



The Bates plan, to be located on Staten Island.

(Continued from preceding page.)

writer in 1906 for the establishment of a union seaport terminal outside the Narrows, where rail borne and water borne commerce may meet with a minimum cost and a minimum loss in labor and delay. Now a sky borne commerce must also find loading and transfer facilities. The project proposes:

(a) The purchase by the authorities (through negotiation or condemnation if necessary) of the stretch of land fronting the lower bay on the south shore of Staten Island;

(b) The paralleling of this zone with a ship channel 1,200 feet wide inside a breakwater;

(c) The branching northward from this channel of a pier system with slips half a mile long and 400 feet wide, of the most modern construction and equal to docking the largest vessels;

(d) The building of large freight and passenger yards and a seaport junction railroad connecting the terminal site with the trunk railway lines, leading west and north and south.

(e) The design would provide for ocean terminal warehouse facilities, for barge lines, for the care of grain and other produce intended for transshipment to foreign and coastwise ports, and for adequate dockage for ocean steamships, particularly for those carrying full cargoes of grain and coarse freights, both in and outward bound.

#### Many Miles of Deep Waterfront.

It means the creation of many miles of deep water front, with direct western rail connections; a general terminal system readily accessible to both rail and water and air carriers at all seasons and under varying weather, tidal and ice conditions; a land and water commercial terminal and harbor for transatlantic and domestic air borne passengers, mails and goods. Unlike a great bridge and a tunnel, which must be completed to be serviceable, each pier section made goes at once into use, one after another.

Their operation affecting the prompt and efficient transfer and warehousing of freights would release cars, ships and canal barges quickly on their arrival in port. They would relieve—indeed entirely prevent—the congestion which now causes reduced earnings, delays and serious interruptions to both freight and passenger traffic, and the dislocation of hundreds of established businesses to serve war needs.

They would insure a uniformity of cost and service to both the carrier and the patron by removing the competitive waste caused by the varying imperfect physical development of the numerous separate railroad terminals. These terminals would be free for the evolution of facilities sorely needed exclusively in the handling of increasing domestic traffic. The new harbor would not lessen their office, only relieve it and increase rail and ship earnings by reducing harbor delays.

#### Would Permit Classification.

It would permit a distinctive classification of export and coastwise freights while these latter were still in rail transit, abolishing the time and labor waste of this process when done in the cluttered and expensive operating zones adjacent to the inner harbor. It would undoubtedly attract extensive manufacturing, always seeking direct water facilities. These would bring their attendant business and their industrial and residential populations.

No other seaboard location has its strategic situation for the handling of air borne commerce. The war's cessation will open a widening era of aerial transportation. The Alps, the Caucasus, the Mediterranean, all have been flown across. Turin to London is a six hour flight. Single Italian airplanes are carrying twenty-five persons each. French Corsi-

can mails are airplane carried. Sicily's posts from Rome come in by air.

Valuable light materials of battle are air transported every day in Europe and an aerial ambulance is in service. Multi-motored planes which can lift an automobile will turn from carrying bombs to carrying express freights. Half a dozen plans are under way already for the conquest of the transatlantic air routes when the war ends. Designers in this country are preparing for the production in quantity of small business machines. Plans for a daily London-Paris express passenger air service are perfected and await only the return of peace.

#### Airplanes for Swift Transport.

The man carrying airplane has already proved a ready means of swift transport. Freight and passenger carrying airplanes are in process of practical development. As the family motor car and the motor truck followed the dangerous first racing automobiles, so the aerial transport car for passengers and for freight will come into efficient use behind the war used airplanes of the moment.

Commerce is to be no longer, therefore, a matter of ships and railways only, seeking union at deep water. From now on it includes the airplane seeking union with both ship and railway in a land and deep water harbor. This triple union is impossible elsewhere on the Atlantic seaboard with the intensive and extensive efficiency inviting in New York harbor.

With the building of the piers and the providing of their accessory facilities would come the laying out and the completion of the first aerial land and deep water harbor in the world. It would have roadways and water hangars, and landing and departure fields for the receipt of aerial mail, passenger and freight carriers. Its approach from either land or water would be without the hazards to air navigation which customarily surround a city.

A long flight in from sea above the lower bay encounters none of the topographical or floating risks that a flight to landings in the inner harbor would encounter. Were a seaplane forced to descend before reaching its sheltered area in the projected terminal it could do so with safety in the outer bay. Approach to the new terminal by land from inland would also be without the dangers incident to passing over city dwellings—dangers which must attend attempted flights to any air harbor in the upper port.

#### Air Station at Great Kills.

The best location for the aerial station would naturally be at the western end of the pier system at the Great Kills.

The site has the double advantage of being isolated enough from other modes of travel to safeguard the arrival and departure of the planes and at the same time is in sufficient proximity to the present and proposed railroad systems to facilitate easy land transport.

It is well sheltered from the elements, and the addition of protecting arms for the hydroplane bay will make it practically ideal for its purpose.

While primarily utilitarian, the elements of a new water harbor and a new air harbor can be arranged to form monumental and beautiful masses both in plan and elevation. In this advantageous location they can be developed into a crowning feature of the greatest port in the world. All may here be realized in months that elsewhere would take as many years. The location has the incalculable advantage of not jeopardizing the proper regulation of our regal Hudson.

The subsidence of the Atlantic coast, a hundred feet and probably many more, moved the mouths of all the New York and New Jersey rivers far inland from where they emptied when this continent emerged or when the ice cap whose terminal moraine now makes the sand and

gravels of Long Island started its long retreat, its three thousand mile retirement to the Arctic. Then our Hudson, fed of melting ice, ran over the verge of the continent nearly one hundred miles southeast of where Sandy Hook survives the sunken coast.

The lower bay between Staten Island and the Jersey Highlands was once a lake, and then a meadow, untouched of tide, then a marsh of salt lagoons, until the advancing ocean claimed it for its waves, but only little waves, because now its silt filled shallows lie but one to three fathoms deep. The lower bay was prepared for us through unnumbered aeons, and not only the lower but the inner bay, the North River and the majestic course of the Hudson. All the treasures washed in this and the uncounted wars of history, all the toil of the billions who have laid them down, would not suffice to carve its valley and the groovings of its hills.

#### The Hudson is Priceless.

As a convenience to modern commerce the Hudson is priceless. It is a tidal stream all the way to Troy, and drains a great watershed besides. Engineering could not make the Hudson, but it can better it mightily for commerce and navigation. In the flowing and the ebbing tides and in the drainage, seaward bound, there is perpetual motion, the perpetual energy and the perpetual engine that, harnessed scientifically, could make the river from the Narrows, past the Battery and all the way to Albany and Troy for 150 miles, a vast continental harbor with a self-maintaining channel navigable to the largest ships.

But this regulating, this harnessing, this designing for ourselves and posterity—how has it proceeded? Before the civil war, in our conception of government, the improvement of rivers and harbors was centered in the Navy Department. Such improvements related primarily to things afloat, and what more natural than that it was deemed a naval affair? What more unnatural than that after the war it should be displaced?

For generations engineers of all orders have been coming to the New York harbor and the imperial Hudson, and commissions and railroads have been nibbling the water fronts of the river. All were working outside of any comprehensive plan, without even knowledge of the science of making a harbor and regulating a tidal river in the interests of navigation.

They are not to be all lightly condemned, for no American civil engineer could gain any wide experience in the art except abroad. In America he must serve in some very subordinate position which made the vocation unattractive. Practically the book was sealed against the profession and went to the ten men or so who won highest rank in their West Point army course.

#### No Textbook on Tidal Waters.

There is yet no American textbook written or studied anywhere teaching how to handle navigable tidal waters. It all has to be learned after school. Even this illogical system, moulded on an ancient Chinese model, has developed some remarkable army engineers who have graced their calling and served their country well. But the profession did not know how to develop a tidal harbor or a tidal river in aid of navigation.

Indeed the world did not know how until within this generation in Germany, Holland and Belgium, the art was born, of which Franzius of Bremen was the Nestor. In all the United States there is not today a river which has been redeemed in the scientific method with which he moulded the bed of the Weser and directed the work of its waters to serving, not to crossing, the purposes of man.

Neither England nor France nor Italy developed tidal engineers. In Russia, even in tideless Petrograd, was the first school for such studies.

The United States, with more tidal streams and river harbor mouths than all these lands put together and with hundreds of millions of dollars of expenditure, has not one exemplar of scientific river regulation. In Australia there are several.

In 1893 there came in from the Pacific a cyclone which upon the hills of the Darling Downs back of the capital city, Brisbane, spilled nearly three feet of water in a night. The resultant flood shoaled the thirty mile tidal river approach to the city from twenty-seven feet to seven feet in a day. Such masses of silt were deposited that it took four years to dig it out.

#### River Put Into Harness.

Then the river was put into harness, an easy working harness of some sixty miles of training banks, properly located and spaced. Now the more it rains the deeper becomes the navigable way, because there are no enlargements where the silt laden stream can drop its load, which it must carry to the sand consuming sea. It does this with even running speed, not by fits and starts.

The Hudson, both sides of it, is scarred with the unrelated labors of neophytes, from old Fort Orange to the lightship off Sandy Hook.

A few reflections on river regulation founded on some basic facts may suffice for this brief review.

A tidal river bed—the Hudson trough—has three dimensions, length, width and depth, all the way from its head of navigation to the sea. The Hudson's length cannot be altered. On its western side it is bordered and hemmed by the hard volcanic dyke which begins over by the Arthur Kill on Staten Island, is cleft by the Kill van Kull, starts afresh at Bayonne, rises in the dark walls of the Palisades, makes Storm King Mountain and the Capitol Hill at Albany and runs to make the rim over which the Mohawk spills. Since pre-glacial days the river could not work west, long as its waters and its ice have rubbed the western bank.

Some rivers may have their length curtailed or augmented, but not the Hudson. If forty feet of water to Albany be held our price of admiralty, then the ruling depth for navigation must be nowhere less, and over forty feet the depth factor may not be counted. The factor, therefore, that we have to work with is width.

#### Currents Should Be Uniform.

For the right service of navigation the currents should be as uniform as it is feasible to make them—the currents due to tidal flood and ebb, and those due to the fresh water discharge of the main stream and its successive tributaries, whether they be low, normal or in freshet. If the currents be nearly uniform sand and silt eroded from the hills will not deposit.

The ebb tide reinforced by the fresh water discharge will bear them to the sea, where they will drop at last upon the ocean bar to be itself placed where the contour depths make certain that it will not lessen the ruling depth and where the least annual dredging will be required to maintain it. For accomplishing all this the element width is the key.

It is manifest next that the currents at ebb and flood in freshet and in times of normal flow should all traverse the same channel, which becoming thereby the deepest groove is the way for deep draught ships.

If then there be a civic or State pride for perfect dock locations and pier constructions on the North River fronts or for perfectly located training walls along the reaches from Forts Lee and Washington to Troy, let the Hudson be diagrammed. There will stand revealed where every engineer has sinned against the border

(Continued on following page.)