the sand.

It forms a separate mound.

S. L. EMBLACEMENT.—The nearest are one in No. 4 work, and one at the top of the electric lighthouse.

OBSTACLE.—There is a wire entanglement surrounding the work.

COMMUNICATIONS.

Railway.—A branch line under construction in June, 1914.

Telephone.—No information.

## Work No. 4—(Chart 2, Plan 3).

DATE OF CONSTRUCTION.—1912 and 1913.

SITE.—This work occupies the space between the sea-ends of Süd Strasse and Friese Strasse.

There are three banks end to end, in a line parallel to the sea wall, roughly north-west and southeast.

PARAPETS.—The bank at the northwest end is about 35 feet long and forms a parapet, being revetted in concrete to a height of 6 feet. There is a door in this revetment.

It is not known whether the crest of the sand is much higher than the top of the revetment.

A platform is formed of planks and sand in rear of this parapet.

The second or central bank forms a parapet exactly similar to the one just described. It has the same dimensions.

Work No. 4—*continued*.

**CASEMATES.**—The third bank contains underground quarters, and is larger than the other two banks. It is about 24 feet from front to rear.

Viewed from the rear, *i. e.*, from the northeast, it appears to be exactly similar to the rear view of the living casemates of No. 2 work, there being visible a concrete wall 55 feet long and 10 feet high, with windows and doors. Ventilators appear along the top of this wall, and the crest of the grass-covered sand bank is seen above them.

A level concreted space is laid out in rear of this building. It is the same length as the building, 55 feet, but its width is not known.

**GARRISON.**—There would appear to be accommodation for about 36 men.

**HEIGHTS ABOVE PLATFORM.**

The crests of the two parapets are probably 9 feet above the gun platforms in rear, but they may possibly be only 6 feet above them.

The crest of the casemate bank is 13 feet above the concrete space in rear of it.

**HEIGHT ABOVE SEA.**—The crests of the northwest bank and the centre bank (the two supposed parapets) are 30 feet above high water.

That of the third bank (containing living quarters) is not known. There must be about  $4\frac{1}{2}$  feet of difference to be accounted for and if the crest of this bank is not higher than that of the two parapets northwest of it then its platform must be on a lower level.

**ARMAMENT.**—No information.

**FIELD OF FIRE.**—Toward Rottum Island.

**P. F. CELLS.**—There are two position-finding stations on the left flank (southeast), one in rear and the other in front of and in line with the three banks.

They are both similarly constructed, and consist of a mound containing a concrete chamber, the concrete wall with one door being visible from the rear.

Each station has a platform at one side of the wall, reached by steps, the platform being  $4\frac{1}{2}$  feet from the top of the portion of mound immediately in front of it.

The platform of the station that stands in rear is situated on its northwest side.

The platform of the front P. F. station is on its southeast side.

**S. L. EMBLEMMENTS.**—In rear of the middle of the three banks is a storm-signal station, manned by seamen.

In rear of this storm-signal there is a hut which contains two searchlights on four-wheeled trolleys.

A concrete pavement for the S. L. trolleys to run on passes through this hut and leads on either side to the flanks of the work. On the northwest flank it leads beyond the work and crosses Friese Strasse.

At each flank it broadens out into a platform for the searchlight and its crew and this platform is 6 feet below the top of the sea wall.

**TRENCH AND M. G. EPAULEMENT.**—Well in rear of this work and facing north and northeast are a trench and a machine gun epaulement facing inland.

**OBSTACLES.**

A 2-foot barbed wire fence runs along the front of the three banks and of the advanced P. F. cells. This fence is parallel with the sea wall.

From the ends of this fence a wire entanglement 6 feet high and 4 yards wide runs inland and is bent round to enclose the work in rear.

**COMMUNICATIONS.**—Telephone wires lead underground from each observation station and from some spot on the western side of the enclosure and pass underground and separately out of the enclosure in rear. There are seven wires altogether after junction outside the enclosure, and these are led in a single duct (underground) direct to the old lighthouse.

## Work No. 5—(Chart 2, Plan 3).

**DATE OF CONSTRUCTION.**—First completed early 1912, enlarged 1913.

**SITE.**—The surface of the sand stretching inland from the sea wall at this part is almost level, and the battery lies parallel with the sea wall, and about 15 yards from it.

**TRACE AND PROFILE.**—The trace of this work is straight. The work is 180 feet long. The crest is very little raised above the nearly level sand in front.

Beneath the crest there is overhead cover or concrete casemates.

The level for the gun platforms has been obtained by excavation.

In rear of the platforms the ground slopes up gradually to the natural surface.

There are seven traverses with their tops level with the crest. There are also two mounds or large flank traverses rising 2 feet above the level of the crest. These two mounds contain concrete chambers, and may possibly be cupolas.

Work No. 6—continued.

The chamber has ventilators and a chimney which emerge through the lower promenade, and it is probably about 30 feet long, 8 feet wide at its south end and 13 feet wide at its northern end.

The interior height of the chamber is not known, but judging from details that are known the interior height can not be less than 8 feet.

HEIGHT OF ROOF ABOVE PLATFORM.—This can not be inferred from interior height of chamber, as the floor of the chamber may be on a different level from that of the platform.

Assuming the door to be a 6-foot door, and the top of the windows on either side to be no higher than door; the height of roof above platform might be as little as 7 feet (minimum). It is probably 10 feet.

LARGE SHED.—A short distance south of the work and east of the railway there is a very large shed standing in a hollow of the sands.

There are windows with shutters and a pair of large folding doors in the end facing the sea. Its length is at right angles to the sea front.

A brick-paved pathway leads from the folding doors up an incline to join the brick pathway which runs parallel with the shore, and this communicates with the ramp at the south end of the sunken platform. There is another ramp leading down to the sands. The shed was probably built for bathing machines.

GUN SHED.—A short distance northeast of the work and inland of the railway there is a green shed standing on ground level with the railway, the brick path and the roof of the chamber. Its length is parallel to the sea front.

The southern end has folding doors and is concealed by artificial mounds. These mounds consist of brushwood covered with sand and grass grown.

The shed is reported to contain guns and howitzers.

INFANTRY PARAPET.—A curved parapet for infantry or machine guns occupies the southwest corner of the work and commands the shore and lower promenade to the southwest. This is the cable landing point and the old cable house used in peace time is in rear (east) of the work.

COMMUNICATIONS.—The railway running parallel with the shore connects southwards with work No. 5 and all parts of the island, and northward it passes close to Works 7, 8, and 9.

Telegraph.—The land lines from cables lead as described under "Cables, land lines," page 8.

Telephone.—This work and cable house is connected with the post office.

Work No. 7—(Chart 2, Plan 3).

DATE OF CONSTRUCTION—1912 and 1913.

Work No. 7 consists of a building, casemates, covered with sand and intended for living quarters. A concrete platform in rear of the casemates and two chambers reached by steps, one on each flank of the casemates.

The platform is reported as being intended for heavy howitzers.

SITE.—Abreast the space between groins "6" and "VII," its east end being opposite groin "VII."

At this part of the island the natural surface of the sand just inland of the sea wall is some 10 or 15 feet lower than the top of the sea wall.

The crest of the bank of sand which covers the living casemates is about 1 foot higher than the top of the sea wall and about 4 to 5 yards from it.

The upper promenade and the railway both run along the top of the sea wall here.

THE CASEMATES.—These are comprised in a concrete building, length 45 feet, height 10 feet, and depth from front to rear about 12 to 15 feet.

The only wall visible is the south one, sand and grass covering the rest of the building, including the roof.

The south wall has two doors and about 10 small windows, and there is a semi-circular projection about the middle. Some 10 ventilators and 1 chimney project from the roof through the sand. (See Plate 4).

GARRISON.—There is accommodation for about 30 men.

CONCRETE PLATFORM.—The length is about 50 feet, width not known. A path leads from each end and curves toward the ends of the bank to the foot of two short flights of steps.

These steps lead to the two mounds believed to contain the 21 cm. guns. These mounds have also been reported as being two position-finding stations.

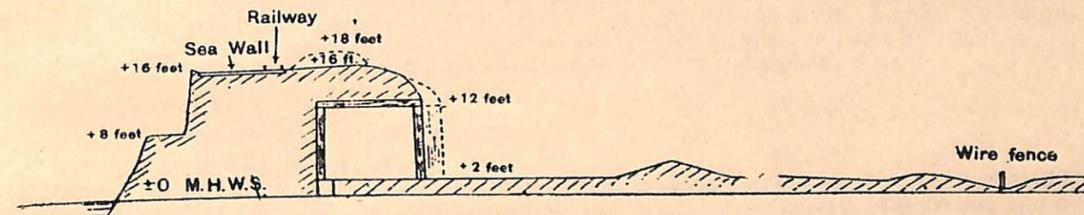
This platform is probably nothing more than the yard or space necessary for hygienic reasons for such living casemates, but might, of course, be utilized for howitzers.

I. D. 978, Section 1.  
PLATE 4.  
To face page 20.

BORKUM.

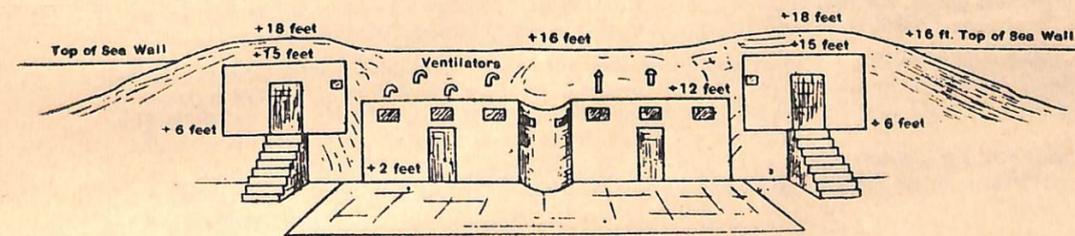
WORK NO. 7.

Section through casemates.



WORK NO. 7.

Appearance from the rear.



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**Work No. 7—continued.**

**HEIGHTS.**—The crest above the casemates is about 13 feet above the platform in rear and about 18 feet above high water.

**FLANK CHAMBERS (?CUPOLAS).**—Viewed from the sea there are two mounds, one on either flank of the crest of this work.

They are reported to be 45 feet apart and this distance is equal to the length of the casemates and would seem to indicate that possibly a disappearing mounting is built into each flank of the work, and that the cupola was concealed at the time of observation.

Viewed from the sea, two black metal objects appear which may be covers to the gun-port or observation hoods. When last seen they appeared more like the latter; that is to say, as if they were circular flat-topped steel hoods. Each metal object has three slots cut in the arc facing the sea, and in the centre of its flat top there is a round hole covered with a circular steel cap about 10 inches in diameter.

Viewed from the rear, access to these flank chambers appears to be by a door at the top of each of the two flights of steps.

The door for each chamber is in the middle of a wall 15 feet long by 9 feet high. At the inner end of each wall, the end nearer the casemates, and in line with the top of the door, there is a round hole covered with a circular cap. The cap is about 8 inches in diameter and attached by a chain and padlock outside.

**ARMAMENT.**

2—21-cm. guns, disappearing

Range, 16,400 yards.

This work affords another alternative position for howitzers and might be utilised for 1—21-cm. howitzer transported by means of girdled wheels and motor traction, or for 2—15-cm. howitzers.

**FIELD OF FIRE.**

**Guns.**—The approaches to the Oster Ems.

**Howitzers.**—The Riff Gatt and Oster Ems.

**WATER SUPPLY.**—There is a well and pump in rear of the work, outside the wire fence.

**OBSTACLE.**—A barbed-wire fence, 6 feet high, runs parallel with the work in rear and is bent round at either end to meet the sea wall.

**COMMUNICATIONS.**—Underground telephone cable from the westerly P. F. station to the old lighthouse. Another from the easterly P. F. station to the barracks.

**Work No. 8—(Chart 2, Plan 3).**

**DATE OF CONSTRUCTION.**—Completed end of 1913. This work comprises living quarters and a parapet some 200 yards apart, and in this respect resembles Nos. 2 and 4.

**THE PARAPET.**—This is situated abreast the end groin and in rear (south) of the north-eastern extremity of the sea wall, as it was at end of 1913 when an extension had just been completed. The natural surface of the sand here lies level with the brick walk on the top of the sea dyke, and with the railway.

At about 20 to 30 yards inland from (*i. e.*, south of) the railway the ground falls suddenly to a slight hollow. The break of contour has been utilised in constructing the parapet.

**TRACE AND PROFILE.**—The parapet is straight and about 25 to 30 feet long. It is revetted in concrete to a height of 9 feet, and there is a concrete platform in rear. There is a door in the revetment, and some kind of chamber as a chimney and two ventilators rise from the top.

The height of the crest above the platform is not known, but allowing for 3 feet of sand above the concrete it would be 12 feet.

The crest of parapet is about 20 feet above high water.

**CASEMATES.**—These were completed about January, 1914, soon after the battery. They are situated about 200 yards west of the battery and abreast the second groin from the northeastern extremity of the sea wall and railway.

The natural surface of the sand at this spot rises at a slope of about 20 degrees until at a distance of about 20 yards inland of the railway it reaches the crest of a small ridge and commences its descent to a valley parallel to the shore.

The building is situated on the reverse slope of this ridge, facing in a southerly direction and looking across the valley. To the west it is protected by a spur of its own ridge projecting into the valley.

The building is about 40 feet long and 12 feet high and about 12 to 15 feet from front to back. The southern face of the building has two doors and six windows and overlooks a concrete yard or platform.

The height of the crest above the platform must be at least 15 feet.

Height of crest above sea about 38 feet. (See Plate 5.)

**Work No. 8—continued.**

The roof is flat and black in colour. The north side of the building is against the sand of the ridge, and it is probable that the roof has since been covered with sand like the buildings of similar nature in works 2, 4, and 7. A concrete chimney rises high above the roof.

There is accommodation for about 25 men.

**ARMAMENT.**

2—21-cm. howitzers.

(One in rear of parapet, one in rear of casemates.)  
Range, 9,000 yards.

**FIELD OF FIRE.**—The Oster Ems.

**OBSTACLE.**—A wire entanglement surrounds the parapet only, not the casemates.

**COMMUNICATIONS.**—Telephone from the parapet underground to the barracks to the southward.

**Work No. 9—(Chart 2, Plan 3).**

**DATE OF CONSTRUCTION.**—Completed early 1912.

**SITE.**—About S. by E. of work No. 8, and about 200 yards north of the railway line. It is in the midst of sand dunes, and no evidence of its position is visible from railway or sea wall.

**ARMAMENT (1912).**

4—28-cm. coast howitzers.

Range, 13,500 yards.

These are mounted on central pivot mountings on a long sunken platform. Light rails serve the position, but no details are known.

**FIELD OF FIRE.**—All round.

**MAGAZINES.**—Two underground magazines are reported east by south of the howitzer platform. They form two large mounds and the branch railway line passes between them.

**POSITION FINDER.**—One station bears about east by north of the howitzer position. The hood is not visible from the road or railway. The top of the mound concealing it is higher than that of the other banks in the vicinity.

**LIVING CASEMATES.**—These are under the long sand dune parallel and close to the railway, from which they are, of course, invisible. Their windows and doors face northward and are masked by other sand dunes, natural and artificial.

**OBSTACLE.**—A 6-foot wire fence encloses the whole of the above, as shown on Plan 3.

**COMMUNICATIONS.**—The railway passes through the southeastern corner of the enclosure, and a branch leads off north and northwestward toward the howitzer battery.

A telephone leads underground from the P. F. station in an easterly direction, leaves the enclosure at its eastern corner, and joins the main telephone cable which traverses the island from east to west.

Another underground telephone leads from a part of the work not known, passes under the railway just east of the living casemates, continues eastward under the pathway which separates the enclosure of No. 9 work from that of No. 10 work.

**Work No. 10—(Chart 2, Plan 3).**

**DATE OF CONSTRUCTION.**—Completed early 1912.

**SITE.**—From 500 to 700 yards southwest of Jagerheim. The work is completely concealed from view among the sand dunes south of the railway.

**ARMAMENT (1912).**

4—28-cm. coast howitzers.

Range, 13,500 yards.

These are mounted on central pivot mountings. The four howitzers are in line. They are on concrete beds.

**FIELD OF FIRE.**—All-round fire.

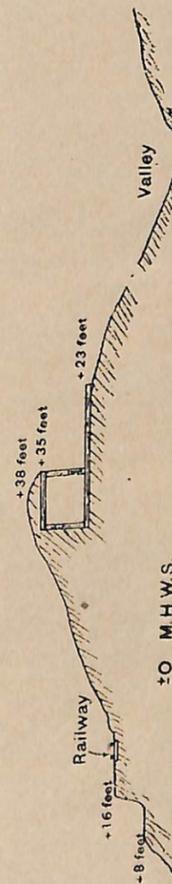
**MAGAZINE.**—There is a magazine situated northeast of the battery about 200 to 300 yards. It is built of concrete and is entirely covered by a mound of sand. It is not known whether this is the magazine for the howitzer battery. It is probable that it forms part of the central ammunition depot of the island, which is situated just on the opposite side of the railway.

There is probably a magazine for the howitzer battery concealed in the sand dunes more to the south.

**POSITION FINDERS.**—No information.

**BORKUM.  
WORK NO. 8.**

Section through casemates.



**WORK NO. 12.**

Section.



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**Work No. 10—continued.**

**OBSTACLE.**—There is a 6-foot wire fence enclosing this work and the central ammunition depot and a large area besides, as shown on Plan 3.

**COMMUNICATIONS.**—Underground telephone wire from some part of this work to work No. 9.

The railway enters the enclosure on the west, and describing an arc through the centre of the enclosure makes its exit at the northeast corner, crossing the main road soon afterwards and proceeding across the narrow neck of land to the Ostland. It is probable that a short branch of the line leads into the howitzer position.

**Work No. 11—Works Nos. 11 and 11A are not permanent works.**

**DATE OF CONSTRUCTION.**—1912.

**SITE.**—At the western end of the narrow neck of land connecting Westland with Ostland, and facing east.

**ARMAMENT.**

4—9-cm. field guns.?

Range 7,100 yards.

During manoeuvres this field work has been occupied by infantry and machine guns.

**FIELD OF FIRE.**—It commands the defile through which the road and railway pass from Ostland to Westland.

**SEARCHLIGHT.**—Either in or near the work.

**OBSTACLE.**—A wire entanglement 4 yards wide completely surrounds the work, and two straight lengths of wire entanglement lead the one southeastward to meet the railway, the other northward amongst the sand dunes.

**Work No. 11A.—This work, like No. 11, is not a permanent work.**

**SITE.**—In 1913 this temporary field work occupied the position shown some 500 yards south of No. 11.

**ARMAMENT.**

4—9-cm. field guns.

Range, 7,100 yards.

The battery is prepared for either light field guns or infantry and machine guns.

**FIELD OF FIRE.**—It commands the two or three possible approaches for infantry from Ostland to Westland across the narrow part of the Tuskendoor.

**OBSTACLE.**—A wire entanglement surrounds the work.

**Work No. 12—(Chart 2, Plan 3, Plate 5).**

The same wire entanglement encloses Nos. 12 and 12A.

**DATE OF CONSTRUCTION.**—Completed early 1912, enlarged 1913.

**SITE.**—About 1,000 yards from high-water mark and some 450 to 500 yards north of the road junction northeast of Ostland village. It is built on the reverse slope (southern) of a long sand dune just north of the railway.

The gun platforms in the battery are some 20 feet above the ground just in rear, which is flat for some 20 or 30 yards southwards, and on which the railway is laid.

**TRACE AND PROFILE.**—The parapet is straight and 100 yards long. It is revetted in concrete to a height of 6 feet. The gun platform is of concrete, and is supported by concrete living casemates below.

There are 5 traverses of concrete covered with sand, each traverse containing chambers at each side. The tops of the traverses are level with the crest of the parapet.

There are 4 gun platforms for 2 guns each.

The crest is probably about 8 feet above the gun platforms.

**HEIGHT ABOVE SEA.**—About 40 feet above M.H.W.S.

**ARMAMENT.**—It is now known positively that early in 1912 the armament of this battery was 4—15-cm. Q.F. guns, on coast mountings. Range 13,100 yards. In 1913, however, two guns were seen between each pair of traverses, and large alterations took place. It is believed that 2 heavy disappearing guns in cupolas were mounted.

The armament is now considered to be—

2—21-cm. guns, disappearing.

Range, 16,400 yards.

8—18.5-cm. guns, disappearing.

Range, ? 14,500 yards.

**FIELD OF FIRE.**—The Oster Ems, and also the open sea north of the Oster Ems, whence an enemy fleet might bombard not only the Borkum defences but war vessels lying in the Randzel Gat and Fischer Balje, or in the dredged anchorage east of Borkum.

**MAGAZINES.**—About 40 yards clear of the east flank of this battery there are two concrete buildings covered with a mound of sand. The buildings were seen before they were

**Work No. 12—continued.**

covered, and appeared to be about 24 feet long by 15 feet from front to rear and about 10 feet high.

**SEARCHLIGHT.**—There is a searchlight position about 450 to 500 yards northeast of the east flank of the battery.

**OBSTACLE** (see also under 12A).—A wire entanglement surrounds this work and No. 12A.

**GUARDHOUSE.**—This is just south of the west flank of the battery. The walls are loop-holed.

**COMMUNICATIONS.**—The railway runs past the rear of the battery within 20 to 30 yards. There is telephone connection underground to the main telephone cable running from east to west of the island.

**Work No. 12A—(Chart 2, Plan 3).**

This comprises 2 howitzer emplacements combined with living casemates similar to works Nos. 2, 4, 7 and 8, and it is comprised within the same wire entanglement as work No. 12.

**SITE.**—The western emplacement and living casemates are situated 80 yards east of the east flank of the parapet of No. 12 work.

**TRACE AND PROFILE.**—Similar to the "Living Casemates" of Nos. 2, 4, 7 and 8.

**ARMAMENT.**

6—15-cm. field howitzers.  
Range, 6,600 yards.

**FIELD OF FIRE.**—The Oster Ems.

**OBSTACLE.**—The same wire entanglement encloses 12 and 12A.

**COMMUNICATIONS.**—Railway. This passes close in rear of the parapets. Telephone probably underground to join the main alignment of telephone wires alongside road No. 3.

**Work No. 13—(See Chart 2, Plan 3).**

**DATE OF CONSTRUCTION.**—1913.

**SITE.**—About 500 yards east of 12A and just north of the railway. It is due north of "VOGELWÄRTER."

**TRACE AND PROFILE.**—The work consists of a straight parapet running east and west. Length not known. It is revetted in concrete to a height of at least 7 feet. There is one door in this revetment and a ventilator projects at the top. It is not known whether the ground in rear is concreted.

The height of the crest above the ground in rear is at least 9 feet.

**HEIGHT ABOVE SEA.**—About 30 feet.

**ARMAMENT.**—No information.

**FIELD OF FIRE.**—The Oster Ems.

**MAGAZINE.**—Beyond the chamber in the parapet the nearest supply would be from No. 12 work. It would seem possible to cut this off by destroying the railway between the two works.

There appears to be no P.F. station.

**COMMUNICATIONS.**—The railway passes close in rear of the work.

Telephone wires lead underground to the main, telephone cable runs close to the alignment of road No. 3 to the south of "Vogelwärter" and a branch lead connects with this work.

**Work No. 14—(See Chart 2, Plan 3).**

**DATE OF CONSTRUCTION.**—Early 1913.

**SITE.**—This is the most northerly and most easterly work in the island, and is built into the southern slope of a very high sand dune.

**PARAPET.**—There would appear to be a short parapet, perhaps 30 feet long, between two higher chambers, covered except the rear with sand and grass. The parapet is revetted in concrete to a height of about 7 feet.

The height of the crest above the platform in rear being about 10 feet.

**HEIGHT ABOVE SEA.**—50 feet.

**FLANK CHAMBERS.**—The rear of these appear as concrete walls, no dimensions are known, and they are probably similar to those of work No. 7.

**ARMAMENT.**

2—21-cm. guns, disappearing.  
Range, 16,400 yards.

**Work No. 14—Continued.**

**FIELD OF FIRE.**—The Oster Ems.

**OBSTACLES.**—Wire entanglement.

**COMMUNICATIONS.**—Rail. The terminus of the Government railway is in the enclosure in rear of (south of) this work.

Telephone. An underground telephone runs near the railway and then south to road No. 3, where it follows the alignment of the road westward.

**Work No. 15. (See Chart 2, Plan 3).**

**DATE OF CONSTRUCTION.**—Completed end of 1913.

**SITE.**—It is north of No. 3 road and southwest of the East Beacon. It is the highest battery in the island. It is visible from the pier and from Fischer Balje.

**TRACE.**—Straight and roughly west by north and east by south.

**PROFILE.**—No details obtainable.

**ARMAMENT.**—Not known, but see next paragraph.

**FIELD OF FIRE.**—Probably this battery commands Juist as well as the open sea to the northeast.

As 12-inch guns have been reported in the island, this might possibly be the position of one or a pair of them, but they are more likely to be in turrets as work No. 16.

**OBSTACLES.**—A wire entanglement surrounds the work. The northern margin of the entanglement is about 30 yards north of the crest of the work.

**COMMUNICATIONS.**—Rail. A branch from the Government railway runs south and east into the enclosure of this work.

Telephone. An underground line joins the main trunk of telephone wires which follows the route of road No. 3 to the west.

Another telephone line runs underground to the south and connects this work with a sand dune about 700 yards south by east from it. It is thought the land lines of the cables pass through a chamber in this sand dune (see "Eastern Landing Place," top of page 11), and thence to the bend in road No. 3 near by.

It has been reported that there is also a P. F. cell at this sand dune.

**Work No. 16.**

**SITE.**—Not known.

**ARMAMENT.** Turret A.—2—30.5-cm. L. 50 guns.  
Turret B.—2—30.5-cm. L. 50 guns.  
Range, ? 24,000 yards.

**Work No. 17.**

**SITE.**—Not known.

**ARMAMENT.** 3—30.5-cm. howitzers in separate pits.

**SUBMARINE DEFENCES.**

(See Chart 2.)

*Note.*—All bearings, whether given in points or degrees, are true.

These consist of mine fields laid in the approaches to the Borkum Anchorages, disposed as described below and shown on Chart 2.

As far as can be ascertained there were no booms, no nets, and no torpedo batteries in the scheme of submarine defences at Borkum at the outbreak of war, although there were probably arrangements for blocking by sinking of vessels as described below, after the mine fields.

**Mine Fields.**

These is described in order according to the channels in which they occur, the channels being taken in sequence from southwest to northeast.

When there is more than one mine field in a channel the outermost or one nearer the open sea is mentioned first.

**Huibert Gat Mines.** (Laid when for any reason the Randzel Gat mines are ineffective.)

The mine field in this channel (which is the deepest and most important approach to Emden as well as to Borkum West Anchorage) is situated at its inner end north by west of Rottum Light.

Its alignment is from WNW. to ESE. It is thus inclined at an angle of about 26 degrees from the entering course of vessels at this point.

There is a gap at about the middle of this mine field which allows for a 99-foot clearance on either beam of a vessel entering.

The course for vessels entering is given on Chart 2.

The mine field is some 2,700 yards long, including the gap, and there are probably over 100 mines.

The mines are 74 feet apart.  
Depth below surface not known.

A vessel getting safely through this mine field has still to pass the mine field in Randzel Gat mentioned later.

#### Wester Ems Mines.

The mine field in this channel is in two wings, the western one in the fairway proper, the eastern running into the inner end of the Riff Gat.

*The western wing* runs from the north sunken spit of Ballon Flat (Red Buoy WB) to Black Buoy No. W. 4, which is almost due east 2,200 yards.

Its alignment is thus west and east. It is inclined at an angle of about 17 degrees to the entering course of vessels at this part.

There is a gap at about the middle of this mine field which allows for a clearance of 99 feet on either beam of a vessel entering on the true course.

The course for vessels entering is shown on Chart 2.

The length of the mine field is about 2,200 yards, including the gap; the latter is wide in view of the angle of inclination to the course.

There are some 80 mines.

Distance apart, 74 feet.

Depth below surface not known.

*The eastern wing.*—This runs in a northeasterly direction for 1,000 yards from the eastern extremity of the west wing. It then bends north and continues for 1,500 yards.

There is no gap in this wing. The whole eastern wing is thus about 2,500 yards long.

It is believed to comprise about 100 mines.

Distance apart, 74 feet.

Depth below surface not known.

It is not intended for blocking the Riff Gat, but to obstruct vessels which might avoid the western wing of the Wester Ems mine field.

A vessel avoiding or passing safely through this mine field has still the mine field in Randzel Gat to pass.

#### Riff Gat Mines.

This mine field is situated across the outer end of the Riff Gat north of the Geldsack Flat. Its alignment is roughly SW. by W. and NE. by E.

There is no gap and no clearance past the ends of the field for large vessels.

Its length is about 1,600 yards.

There are some 65 mines.

Distance apart, 74 feet.

Depth below surface not known.

#### Randzel Gat Mines.

There are two mine fields in this channel.

*Outer line.*—The most northerly or outer line runs roughly east and west from the north sunken spit of Huibert Flat (Wester Ems Light Buoy) toward the Borkum High Lighthouse.

The alignment is 86° true.

There is no gap, the course for ships passes by the east end of the mine field, and between this and the Borkum shore. See Chart 2.

The eastern end is marked by a special buoy which, however, is liable to be removed under acute danger of attack.

The length of the mine field is about 1,800 yards.

There are about 34 mines.

Distance apart about 148 feet (this does not quite account for the length given by about 450 yards).

Depth below M.L.W.S., 6 feet.

*The inner line* runs roughly in a north and south direction.

The northern end is 1,800 yards due west from the outer end of groin No. XIV (at the foot of Sud Strasse). It is marked by a special buoy in war time.

The mine field runs 174° true from this buoy.

There is no gap in it.

The course for ships entering passes between it and the Borkum shore.

The length is 1,900 yards.

There are about 42 mines.

Distance apart, 148 feet.

Depth below M.L.W.S., 6 feet.

The Randzel Gat mine fields, inner and outer, are the permanent mine fields, those in the Outer Entrance channels (Huibert, Wester Ems and Riff) are exceptional.

#### Oster Ems Mines.

There are two positions for mine fields in this channel, the inner one being probably used permanently from times of strained international relations onwards and the outer exceptionally and at what is termed acute war conditions.

*Outer Mine Field.*—This is laid at the position which is shown in Admiralty Charts as a shallow constituting the bar of the Oster Ems.

This shallow does not really exist, there being a channel (natural or dredged) having a width of about 500 yards and a depth M. L. W. S. of 24 feet. It is this channel which is blocked by the outer mine field.

There are three lines of mines in this outer field. The outermost runs from a sunken spit north of Brauer Flat Red Buoy O. E. in a direction 62° true for 900 yards. Black Buoy O. 4 is removed from its peace position and placed at the eastern extreme of this line of mines.

The two other lines run from the extremities of the first line upstream and converge to cross. The triangle thus formed lies roughly north of defensive work No. 12 and its searchlight.

The spot where the two lines cross, 104° true 1,330 yards from Red Buoy O. E.

The line of mines which runs along this bearing continues for a total length of 2,850 yards from the Red Buoy.

The other line stops just after crossing, and is about 1,200 yards long, terminating at Red Buoy O. F.

There is no gap in this mine field.

There is a clear passage about 200 yards wide just north of the mine field and between its northern apex (Black Buoy O. 4) and the sunken spit just northwest of it, with depth of over 18 feet M. L. W. S.

On the north side of the channel and on a bearing of about 114° there are a buoy and a lightship; the buoy is Black O. 2 and is 4,250 yards seaward of the northern apex of the mine field, and the lightship is 2,600 yards upstream from this apex.

The safest course for vessels entering is to leave this buoy on the port hand and steer straight for lightship, leaving Buoy O. 4 close on starboard hand and this lightship on the starboard hand, passing as close as possible to all three. This leads very close to the sunken spit and gives the mine field a fairly wide berth on the starboard hand.

After passing the lightship there is a clear run to the eastern anchorage, and thence to the war anchorage.

The total length of the three lines in outer field is about 4,750 yards.

The number of mines is not known.

Distance apart is not known.

Depth below surface is not known.

*Inner Mine Field.*—This consists of two arms, each approximately 1,200 yards long, which contain an angle of about 110 degrees.

The northern arm runs roughly W. N. W. to E. S. E. and stretching roughly south from its eastern end runs the southern arm.

The northern arm starts from Red Buoy O. F., which retains its peace position. Its exact alignment is reported to be 109° true.

Length, 1,200 yards.

Number of mines, 25.

Distance apart, 145 feet.

Depth below M. L. W. S., 6 feet.

The southern arm starts from the eastern end of the northern arm. Its exact alignment, 179° true.

Length, 1,250 yards (see next line but one).

Number of mines, 41.

Distance apart, 145 feet. This arrangement would occupy about 2,000 yards and probably the mine field is this length.

Depth below M. L. W. S., 3½ feet.

#### Sunken Ships.

Arrangements are believed to have been made for sinking ships partly filled with cement in the following positions:

- (1) Randzel Gat above the inner mine field in a line roughly N. and S. from the eastern drying out part of Hohe Reef to the northern drying out sand of Huibert Flat.
- (2) Across the entrance to Fisser Balje from Randzel Gat.
- (3) Oster Ems.—Above the mine fields across the channel, the Memmert Beacon in line with Borkum East Beacon.

## EMDEN.

NOTE.—All bearings, whether given in points or degrees, are true.

### APPROACHES.

(See Map 1, Chart 2.)

#### EMS RIVER.

The *Ems River* rises southwest of *Minden* and flows through Westphalia, then through Western Hanover, and passing through the *Dollart*, near *Emden*, enters the North Sea through a wide estuary about 35 miles below *Emden*, near *Borkum*. This estuary is mostly occupied by the islands *Rottum*, *Borkum*, and *Juist* and the sands connected with them.

#### FRONTIER.

The frontier between *Holland* and *Germany* is to be found in this estuary, the island of *Rottum* being Dutch, and *Borkum* and *Juist* German.

#### Entrance Channels.

In winter there are frequent dense fogs off the mouth of the *Ems*. There are two main channels from the sea to *Emden*, the *Randzel Gat* and the *Oster Ems*, the former lying between the islands of *Rottum* and *Borkum*, and the latter between *Borkum* and *Juist*.

It is believed that there is sufficient water (at high water) for vessels drawing 11 feet to pass from the *Friesche Zee Gat* between *Engelsmans Plaat* and *Schiermonnikoog*, behind the islands *Schiermonnikoog*, *Simons Sand*, *Bosch Plaat*, *Rottumer Plaat*, and *Rottum*, into the *Randzel Gat*, and it is possible that vessels of that draught could enter at the *Texel* or *Vlie Gat* and come right through behind the islands to the *Ems*.

This channel would be sufficiently wide to allow vessels to pass  $4\frac{1}{2}$  miles from the nearest Dutch sentry. It might be used by German T. B. Ds. using *Emden* as base, to slip by a patrol off the mouth of the *Ems*.

#### Depths.

##### RANDZEL GAT.

On account of shoals the *Randzel Gat* is divided into three channels, the *Huibert Gat*, the *Wester Ems*, and the *Riff Gat*.

The *Huibert Gat* has a least depth of 30 feet M. L. W. S. ( $38\frac{1}{2}$  feet M. H. W. S.), but is reported to be shoaling. This least depth is at a point N. of the centre of *Rottum Island*.

The *Wester Ems* has a least depth of  $19\frac{1}{2}$  feet M. L. W. S. (28 feet M. H. W. S.) through most of its length.

The *Riff Gat* has a least depth of 19 feet M. L. W. S. ( $27\frac{1}{2}$  feet M. H. W. S.) near its sea mouth.

After passing through any one of these channels a vessel would enter the *Randzel Gat*, the least depth in which,  $21\frac{1}{2}$  feet M. L. W. S. (31 feet M. H. W. S.), is to be found at a point W. from *Pilsum* lighthouse.

From this point the approach to *Emden* is by the main channel of the *Ems River*, the least depth in which, 22 feet M. L. W. S. ( $31\frac{1}{2}$  feet M. H. W. S.), is situated at two points W. and S., respectively, from the *Knock*, a prominent point of land about 5 miles below *Emden*.

##### OSTER EMS.

In this channel the least depth is 8 feet M. L. W. S. ( $17\frac{1}{2}$  feet M. H. W. S.), situated just below its junction with the main channel of the *Ems*, S. E. of the centre of the island of *Borkum*. This channel is, therefore, only of use to small vessels even at high water (see also under *Borkum*, page 4).

##### SECRET CHANNEL.

It is believed that there are channels between *Juist* and the mainland through which, at high water, it is possible to bring T. B. Ds. This channel has been reported to exist and to extend, behind the *East Frisian Islands*, to the *Jade* (see under *Wangeroog*, section 2).

##### TIDES.

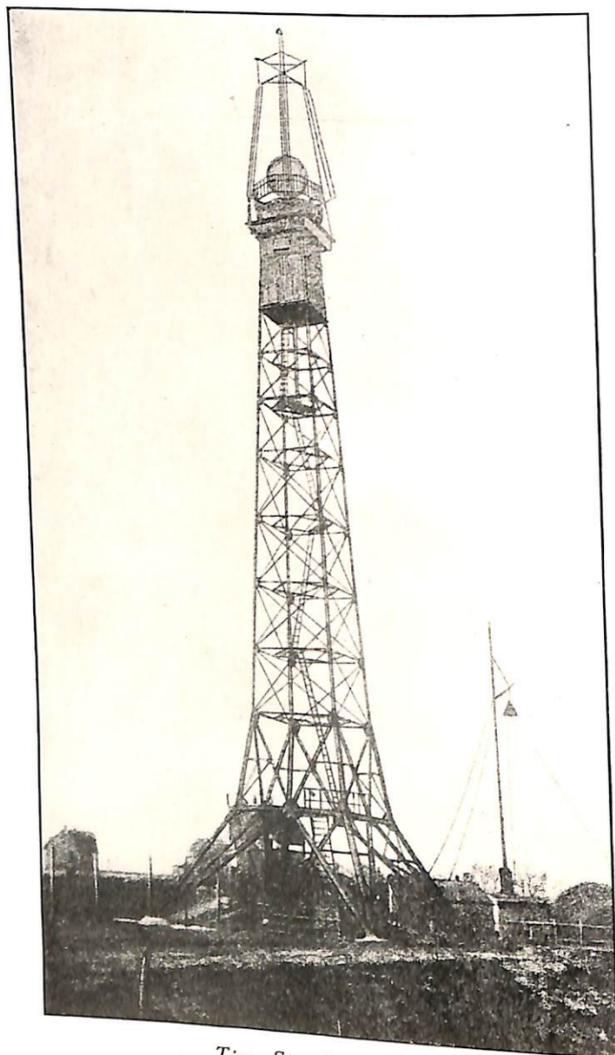
In some of the channels the tides set across (see *Sailing Directions*).  
H. W. occurs at *Borkum*  $1\frac{1}{4}$  hours earlier than it does at *Emden*.

#### Anchorage.

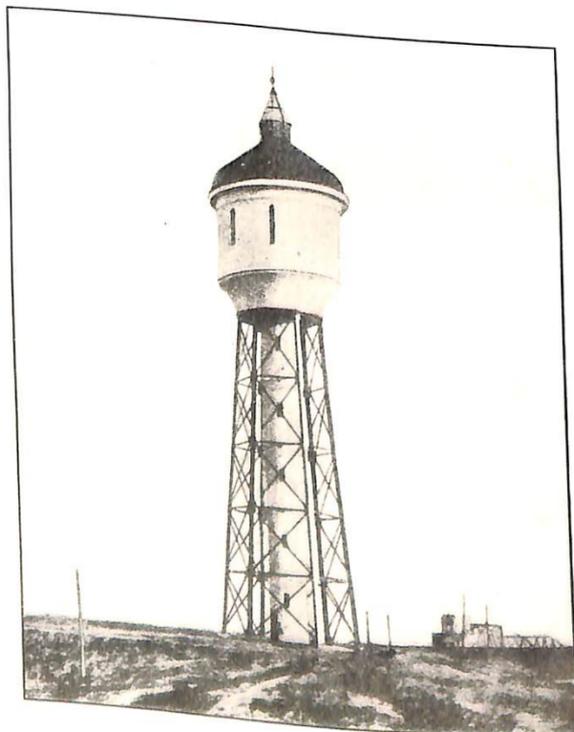
There is excellent anchorage south of *Borkum* in the *Randzel Gat* and also on the north side of the main channel of the *Ems* just below the bifurcation of the *Randzel Gat* and *Oster Ems*.

It is believed that the *Randzel Flat* has been dredged at the head of the *Fischer Balje*, so as to form an anchorage for large vessels with an entrance both S. W. and N. E., i. e., by the *Fischer Balje* and the *Hörns Balje* (see under *Borkum*, "War Anchorage," page 5).

EMDEN.  
AUSSEN HAFEN.



Time Signal Tower.



Water Tower.

ICE.  
Ice may be expected in the Ems in January and February.  
Ice appears on an average three days annually off *Borkum* and 25 days off *Pilsum*.  
In 1908 there were two large ice breakers at Emden.

Projected Extensions.

See under "Commercial Port, 1913 Harbour, Hafenbecken," page 30, and under "Naval Port," page 41.

COMMERCIAL PORT.

(See Plan 4.)\*

Position and Area.

The port of Emden is entered from the *Ems River*, about 35 miles from the sea and on the north side of the *Dollart*, by means of a channel dredged to a depth of 29 feet M.L.W.S. (38½ feet M.H.W.S.) in the bed of the river.

The river is now about 2 miles from the town, which stands at the head of the harbour. This harbour was originally one of the many creeks among the mud flats which surround the *Dollart*, but by building wharves on the banks of the creek, reclaiming the mud flats, and dredging, the present harbour, which covers an area of about 200 acres, has been formed.

Hands Employed and Living Accommodations.

In January, 1914, 1,100 dockers were employed. Living accommodation is provided for them in two places, one to the westward of the junction of the *Binnen Fahrwasser* and the *Binnen Hafen*, and the other near the *Larrelter Strasse Railway Station*, west of the *Alter Hafen*.

The harbour consists of two main portions, the *Old Harbour* and the *1913 Harbour*. The *Old Harbour* is again subdivided into the *Aussen Hafen*, the *Binnen Hafen* and *Fahrwasser*, and the *Alter Hafen*, and the whole lie in a northeast and southwest direction. The *1913 Harbour* is subdivided into the *Vorhafen*, the *Hafenbecken*, and the *Ost Hafen*.

The Old Harbour.

AUSSEN HAFEN.

This is the tidal part of the harbour and lies between high dykes, the western one of which ends in a curved stone pier 725 feet long. It is 4,590 feet long, 310 feet broad, and its depth is 25½ feet M.L.W.S. (35 feet M.H.W.S.). Dredging is continual, and it is proposed to increase the depth to 37¾ feet at average high water.

There is accommodation for 13 vessels 400 feet long, 7 alongside the quay and 6 at the dolphins, of which there are 16 on the southeast side of the harbour.

The whole of this harbour is a "free area" for fiscal purposes.† The quay is on the northwest side of the harbour and is 2,900 feet long, and there is 25½ feet M.L.W.S. alongside. It is broad and well served by the railway.

On it stand two large goods sheds (the southern of which belongs to the Hamburg Amerika Line and provides a submarine charging station; the northern is of wood, belongs to Lehnbering & Co., and is used for naval provisions; north of the latter is a large coal store).

There are also 820 feet of quayage near the head of the harbour, where small passenger steamers of limited draught can lie, and where there are floating stages—alongside a railway station.

Near the southern end of the large quay is a 40-ton crane, and running on rails the whole length of the quay are seven electric cranes, each to lift 3 tons, and three to lift 5 tons (see "Lifting Appliances, Summary," page 31).

On the eastern side at the head of this harbour are the time signal tower and the water tower. The latter is 82 feet high. (See Plate 6.)

BINNEN HAFEN AND FAHRWASSER.

This is the central portion of the Old Harbour, and is entered from the *Aussen Hafen* by two entrances, the western of which is called the *Alte Schutzschleuse* and the eastern the *Emder Seeschleuse*.

The former is closed by a sluice gate, and therefore can only be opened at about high water; it is, however, no longer in use.

The latter contains a lock, with an available length of 377 feet, a width of 49 feet, and a depth over the sill of 21½ feet at high water. This lock can not be used when and if the water is higher in the *Aussen Hafen* than in the *Binnen Hafen*. It also has a round bottom, which restricts the entrance of vessels with flat bottom and large beam. Thus, width at 12 feet depth is 49 feet, at 14½ feet is 48 feet, at 15½ feet is 45 feet, at 16½ feet is 42 feet, at 17½ feet is 37 feet.

\* The plan is based on that produced by the Prussian Government Harbour Works.  
† Compare Hamburg, Bremen, Lübeck, &c.

This harbour is about 2,040 yards long and, as far as the Nordseewerke, has a width of 590 feet and a depth of 23 feet. Above these works it narrows to 197 feet and has a depth of 17 feet 3 inches.

On the western side are three basins (which are numbered 1, 2, and 3, the north-eastern being No. 1), which branch off in a northerly direction. Each is about 1,140 feet long, 195 feet wide, and 19 feet 8 inches deep.

There are also two basins at the northern end of the harbour on the eastern side for small craft. There are 12½ feet of water in these.

At the southern end on the western side of this harbour is the *Electric Power station* (which supplies power for the cranes and other machinery), and on the eastern side is the *Quarantine establishment*.

This harbour is not much used by ocean steamers, and is largely given up to the fishery trade and shipbuilding (see under "Shipbuilding Yards").

There appear to be no cranes on the north-west side of this harbour, but on the south-east side, near the railway bridge, there is a 25-ton crane, and at the *Nordseewerke* there are one 10-ton and five 3-ton cranes. At this point there is also a large goods shed and railway sidings.

The northern limit of this harbour is a railway swing-bridge.

#### ALTER HAFEN.

This consists of several basins for small craft, and extends in a northeasterly direction, with an irregular outline, from the railway swing-bridge to the *Kesselschleuse* of the *Ems-Jade* canal.

The *Railway Station*, with extensive sidings and quays, is on the southeast side of this harbour.

In August, 1913, 22 T.B.Ds. moored at the mouth of the basin about 440 yards above the railway bridge. 15 feet of water is reported at this spot.

#### The 1913 Harbour.

This harbour lies to the southeastward of the Old Harbour.

#### THE VORHAFEN.

This harbour is tidal, and is merely the entrance to the lock which connects it with the *Hafenbecken*, and lies in an E.N.E. and W.S.W. direction at the southern end of the *Old Harbour*.

It is 1,640 feet long, has an average width of 327 feet, and is 30½ feet deep M.L.W.S., 40 feet at M.H.W.S.

There is no quayage, but there are six dolphins on the northern side and eight on the southern side.

#### HAFENBECKEN.

This is the central portion of the 1913 Harbour, and is entered from the *Vorhafen* by a lock called the *Neue Emden Seeschleuse*. This lock has an available length of 853 feet, a width of 131 feet, and the depth on the sill is 32½ feet M.L.W.S. (42 feet M.H.W.S.). It can be used as a dock.

The *Hafenbecken* is 4,400 feet long, and is 1,740 feet wide at the south end and 950 feet wide at the north end, and a depth of 32½ feet is maintained by dredging.

This basin has no quayage, and vessels are moored to dolphins, of which there are 14.

There are six berths for large vessels, five berths for medium-sized vessels, and one for small vessels (June, 1914).

A railway runs nearly right round the basin. Four basins are projected on the eastern side of the *Hafenbecken*, as shown on the plan. They will cover, in the aggregate, 165½ acres.

THE OST-HAFEN is formed by the widening of the *Ems-Dortmund* canal, and opens direct on to the *Binnen Hafen* of the Old Harbour and the *Hafenbecken* of the 1913 Harbour.

There is, however, a railway swing-bridge, 250 feet long, operated electrically, between the *Hafenbecken* and *Ost-Hafen*. This bridge is reported to be very quick-working. The *Ost-Hafen* lies in an E. by N. and S. by W. direction, and is 4,430 feet long. Starting from its junction with the *Binnen Hafen* and the *Hafenbecken* it is 656 feet wide for a distance of 1,542 feet, then 558 feet for a distance of 2,198 feet, then 410 feet for 656 feet up to the funnel-shaped entrance to the *Ems-Dortmund* canal.

It is nontidal and has been dredged to a depth of 32½ feet.

The channel from the *Hafenbecken* under the railway swing-bridge is 425 feet long, 262 feet wide, and 32½ feet deep. Under the bridge the channel is divided into three by two masonry piers. The bridge pivots on the west one and the section between the east pier and the land does not open and there is only 13½ feet headroom. The bridge, when open, leaves a channel 129½ feet wide and 42½ feet deep in the centre opening. The western opening is 55½ feet wide and the bottom slopes from 0 to 25½ feet deep.

Near the middle of the north side of the *Ost-Hafen* a basin 1,575 feet long, 230 feet broad, and 29½ feet deep branches off in a N.E. and S.W. direction.

#### Quayage.

##### Summary:

Harbour.	Section.	Position.	Length.	Depth alongside.
Old Harbour...	Aussen Hafen (tidal)...	Northwest side of <i>Aussen Hafen</i> .....	2,900	25½ feet M.L.W.S.
		Northern end of northwest side of <i>Aussen Hafen</i> .....	820	12 "
	Binnen Hafen (nontidal).	<i>Binnen Hafen</i> .....	3,250	23 feet.
		Basins on northwest side of <i>Binnen Hafen</i> .....	4,767	19½ "
	Binnen Fahrwasser (nontidal).	<i>Binnen Fahrwasser</i> (southern end).....	945	23 "
<i>Binnen Fahrwasser</i> (northern end).....		2,020	17 "	
1913 Harbour...	Hafenbecken (nontidal).	Basin on northwest side of <i>Binnen Fahrwasser</i> .....	2,526	19½ "
		<i>Neue Emden Seeschleuse</i> .....	1,700	32 "
	Vorhafen (tidal).....	<i>Hafenbecken</i> (sloping sides).....	Nil.	
		<i>Vorhafen</i> (sloping sides).....	Nil.	
	Ost-Hafen (nontidal).....	South side, believed to have quays, and if so dimensions are—	? 2,790*	? 29½ feet
	North side, east of branch basin.....	902	? 29½ "	
	North side, near building slips.....	400	29½ "	

\*This does not take into account that part of the quay just to the eastward of the entrance from the *Hafenbecken*, which is fully taken up by the floating dock. (See "Docks" and Plan No. 4.)

#### Lifting Appliances.

##### Summary:

Harbour.	Section.	Position.	Number.	Capacity.	Power.	Radius.
Old Harbour....	Aussen Hafen....	Near southwest end of quays.	1	Tons. 40	Electric....	45 feet.
		On quays, on rails.....	7	3	"	Hoist 82 feet.
		Southwest end of quays, transporters on rails.	3	5	"	82 feet.
	Binnen Hafen and Fahrwasser.	Southeast side by large (railway) goods shed.	1	10	"	62 feet.
		Near northern end, southeast side.	1	25		
	Southeast side, by large goods shed.	5	3	Electric....	32½ feet.	

There are also five 3-ton floating cranes. A 65-ton travelling electric crane was ordered by the *Nordseewerke* in 1913, to be on quay to southward of slips and was building in January, 1914.

#### Building Slips.

The *Nordseewerke* has, on the point of land between the *Binnen Hafen* and the branch basin of the *Ost Hafen*, the following building slips:

No. 1, one 666 feet long and 138 feet broad.

Nos. 2 and 3, each 853 feet long and 131 feet broad.

No. 1 has gantries 138 feet high (5 on each side) with beams across top from side to side. Under the beams, 2 electric lifters travel from end to end of slip.

No. 4, a broadside slip to eastward of other slips in the *Ost Hafen*. On this slip some caissons for *Helgoland* were built 1912-13-14.

The two new slips are to be covered in and provided with electric lifters similar to those over No. 1.

In the *Binnen Fahrwasser* at the southeast side near the railway bridge the *Prussian Government Harbour Works* slips for building and repair of harbour craft (dredgers, tugs, lighters, &c.) are situated.

Near the centre of the north side of the *Binnen Fahrwasser* are the slips (? two) of the *Emder Maschinenfabrik*. These are small and are used for the construction and repair of canal and sea barges, fishing vessels, &c.

There are also some small slips on the east side of the basin No. 2, *Grassen's Slip Wharf*, in the *Binnen Hafen*.

All the slips have branch lines of the railway connecting them with the main service.

**Building Capacity.****NORDSEEWERKE.**

At these works the following have been built:

- 1913.—One oil-tank steamer, 387 feet long, 52½ feet beam, 7,300 tons.  
 1914.—One steamer, 5,600 tons.  
 One tank vessel, 1,000 tons.  
 Two pontoons for 250-ton cranes.  
 Six large cofferdams.

A steamer of 10,000 tons was ordered in January, 1914, and a 4,000-ton floating dock for the *Argentine Government* in June, 1914.

**PRUSSIAN GOVERNMENT YARD.**

So far only small harbour vessels have been built here.  
 The other yards can only undertake minor work.

**Docks.**

As mentioned above, the lock between the *Vorhafen* and the *Hafenbecken* of the 1913 Harbour is capable of being used as a dock.

There is also a floating dock which is moored on the south side of the *Ost Hafen* just to the eastward of the mouth of the channel to the *Hafenbecken*.

**PATENT SLIPS.**

There are six small patent slips, the largest of which can take vessels up to 150 feet long and 15 feet draught.

**Repair Capacity.**

The *Nordseewerke* undertakes considerable repairs, and the floating dock belongs to this firm.

A sum of 12,500*l.* was spent in 1913 in building new workshops and bringing the old ones up to date.

The other works can only undertake small repairs.

**DOCKS.**

Summary:

Dock or slip.	Position.	Length on blocks.	Width.	Depth over blocks.	Remarks.
Dry dock.....	Between <i>Vorhafen</i> and <i>Hafenbecken</i> of 1913 Harbour.	Feet. ? 820	Feet. 130	Feet. 32½	Built as a lock.
Floating dock.....	In <i>Ost-Hafen</i> just to eastward of entrance to <i>Hafenbecken</i> .	284½	59	17½	Lifting capacity, 3,200 tons.
Floating dock.....		180	59	17	Lifting capacity, 3,000 tons.
Floating dock.....		134	59	17	Lifting capacity, 2,250 tons.
Patent slips.....	Near north end of <i>Binnen Fahrwasser</i> .	80-120		7½-10	Five (private firms). Prussian Government Harbour Works.

A large floating dock is projected for the *Nordseewerke*.

**Machine Shops.**

As mentioned above, the *Nordseewerke* spent 12,500*l.* in building and renovating their workshops. This firm also spent 75,000*l.* on new machinery and has built a new electric power house (see under "Lighting and Power"). During 1913 the Government Harbour Authority spent 20,000*l.* on new workshops. They could undertake small repairs.

**Lighting and Power.**

The town is now lit by both gas and electric light, as are also all the quays and basins.

The town power house is on the western side of the *Binnen Hafen*, close by the entrance from the *Aussen Hafen*. This power house not only supplies light to the town, &c., but also power for working the cranes, lock gates, and electric tramways.

The *Nordseewerke* has its own light and power station, the power for which, however, is derived from the *Wiesmoor Power* station, 17½ miles E. by N. of *Emden*.

This station is, nominally, the property of Messrs. Siemens-Schuckert, but it is reported that the Government is the real owner.

The gas works are alongside the waterworks (see under "Town," page 36).

**Water.**

The water supply and pumping station is at the southeast corner of the town just north of the *Railway Station*.

The water supply for the *Quarantine Station* and the houses of the harbour officials (who live on the southeast side of the *Aussen Hafen*), is brought across the *Hafenbecken* swing-bridge. In order that the supply may not be interrupted when the bridge is opened, an 82-foot water tower has been erected between the northern end of the *Aussen Hafen* and the *Hafenbecken*. Water is supplied to vessels alongside the quays by hoses from hydrants.

**Communications.**

The harbour has an excellent railway service, practically every quay and basin being linked with the main service.

In addition, the quays of the *Aussen Hafen* are connected with the town by an electric tramway (see under "Town—Internal Communications").

**Coal and Oil.****COAL.**

No large stocks of coal are kept, but there is a large export of this commodity.

The only coal store of any account stands just behind the quay on the northwest side of the *Aussen Hafen* at about the middle of its length.

This is a private store (belonging to *Lehnkering & Co.* of Duisberg) and is provided with two transporters and travelling cranes (3 tons each).

This firm is under contract to maintain a stock of 2,500 tons of coal.

There are several other firms which keep stocks of about 1,000 tons.

The coal reaches Emden either by rail from the mines of Westphalia direct or else by rail from the mines to *Dortmund* and thence by the *Dortmund-Ems* Canal in lighters.

In May, 1913, four small cruisers coaled in the *Aussen Hafen*, three lying alongside the quays, and one at the dolphins. One of the three (*Köln*) was coaled (500 tons) by a 3-ton crane from the quay and by a 3-ton floating crane from a lighter outside; the two others (500 tons each) from trucks on the quay railway by 3-ton cranes. The fourth (*Arkona*) took 800 tons from one lighter by means of a 3-ton floating crane. All the cranes, both land and floating, were worked by shore labour.

In March, 1914, the 2nd squadron coaled in the *Randzel Gat* anchorage by means of a lighter (carrying 740 tons) on each side and wicker baskets each holding about 2 cwt.

The coal, which was in bulk in lighters, was double-screened steam coal from *Westphalia*, and the coaling was carried out by the crews of the ships. One ship is reported to have taken in 1,800 tons in 1½ hours, and another 2,200 tons in under 5 hours.

Coal is continually arriving at Emden and there are, therefore, generally several filled lighters available.

For coaling in the *Randzel Gat* fine weather is essential.

**PATENT FUEL.**

There is a patent fuel factory just to the eastward of the mouth of the branch basin of the *Ost Hafen*, and its products are reported to be of first quality.

A stock of about 25,000 tons is kept, and the producing capacity is great, for in 1912 this factory supplied 120,000 tons of fuel to the Italian State Railways besides its normal production.

**OIL.**

At the beginning of 1914 there were three oil-fuel tanks, two at the entrance to the harbour and one near the electric power house at the southern end of the *Binnen Hafen*.

Others were being built by local shipping companies in 1914, but it was reported that the Imperial Navy would defray part of the cost.

In January, 1914, the storage capacity was 7,000 tons and the tanks were connected to the quays by pipes.

In February, 1914, it was reported that the storage capacity was to be increased to 20,000 tons.

Most of the oil is produced in *Westphalia* and is carried by canal in three 750-ton tank lighters, but some is imported from *Roumania*. This latter will be able to come direct from the wells to *Emden* in lighters when a short section of canal in *Westphalia* is completed (due 1915).

**Harbour Craft.**

The Government harbour works have the following tugs:

Number.	H. P.	Remarks.
2	400.....	Both have searchlights.
2	300.....	One has searchlight.....
1	250.....	} All seagoing.
1	200.....	
4	100 and under.....	

Also one steamer ("Ostfriesland") for service of lightships, buoys, &c., fitted with search-light and wireless, and a steam tender for coaling dredges fitted with a Temperley transporter.

There is a regular service of motor boats from the town hall to the *Aussen Hafen*.

There are 11 small passenger steamers carrying from 300 to 500 persons. The largest is, however, reported to have accommodation for 900.

The details of these steamers will be found under the heading "Communications," page 37.

There is always a considerable number of canal tugs in the port and *Ems River*.

The following privately owned tugs are to be found at Emden:

Number.	H. P.	Remarks.
2	430	Draught, 13 feet. ? Salvage pump. Built 1913. Belong to Wessels Co. Two are Rhine tugs, the draught of which is 6½ feet. One belongs to Wessels Co. Belong to Wessels Co.
2	400	
3	350	
1	300	
2	250	

### Trade and Shipping.

The trade of Emden has increased very rapidly during the last few years, and doubtless the completion of the 1913 harbour and projected extensions will still further stimulate it.

The following table shows the tonnage of seagoing and coasting vessels entered and cleared during 1911-12-13:

	1911		1912		1913	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
Entered with cargo.....			1,934	926,160	1,965	898,993
"    without cargo.....			979	701,378	942	664,509
Entered, total.....	2,761	1,286,624	2,913	1,627,538	2,907	1,563,502
Cleared with cargo.....			2,475	946,008	2,525	961,722
"    without cargo.....			440	691,957	338	592,866
Cleared, total.....	2,730	1,276,043	2,915	1,637,965	2,863	1,554,588
Grand total.....	5,491	2,562,667	5,828	3,265,503	5,770	3,118,090

N. B.—The decrease of shipping in 1913 was due to a strike of dock labourers which lasted from May to October.

There was a recovery from the effects of the 1913 strike as is shown by the figures for the first quarter of 1914, during which 648 vessels of 575,430 tons entered.

The following table shows the numbers and tonnage of the canal and river shipping entered during 1912 and 1913:

	1912		1913	
	Vessels.	Tonnage.	Vessels.	Tonnage.
River shipping.....	2,952	74,386	3,507	79,801
Canal shipping.....	3,339	1,414,173	3,697	1,581,015
Total.....	6,291	1,488,559	7,204	1,660,816

### IMPORTS AND EXPORTS.

The imports and exports for the 1911-12-13 were as shown in the following table:

	1911	1912	1913
Imports.....	Tons. 1,538,835	Tons. 1,571,425	Tons. *1,531,110
Exports.....	1,270,080	1,607,220	1,651,275
Total.....	2,808,915	3,178,645	3,182,385

\* Decrease due to strike of dock labourers.

The principal import is *iron ore*, which represented in 1913 about 95 per cent of the total, and came mainly from Norway and Sweden.

The principal exports are *coal and coke*. Combined they represented, in 1913, about 84 per cent of the exports. They were mainly shipped to German ports.

If the *patent fuel* (which was exported to Italy) be added, the fuels exported would be nearly 95 per cent of the total exports.

### PRIVATE SHIPBUILDING YARDS AND ENGINEERING WORKS.

THE NORDSEEWERKE is the principal shipbuilding and engineering yard. It is owned by the Deutsch-Luxemburgische-Bergwerksgesellschaft (Hugo Stinnes controls this company) and is situated on the tongue of land between the *Binnen Hafen* and the *Ost Hafen*.

It has an area of 66½ acres and, at the beginning of 1914, 780 men were employed and about 130 houses had been built, about half a mile to the eastward of the works, for their accommodation.

There are two quays belonging to this firm, one 853 feet long on the west side in the *Binnen Hafen*, and one 400 feet long on the south side in the *Ost Hafen*. The former has 23 feet of water alongside and the latter 29½ feet. Both are served by a branch railway line.

For further details see under the various headings under "Commercial Port," page 31.

Under the same control is the HOHENZOLLERN HÜTTE (smelters and iron foundry) which lies on the south side of the *Ost Hafen* to the eastward of the *Hafenbecken*.

It covers an area of 69½ acres, but the firm has also bought 180½ acres in the *Neuen Polder*. It is not certain whether the *Ost Hafen* has quays at these works, but there is a water frontage of 2,790 feet and the harbour is reported to be 29½ feet deep in this part.

It was proposed to reopen these works and rebuild and add to the blast furnaces of the smelting plant in 1913 and, further, to build rolling and drawing mills for plate and tube making. It appears that this work has been postponed.

### THE TOWN.

(See Plan 4.)

#### Position, Area, and Population.

The town stands at the junction of the *Ems-Jade Canal* and the *Alter Hafen* and surrounds the latter.

As mentioned above, the Old Harbour was formerly a creek with extensive mud flats on each bank.

These mud flats were awash at high water, but have now been reclaimed and quays have been built on the banks. The town is therefore removed from the shores of the *Dollart* about 2 miles.

It covers an area of under 400 acres and is intersected by canals.

It has a population of about 25,000.

On the landward (northern) side it is surrounded by old earthworks.

#### Buildings and Hospitals.

Near the centre of the town at the head of the northeastern basin is the *town hall* (built in 1575).

South of this and opposite the railway basin is the *imperial bank*.

Southwest of the town hall is the *old church* (sharp spire) and south and southwest close to this church are *schools*. Close to the southward of these schools are the local *law courts*.

Due west and halfway between the town hall and the Larreter Strasse Railway Station is the *municipal hospital*, and close to the east of this is the *museum of local antiquities*. A short distance to the W. N. W. of the hospital is the *slaughter house*.

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Northwest of the town hall and close to the old fortifications is the *Natural History Museum*.

Due north of the town hall and about halfway to the old fortifications is the *Landrats* (Sub-prefect's) office, and close to the fortifications is the *Wilhelms Gymnasium* (College).

East-northeast of the town hall, about halfway to the fortifications is the *post and telegraph office* on which is a small W/T installation. In the same direction and not far from the fortifications is the *new church* (cruciform with small octagonal tower in centre).

Southwest of the town hall and at the western end of a small canal are the *waterworks* and the *gas works*.

South-southwest of the town hall and near the railway dock is the *railway station*.

Outside the old fortifications to the northwest and northeast are large brickfields, and about 1,000 yards to the north of the town are the *barracks* for the garrison, near which is a large drill ground. About halfway between the fortifications and the barracks is the *Lutheran church*.

Near the southwest corner of the town, just south of the railway, the H. A. Linie has built a large building for the accommodation of 800 emigrants. Close beside this building is that of the N. D. L. which accommodates 1,000 emigrants.

The *Customs head office* stands about 100 yards northwest of the railway station.

**Lighting, Power, and Water.**

The town is lit by electricity and gas, the former supplied by the power station at the southern end of the *Binnen Hafen* and the latter by the *gas works* north of the *railway station*. For waterworks, see under "Buildings and Hospitals" above, and page 32.

**Internal Communications.**

There is one electric tramway line which connects the *town hall* gardens with the mouth of the *Aussen Hafen* behind the quays.

**Coal, Oil, &c.**

See under "Commercial Port," page 33.

**Steamship Services.—**

**COMMUNICATIONS.**

Service No.	Companies.	Sailings.	Ports of call.	Terminal port.
1	Hamburg Amerika Linie....	Fortnightly.....	(Homeward only) Baltimore....	Boston, Mass.
2	Emder Verkehrsgesellschaft (Hamburg Amerika Linie).	Monthly.....	Aden, Colombo, Sydney.....	Melbourne.
3		Three-weekly.....	Antwerp, Rio de Janeiro, Monte Video, ? other ports.	Buenos Ayres.
4		Occasional (? monthly).	Antwerp, ? Port Sudan, Jibuti, Muskat, Bander Abbas, Linga, Barein, Bushire, Mohammera, Alwaz, Basra.	Baghdad.
5	Hamburg Amerika Linie*....	Occasional.....	Rotterdam, Antwerp, Penang, Singapore.	Manila, P. I.
6		Monthly.....	?	Philadelphia.
7	Norddeutscher Lloyd *....	Monthly.....	Boston, Mass., New York, (homeward Baltimore).	New Orleans.
8		Bi-monthly.....	Baltimore, New York and Philadelphia alternately.	Galveston.
9		Monthly.....	Antwerp, Boulogne, Coruña, Villagarcia (Vigo occasionally), Lisbon (Madeira occasionally), Rio de Janeiro, Monte Video.	Buenos Ayres.
10		Occasional.....	Antwerp, Leixões, Lisbon, Madeira, Pernambuco, and Bahia alternately, Rio de Janeiro, San Francisco do Sul.	Santos.
11		Monthly.....	Rotterdam, Antwerp, Southampton, Lisbon, Gibraltar, Algiers, Genoa, Naples, Aden, Colombo, Panang, Singapore, Hong Kong, Shanghai, Tsingtau, Taku, Dalny, Kobe.	Yokohama.
12	These two services start alternate fortnights. Thus the service as far as Hong Kong is fortnightly.	Monthly.....	Same as above to Hong Kong, Manila, Angaur, Yap, Maron, Friedrich-Wilhelmshafen, Rabaul, Brisbane.	Sydney.

All the above services start from Hamburg or Bremen and Emden is only a port of call.

\* These two services work together to make a fortnightly service to the United States.

Service No.	Companies.	Sailings.	Ports of call.	Terminal port.
13.	Swenska Lloyd.....	Monthly.....	Halmstadt and S. Swedish ports. (Inaugurated May 1914).....	Gothenburg.
14	Ember Reederei Aktien-Gesellschaft.	Occasional.....	(Increased to twice, three, and four times daily according to season).	Borkum.
15		Daily (in winter).....		Nordeney.
16		Daily (in summer).....	(Reduced to twice a week in winter) Borkum, Juist.	Delfzijl.
17		Three times daily (in summer).....	(Reduced to twice daily in winter).	Libau.
18	Baltischer Lloyd.....	Monthly.....	Bremen (inaugurated 1914).....	

In addition to the above, there are several lines of tramp steamers which make Emden a port of call when freight inducements offer. These calls are, of course, at very irregular intervals and can not be, in any way, depended upon.

**LIST OF LOCAL PASSENGER STEAMERS.**

Name.	Tonnage (gross).	Propulsion.	Speed.	Number of passengers carried.
			<i>Knots.</i>	
			13	Said to carry 900.
Westfalen (has a searchlight).....	385	Paddle.....	12	500.
Victoria.....	275	Paddle.....	12	400.
Borkum.....	190	Paddle.....	12	400.
Emden.....	217	Paddle.....	?	400.
Frisia III.....	?	Paddle.....	12	400 and cargo.
Prinz Heinrich.....	?	Screw.....	?	400 and cargo.
Kaiser Wilhelm II.....	?	Twin screw.....	?	300.
Norderney.....	?	Paddle.....	?	220 and cargo.
Dr. von Stephan.....	140	Screw.....	?	

All the above steamers are on the *Borkum* service only except "Westfalen," which occasionally runs to other islands.

Norddeich (has a searchlight).....	?	?	?	500.
This steamer is used for the <i>Norderney</i> service only.				
Juliana.....	?	Motor.....	?	25 (?).
This motor boat runs daily to <i>Greetsiel</i> and back.				

All the local passenger steamers use the landing place at the western side at the head of the *Aussen Hafen*.

Some of these steamers were used to carry troops from Emden to *Borkum* in February, 1913, during a test mobilisation (see page 41). On demobilisation the general officer commanding expressed his satisfaction with the steamers (presumably as to their troop-carrying capacity).

**Railways.**

The principal *railway station* is near the southeastern corner of the town, and there are large sidings all round the railway basin.

The main line of the State railway from *Münster* (double line) enters the town over a bridge across the canal joining the *Ems-Jade* and *Ems-Dortmund* Canals, about 3/4 of a mile to the southeast of the town. It passes over the *Old Harbour* by the bridge between the *Binnen Fahrwasser* and the *Alter Hafen*, and after passing the *Larrelter Strasse Goods Station* and *Halt*, runs clear of the town over a small bridge across the *Larrelter-Tief* (small canal) close outside the old earthworks northwest of the town.

The first and last of these bridges are important, for, if they were cut, Emden and its harbours would be entirely cut off by rail.

A railway is building (June, 1914) to encircle the town outside the old fortifications.

On the south Emden is connected by rail with *Münster* (89 statute miles)\* and on the north with *Norddeich* (23 statute miles). The line was to be doubled during 1914.

At *Norden*, on the latter line (18 1/2 statute miles), the *coast railway* branches off through *Esens* and *Jever* to *Wilhelmshaven*.

\* The distances are measured along the railway from the principal and Larrelter railway stations, respectively.

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At *Abelitz* (9½ statute miles) there is another branch which passes through *Aurich*, where it branches again, to *Wittmund* and *Leer*.

At *Leer*, on the Münster line (16 statute miles), there are two branches, one to *Aurich* (see above) and the other to *Oldenburg* (50 statute miles), and thence to *Bremen* (78¼ statute miles).

There is also a light railway which runs from the *Larrelter Strasse* Station to *Pewsum* (7¼ statute miles), *Pilsun* (12¾ statute miles), and *Greetsiel* (19¾ statute miles).

A light railway connects *Ogenbargen* (about halfway between *Aurich* and *Wittmund*) with *Esens* and *Bensersiel*.

It runs close and parallel to the main road between *Ogenbargen* and *Bensersiel* (see under *Roads* (10a)).

PROJECTED RAILWAYS.

In 1910 it was reported that the following light railways were to be built:

Emden to *Riepe* and *Ost Grossefehn* (on the *Leer-Aurich* line).

Emden to *Rysum* and *Groothusen* (on the *Emden-Greetsiel* line).

*Pewsum* (on the *Emden-Greetsiel* line) to *Norden* following the road *Grimersum* to *Norden* (see under *Roads* (7)).

These light railways do not appear to have been taken in hand yet (June, 1914).

A large goods station has been built near the *Larrelter Strasse* light railway station, but is seldom used.

Roads and Road Services.

Almost all the main roads in *East Friesland* are paved with bricks and in some cases an iron track is laid in the middle of the brick paving for the passage of heavy loads. The iron is placed in two lines so as to take the wheels of large vehicles.

The roads were in very good condition in June, 1914.

There are four main roads from Emden running (1) west, (2) north, (3) northeast, and (4) southeast.

(1) West to *Larrelt*, 2¾ statute miles, southwest to *Wybelsum*, 4½ statute miles, northwest to *Rysum*, 8½ statute miles, northeast to *Loguard*, 9½ statute miles, north to *Kampen*, 10½ statute miles, and *Hamswehrum*, 12½ statute miles, northeast to *Groothusen*, 13¼ statute miles (meets (5) here), north through *Manslagt*, 15 statute miles, and *Pilsun*, 16¾ statute miles, to *Hauen* 17¾ miles, then east by north to *Greetsiel*, 19 statute miles (see 2a).

(2) North to *Hinte Harsweg*, 2½ statute miles, fork here to northwest (2a) and north-east (2b).

(2a) Northwest to *Hinte*, 3¾ statute miles (crossroad (5) here), and to *Cirkwehrum*, 5½ statute miles, and *Damhusen*, 6¾ statute miles, northeast to *Uttum*, 7¼ statute miles, north-west to *Jennelt*, 8½ statute miles, northeast to *Eilsum*, 9 statute miles (this portion being part of (6), northwest to *Greetsiel*, 12¾ statute miles (see (1)).

(2b) Northeast to *Loppersum* (here (7) branches north-northeast), 4½ statute miles and *Georgsheil*, 9¾ statute miles (here (8) branches to northward), then east through *Moordorf*, 12¼ statute miles, to *Aurich*, 16½ statute miles.

(3) Northeast to *Wolthusen*, 1½ statute miles, and *Uphusen*, 2¾ statute miles.

(4) Southeast to *Borssum*, 2¼ statute miles, east by south through *Pettum*, 4½ statute miles, to *Oldersum*, 7¾ statute miles (here (9) branches to north), southeast to *Terborg*, 10½ statute miles, south to *Leer*, 17 statute miles.

(5) From *Loppersum* (see (2b)), W. S. W., through *Hinte* (see (2a)) to *Grosse Midlum*, W. N. W. through *Freedsum* to *Pewsum*, where it forks west to *Groothusen* (see (1)) and north (see (6)).

(6) From *Pewsum* (see (5)) northeast, through *Jennelt* and *Eilsum* (see (2a)), to *Grimersum*, then northeast and east to *Wirdum* (see (7)), then northeast to *Marienhafen* (see (8)).

(7) From *Loppersum* (see (2b)) N. N. W., to *Wirdum* (see (6)), then west along 1 mile of (6), then north to *Norden* (see (8)).

(8) From *Georgsheil* (see (2b)) N. N. W., through *Marienhafen*, 13¾ statute miles (see (6)), to *Norden* (see (7)), 19¾ statute miles, and *Norddeich*, 22 statute miles.

(9) From *Oldersum* (see (4)) north to *Riepe*, northeast to the *Ems-Jade Canal*, north to *Westerende*, and northeast to *Aurich* (see (2b)), north to *Sandhorst*, *Westerholt*, and *Dornum*.

(10) From *Sandhorst* (see (9)) northeast and east-by-north to *Plaggenburg*, northeast to *Ogenbargen*; then east-northeast to *Wittmund*.

(10a) From *Ogenbargen* (see (10)) north-northeast to *Brill*, north-by-west to *Esens*, and north-northwest to *Bensersiel*.

N. B.—The distances are given in statute miles from the town hall at Emden.

ROAD SERVICES.

The following motor-omnibus services run in summer (? winter also):

Start from—	Through—	To and time taken.	Service.
1. Emden post office...	Larrelt, Wybelsum, Rysum...	Loquard, 2 h. 10 m. ....	Twice daily each way. Leaves Greetsiel on Tuesdays and Fridays at 6.30 a. m. and returns on same days leaving Emden at 3 p. m.
2. Weinburg Hotel.....	Hinte, Cirkwehrum, Uttum, Jennelt, Eilsum.	Greetsiel, 2½ h. to Emden; 3¼ h. to Greetsiel.	

There is an electric tram service every 20 minutes from the *Alter Markt*, opposite the town hall, to the southern end of the quays of the *Aussen Hafen*. The service begins at 5.40 a. m. and finishes at 11.0 p. m.

Cables.

The landing place of the so-called Emden cables is not actually at Emden but at *Greetsiel* (see page 45).

Telegraph and Telephones.

Emden is connected with the main telegraph service of the German Empire and is in direct telephonic communication with *Wilhelmshafen*, *Oldenburg*, and *Berlin* in addition to the local service.

Canals.

The *Ems-Jade Canal* and the *Dortmund-Ems Canal* debouch into the *Binnen* and *Ost-Hafen* respectively.

For the purposes of the Emden communications the so-called *Dortmund-Ems Canal* is treated as though it were a canal from *Herne* (in *Westfalen*) to Emden with a branch to *Dortmund* between *Datteln* and *Henrichenburg*, 158 miles from Emden.

Ems-Jade Canal (see Plan 5).

This canal is 43 miles long and connects Emden with *Wilhelmshaven*. It passes through *Wolthusen* (¾ mile), *Uphusen* (1¼ miles), *Westerende* (10½ miles), *Aurich* (13½ miles), *Wiesens* (17¾ miles), *Brinkenshohe* (26 miles), *Reepsholt* (30 miles), *Dykhausen* (35½ miles) and *Mariensiel* (39½ miles). (The distances are given in statute miles from the *Kesselschleuse* at the head of the *Binnen-Hafen* at Emden.)

There are six locks and they are of the following dimensions:

Lock.	Distance from Kessel-schleuse.	Length.	Width.	Depth over sill.	Going eastward.		Remarks.
					Rise.	Fall.	
	Miles.	Feet.	Feet.	Feet.	Feet.	Feet.	
No. 1.....	0	155½	24¾	6½?	6	9	Circular, double. These locks have been reported to be much deeper, but it is believed that the lesser depth is correct.
(Kesselschleuse).	11¼	111½	19¾	6½?	4	10	
No. 2.....	18¾	131½	16½	6½?	9	3	
" 3.....	25½	131½	19¾	6½?	8	3	
" 4.....	26¾	131½	24¾	9	8	3	
" 5.....	42	155½?	24¾	9	8	3	

There are 36 bridges over the canal and they are all swing bridges except two. The least opening when the bridges are swung is 19¾ feet. It has been stated, frequently, that the whole canal is to be deepened and the locks made larger so that warships could pass from Emden to *Wilhelmshaven* and vice versa, but so far only the ends of the canal have been deepened (i. e., to 8¼ ft. between Locks 1 and 2 and Locks 5 and 6). It is rumoured, also, that a branch will be built from *Uphusen* to the *Knock* in order that vessels may avoid the shallow part of the *Ems* near the mouth of *Emden Harbour*.

Dortmund-Ems (Herne-Emden) Canal (see Plan 5).

This canal is 167 miles long (and with the *Herne-Rhine* canal connects Emden with the *Rhine* system (see below) at *Ruhrort* (Laar)). There are 19 locks (the first of which is at the eastern end of the *Ost-Hafen*), and one tank lift. The tank lift has useful dimensions as follows: Length, 225 feet; width, 28¼ feet; depth over sill, 7½ feet.

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For navigation purposes the canal may be divided as follows:

- (1) *Emden to Oldersum*, 2 locks.  
Length, 328 feet; width, 33 feet; depth,  $8\frac{1}{4}$  feet;  $6\frac{3}{4}$  miles.
- (2) *Oldersum to Papenburg*, no locks (Ems River), depth,  $8\frac{1}{4}$  feet;  $21\frac{3}{4}$  miles. (*Papenburg* stands about 1 mile from the main canal and has a short branch canal in which there is one lock.)
- (3) *Papenburg to Meppen*, 5 locks.  
 $577\frac{1}{2}$  feet long, 33 feet wide,  $8\frac{1}{4}$  feet deep,  $38\frac{1}{2}$  miles.
- (4) *Meppen to Gleesen*.  
4 locks, 554 feet long, 33 feet wide,  $8\frac{1}{4}$  feet deep, 16 miles.
- (5) *Gleesen to Munster*, 8 locks.  
220 feet long,  $28\frac{1}{4}$  feet wide,  $8\frac{1}{4}$  feet deep,  $43\frac{1}{2}$  miles.
- (6) *Munster to the tank lift*, no locks.  
 $8\frac{1}{4}$  feet deep,  $33\frac{3}{4}$  miles.
- (7) Tank lift to *Herne*, no locks.  
 $8\frac{1}{4}$  feet deep,  $6\frac{3}{4}$  miles.

#### BRANCH.

- (8) Tank lift to *Dortmund*, no locks.  
 $8\frac{1}{4}$  feet deep,  $10\frac{3}{4}$  miles.\*

There is a canal *Herne* to the Rhine at *Ruhrort (Laar)*, which passes close to Krupp's Works at Essen, opened September, 1914. The following are its dimensions:

Total length.	Minimum length of locks.	Minimum width of locks.	Minimum navigable depth.	Clearance under bridges.	
	Feet.	Feet.	Feet.	Feet.	
25 miles.....	220	$31\frac{1}{2}$	$8\frac{1}{4}$	13	7 locks.

From *Ruhrort* it is possible to connect with ocean-going traffic by descending the *Rhine*, passing into Dutch territory near *Emmerich*, then down the *Waal River*, through *De Noord* to *Rotterdam*.

By branching off at *Dordrecht* to the southward through the *Kil*, or by passing through the *Nieuwe Merwede* into the *Hollandsche Diep*, through the *Volkerak* to the *East Schelde*, then through the *Hansweert Canal* and *West Schelde*, Antwerp may be reached.

The dimensions of the canals and rivers are as follows:

From—	To—	Length of section.	Length of locks.	Width of locks.	Minimum depth.	Remarks.
		Statute miles.	Feet.	Feet.	Feet.	
Emden.....	Herne.....	167	216 $\frac{1}{2}$	27	$8\frac{1}{4}$	13-foot headway under bridges.
Herne.....	Ruhrort.....	25	216 $\frac{1}{2}$	30	$8\frac{1}{4}$	16-foot headway.
Ruhrort.....	Emmerich.....	44 $\frac{1}{2}$	328	39 $\frac{1}{2}$	9	River Rhine, 28 $\frac{1}{2}$ -foot headway.
Emmerich.....	Dordrecht.....	76 $\frac{3}{4}$			9 M. L. W. S.	Partly tidal, 32-foot headway.
Dordrecht.....	Rotterdam.....	12 $\frac{3}{4}$			10 M. L. W. S.	Tidal.
Dordrecht.....	Antwerp.....	62			12 M. L. W. S.	Tidal.

#### Bevergern-Hannover Canal.

At *Bevergern*,  $37\frac{1}{2}$  miles from Emden, in section (5) of the *Emden-Herne Canal*, a branch canal,  $107\frac{1}{2}$  miles long, to *Hannover* is under construction.

It is reported that it may be carried as far as *Magdeburg* on the *Elbe*.

The projected portion from *Hannover* to the *Elbe* is called the *Mittelland Canal*.

From the *Bevergern-Hannover Canal*, which will have no locks, there will be a branch to *Osnabruck* from *Bramsche* (one lock).

The main canal will pass through *Wittlage*, *Lubbecke*, *Minden* (where it will cross the *Weser River*), *Buckeburg*, *Hannover*, and *Linden*.

The canalisation of the *Weser* from *Minden* to *Bremen* is projected. (See section 3, page 42.)

The locks are to be of the same size as those in section (5) of the *Emden-Herne Canal*.

The *Bevergern-Minden* section should be completed by March and the *Minden-Hannover* section by June, 1915.

#### MINOR CANALS.

At Emden there are also the following irrigation, draining, and supply canals:

- (1) *Larrelter Tief* (to westward).
- (2) *Hinter Tief* (to northward).
- (3) *Treck Tief* (to northwestward).
- (4) *Fehntjer Tief* (to southeastward).
- (5) *Vorflut Kanal* (*Ems-Jade canal to Ems*).

\* The distances are the lengths of the sections in statute miles.

These are all very shallow and only small boats could use them under favourable circumstances.

The last is a supply canal for the harbours, the sluice at the junction with the *Ems* being opened at high water when it is desired to raise the level of the water in the harbours above the locks.

It also joins the *Ems-Jade* and *Dortmund-Ems* Canals and the part between these canals is navigable.

#### NAVAL PORT.

There is no naval harbour at Emden, but light cruisers and T.B.D.'s use the port as a coaling station, and battleships and battle cruisers are coaled by contract by means of lighters off *Borkum* from here (see page 33).

An old armoured coast defence ship, the "*Frithjof*" or "*Hagen*," is stationed here.

It is rumoured, however, that the reclamation of the *Larrelter Watt*, which is now proceeding, is for the purpose of constructing an imperial naval harbour, the entrance to which will be near the *Knock* via the *Fischersgatje*.

The sum of 305,000*l.* was to be expended on this reclamation in 1914.

#### Submarine Depot and Destroyer Base.

In war the port of Emden is used as a depot both for submarines and destroyers. A hulk has been fitted as a repair ship and these vessels, on return from cruising, have their defects made good and their crews rested on board of this hulk. They also take in fuel here, and there is an electric charging station for submarines.

#### Mining Depot.

The old light cruiser "*Arkona*" has been converted into a mine-layer and uses Emden as her base.

She is continually practising mine laying in the mouth of the *Ems* and the hulk "*Komet*" has been attached to her as a (? mine) store.

A second mine layer was reported to be about to be attached to Emden in June, 1913.

In July, 1913, two torpedo boats (Nos. 24 and 28) fitted as mine sweepers, were first stationed at Emden.

It is probable that there is now one division of these boats (12 boats) stationed at Emden for mine sweeping. They are fitted with a roller or winch in the stern like some of the old boats at *Cuxhaven*.

#### Aerial Base.

In October, 1912, it was proposed to build an airship harbour at *Uphusen* ( $2\frac{1}{4}$  statute miles to northeast of Emden). Nothing more has been heard of this project.

At about the same time the local press reported that negotiations were in progress for the purchase of land near *Simonswolde* ( $7\frac{1}{2}$  statute miles east of Emden) to form an aviation station and to build a small branch line to connect this place with the main railway *Munster to Emden*.

In January, 1913, the papers suddenly ceased mentioning this proposal and few reports on this subject have been received since. It is significant, however, that the price to be paid and the name of the owner of the land were mentioned, and that it was reported in March, 1913, that four naval aviators had been at Emden for some time.

Further, in August, 1913, it was reported that the Imperial Navy had built, early in 1913, some seaplane hangars, but the position was not stated (? near the mouth of the *Aussen Hafen*). The report continued that a contract to build a double revolving shed for airships had been given to a *Dusseldorf* firm.

Late in 1914 a report was received to the effect that two airship sheds had been completed near *Simonswolde*.

#### Embarkation Equipment.

In February, 1913, a trial mobilisation was carried out, the object being to ascertain how long it would take to throw troops into *Borkum*.

The alarm was given at 9.30 p. m., and five small steamers belonging to the harbour authorities and the *Borkum Steamship Company* were immediately requisitioned.

By 8 a. m. two batteries of foot artillery and three battalions of infantry had been embarked and despatched.

In summer, when all the small passenger steamers are available, the embarkation would, probably, have been much accelerated.

The mobilisation is believed to have been ordered without any previous warning having been given.

#### Naval Uses of the Port.

See under "*Commercial Port, Coal and Oil*" (page 33).

#### ARMY DETAILS.

##### Garrison.

There are two batteries of foot artillery permanently stationed at Emden, being half of the "*II Battalion of the 2nd Foot Artillery Regiment for Coast Defence*." The other half of this battalion is at *Borkum*, and the Emden batteries are under the orders of the officer commanding at *Borkum*, where they are to be sent in war (see *Borkum*, page 14). (Each battery consists of 4 officers and 121 men.)

According to the German press, a new *Landwehr* regiment was to be formed at Emden (June, 1913), and the municipality was to erect a storehouse opposite the barracks on the side of the parade ground for the purpose of storing 20 wagons, 3,500 rifles, and 151,000 cartridges.

This regiment has since been formed, and in January, 1913, the Emden municipality voted the sum of 6,200*l.* to build a storehouse on the military drill ground. The war garrison is about 2,000 men (*i. e.*, one Landwehr regiment).

**Barracks.**

A large barracks and drill ground were completed in 1913. The barracks stands on the east bank of the *Hinder Tief*, 1,000 yards north of the old earthworks round the town. Only half the original design was completed, it having been decided to house some troops at Borkum. As they stand, the barracks have accommodation for 2,000 men.

**General.**

Emden is a defended port, being effectively protected by Borkum and the frontier defences. Antiaircraft guns have been mounted for the protection of the oil tanks. One is mounted on top of the 40-ton crane, one west of the old sluice.

**Submarine Defences.**

See under Borkum (page 25).

**Mobile Batteries.**

There were four or five 15-cm. (5.9-inch) mobile howitzers at Emden in May, 1914. They were kept in the "storehouse" on the drill ground (*see above*).

**Magazine.**

The "storehouse" mentioned above is apparently used as a magazine for rifle ammunition and probably also for the howitzer ammunition for the mobile battery. There is also said to be "a considerable store of rifle ammunition" in one of the buildings of the barracks (*see above*).

**DEFENCES.**

**PORTS ON THE EMS RIVER.**

**LEERORT.**

(See Map 1.)

This is a village situated about 17 miles above Emden, on the right bank of the *Ems*, at the point where it is joined by the river *Leda*. There is a quay about 1,625 feet long. Vessels lighten here in order to proceed safely to *Papenburg* to get berthed. *Leerort* is also the deep-draught port for *Leer*, about 2½ miles up the *Leda*. There is no railway communication between *Leerort* and any other place.

**LEER.**

(See Map 1.)

A town with extensive shipping trade, about 18 miles above Emden, on the right bank of the *Leda*, which flows into the *Ems*, 2¼ miles distant. The population is about 13,500. In 1900, 4,254 vessels, tonnage 139,193, cleared from the port of *Leer*, including river steamers and barges. *Leer* can be reached by vessels of 16½ feet draught at average high water, the least water in the *Ems* and *Leda* being 9½ feet at L.W.O.S., and the average rise 8 feet.

**Harbour.**

The new harbour, which is nontidal, was opened in 1903. It was formed by damming in the large bend made by the river at this point, and cutting a new channel for the latter at the south end of the bend; the island thus formed is called *Nesse*. The harbour is entered from the river through a lock 476 feet long, 59 feet wide, and with 22½ feet over the sill at average high water, and has a total area of about 103 acres. It consists of two basins, each about 120 yards broad, and about 2,300 and 1,500 yards long, respectively. The available length of the lock giving access to the harbour is 473½ feet. The depth in the harbour would appear to be only 19½ feet, but it is being increased to 23 feet.

**Quayage.**

The quays in the western basin are traversed by lines connected with main line of railway. The depth in the harbour is stated to be 23 feet. There is another long quay for small craft below the town.

**Cranes.**

There is one 15-ton crane besides seven others, with a capacity of ½ to 1¾ tons.

**Repairing Facilities.**

There are no docks or patent slips. There is a small yard for building wooden ships, and small repairs in iron and steel can be effected by Heuer & Sons.

**Railway.**

- (1) To *Oldenburg*.
- (2) To *Munster* or *Emden*.

**Canals.**

*Leer* is close to the *Dortmund-Ems* Canal, which here coincides with the bed of the river *Ems*.

The *Hunte-Ems* Canal, from *Elsfleth* (*Weser* River) and *Oldenburg* debouches here. At present it is very shallow, but it is proposed to widen and deepen it.

**Coal.**

A stock of about 1,000 tons of coal is kept.

**PAPENBURG.**

(See Map 1.)

Another shipping town, principally engaged in the timber trade, about 15 miles above *Leer* and 5 miles from the right bank of the *Ems*.

The population is about 7,500 (1914). A deepened portion of the *Dortmund-Ems* Canal (which leaves the river bed here) connects the *Ems* with the town.

The river between *Leerort* and *Papenburg* is being deepened to allow vessels of 16 feet draught to come up. This work should be finished at the end of 1915.

Vessels of 14½ feet draught reached the harbour in 1913 on the top of spring tides.

**Harbour.**

The harbour is formed by the deep canal, just mentioned, which is provided with locks about 1½ miles from the town. In this stretch vessels of 13 feet draught can lie at all times, but the depth is being increased to 17½ feet to correspond with the new lock.

The dimensions of the new lock are:

Length.....	295½ feet.
Clear width.....	49½ "
Depth on sill.....	17½ "

The old lock is 170½ feet long and 34½ feet wide with 11½ feet of water on the sill.

**Shipbuilding.**

There is an iron ship building yard (J. L. Mayer), mainly for river craft of all kinds, and also a wooden ship building yard.

On either side of the *Papenburg* Canal a length of 1,000 feet of ground has been appropriated for warehouses.

These various improvements are due to the increase of traffic caused by the *Dortmund-Ems* Canal.

**Patent Slips.**

There are slipways just inside the lock, which will take vessels 300 feet long.

**Railway.**

- (1) To *Leer* (branch to *Oldenburg*) and *Emden*.
- (2) To *Munster*.

**Canal.**

*Dortmund-Ems* Canal to *Dortmund* and *Herne* (*see page 39*). Above *Papenburg* the *Ems* is too shallow for navigation and all traffic goes by this canal.

**Trade.**

The following table gives the number and registered tonnage of the vessels entered during 1913:

Nationality.	Description.	Number.	Regd. tonnage.
British.....	Steamers.....	2	2,251
Foreign.....	".....	79	24,511
British.....	Sailing vessels.....	3	378
Foreign.....	".....	134	16,497
Foreign.....	Sea-lighters.....	29	15,079
Foreign.....	".....		
Total.....		247	58,716

This table does not include canal traffic.

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## COAST FROM THE KNOCK TO NORDERNEY.

(See Map 1, Chart 16.)

(Chart 16 is with Section 4.)

## THE KNOCK.

The *Knock* is a point of land, on which is a lighthouse, about 5 miles below *Emden* on the *River Ems*. It is 32 miles from the open sea, and is reached by the same channels as *Emden* (see page 28).

## Anchorage.

Its importance lies in the fact that off it there is an anchorage for large vessels with a least depth of 26 feet at M.L.W.S., and a maximum depth of 41 feet at M.L.W.S. A dyke has been built from a point about  $\frac{1}{4}$  mile to the eastward of the lighthouse in a southeasterly direction for 990 yards, then to the eastward for 1,500 yards on the edge of the *Wybelsumer Watt*.

The channel of the *Ems* to *Emden* is being dredged here continually, and the spoil is pumped through a pipe line on to the *Wybelsumer Watt* behind the dyke. It is proposed, eventually, to reclaim and dredge this *Watt* so as to form a naval harbor between the *Knock* and *Emden* (see page 41).

## Canal.

It is also rumoured that the *Ems-Jade* Canal will be connected with the *Knock* by enlarging the *Knocker*, *Wybelsumer*, and *Larrelter Tiefs*, and connecting the last with the main canal at *Uphusen* (see page 39).

## Aerial Base.

There is an airship shed (partly underground) at a spot about  $1\frac{3}{4}$  miles N.N.E. of the lighthouse and gas works have been erected here.

## Defences.

Early in 1914 it was reported that the question of establishing a battery of antitorpedo-craft guns at the *Knock* was being discussed.

There was a dyke running right around the point near the *Knock* which would, in the opinion of an observer who visited the *Knock* in June, 1914, make a good parapet for guns or howitzers.

This dyke follows the high-water line from *Wybelsumer* ( $2\frac{1}{2}$  miles to the eastward) as far as the vicinity of the *Kampen* Lighthouse (about 4 miles to the northward), and would serve the same purpose at almost any point of its length.

It is, however, to be noted that, the entrance to the *Ems* being commanded by the immensely strong fortifications on the island of *Borkum*, it is unlikely that the dyke would be so used.

On the other hand, the lock for the 1913 Harbour at *Emden* (see page 30) is a single lock, and if one gate were damaged the lock would be useless (except at very high water) for entering the harbour, and, further, could not be used as a dock.

Fears for its safety might, therefore, induce the mounting of guns behind the dyke to repel torpedo craft which might slip past *Borkum* in thick weather, or aircraft at any time.

## GREETSIEL.

(See Map 1.)

E.S.E. of *Borkum* a shallow creek, called the *Ley Bucht*, joins the *Oster-Ems*. This creek leads to *Greetsiel* on the mainland, about 11 miles to the northward of *Emden*.

There are only 5 feet at M.L.W.S. (average rise, 9 feet) in this creek, and though the town, of some 850 inhabitants, is of very little importance commercially, it is of some interest as the landing place for some of the telegraph cables from *Borkum* on their way to *Emden*.

## ROADS AND RAILWAY.

*Greetsiel* is reached from *Emden* by roads Nos. (1), (2), and (2a) (see page 38), and by light railway (see page 38).

There is also a motor-omnibus service which follows roads (2) and (2a) (see page 38).

## COMMUNICATIONS.

## GREETSIEL.

## Cables.

From—	To—	Date of laying.	Number of wires.	Total length (sea miles).	Owners.	Remarks.
Greetsiel, Borkum.....	Lowestoft.....	1871	4	227	British and German Governments.	
Greetsiel, Borkum.....	Brest (Le Minou)...	1882	1	698	German Government.	This was Valencia cable, but was led to Brest in 1911.
Greetsiel, Borkum.....	Bacton.....	1891	4	229	British and German Governments.	
Greetsiel, Borkum.....	Vigo.....	1894-96	1	1,133	Deutsch-Atlantic Telegraph Co.	German Government three wires as far as Borkum.
Greetsiel, Borkum.....	Bacton.....	1896	4	242	British and German Governments.	
Greetsiel, Borkum.....	Horta, New York (Coney Island).	1900	1	4,162	Deutsch-Atlantic Telegraph Co.	Two wires to Borkum.
Greetsiel, Borkum.....	Bacton.....	1901	4	251	British and German Governments.	German Government to Borkum.
Greetsiel, Borkum.....	Horta.....	1903	1	1,934	Deutsch-Atlantic Telegraph Co.	Two wires to Borkum.

The following two cables land near Greetsiel:

From—	Bearing and distance from Greetsiel.	To—	Date of laying.	Number of wires.	Total length (sea miles).	Owners.	Remarks.
Hauen.....	W. b. N. 2 miles...	Borkum, Juist, and Norderney.	1870-87	1	28	German Government.	
Pils um (Manslagt).	S. W. 3 miles.....	Borkum, Teneriffe, Monrovia, Pernambuco (branch to Togo and Duala, Kamerun).	1909-10	1	5,782	Deutsch-Südamerikanische Telegraph Co.	3,906 miles to Monrovia.

All the cables are said to be buried about 3 feet underground alongside roads (2a) and (2) (see page 38), but only about  $1\frac{1}{2}$  feet below the surface across the *Watts*.

## NORDDEICH.

(See Map 1.)

About 9 miles north of *Greetsiel* is *Norddeich*. It is the harbour of *Norden*, which lies about  $2\frac{1}{2}$  miles to the southward.

*Norddeich* is of no interest commercially, but is important as the landing place of some submarine cables and for its W/T station.

It has a small and shallow harbour for fishing vessels, but the approaches are only 6 feet deep at M. L. W. S.

It is protected by the sea dyke of East Friesland, which is 19 feet above M. H. W. S. at this point.

## APPROACHES.

*Norddeich* may be entered either by the *Oster-Ems* or the *Norderneyer See Gat*. The passage from the *Oster-Ems* is shallow, and only 4 feet at average high water will be found unless the secret channel behind the *East Frisian Islands* mentioned on page 25 exists.

Through the *Norderneyer See Gat*, which is the channel between the islands of *Juist* and *Norderney*, there is only about 8 feet at M. L. W. S. After passing the island of *Norderney* the *Buse Tief* is entered, where the shoalest spot carries 6 feet at M. L. W. S. just off the entrance to the dams, which have been built out from the shore nearly  $1\frac{1}{2}$  miles on each side of the channel.

## PORT.

## Quay.

There is a small pier at the head of the channel on to which the railway from *Emden* and *Norden* runs (see page 37).

Alongside this pier there is 5 feet of water at M. L. W. S.

## Lifting Appliances.

There are two 1-ton cranes (hand) on the railway pier.

## COMMUNICATIONS.

## Steamship Services.

A steamer runs daily (in summer as much as 10 times daily) to *Norderney*.

## Railways (see page 37).

There is a branch of this main line from Norden through *Dornum*, *Esens*, *Wittmund*, and *Jever* to *Wilhelmshaven* (see page 37).

## Roads.

In addition to the main road to Norden and Emden ((8) page 38), there are the following:

- (A.) From *Norden* (2½ statute miles\*) W. S. W. to *Utlandshörn* (6¾ statute miles).  
 (A¹.) At 3¾ statute miles on road (A.) a branch N. W. to *Osterwarf* (5½ statute miles).  
 (B.) At 1½ statute miles on Norden road, a road to N. N. E. which runs parallel to the coast at an average distance of ¾ statute mile from it to *Nessmersiel* (10½ statute miles) and *Dornumersiel* (15¾ statute miles).  
 (B¹.) At 7½ statute miles on road (B.) a cross road, N. W. to *Hilgenriedersiel* (8 statute miles), S. E. to junction with (C¹.) (10½ statute miles).  
 (C.) From *Norden* (2½ statute miles) E. N. to *Hage* (5¾ statute miles) (at 6 statute miles (C¹.) branches N. E. and *Arle* (10¾ statute miles), E. S. to *Nenndorf* (13 statute miles), E. to *Westerholt* (14 statute miles), (here main road *Aurich* (see page 38) to *Dornum* crosses S. E. and N. W.) N. E. and E. to *West Ochtersum* (16½ statute miles), E. to *Barkholt* (18¼ statute miles), N. E. to *Holtgast* (20½ statute miles) where it joins (C¹.) 2½ statute miles from *Esens*.  
 (C¹.) From *Hage* (see (C.)) N. E. to junction with (B¹.) (8½ statute miles) and to *Westdorf* (9¼ statute miles), E. N. E. to *Nesse* (12 statute miles), E. S. to *Dornum* (14¾ statute miles) (here *Aurich-Dornum* main road branches E. S.), then N. E. and E. to *Westerackum* (14¾ statute miles), S. E., E., and S. E. to *Fulkrum* (18¾ statute miles), E. S. E. and E. to junction with (C.) (20½ statute miles), E. N. and N. E. to *Esens* (22¾ statute miles).

## Cables.

There is a cable to Lowestoft which lands near Norddeich (about 2¾ statute miles to the N. E.).

That portion which lies between Norddeich and Norderney (6 miles) is under the control of the British and German Governments, the remainder (225 miles) being entirely British.

The cable was laid in 1866, and has four wires, of which one is at the disposal of the Indo-European Telegraph Company.

## Telegraph and Telephone.

Norddeich is connected both telegraphically and telephonically with Norden and thence to the whole Empire.

## Wireless Telegraphy.

A high power W/T installation stands a short distance inside the coast dyke, about 2 miles S. W. of the railway pier, and 400 yards inland.

Its call letters are KAV, and it is said to have a radius of 950 miles with a wave length of 600 meters, Telefunken system. It has 4 lattice and 6 pole masts, and the country round it is marshy, intersected by dykes and drainage canals and covered with short grass.

## General.

## DEFENCES.

There are no permanent defences, so far as is known, but it is possible that, in war time, some steps may be taken to defend the W/T station.

It was reported in June, 1913, that Krupp had acquired a site for testing anti-aircraft guns.

## Garrison.

It is reported that a force of 1,500 men would be stationed at Norddeich and Norden in war time, but the composition of the force was not stated.

## Aerial Base.

It is reported that there are some *aeroplane hangars* and an *airship shed* on the road between Norden and Norddeich.

\*The distances are in statute miles along the roads from Norddeich Pier.

## JUIST.

(See Map 1 and Plan 6.)

## General Description.

*Juist* lies between the islands of Borkum and Norderney, from which it is separated by the Oster Ems and the Buse Tief, respectively. The eastern end of the island, which is the nearest point to the mainland, is some 4½ nautical miles from Norddeich.

The island is 9 miles long, and has an average width of 1,100 yards; its area is about 6 square miles.

Like Borkum, it is divided into two portions, the sea having broken through the dunes somewhat to the west of the centre. The two parts are now united by an artificial dam extending across the wide stretch of sands, known as the *Hammer*, which mark the position of the inundation.

The western and smaller portion is known as the *Bill*, and is further subdivided, according to the height of the dunes, into the *Grosse* or *Alt* and the *Kleine* or *Neu Bill*. It is the most exposed portion of the island, and consequently changes in its configuration are frequent. The dunes attain a height of from 34 to 62 feet in the Alt Bill and of from 33 to 50 feet in the Neu Bill.

The soil is light and marshy, and the dune valleys, which are larger than elsewhere on the island, resemble those found on Borkum, and are well covered with vegetation.

The southern part of the Bill consists of reclaimed land protected by an embankment and constitutes the only cultivated land on the island. A considerable sum was expended in 1912-13 for extending the reclamation and repairing the embankment.

The western extremity is formed by a low-lying expanse of shifting sand, known as the *Haak*, and here the island attains the maximum width of 1,603 yards.

The eastern portion of the island consists principally of dunes, ranging in height from 23 to 68 feet. The dunes are generally highest along the north shore and decrease in height as the south shore is approached. The highest point is the *Delldune* (height 68 feet).

The eastern extremity consists of the low-lying *Kalfamer Sands*, which are gradually extending in the direction of Norderney.

Dangerous shoals, for the most part dry at low water, extend in a northwesterly direction for some 2,000 yards from the west end of the island, and from the eastern end similar shoals stretch to the Norderneyer Seegat and Buse Tief.

To the south of the island lies a large expanse of Watt intersected in the vicinity of the island by the *Juister Balje* (depths 2 to 6½ fathoms). This channel is not, however, accessible from the sea, and small boats can enter and leave the Balje only in calm weather.

The northern shore shelves gradually to deep water, and the approach to it from the north is unobstructed. The beach is of fine sand, and between high and low water marks (width from 200 to 350 yards) it is firm and suitable for wheeled traffic.

At high-water springs, the sea approaches to within a few yards of the foot of the dunes and the Hammer Sands are impassable.

The surf is very heavy on both shores of the island, and landing is frequently impossible even on the south shore, except at the pier.

The local landmarks are the Kurhaus, a small pavilion somewhat to the east of the Kurhaus, and a beacon with cylindrical head at the eastern extremity of the dunes.

## APPROACHES.

The *Buse Tief* at the east end of the island opens into the Norderneyer Seegat and is very narrow. The depth on the bar at the entrance is 5¾ feet at M.L.W.S., but inside there are depths of from 2 to 4¾ fathoms.

The mean rise of tide is 7½ feet.

## Anchorages.

The only anchorage affording any shelter in the vicinity of the island lies in the Oster Ems (see under Borkum, page 4).

The approach from this anchorage to the island is, however, difficult and only practicable for boats in calm weather at high water. Local knowledge is required, as the channels are subject to frequent changes.

Deep-draught vessels can lie about 3 nautical miles off the north shore of the island in 5½ to 7½ fathoms. The holding ground is good, but the anchorage is completely exposed.

Any portion of the north shore appears to be suitable for effecting a landing, but only under favorable weather conditions, owing to the prevalence of heavy surf.

## Pier.

On the south side of the island an embankment, constructed in 1898 and protected by deeply sunk fascines, extends some 1,600 yards across the Watt and terminates at the Juister Balje in a landing stage, used by the local shallow-draught steamers. It is in connection with the light railway (see page 48).

The pier is a wooden structure about 12 feet wide. There are no facilities for dealing with heavy weights.

#### VILLAGES.

##### Population.

There are about 500 inhabitants, but during the summer some 6,000 visitors frequent the island.

##### Position and Description.

Almost in the centre of the island on the southern edge of the dunes stand some 90 to 120 houses, grouped into two villages known as *Osterhook* and *Westerhook*, or more ordinarily as *Ostdorf* and *Westdorf*.

The villages, separated by an open space used as gardens, are sheltered on the north by high dunes, while to the south, low hummocks extend as far as the Watt and protect them from inundation.

Westerhook is the principal bathing resort and contains most of the hotels and boarding houses, as well as the post and telegraph office and terminus of the steam tramway. Broad stone-paved paths lead in all directions through both villages.

The Kurhaus lies in the dunes to the north of the open space between the villages.

There is a sea-bathing establishment in the north part of Osterhook, and farther north in the dunes lies an engine house, probably in connection with this establishment.

A few hundred yards to the west of Westerhook there is a small group of houses, and still farther west and about 1½ miles from the village lies the small hamlet of *Loog*, which contains two inns.

There are two or three houses on the southern part of the Bill.

There are two lifeboat stations on the island, one being on the southwest part of the Bill and the other to the south of Osterhook.

##### Water.

Drinking water was laid on to the houses in Osterhook and Westerhook in 1906.

There are three wells, and they, together with the engine house for the waterworks, are situated at the northern end of the village.

##### Coal.

There is very little coal on the island beyond what is consumed by the inhabitants for cooking and heating purposes. There are, perhaps, 100 tons at the waterworks and the warm swimming baths.

##### Provisions.

The local resources are few, nearly all supplies having to be imported. In March, 1910, there were reported to be over 100 cows in the island.

#### COMMUNICATIONS.

##### Steamship Services.

During the summer daily communication is maintained between *Norddeich* on the mainland and the island by shallow-draught steamers (¾ hour) and motor ferryboat (1½ hours). There is also a daily steamer to *Emden*, *Borkum*, and *Norderney*. Occasionally brakes drive out to the steamers into about 4 feet of water to disembark the passengers.

##### Railway.

A light railway, rather over 1½ miles in length, extends from the landing stage to Westerhook village.

The rolling stock in 1910 consisted of two gas motor engines, five passenger coaches, two trucks, and one van. The track is in fairly good condition, the sleepers being laid about 1½ feet apart, and well bedded in sand. The gauge is 1 metre (3¼ feet).

##### Roads.

A sandy road extends from Westerhook to the Bill, but is not suitable for heavy traffic, being merely a track. Visitors usually drive either along the south shore or *via* Loog along the north shore at low water.

Three asphalt paths lead northward from the villages through the dunes to the north shore.

At low water the sands surrounding the island are hard and suitable for wheeled traffic.

It is not possible to cross to the mainland on foot at low water.

There are a few horses on the island, and vehicles can be obtained in the villages.

##### Cables, Telegraphs, and Telephones.

Two local cables lead from Juist to *Borkum*, and also to *Norderney*. There is no direct telegraphic communication with the mainland, but only *via* *Borkum* or *Norderney*. The telegraph office is in Westerhook village.

There is telephonic communication between Juist and *Borkum* and *Norderney* Islands. There is, moreover, telephonic communication between all the islands of the East Frisian group.

#### DEFENCES.

In June 1913 a project for the fortification of the island was reported, but nothing more has been heard of it.

The nearest garrison is that of *Borkum*, and some of the guns of *Borkum* command the approaches to Juist by the *Oster Ems* as well as the western end of the island.

#### NORDERNEY.

(See Map 1 and Plan 6.)

##### General Description.

The island of *Norderney* is situated at a distance of from 2 to 4½ nautical miles from the East Frisian coast, the longer distance lying between the west end of the island and *Norddeich* on the mainland. It is separated from Juist by the *Norderneyer Seegat* and *Buse Tief*, and from *Baltrum* by the *Wichter Ehe*.

The island derives some strategical importance from commanding the *Seegat* and *Riffgat*, deep narrow channels navigable by small vessels with local knowledge, which can be used as anchorages for torpedo boats. These anchorages are, however, within some 8,000 yards of the mainland. It is also the landing place of the British cable from *Lowestoft* (see page 51).

It is the third largest of the East Frisian Islands, and is 8 miles long, from 1,100 to 2,300 yards in width, and comprises an area of about 5½ square miles. The central and western portions of the island consist for the most part of dune bridges. A longitudinal ridge (height 33 to 68 feet) borders the north shore from the town to the centre of the island, and another group of dunes lies to the south and southeast of the *Seehospiz*. The other principal groups include the *Schwarze Dune* (height 59 feet) situated on the south shore overlooking the *Fischerhafen*, the *Mowen Dune* (height 59 to 66 feet) in the central portion of the island, and a larger group known as the *Weisse Dune* (height 59 to 66 feet) situated to the northwest and west of the lighthouse.

The central portion of the island is generally low lying, but contains some sand hillocks, which, like those on the south shore, are not so barren as the dunes situated on the northern shore.

The soil of the greater portion of the central and northwest parts consists of alluvial mud mixed with sand, and similar soil constitutes the meadow land to the south of the town and the *Grohde* to the south and east of the lighthouse.

The meadows to the south of the town are enclosed by low dykes, the inner one of which terminates at the *Alte Schanze*, while the more recently constructed portion of the outer dyke is continued as far as the boat-building establishment.

From this point eastward dunes protect the southern side of the island from inundation. Within the *Schwarze* and *Mowen Dunes* lies a large valley, of which a large portion is under cultivation. To the eastward of the *Mowen Dune* and southwest of the *Weisse Dune* there is a considerable expanse of pasture land.

The eastern portion of the island consists of a large expanse of low-lying soft sand.

Plantations of alders and fir trees are to be found in the western part of the island and trees have been planted in the public gardens in the town.

The shore, from the southwest point to the small pavilion "*Marienhohe*" some 300 yards northwest of the church, is steep to toward the *Seegat*. From this point northward it is fringed by a dangerous outlying sandbank, which extends seaward for about 2 nautical miles and on which surf is nearly always visible.

Further to the east the *Nord Strand* shelves gradually to deep water and approach to it is clear and open, but at the eastern end of the island more sand banks extend as far as the entrance to the *Wichter Ehe*.

The *Norderneyer Watt* skirts the south side of the island.

The west and northwest shores consist of fine sand and are firm and level between high and low water marks; above high-water mark the sand is dry and soft. At low water the width is about 200 yards. The south shore is muddy.

The surf on the northwest and north shores is very heavy, especially in northerly winds.

A sea wall extends for about 2,700 yards round the northwest angle of the island, encircling the town. It is built of squared sandstone on a foundation of piles and fascines, and is some 6½ feet in height; the top forms a promenade 26 feet in width. From the wall twelve stone groins, 26 feet in width and 150 yards in length, extend radially at intervals of about 200 yards. The extremities of the groins are marked by small buoys, which are at times run under by the strong current in the *Seegat*.

*Norderney Lighthouse* is an octagonal red tower, 176 feet in height above the ground level, standing in the central portion of the island to the southeast of the *Weisse Dune*.

Norderney Beacon is situated on a dune, 49 feet in height, in the west part of the island. It consists of a hexagonal brick foundation surmounted by a black wooden lattice beacon, 38 feet in height. The head is formed of two triangles, one in a north and south direction with the apex downward, and the other in an east and west direction with the apex upward.

A few yards to the west of the beacon stands the square water tower, 45 feet in height.

In addition to the above, there are a number of conspicuous buildings on the west end of the island, e.g., the Windmill, Bremer Hauser, Pavilion, Strand Hotel, Konversationshaus, electric generating station with high chimney, Seehospiz, church, and school with minaret in the centre.

#### APPROACHES.

Shallow-draught vessels can enter the *Norderneyer Seegat*, but it is advisable only to do so in calm weather and on the flood tide, as the bar is subject to very frequent changes.

The *Schluchter*, or western entrance, is very narrow where it opens into the Seegat. In 1907 there was a depth of  $7\frac{3}{4}$  feet on the bar at M.L.W.S. The mean tide rise is  $7\frac{3}{4}$  feet.

Inside the bar off the west end of the island there is a depth of from  $5\frac{1}{2}$  to 8 fathoms in the Seegat at M.L.W.S. At the southwest corner of the island the channel bends to the east and beyond the Fischerhafen is known as the *Riff Gat* (depth 4 to  $5\frac{1}{2}$  fathoms).

#### Anchorage.

There is a sheltered anchorage for small craft in the Seegat at the southwest corner of the island in about 6 fathoms. Good anchor bearings are the windmill in line with the beacon or water tower, and the church over the centre of the Logirhaus (see Map 5).

Deep-draught vessels can lie about  $2\frac{1}{2}$  nautical miles off the north shore of the island in  $6\frac{1}{2}$  fathoms. The anchorage is, however, completely exposed.

The best position for landing from small craft and boats appears to be the west and southwest shores, though it must be borne in mind that there is a strong current in the Seegat.

The north shore could also be used under favourable weather conditions.

#### THE PORT.

The port is called the Fischerhafen, and is situated to the east of the landing place. It is used principally as a harbour of refuge for fishing boats, and to a smaller extent as a commercial harbour for passenger steamers and small coasting vessels.

It has been reported recently that the harbour is being used at intervals by German torpedo boats.

The east mole rises above high-water mark, but the eastern portion of the harbour wall is submerged at half tide.

The depth alongside the west mole are  $8\frac{1}{2}$  to  $9\frac{3}{4}$  feet and 16 to  $17\frac{1}{2}$  feet at M.L. and H. W. S., respectively.

At the northwest corner of the island an iron pier, some 16 feet in width, extends seaward from the Victoria Halle for about 190 yards. The pier head forms a promenade each about 50 feet square, which could be used as landing places.

The depth alongside the pierhead is about  $14\frac{1}{2}$  and  $6\frac{1}{2}$  feet at M.H. and L.W.S., respectively.

On the west shore there is a boat pier, some 200 yards in length, with depth of about  $26\frac{3}{4}$  and 19 feet alongside the head at M.H. and L.W.S., respectively.

The principal landing place lies to the southeast of the town, and consists of an embankment, some 1,300 yards in length, terminating in a landing stage.

There are depths of about  $13\frac{3}{4}$  and 6 feet alongside the stage at high and low water O.S., respectively.

#### Lifting Appliances.

On the west mole there are two manual power travelling cranes, each of  $1\frac{1}{2}$  tons capacity.

#### Coal and Water.

Coal is obtainable, there being usually from 50 to 100 tons in stock. Drinking water is laid on to the mole, and facilities are provided for supplying ships with water.

#### Transport.

In 1910 there were some 100 horses, and the same number of wheeled vehicles, principally consisting of cabs.

#### THE TOWN.

The town is situated on the western extremity of the island and is quite modern. There are some fine public buildings, numerous hotels, boarding houses, restaurants, bathing establishments, &c.

The *post and telegraph office* stands almost exactly in the centre of the town.

There is a large *slaughterhouse* with cold-storage plant northeast of the Alte Schanze (see below).

To the northwest of this is the "Seehospiz Kaiserin Friederich," a large *sanatorium* for children, with accommodation for 280 patients.

There is a *hospital* N. by W. of the Alte Schanze, and in the same grounds is a large *poorhouse*.

Near the northwest corner of the Alte Schanze there is, apparently, another small *hospital*. Northwest of this are the *Central School* and the *gymnasium*.

The *Alte Schanze*, near the southeast corner of the town, is an old earthwork, and it and the land to the west of it along the south of the town have been converted into a park.

#### Population.

The inhabitants number some 4,000, but the island is visited annually by over 38,000 persons.

#### Lighting.

The streets are lit by gas (incandescent), but all the principal buildings by electricity.

The gas works are about  $\frac{3}{4}$  of a mile E. by N. of the Alte Schanze.

The electric-light and power station is near the southwest corner of the town.

#### Water.

Water is laid on at all houses, and there is a water tower and pumping station with wells near the beacon east of the town.

#### Internal Communications.

All the streets are paved, and there are no trams or light railways, but there are numerous cabs and omnibuses.

#### COMMUNICATIONS.

#### Steamship Services.

During the summer steamers run (10 to 13 times a day) between *Norddeich* and the island (35 minutes), and during the winter a daily mail steamer runs regularly between the same points.

The Hamburg-Amerika and Norddeutscher-Lloyd lines run steamers during the summer from *Hamburg* and *Bremerhaven*, respectively, to Norderney, some of which call at Helgoland.

There is also a daily service to *Juist*, *Borkum*, and *Emden*.

#### Roads.

A paved road leads from the landing place to the town.

Northeast of the Alte Schanze a brick-paved road leads past the gas works to the dairy farm (*Meierei*) about  $1\frac{1}{2}$  miles from the town, and from this point a footpath extends across the dunes to "Wilhelmshöhe."

A road suitable for light wheeled traffic skirts the south shore, and, following the foot of the dunes, leads to the lighthouse and another dairy farm (*Molkerei*).

The old post road across the Watt to *Hilgenriedersiel* on the mainland strikes off from the road to the lighthouse about a mile to the east of the harbour. The track is marked by birch-tree beacons, and can only be used at low water.

#### Cables.

(1) Norderney is the landing station of the British cable (4 wires) from Lowestoft, which is continued to *Norddeich* on the mainland. The cable house is situated in the southwest portion of the town, close to the sea wall.

(2) and (3) Two local cables lead to *Vinkenpolder* on the mainland,  $2\frac{1}{2}$  miles northeast of *Norddeich*, and (4) and (5) two *via Juist* to *Borkum*.

(6) One cable leads eastward *via Baltrum*, *Langeoog*, and *Spiekeroog* to *Neu-Harlingersiel* on the mainland.

(7) A cable from *Mundestey* (Norfolk) lands here. It is the joint property of the British and German Governments.

(8) There is also a cable to *Hilgenriedersiel* on the mainland (see below).

#### Telegraphs and Telephones.

The island is in telephonic communication with the mainland, and with *Borkum*, *Spiekeroog*, *Wangeroog*, and, it is believed, *Juist*.

The lighthouse is a telegraph station, and is connected to the mainland system by a cable leading to *Hilgenriedersiel*. The telegraph office is in the centre of the town in the Post Strasse.

#### MINING BASE.

Norderney is reported to be "an important mining station," and mine ships from *Cuxhaven* are frequently to be seen off the island.

In 1911 it was reported that there were large stores of mines in the island. Part of the deep-sea mine field northwest of Baltrum is probably laid from this base. There is a resident naval staff of 3 officers and 30 men of the mining division. Mining boats of the Cuxhaven mining flotilla often put in to the harbour.

**Fortifications.****DEFENCES.**

In 1911 it was reported that a battery armed with 9.45-inch (24 cm.) guns existed on the island, but nothing further has been heard of it and its position is not known. There is probably a battery of light guns at each end of the island. Further defences were probably intended to be field works for construction in war time.

**Submarine.**

The scheme of coast defence is said to include the laying of two mine fields to block the channels east and west of Norderney; also a deep-sea mine field north of the island and extending toward Helgoland.

**HILGENRIEDERSIEL.**

(See Map 1.)

**Position and General Description.**

This small village lies on the coast 6 miles to the northeastward of *Norddeich* and derives its importance from the fact that it is the landing place of the telegraph cable joining *Norderney* with the mainland system, and is the starting point of the "post road" to *Norderney*. *Hilgenriedersiel* is protected by two dykes, 550 and 960 yards from high-water line, respectively.

These dykes are about 12 feet above M.H.W.S. and steep-to on the shore side, and are part of the sea dyke of East Friesland.

**Roads.****COMMUNICATIONS.**

The only road to and from Hilgenriedersiel is that mentioned on page 43 and lettered (B<sup>1</sup>), but there are paths on the top of the dykes all along the coast both east and west. The old post road to *Norderney* is a continuation across the *Watt* of the main road and strikes out from the shore N. by E. (true) until two beacons on *Norderney* are in line. M.L.W.S. mark the line of the watershed on the *Watt*, which is about 3 feet above

**Cable.**

The cable from *Norderney* is believed to land a short distance to the westward of the old post road. It is said to cross the *Watt* about 1½ feet below the surface of the sand and mud.

**Position.****AIRSHIP BASE.**

North of Hage railway station, on the line Norden-Dornum. It is in the bend, i.e., N.W. of the corner, of the 1st class road, Norden-Hage-Hilgenriedersiel. Norderney Pier is about 8 nautical miles N.W. of the base, Borkum about 25 miles west. A new motor road runs from Hage northward, passing under the railway line and through the airship base. The sheds and barracks are east of this road, the gas plant and magazine on its west side. A thick plantation lies S.E. and another S.W. of the base, one on either side of Hage.

**Sheds.**

There are four sheds, built of wood. Each shed has its length lying east and west. The four sheds are disposed in a N. and S. line, parallel to one another and on the east side of the new road. The sheds are numbered from N. to S.

**Barracks.**

These are between sheds 2 and 3.

**Gas Works.**

These are two buildings west of the new road, the roofs being Ziegeldacher. Further westward and slightly north are three gasometers, one of which is very large; the other two small. The capacity is not known.

**Bomb Magazine.**

This lies south of the gas works. The roof is Ziegeldach.

**COAST FROM NESSMERSIEL TO SCHILLIG.****NESSMERSIEL.**

(See Map 1.)

**Position and General Description.**

Between the islands of *Norderney* and *Baltrum* there is a shallow channel called the *Wichter Ee*. At the head of this channel and on the mainland, about 2¼ miles S. b. E. (true) from the eastern point of *Norderney*, is the small village of Nessmersiel.

It is only a small fishing village, and its only interests lie in the fact that it is from here that the passenger vessel to *Baltrum* runs, that the cable connecting *Baltrum* with the mainland lands near it, and the importance of the sluice.

**Approaches.**

The approach to Nessmersiel is through the *Wichter Ee* and across the western part of the *Stein Plate*.

The *Stein Plate* dries out for a distance of one mile and there is only 5 feet of water over it at H.W.O.S.

**Harbour.**

The harbour consists of a small pool left by the tide just off the mouth of the *Harke Tief*, a small drainage canal which debouches into the sea at this point, passing through a sluice at Nessmersiel.

There are 3 feet of water in the harbour at M.L.W.S. and 11 feet at M.H.W.S. A groin has been built out for a distance of 1,050 yards in a N.N.E. direction from the mouth of the *Harke Tief*, which is used as a landing place.

**Communications.****BY SEA.**

A motor boat runs from here to *Baltrum*.

**BY LAND.**

The main road from *Norden* to *Dornumersiel* and *Esens* runs through this village and, in summer, there is an omnibus service from the railway station at *Dornum* (5 statute miles) on the "Coast Railway" between *Norden* and *Esens*.

**CABLE.**

The cable from *Baltrum* lands at a point about 1¾ miles to the eastward of the village.

**TELEGRAPH AND TELEPHONE.**

Nessmersiel is connected with the main telegraphic and telephonic systems of the Empire.

**Defences.**

As far as is known there are no defences, but in view of the fact that, if the sluice were destroyed, all the coast of East Friesland from *Emden* to *Esens*, for a distance of about 4 miles inland, would be flooded at high water, it would seem that some precautions against attack would be very necessary in war.

This applies to all the Siels on this coast (see under *Dornumersiel*, page 55, *Neu-Harlingersiel*, page 58, *Karolinensiel*, page 60, &c.).

**BALTRUM.**

(See Map 1 and Plan 7.)

**General Description.**

*Baltrum*, the smallest of the East Frisian Islands, lies at a distance of about 2½ nautical miles from the mainland between the islands of *Norderney* and *Langeoog*, from which it is separated by the *Wichter Ee* and *Ackumer Ee*, respectively. The island does not appear to be of any strategical importance.

The island is rather over 3 miles in length, some 2,000 yards in width at the widest part, and contains an area of 2½ square miles.

Dunes, for the most part planted with marram grass, extend from the west end to the centre of the island, and attain their maximum elevation in the vicinity of *Ostdorf*, but nowhere exceed some 50 feet in height.

The eastern and widest portion of the island consists of a low expanse of soft sand, where fresh dune ridges are gradually forming.

Grass grows abundantly in the sheltered valleys of the central portion, and there are also numerous well-cultivated gardens, surrounded by stone walls as a protection against the drifting sand.

On the south side of the island lies a considerable expanse of meadow land.

At the southwest point the shore projects in a southerly direction for some distance, forming a sheltered anchorage for the local boats.

The west shore is steep-to, but on the northwest and north the island is fringed by sand banks, which at the northeastern point extend as far as the entrance to the *Ackumer Ee*. The narrow strip of shore bordering the *Ackumer Ee* is extremely steep-to.

From the south side of the island the Watt extends to the mainland, and is, for the most part, dry at low water.

The shore is of fine sand, and is hard below high-water mark.

The surf is moderately heavy.

The northwest corner of the island is protected by a sea wall, some 2,200 yards in length, constructed of stone and piles, and having 15 stone groins.

#### Approaches.

The *Wichter Ee* is an unimportant shallow channel at the western end of the island, the entrance to which is not buoyed and which is only used by the local fishermen.

The east shore is approached through the *Ackumer Ee* (see under *Langeoog*, page 56).

#### Anchorage.

Deep-draught vessels can anchor about 3 nautical miles from the north shore of the island in  $5\frac{1}{2}$  to  $6\frac{1}{2}$  fathoms. The anchorage is exposed, and could only be used in favourable weather conditions.

The west and northwest shores do not appear to be suitable for landing purposes owing to the difficulty of approach. The steep-to east shore is, perhaps, the most suitable point, but the sand above high-water mark is very soft.

#### Pier.

The southernmost groin of the sea wall, situated about 500 yards to the southeast of *Westdorf*, is used as a landing place for the local ferryboat.

#### VILLAGES.

The inhabitants number about 200. In 1912 there were over 500 visitors to the island during the summer.

There are two villages. *Westdorf*, as the larger is called, is situated at the west end of the island, and consists of 32 houses, including two small hotels, and the church and schoolhouse. *Ostdorf* contains 12 houses, including an inn, and is located in the centre of the island about 1,600 yards eastward of *Westdorf*.

There is a lifeboat station on the south shore close to *Ostdorf*.

#### Supplies.

Some sheep and a few cows are kept on the island.

The only crop produced on the island is potatoes.

#### Water.

The various houses and cottages have their own pumps and wells. There is no water tower or pumping station.

#### COMMUNICATIONS.

##### By Sea.

There is a motor boat service to *Nessmersiel* on the mainland (about 1 hour), see page 53.

There is, in summer, a daily steamer between *Norderney* and *Baltrum* belonging to Herr *Küper* of *Baltrum*.

The "Norden" and "Frisia" Companies of *Norderney* also run steamers, in summer, between all the islands from *Norderney* to *Wangeroog*, inclusive.

##### By Road.

The roads in the villages and leading to the bathing shore are on the corduroy system, but in spite of this the going is heavy, due to drift sand.

It is possible to cross to the mainland on foot at low water, but guides are necessary, as the track is not marked.

#### By Cable.

The cable between *Norderney*, *Langeoog*, and *Spiekeroog*, laid in 1874, connects these islands with *Baltrum*.

Another cable connects *Baltrum* with the mainland near *Nessmersiel* (see page 53).

The cables are believed to land near *Ostdorf* in the centre of the southern shore of the island.

#### Wireless Telegraphy.

A wireless station exists, and is used as one of a chain along the islands for signalling the approach of ships passing along the mine-free channel close to the islands.

#### Telegraphs and Telephones.

The island is in telegraphic communication with the main system of the Empire by means of the *Nessmersiel* cable.

The post and telegraph office is at the "Hotel zur Post" in *Westford*.

Telephonic communication with the mainland is reported to exist, in an unofficial publication, but this report lacks confirmation.

#### DEFENCES.

It is believed that there are no permanent defences on the island.

#### Mine Area.

It is reported (30th January, 1915) that a mined area exists off *Baltrum*, running in a northwesterly direction about 10 miles, then turning toward the N.E. to a point situated about 10 miles W. of *Helgoland*.

The westernmost point of this area is marked by a buoy (on which is a light, no further details known) in lat.  $53^{\circ} 52' N.$ , long.  $7^{\circ} 15' E.$

A warning buoy (black conical) has been placed 7 miles due W. of this.

A clear channel exists, however, along the coast of the islands.

#### DORNUMERSIEL.

(See Map 1.)

#### Position and General Description.

This is one of the many villages surrounding the sluices of the drainage canals of East Friesland, the greater part of which lies on an average 2 feet below the level of high water.

It lies S. b. E. of the western end of the island of *Langeoog* on the mainland at the mouth of the *Neues Tief*.

Just before reaching the sea the *Neues Tief* forks and forms a delta in which there is one small island about 875 yards long, in a northeasterly and southwesterly direction, and about 200 yards wide.

In consequence there are two sluices, the northwestern one being the *Dornumersiel* and the southeastern one the *Westerackumersiel*.

There is another sluice at the mouth of the *Pump Tief*, called *Pumpsiel*, about 1,800 yards E.S.E. of *Westerackumersiel*.

The coast dyke is about 12 feet high (above M.H.W.S.) in this locality.

#### Approaches.

The approach is through the *Ackumer Ee*, but the Watt dries out for a distance of  $\frac{2}{3}$  of a mile from the mouth of the harbour. There is a depth of 1 foot at M.H.W.S. and the channel is marked with stakes.

#### Communications.

The nearest railway station is at *Dornum*,  $2\frac{1}{2}$  miles S.W.

The main road from *Norden* follows the coast and passes through *Dornumersiel* and on through *Bensersiel* (see page 57) as far as *Neu-Harlingersiel* (see page 58).

#### Defences.

There are no defences, but see under *Nessmersiel*, page 53.

#### LANGEOOG.

(See Map 1 and Plan 7.)

#### Position and General Description.

*Langeoog* lies at an average distance of 4 nautical miles from the mainland, but the southwestern extremity is only some  $2\frac{1}{2}$  miles from the village of *Dornumersiel*. It is separated from *Baltrum* by the *Ackumer Ee* and from *Spiekeroog* by the *Otzumer Balje*.

The island is apparently of no particular strategic importance.

Langeoog has a total length of about 7 miles, a mean width of 1 mile, and an area of  $5\frac{1}{4}$  square miles.

From the north it appears to consist of three separate portions, and without local knowledge one end is easily mistaken for the neighbouring island.

Actually the island is divided into four parts, viz. the *Flinthorn Dunen*, including the Flinthorn, the *Westende*, the *Melkhorn*, and the *Ostende*.

The *Flinthorn Dunen* (height 16 to 30 feet) are of comparatively recent formation. At exceptional spring tides they are cut off from the *Westende*, but at ordinary high-water springs the barren expanse of soft sand uniting the two parts can be traversed without danger.

The *Westende* consists of a horseshoe-shaped mass of dunes, with the concave side facing southeast. The dunes (height 33 to 66 feet) attain the maximum elevation at the west end of the island, and enclose, and to a certain extent shelter, the village of Langeoog on the north and west.

Eastward of the village a large expanse of meadow and pasture land, partially enclosed by wire fences, extends as far as the *Grosse Schlopp*.

The *Melkhorn*, which is uninhabited, is bounded on the west by the *Grosse Schlopp* and on the east by the *Kleine Schlopp*. The northern portion consists of an irregular mass of dunes (height 36 to 50 feet) and the southern portion of good meadow land.

The *Ostende*, including the *Osterhook*, which extends as far as the *Otzumer Balje*, generally resembles the *Melkhorn* in its physical features. It consists of longitudinal dune ridges (height 33 to 46 feet) on the north and of good meadow land enclosed by wire fences on the south.

During the heavy northwesterly storms experienced in autumn and winter the low-lying meadows are often submerged to a depth of 3 feet, and the land is covered with fertile alluvial mud. Occasionally, during summer, a similar storm occurs, destroying the hay crop.

There is no arable land on the island.

The shore at the west end of the island slopes fairly steeply to the *Ackumer Ee*, but on the northwest is fringed by outlying sand banks intersected by shallow channels.

The north shore shelves gradually and uniformly to deep water and the approach to it is unobstructed. At the eastern end, however, shoals extend to the *Otzumer Balje*.

The shore is of fine sand, and below high-water mark is firm; on the northwest it is very flat.

#### Approaches and Anchorage.

The *Ackumer Ee* at the west end of Langeoog has a depth of from  $2\frac{1}{2}$  to 5 feet on the bar at M.L.W.S. The mean tide rise is  $7\frac{3}{4}$  feet. The channel is narrow and runs between shoals extending northeasterly from *Baltrum* and northwesterly from Langeoog. Off the east end of *Baltrum* and southwest point of Langeoog there are depths of  $4\frac{1}{4}$  to  $9\frac{3}{4}$  fathoms.

The channel is only suitable for small craft and requires local knowledge. Deep-draught vessels can anchor in calm weather some  $2\frac{1}{2}$  nautical miles off the north shore of the island in  $5\frac{1}{2}$  to  $6\frac{1}{2}$  fathoms.

The shore to the north of the *Melkhorn* appears to be the most suitable point for landing.

#### Pier.

There is a pier about 1 statute mile long, southeastward of the village, which is, however, not long enough, as the Watt dries out beyond it at low water.

There are  $4\frac{1}{2}$  feet of water alongside at M.H.W.S., and the springs rise is 8 feet.

#### Village.

The village of *Langeoog* (inset on Plan 8) is situated at the northwest corner of the island, and consists of 70 to 80 houses, including five hotels, in addition to a schoolhouse, and a church with tower 75 feet in height.

The gardens in the village are surrounded by fairly high walls, and the roads and open spaces are covered with grass. To the northeast lies the "*Hospiz des Klosters Loccum*," an establishment under the control of a Lutheran sisterhood, containing accommodation for some 200 visitors. There is a small infirmary attached to the hospiz.

There is a lifeboat station in the south part of the village and a second at the east end of the island.

A large dairy farm (*Meierei*) belonging to the hospiz is situated on the *Ostende*.

#### Population.

The resident population exceeds 500, and the visitors numbered over 5,000 in the summer of 1912.

#### Provisions and Water.

About 120 cows are kept at the dairy farm (*Meierei*) on the *Ostende*, and many of the inhabitants of Langeoog village also own cattle. Good potatoes and other vegetables are grown in the village.

The water supply is obtained from wells in the dunes, the best wells being those belonging to the hospiz. The water is often very yellowish in colour, but is not unhealthy.

#### Communications.

##### BY SEA.

A steamer runs daily to the pier from *Bensersiel* ( $\frac{1}{2}$  hour) in summer, 1st June–30th September, S.S. "Kaiserin Auguste Victoria."

There is a sailing postal ferry from the same place all the year round ( $1\frac{1}{2}$  hours).

For interisland communications, see under *Baltrum* (page 54).

##### BY LAND.

A horse tramway runs from the *hospiz* to the outer end of the pier (about 2 miles, 20 minutes).

The streets of the villages are sandy and grass grown, but paved paths lead through the dunes to the northwestward, where the bathing establishments are situated on the beach.

A road, suitable for light wheeled traffic, runs nearly the whole length of the island from the *hospiz* to the *Meierei*.

#### TELEGRAPHIC AND TELEPHONIC.

Telegraph cables lead to *Baltrum* and via *Spiekeroog* to *Neu-Harlingersiel* on the mainland. The post and telegraph office is in the village at the corner of the main road leading to the *hospiz*.

A telephone cable was laid in 1904 from the vicinity of the pier to *Bensersiel* (see page 58), at which place connection with the main telephonic system of the Empire is made.

#### Aerial Base.

On Christmas Day, 1914, an aerial observer flew over this island and reported having seen, and dropped a bomb on, some huts between the *Herrenhus Dune* and the *Melkhorn*.

These huts were painted a dull reddish colour and resembled hangars.

#### Defences.

In view of this reported aerial base, it is probable that the island is defended and a report to this effect has been received, but no details are known.

### BENSERSIEL.

(See Map 1.)

#### Position and General Description.

This is another village at a sluice, but with this difference from the others on this coast—the sluice is only opened at high water, as the *Benser Tief* (at the mouth of which this sluice is) is on a higher level than the surrounding country as far as *Dunum*.

The village is about  $3\frac{1}{2}$  miles to the eastward of *Dornumersiel* (see page 55), and south of the centre of the island of *Langeoog*.

The sea dyke is about 12 feet above M.H.W.S. at this point.

#### Approaches.

*Bensersiel* is approached from the sea by a branch of the *Ackumer Ee* (see page 56) called the *Rute*.

The deepest channel over the Watt, which dries out, at this point, for a distance of 2,500 yards, is marked by stakes as far as the end of the 1,550-yard long groin which protects the sluice from silting up.

There are not more than 4 feet of water in this approach at M.H.W.S.

#### Harbour.

There is a small harbour just outside the sluice for fishing boats, but it is very shallow even at high water. It is quite dry at low water.

#### Communications.

##### BY SEA.

A steamer runs daily, from 1st June to 30th September, to *Langeoog* (see above).

A postal ferry runs daily to the same place all the year round.

## BY LAND.

The nearest railway station on the "coast railway" is at *Esens*, 2½ miles, and there is an omnibus service connecting these two places, as well as the light railway.

The light railway connects *Bensersiel* with *Esens* and *Ogenbargen* on the *Aurich-Wittmund* branch of the State railway. (See under "Emden, Railways," pages 37 and 38.)

## CABLES, TELEGRAPH, AND TELEPHONE.

A telephone cable from *Langeoog* lands here (see under *Langeoog*, page 57).

*Bensersiel* is in telegraphic and telephonic communication with the main system of the Empire.

## CANAL.

The *Benser Tief* is used to convey goods by means of small barges. There are no locks, and the dimensions of the canal are not known.

## Defences.

No defences are known to exist here, but see under *Nessmersiel*, page 53.

## NEU-HARLINGERSIEL.

(See Map 1.)

## Position and General Description.

Yet another of the sluices of the East Frisian coast. There are two tiefs which drain into the sea through this sluice, the *Werdumer Tief* or *Harle* and the *Alt-Harlingersieler Tief*. The latter is a branch of the *Wittmunder Tief* (see page 60) and runs into the *Harle* about 250 yards above the sluice.

*Neu-Harlingersiel* is about 5½ miles E.N.E. of *Bensersiel* and south of the western end of *Spiekeroog*.

The sea dyke here is about 15 feet above M.H.W.S.

## Approaches.

The Watt dries out for a distance of about 1,200 yards, where the *Schill Balje* (a branch of the *Otzumer Balje*) (see page 59) approaches the coast.

The deepest channel (at high water) over the Watt is marked by stakes and a 1,350-yard groin extends from the high-water line on the western side of it.

## Harbour.

There is a small fishing harbour which has 3 or 4 feet in it at low water, but which dries across the mouth. There are 11½ feet of water in the harbour at M.H.W.S.

## Communications.

## BY SEA.

There is a daily service to *Spiekeroog* by the motor boat "Spiekeroog" all the year around, 1 hour.

The steamer from *Harle* (see page 60) to *Spiekeroog* also calls here.

## BY LAND.

There is a daily omnibus service from the railway station at *Esens* (5¾ miles). In summer the service is twice or three times daily.

## CABLES.

This is the landing place of the cable from *Spiekeroog* (see page 59).

## TELEGRAPH AND TELEPHONE.

The post and telegraph office is opposite *Mingers Hotel* on the south side of the harbour.

## Defences.

As far as is known there are no defences, but see under *Nessmersiel*, page 53.

## SPIEKEROOG.

(See Map 1 and Plan 10.)

(Plan 10 is issued with Section 2.)

## Position and General Description.

*Spiekeroog*, which lies between the islands of *Langeoog* and *Wangeroog*, and from which it is separated by the *Otzumer Balje* and the *Harle*, respectively, is some 3½ nautical miles from the mainland.

The island is some 6 miles in length, from 1¼ to 1¾ miles in width and, including the sands, covers an area of 3¾ square miles.

The eastern and larger portion is formed by a low expanse of soft sand, for the most part only some 3 feet above high-water mark.

The western and smaller portion is bordered on the north by a semicircular mass of dune ridges lying with the opening toward the south. On the southwest the sea has broken through the dunes, necessitating the protection of the island against further encroachment.

The highest dunes (height 50 to 69 feet) are situated in the north and northwest, a particularly conspicuous group being the *Weisse Dünen* (height 69 feet).

In the centre and east the dunes are intersected by numerous fertile grassy valleys, some of which are well wooded; the best known of these valleys is the *Friederikenthal*, which is situated in the southeast and contains a small plantation.

The dunes are generally well covered with marram grass, and many fine specimens of trees are to be seen in the village. To the south of the dunes, fertile meadows, enclosed in places by low dykes and wire fences, extend to the shore.

The shore is sandy and firm between high and low water marks. The surf is very heavy.

The northwest side of the island is protected against further encroachment for a distance of about 1,500 yards by a sea wall and strong palisades. The wall, which is 600 yards in length and 20 feet high, forms a good promenade, 13 feet wide. Twelve groins extend seaward at intervals of about 150 yards.

## Approaches.

The *Otzumer Balje* is a small-craft channel which intersects the sand banks between *Langeoog* and *Spiekeroog*. The depth on the bar at M.L.W.S. was 6½ feet in 1907. The mean tide rise is 8½ feet. Inside there are depths of 3¼ to 9¼ fathoms. The channel is, however, subject to frequent alterations, and great care should be employed in using it.

The *Schill Balje* (depths 3¼ to 7½ fathoms) extends in an east-southeasterly direction from the *Otzumer Balje*.

## Anchorage.

Large vessels can anchor about 2¼ nautical miles off the north shore of the island in about 6 fathoms, but the anchorage is completely exposed to all winds. In the event of a landing being necessary, the shore to the north of the beacon appears to be the most suitable position in calm weather.

## Pier.

There is a pier on the south side of the island in connection with the tramway to the village. It is of wood. There are no cranes or facilities for lifting heavy weights.

## Village.

The inhabitants, who number about 200, obtain their livelihood by cattle breeding, fishing, and catering for the summer visitors, of whom some 2,300 visited the island in 1913.

The village of *Spiekeroog* (see Inset on Plan 10) is situated under the shelter of the dunes in the western part of the island, and consists of some 50 houses, including three hotels, surrounded by gardens and large trees; it also contains a schoolhouse and church. There is a bathing establishment and a pavilion overlooking the northwest shore, and a lifeboat station on the road to the shore.

The water supply is ample. There is no water tower or pumping station, every house and cottage having its own pump and well.

The local supplies are just about sufficient for the inhabitants. Although the number of visitors in summer is not very great, supplies have to be imported for them. In March, 1910, there were estimated to be about 100 cows and 50 sheep in the island.

## Communications.

## BY SEA.

A steamer runs daily during the summer from *Harle* on the mainland, via *Neu-Harlingersiel*, to the island (2 hours). A motor ferryboat runs daily throughout the year between *Neu-Harlingersiel* and the island (1 hour).

## BY LAND.

A horse tramway, about 3,000 yards in length, runs from the pierhead to the village, and a short branch leads to the northwest shore.

There are no roads in the island at all. There are only sandy tracks leading to the various parts of the island. They are quite unsuitable for wheeled traffic.

## CABLES AND TELEGRAPHS.

Telegraph cables lead to *Langeoog* and *Wangeroog* Islands and to *Neu-Harlingersiel* on the mainland. The post and telegraph office is in the village next to the *Hotel zur Linde*, and is 100 yards northwest of the church.

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## TELEPHONES.

There is telephonic communication with the mainland and with the neighbouring islands.

## Defences.

There are no defences. It is understood that only field guns and machine guns are considered to be necessary for the defence of the island.

Some of the guns on the neighbouring island of *Wangeroog* are believed to command the greater part of *Spiekeroog*.

## HARLE (KAROLINENSIEL).

## Position and General Description. (See Map 1.)

This is the last of the sluices on the north coast of East Friesland. It is about 6 miles east of *Neu-Harlingersiel* and due south of the eastern end of *Spiekeroog*, and at the mouth of the *Wittmunder Tief*, which rises near *Wittmund* about  $8\frac{1}{2}$  miles to the southward. *Karolinensiel*, owing to reclamation, is now a mile and a quarter inland and a new sluice has been built about  $\frac{1}{2}$  mile below *Karolinensiel* which is known as the *Friedrichsschleuse*. Reclamation having been pushed out beyond this again, the railway has been carried about  $\frac{3}{4}$  mile farther and its terminus is called *Harle*.

## Approaches.

The approach to *Harle* is by the *Harle Seegat*, the channel between *Spiekeroog* and *Wangeroog*, then up the *Karolinensieler Balje*. In the *Harle Seegat*, which is well buoyed but continually changing, there is a least depth of 5 feet at M.L.W.S. The *Watt* dries out 1 mile beyond the dolphins of the *Harle* groin and there is a depth of  $6\frac{1}{2}$  feet in the staked channel at M.H.W.S. The springs rise is  $8\frac{1}{2}$  feet.

## Harbour.

There is a small fishing harbour at *Harle*, which is very shallow even at high water. A small and shallow harbour exists at *Friedrichsschleuse* as well. A groin extends out from the high-water line, from the west side of the entrance to *Harle* Harbour, to a distance of 1 mile in a north-northeasterly direction. There are dolphins at the end of this groin as also a small light tower.

## Town.

At *Harle* there are only a few houses besides the railway station. *Karolinensiel* and *Friedrichsschleuse* form one village with about 2,000 inhabitants (1913). The church spire is a conspicuous mark for a considerable distance.

## Communications.

## BY SEA.

There is a daily steamer to *Wangeroog* ( $\frac{3}{4}$  hour) and another via *Neu-Harlingersiel* to *Spiekeroog* (2 hours). Both these services only run in summer. In addition to these there are two ferryboats, one motor and one sailing, which ply all the year.

## BY LAND.

A branch of the coast railway connects these villages with *Jever*, *Emden*, and *Wilhelmshaven*. There are good roads in this part of East Friesland (see under *Wilhelmshaven*).

## CABLES.

There are two cables from *Harle* to *Wangeroog*. It is believed that they land north of the railway station.

## TELEGRAPH AND TELEPHONE.

Both will be found in the village of *Karolinensiel* and it is probable that *Harle* is also connected with both services.

## Defences.

No defences have been reported here, but see under *Nessmersiel* (page 53).

## COAST TO SCHILLIG.

## General Description.

This coast presents no special features from the strategic point of view.

The coast dyke continues along it at an average height of about 19 feet above M.H.W.S. In places it is duplicated and even trebled, so that the flooding of the coast districts would not be so easy as at places further to the westward.

At the village of *Schillig* there are considerable defences; these are described under the heading "The Jade-Weser Defences" (see section 2).

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