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2. COASTAL BATTERIES

Among the works commenced immediately upon the outbreak of war was the provision of accommodation for personnel at coastal batteries guarding the approaches to the Dominion's principal ports. Most of the £60,000 authorised for this purpose was spent at Motutapu, North Head, and Narrow Neck (Auckland), and at Fort Dorset and Palmer Head (Wellington). With the exception of Fort Takapuna (Narrow Neck), which was a 4" examination battery, these were all 6" counter-bombardment batteries.

By the time Japan had entered the conflict existing batteries were on a full war-time basis, and several new installations were in various stages of construction. As the possibility of an enemy attack developed, the prosecution of the work was accelerated, and, in addition to improved defences of the four main ports, a chain of batteries was installed to protect secondary ports from Whangaroa to Bluff.

In the Auckland area a big programme of work was carried out on the Whangaparaoa peninsula, where batteries of two 6" and three 9.2" guns were established. (The 6" guns came from North Head, where they were replaced with 4" ones). A second battery of three 9.2" guns was located on Waiheke Island. Further up the coast from the existing battery at North Head (Fort Cautley), a new battery comprising two 6" guns was constructed at Castor Bay.

An enemy attack on the capital would have met counter-bombardment from the existing 6" batteries at Fort Dorset and Palmer Head, augmented by smaller guns at Fort Ballance. These three fortifications were all located on Watts Peninsula, and were closely inter-related with a view to concerted defensive action. Around the coast from Makara a new twin 6" gun battery was established at Fort Opau. The construction of a three-gun 9.2" battery

on Wright's Hill, Karori, was commenced, but only two guns were eventually installed and by the time these were ready the war had ended.

The principal coastal fortification in Canterbury was a battery of two 6" guns at Godley Head, at the entrance to Lyttelton Harbour. Within the harbour mouth two 4" guns were installed at Battery Point.

To the 6" gun already in service on Taiaroa Head, a promontory on the Otago Peninsula, was added a new battery comprising two guns of similar calibre. A new two-gun 6" battery at Tomahawk, a few miles south-east of Dunedin, completed the defences of the fourth most important coastal area.

Further batteries, mostly 6", were established at strategic points in the Marlborough Sounds to deny the use of these waters to hostile shipping.

For closer defensive roles, including counter-offensive against motor torpedo boats, batteries of 6 pounder, 12 pounder, and 4" guns were mounted around the principal ports for use either in conjunction with heavier armament (some of the 4" gun sites have been mentioned in the foregoing) or on their own. Typical of these were the AMTB's at Fort Bastion and on Rangitoto Island, Auckland.

As stated, batteries of guns were also installed to defend the Dominion's secondary ports. These were either 6" or 5" Naval guns, mounted singly or in pairs. The localities concerned were Whangaroa, Bay of Islands, Great Barrier Island, Whangarei, Napier, New Plymouth, Gisborne, Wanganui, Nelson, Westport, Greymouth, Timaru, Oamaru, and Bluff.

* * * *

The construction of coastal fortifications involved very extensive programmes of building and engineering work - especially so in the case of the 9.2" guns.

Preparatory to the erection of barracks accommodation, the site would have to be levelled and drained, access roading provided, and electricity, water, and sewerage facilities supplied. The principal buildings erected comprised: sleeping quarters for officers and men; cookhouses; mess-rooms; conveniences; a hospital; various stores; offices; workshops; a garage; a recreation room; a guard room; and detention cells.

The planning of the gun emplacements and associated engineering structures was carried out by Army Headquarters Fortifications and Works Directorate. Officers of the Public Works Department in conjunction with Army prepared the constructional designs, based generally on information received from the British War Office. The actual pin pointing of the gun positions was also attended to by Army.

The main departure from customary British practice in respect of guns of similar calibre was the method of protection evolved by New Zealand engineers. Instead of thick, heavily-reinforced concrete covers being placed over magazines, engine room, etc., these chambers were built underground, the whole system being designed to provide a minimum of 30 feet of rock cover over the roofs, thus effecting full protection against direct hits from bombs capable of being dropped by carrier aircraft. Each battery of 9.2" guns consisted of three gun emplacements, these and the underground chambers being interconnected by underground access tunnels with the same margin of protection.

The chief advantages of the self-contained underground system were : (1) quick and safe manning, (2) easy replacement of casualties during an action, (3) non-vulnerability of power unit and cables, and (4) greatly facilitated camouflage.

The design of a 9.2" battery called for, in the first

instance, a complete contour survey of the site. From these contours the underground chambers would be located. In designing the tunnels the type of country to be excavated had to be taken into account. The rock at most sites was a weathered greywacke. Before choosing a tunnel section it was logical to see what sections had proved satisfactory in this type of tunnel. Tawa Flat railway tunnel was the obvious one to be examined for this purpose, as it met requirements in regard to dimensions for the main chambers. It was finally adopted. A typical horse-shoe section was adopted for the smaller access tunnels.

At one of the Auckland batteries a large quantity of water was encountered in the underground system. This entailed the designing of an elaborate porous drainage system behind the concrete lining, the water being finally discharged from drains under the floors of the access tunnels.

An interesting feature of the underground design was the manner in which blast in the access tunnels was dealt with. This was done by making several right angled branches in the tunnel, thus dissipating the blast wave before it could reach the vital parts of underground chambers, such as the magazines.

When determining the location of tunnels, every consideration had to be given to difficulties likely to be met in the course of construction. As the access tunnels were not large enough for machinery to be taken in for the excavation of the main chambers, additional drives were provided to give direct access to the main chambers. These were later back filled.

The gun emplacements were constructed in reinforced concrete, with heavily reinforced slabs over the shell recesses to give protection. The foundations for each gun consisted of a circular slab some 6 feet deep and

30 feet in diameter, heavily reinforced. Into this were embedded 52 holding-down bolts of 2½ inch diameter.

The construction of one 9.2" battery alone involved the excavation and lining (with concrete) of : about 350 feet of tunnelling of the size of the Tawa Flat railway tunnel; 2,000 feet of access tunnelling (equivalent to 500 feet of standard railway tunnel); and some 200 feet of shaft. The emplacements entailed the placing of approximately 2,000 cubic yards of concrete.

Power for loading, elevating, and traversing the guns was supplied by two 120 KW 220 volt DC generators, driven by two 180 HP Diesel engines. A 24 KW auxiliary set took care of lighting, ventilation, etc. These power units were housed in a centrally situated, underground engine room.

Fire control instruments were accommodated in an underground battery plotting room (BPR), located in the battery system. Each gun had an underground magazine attached, also a pump chamber for the hydraulic equipment used for operating the guns.

Each 9.2" gun weighed 100 tons, the heaviest part being the barrel (28 tons). To enable such weighty equipment to be installed it was necessary to design a 30 ton travelling gantry and runway. Ammunition was conveyed from the magazine direct to a trolley by means of a power driven hoist. The trolley travelled on rails around the gun pit and delivered the shell to the hydraulically operated hoist in the mounting, which carried it to the breach.

* * *

The foregoing notes relate to the 9.2" batteries. New underground control systems were also excavated at the sites of some of the 6" batteries guarding the principal ports. The extent of this will be touched on in the story of each work.

The smaller gun emplacements presented no major engineering problems. Construction was in steel and reinforced concrete, splinter-proof protection only being required, as well as adequate provision for camouflage.

1. Name of Work: Coastal Battery, Whangaroa.

2. Locality: On the southern headland overlooking the entrance to Whangaroa Harbour.

3. Nature of Work: Construction of a 6" gun emplacement, etc. and provision of accommodation for personnel.

4. References: File: 23/646 Map: 1/A4

5. History: In March, 1942, Army authorised the construction of an emplacement for a 6" Naval gun at Whangaroa, complete with ammunition recesses, a battery observation post, a magazine, war shelters, and accommodation for troops - largely in the form of portable huts.

The site selected for the gun was extremely difficult of access. All materials had to be brought by road to Whangaroa, thence by barge down the harbour to the site near the heads, where they were landed on the beach and transported to the scene of the work by truck and sledge. No road access was provided.

A contracting firm engaged on bridge erection in North Auckland was diverted to Whangaroa, and a series of contracts let for the gun emplacement and associated work, including a landing jetty. The usual troop accommodation was provided, viz: huts for sleeping quarters, ablutions and showers, an officers' mess, and a combined cookhouse and mess - all of temporary (phase one) standard. A septic tank was installed. Owing to an acute shortage of overhead line material, a generating plant for electricity was installed as an alternative to connecting the establishment with the existing power lines.

The project was completed in August, 1943, at a cost of £7,659. It remained in use by Army only until the ensuing November.

1. Name of Work: Coastal Battery, Moturoa Island.

2. Locality: Bay of Islands.

3. Nature of Work: Construction of two 6" gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/599 Map: 1/A5

5. History: On 9 January, 1942, War Cabinet authorised the establishment of two 6" Naval gun batteries in the Bay of Islands area, one of which (a double gun emplacement) was located on Moturoa Island. This was required complete with war shelters, magazines, command posts, stores, regimental aid posts, and battery observation posts, together with the usual hutted type of accommodation for troops. Officers were quartered in new houses built to resemble authentic seaside cottages.

All materials had to be assembled at Opua or Paihia, transported by barge to the island, and then carted by truck from the beach to the site of the work.

A contract for the gun emplacements was let in January, 1942, the same firm later being awarded further contracts for the remainder of the work, including the battery observation posts, a septic tank, and a water tank (all in concrete), also the troops' quarters (cookhouse, mess-rooms, ablutions, officers' quarters, recreation rooms, and a store). These were followed by contracts for searchlight emplacements and engine rooms, the ammunition recesses and overhead covers, magazines, and the command posts.

Plant for the purpose of generating electricity was supplied by the Public Works Department, a proposal to connect the establishment with the existing power system being ruled out on account of shortage of overhead line equipment. Water was obtained by boring wells.

To facilitate handling material for the work, a landing jetty was built at the island. A new road was

Coastal Battery, Moturoa Island (Cont'd).

formed from this jetty to the site of the work at the other end of the island.

The project was completed in January, 1943, at a cost of £27,014. It remained in use by Army only until November of that year.

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1. Name of Work: Coastal Battery, Waitata Point.
2. Locality: Near Russell.
3. Nature of Work: Construction of two 6" gun emplacements, etc. and provision of accommodation for personnel.
4. References: File: 23/599 Map: 1/A6
5. History: The second 6" battery in the Bay of Islands was located at Waitata Point, about a mile from Russell. Here again all materials were brought by barge from Opua or Paihia across the harbour to Russell, and then carted by truck to the site. At the site materials had to be taken down a steep hillside.

Technical requirements in respect of this battery - also a twin gun one - were identical to the battery at Moturoa Island.

Practically all the work was carried out by the same contracting firm : firstly, the gun emplacements, then the accommodation buildings, battery observation posts, septic tank, and water tank, and finally the ammunition recesses and overhead covers, together with searchlight emplacements and engine rooms.

The work was completed in September, 1943, at a cost of £19,493, the battery remaining in service until the following November.

1. Name of Work: Coastal Battery, Whangarei.

2. Locality: North-west of Bream Head, overlooking the entrance to Whangarei Harbour.

3. Nature of Work: Construction of a 5" gun emplacement, etc. and provision of accommodation for personnel.

4. References: File: 23/644 Map: 1/A17

5. History: The construction of a 5" gun emplacement and associated services and buildings for the purpose of protecting Whangarei Harbour was commenced in June, 1942. The site was located about 30 miles from Whangarei, with access by road or, alternatively, across the harbour. A short length of new roading was formed.

A contract for the gun emplacement, battery observation post, engine room, and reservoir (all of concrete construction) was let in July, 1942. The same contractor also carried out the erection of buildings to accommodate troops.

Owing to the limited supply of 5" ammunition available, the usual magazine was dispensed with in this instance.

Electric power was provided by the installation of generating plant.

The work was completed in November, 1942, the expenditure totalling £9,282. As in the case of the other North Auckland gun emplacements, the battery remained in service until about November, 1943.

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1. Name of Work: Coastal Batteries, Whangaparaoa.

2. Locality: At the extreme eastern end of the Whangaparaoa peninsula, approximately 30 miles by road from Auckland, and overlooking the whole of the Hauraki Gulf from Great Barrier Island through to Rangitoto.

3. Nature of Work: Development of a fortification area, including the installation of gun emplacements and

the provision of accommodation for personnel.

4. References: File: 23/525 & 23/700/1 Map: 2/A3

5. History: The defence work carried out for Army at Whangaparaoa fell generally under two headings, viz: (a) the installation of two 6" Naval guns, and (b) the installation of a battery of three 9.2" guns.

The greater part of the earlier project, authorised in October, 1940, was undertaken by contract, and consisted chiefly of a camp for the battery personnel (19 buildings), and the gun emplacements, complete with battery observation post, control posts, etc. Before contracts could be let, however, the Department had to form a road to the area over very hilly country, to enable materials to be delivered by road (a 30 mile trip from Auckland) as well as by sea; to clear the camp site; and to provide access to the gun sites. The principal buildings were large dormitories, a combined mess and kitchen, officers' quarters, an orderly room, a ration store, and a recreation hut. Construction throughout was in timber frame, with wooden or concrete flooring, weatherboards on exterior walls, plaster core wallboard linings, and asbestos cement roofs.

The supply and reticulation of electric power was a major undertaking, as it had to be brought more than 11 miles from Silverdale, the last mile going underground. Water was provided from bores, plus the rainwater catchment from the roofs of the camp buildings. Water from both these sources was pumped up to a reservoir of 80,000 gallons capacity, built on high ground above the camp, and it was then gravity fed as required.

At about this time a camp for fortress troops was also completed:

* *

The construction of the three 9.2" gun battery was

carried out by the Department with its own forces. A camp for 180 workmen was established. Access roading was extended from the 6" battery to the site of the new work, and to Shakespeare Bay, where a breastwork was being erected to facilitate the unloading of metal and supplies from barges.

The design of the battery called for the construction in reinforced concrete of massive gun pits and large underground chambers for magazines, plotting rooms, engine room, and oil stores. These chambers were connected by tunnels and stairways, with sufficient overhead earth cover to ensure protection from bombs or shells. War shelters, also in reinforced concrete, were erected on the surface, together with a miniature range, workshops, and a building for training personnel.

The installation of the guns was undertaken by Army, but associated work such as gun platforms, gantry sections, cable racks, electrical services, etc. remained the responsibility of the Public Works Department. Water supply was arranged by the sinking of five bores and the construction, below ground level, of an 80,000 gallon reservoir.

A total quantity of 9,100 cubic yards of concrete was placed underground. The length of tunnelling excavated aggregated 1,924 feet, and the stairways 616 feet. The floor area of the chambers totalled 11,300 square feet. All concrete was pumped into position. Porous drains were placed behind the tunnel linings, so that conditions underground were entirely free from dampness.

The bulk of the work on the 9.2" battery, including the stairways, was completed within 12 months.

The total cost of all work carried out for Army at Whangaparaoa amounted to £339,831, of which something

GUN PIT UNDER CONSTRUCTION

ARRAY

MAIN TUNNEL TO NO. 3 GUN

COASTAL BATTERY, WHANGAPARAOA
AUCKLAND.

like £200,000 related to the 9.2" battery. It extended over a period from November, 1940 to March, 1944.

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Associated with the Whangaparaoa defence area was the construction of a fortress observation post on Tiritiri Island (references: file: 23/471 Map: 2/44) This was built on the eastern side of the island in the latter half of 1941 at a cost of about £1,500.

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1. Name of Work: Coastal Battery, Waiheke Island.
2. Locality: On the north-eastern side of Waiheke Island, in the Hauraki Gulf, commanding an area from Great Barrier Island to the Coromandel Peninsula.
3. Nature of Work: Construction of three 9.2" gun emplacements, etc. to complete the coastal defence of Auckland from the sea.
4. References: File: 23/826 & 23/700/4 Map: 2/45
5. History: The second 9.2" gun battery for the port of Auckland was located on Waiheke Island, close to Man-o-War Bay, on an area of grazing land not served by roads, wharves, or any other facilities.

The Department commenced operations by building a depot, a camp and a wharf (3,500 square feet) at Man-o-War Bay and by constructing six miles of road to the site, which was situated at an elevation of 400 feet.

The main camp, covering a total floor space of 10,000 square feet, was erected in the fortress area to accommodate 200 men. This was later taken over by Army.

All materials and supplies for the project were barged from Auckland, a distance of 28 miles. This entailed transportation to the wharf at Auckland, towing to Waiheke Island, unloading, and then a haulage uphill of three miles. Weather frequently interrupted the work and,

Coastal Battery, Waiheke Island (Cont'd).

in general, transport was a major problem. With the exception of concrete aggregate and road metal, all materials had to be carried on barges, the use of larger craft being ruled out on account of the small depth of water available at Man-o-War Bay.

Concrete aggregate was crushed on the site from natural basalt and andecite boulders which lay thickly on the surface of the country. As soon as concrete pumps, concrete mixers, crushers, and other plant items had been assembled and were in operation, a start was made on the concreting of the tunnels and chambers. Both the concreting and the tunnelling were done by co-operative contract. Good progress was made and a high standard of work maintained, although obsolete machinery and plant proved a big handicap. Considerable difficulty was also experienced at one stage in obtaining tunnel timber and this almost brought the work to a standstill, which would have been serious as at that time approximately 200 men were employed.

The fortress layout included the construction of three 9.2" gun emplacements connected by 3,000 feet of tunnels and stairways to three magazines, a plotting room, an engine room, three gun stores, three oil stores and three lavatories, of a total floor area of 11,300 square feet, all located underground. Porous drains were built behind the concrete lining and the chambers and tunnels were generally very dry in spite of the saturated formation. The concrete placed by pumps totalled 9,500 cubic yards.

For the water supply, 12 bores were sunk and an 80,000 gallon reservoir constructed underground. Water mains aggregated 8,000 feet. The sewerage scheme included six septic tanks and 3,000 feet of sewers.

Work was commenced in October, 1942, and completed

COASTAL BATTERY, WAIHEKE IS[illegible] AUCKLAND.

TOP LEFT: *Tunnel entrance to gun pit.* RIGHT: *Entrance to mu[illegible], showing timber and concrete construction.* LOWER LEFT: *The magazine.* RIGHT: *[illegible] materials to the Island.*

in October, 1944, after some delay owing to the transfer of most of the staff to the Karapiro hydro-electric scheme.

The total cost of the project was £316,815.

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1. Name of Work: Fort Cautley, North Head.
2. Locality: On a hill at the north-eastern extremity of Devonport, commanding the Rangitoto Channel and the entrance to the Waitemata Harbour.
3. Nature of Work: Development of an existing Coastal fortification from a peace-time to a war basis.
4. References: File: 23/74 Map: 3/A9
5. History: Fort Cautley, similarly to Fort Takapuna, was already a well established fort at the outbreak of war, containing two 6" Naval guns. These were later removed to Whangaparaoa and two 4" guns mounted in their place.

A few permanent buildings were on the site in September, 1939, but an extensive programme of work was necessary in order to bring the fort up to a full war-time footing. Owing to the steep nature of the hill, it was most difficult to find suitable building sites; standard plans of buildings could not be used and in the main a smaller type of building had to be designed to fit into the contours of the hill. Even then, some fairly extensive excavations had to be made. Roading was also somewhat of a problem, and one or two hairpin bends had to be constructed. The principal new buildings were placed near the bottom of the hill on comparatively easy slopes, but this meant that the men had a long climb up to their respective stations.

Work was commenced at Fort Cautley in September, 1939, and completed in April, 1940. Altogether 36 new buildings were erected - messes, stores, dormitories, a

cinema, a recreation hut, an administration building, etc. while fairly extensive alterations were carried out to existing structures.

Twelve-pounder and 6-pounder guns to protect the harbour entrance were also installed at North Head.

The total cost of the work was £66,410.

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1. Name of Work: Coastal Battery and District School of Instruction, Narrow Neck.
2. Locality: On the waterfront between Cheltenham and Narrow Neck beaches, overlooking the Rangitoto Channel.
3. Nature of Work: The development of the Fort Takapuna (4" Battery) to a war-time basis and the establishment of a district school for the training of officers and NCO'S.
4. References: File: 23/119 & 23/148 Map: 3/A7
5. History: Narrow Neck Camp had been constructed for World War I and during the years 1918 to 1939 various buildings had been added; consequently, the nucleus of the camp was well established. Two new permanent buildings, the officers' mess and the men's mess, had been started just prior to September, 1939.

This camp was divided into two areas, Fort Takapuna, comprising two 4" guns and searchlights, and the district school. Work on the development of these two areas commenced in September, 1939, and was carried out on a 'cost-plus' basis, as also were the two buildings mentioned above. The principal structures erected included a sizeable hospital, a canteen and cinema, recreation huts, stores, mess buildings, and dormitories. Altogether, a total of 48 new buildings was erected, the cost, including the formation of roads, parade grounds, etc. amounting to £131,231 in respect of the school of instruction and

COASTAL BATTERY AND DISTRICT SCHOOL OF INSTRUCTION,
NARROW NECK, AUCKLAND.

COASTAL BATTERY, NORTH HEAD (FORT CAUTLEY), AUCKLAND.
(Note Anti-Submarine boom in left foreground).

Coastal Battery & District School of Instruction, Narrow Neck (Cont'd).

£7,699 in respect of the fort.

The work was completed in February, 1941.

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1. Name of Work: Coastal Battery, Motutapu Island.
2. Locality: An island in the Hauraki Gulf.
3. Nature of Work: Development from a peace-time coastal defence station to a fully manned war establishment.
4. References: File: 23/413 Map: 3/A2
5. History: Prior to the war a three-gun 6" battery had been established on Motutapu on the north-western side of the island, and permanent buildings, comprising officers' quarters, cookhouse and mess, store and latrine, built at Administration Bay.

Immediately upon the outbreak of hostilities, steps were taken to build the battery up to a full war-time basis. A complete battery camp was established at Administration Bay, comprising 19 new buildings, while an additional 40-men dormitory was erected up the hill, close to the guns.

All materials for the project had to be transported by barges to Home Bay on the eastern side of the island and then taken across to the camp site, using roads which at first were merely farm tracks. These were improved and metalled. Existing landing facilities were also fairly crude, but a new reinforced concrete wharf with a crane was soon constructed.

In addition to the camp for the 6" coastal battery, camps were erected for a howitzer battery and for fortress troops, whose duty was to guard the island against invasion. Another big undertaking was the underground fortress plotting room, 90 feet by 30 feet, which was constructed in heavy reinforced concrete and contained 300 feet of tunnel access.

Coastal Battery, Motutapu Island (Cont'd).

The camp for fortress troops was located in a U shaped valley. Specially built wooden dugouts were pocketed into the side of the hill in two terraces and were overfilled with spoil and turfed. However, these dugouts, while providing good camouflage, were most unsatisfactory, being very dark and unsanitary. Moreover, they were expensive, owing to the heavy construction required to withstand the weight of earth over them.

Water supply was provided by four bores and a gravity fill dam, with mains laid to the battery position and to the barracks.

A public works camp was erected at Administration Bay at the commencement of the work and kept there throughout the period of construction to take care of maintenance work, roading, water supply, and drainage, etc.

Of the numerous roads formed and metalled, a new one, seven miles in length, connected the adjoining Rangitoto Island (by means of a causeway) with the battery on Motutapu Island and then on to the searchlights at Billy Goat Point, at the northern end of the latter island.

The causeway, 16 feet wide and about seven chains long, linked the two islands across a narrow tidal channel. It was constructed of scoria and stone, with a short span of bridging near the Rangitoto end for the tide to run through.

The whole of the work carried out for Army on Motutapu Island during the war cost £152,478 and involved the excavation of 100,000 cubic yards of material and 900 cubic yards of concreting. It was carried out between October, 1939, and June, 1943.

The provision of magazines on the island for the US Forces is described in Part 5.

TOP: MOTUTAPU ISLAND LOWER: CASTOR BAY, THE SITES OF FURTHER COASTAL BATTERIES IN THE AUCKLAND AREA.

1. Name of Work: Coastal Battery, Castor Bay.

2. Locality: On the coast of the Hauraki Gulf, approximately five miles north of the Narrow Neck battery.

3. Nature of Work: Construction of two 6" gun emplacements, etc., thus forming with Motutapu and Whangaparaoa a triangle of 6" batteries for guarding the approaches to Auckland.

4. References: File: 23/411 Map: 3/A1

5. History: The site selected for the installation of these guns was near the cliff face overlooking the gulf.

The ground behind the gun sites sloped back towards the road, where an area was chosen for the erection of camp buildings. Originally the camp was designed on the lines of a peace-time housing scheme, with the buildings conforming on natural contours, seeing that this was a closely settled residential district. The Army authorities, however, decided on a lay-out consisting of two orderly rows of buildings, which entailed extensive excavation of the site and also made the camp difficult to camouflage.

A road was constructed through the centre of the camp site, with the buildings located on the slopes on either side. Advantage was taken of these slopes by providing under the buildings basement space for use as ablutions, latrines, laundries, etc.

Water for the camp was supplied by a bore from which good water was obtained, even though it was within 100 yards of the sea. An 80,000 gallon reservoir was constructed on a high level and gave a gravity flow to the buildings.

A large septic tank was installed at a low level below the buildings. This necessitated a tunnel being driven through the cliffs, to permit discharge into the sea below high water mark. Altogether 2,550 feet of

Coastal Battery, Castor Bay (Cont'd).

sewers were installed.

Although carried out (by contract) under adverse weather conditions, and despite many constructional problems, the work at Castor Bay was completed right on schedule, at a cost of £72,609.

The project commenced in April, 1941, and finished in May, 1942.

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1. Name of Work: Coastal Battery, Fort Bastion.
2. Locality: Point Bastion, overlooking the entrance to the Waitemata Harbour.
3. Nature of Work: Construction of gun emplacements, etc.
4. References: File: 23/8 Map: 3/A10
5. History: Immediately after Japan had entered the war the emplacement of two 12-pounder guns, to cover the southern portion of the Naval boom at Point Bastion, was authorised, the work being carried out by Army. Overhead protection was provided by the Public Works Department in July, 1942.

During 1943 further work was undertaken by the Department in connection with the installation of 6-pounder twin anti-motor torpedo boat equipment. This comprised constructing a gun emplacement and surrounds, a director tower, searchlight emplacements, and an engine room, together with access paths, fencing, and other associated services.

The total expenditure incurred by the Department at Fort Bastion during the war amounted to £6,760.

COASTAL BATTERY, FORT BASTION, AUCKLAND.

TOP LEFT: Searchlight Emplacement RIGHT: Protection Structure around 6 Pounder Gun LOWER: A comprehensive view of the fort, showing the Savage Memorial in the far background and the Harbour Boom on the left

1. Name of Work: Fortress Observation Post, Rangitoto Island.

2. Locality: A volcanic cone situated north-east of Devonport.

3. Nature of Work: Provision of a camp for personnel manning the Fortress Observation Post on top of Rangitoto.

4. References: File: 23/722/2 Map: 3/A3

5. History: As Rangitoto Island was composed of sharp, volcanic scoria the first problem encountered was to find a suitable camp site in a sheltered position. This was eventually decided upon and the camp erected after numerous transport difficulties. The provision of a water supply for the camp was a troublesome question. A bore had been put down and a small quantity of water located, but the bore was eventually abandoned on account of the porous nature of the scoria. Finally, a 10,000 gallon reservoir was constructed to hold roof water but as the roof catchment area proved too small water had to be transported from Auckland on many occasions during dry summer spells.

The erection of the observation post itself presented a major constructional problem owing to the extreme inaccessibility of the site. All materials had to be hauled up to the top of the cone by a winch.

Work at Rangitoto Island was carried out between October, 1939, and April, 1942, and cost a total of £37,529.

1. Name of Work: Coastal Battery, Gisborne.

2. Locality: Kaiti Hill, about one mile south of Gisborne.

3. Nature of Work: Construction of a 5" gun emplacement, etc. and provision of accommodation for personnel.

4. References: File: 23/649 Map: 5/A4

5. History: The emplacement of a 5" Naval gun on a site selected by Army on Kaiti Hill, Gisborne, was authorised in April, 1942. The work consisted of the emplacement, a command post, war shelters, a magazine, and an overhead gun cover. These were mainly of concrete construction.

The usual accommodation for Army personnel was erected, comprising eight buildings of a total floor area of 4,480 square feet.

Access to the site was provided by the formation and metalling of 1 3/4 miles of road.

Water and electricity were supplied by connecting up with existing mains.

The work was carried out by master schedule contracts. It was completed in January, 1943, at a cost of £8,481.

1. Name of Work: Coastal Battery, Napier.

2. Location: Bluff Hill.

3. Nature of Work: Construction of two 6" gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/648 Map: 5/A6

5. History: In April, 1942, instructions were issued to proceed with the construction of two 6" P 111 gun emplacements of the Colchester design on Bluff Hill, Napier. The work included, in addition to the emplacements, a war shelter, a battery observation post, a magazine, and shell and cartridge racks, a number of buildings such as a kitchen, mess-room, latrines, ablutions, showers, drying-rooms, laundry, etc., also an equipment store and sleeping quarters.

The bulk of the work was carried out by contract under the master schedule system.

The site of the emplacements was on top of Bluff Hill, at an elevation of 336 feet. This, from the tactical point-of-view was satisfactory, but some doubts were raised as to the advisability of placing big guns on a limestone hill which had been considerably fractured during the 1931 earthquake and would perhaps be subject to fresh disturbance during firing operations. However, as the guns were intended for a minor defence role only and no suitable alternative site was available, Army headquarters in June, 1942, confirmed the original location.

Road access had to be provided, and water, electricity and drainage installed.

The whole of the work was completed on 18 December, 1942, at a total cost of £8,447.

COASTAL BATTERIES GUARDING SECONDARY PORTS

TOP LEFT: NAPIER
TOP RIGHT: GISBORNE
LOWER LEFT: WANGANUI
LOWER RIGHT: BLUFF

1. Name of Work: Coastal Battery, New Plymouth.

2. Locality: At the Moturoa end of New Plymouth, overlooking the breakwater and wharves.

3. Nature of Work: Construction of gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/650 Map: 4/A1.

5. History: The construction of emplacements for a two-gun 6" battery for the defence of the port of New Plymouth was authorised in April, 1942. A site at Fitzroy was considered at first, but the final choice fell on the Moturoa locality, at the other end of the borough.

Before the work commenced, however, Army decided to allocate two 155 m.m. guns to New Plymouth in lieu of the 6" battery, and, as these were a mobile type, they were installed in open pits. A timber observation post was erected, and, in a hollow behind this, a camp for the battery personnel was built to simulate a housing development area. Each gun pit had a magazine for shells. A main reserve magazine was also provided.

The dead area seawards of Paritutu (500 feet) was to be covered by 18-pounder field guns.

A master schedule contract was let for all buildings required, the remainder of the work, including excavation, roading, drainage, water supply, sewerage, etc. being carried out by the Department with some assistance from local Army units.

The project was completed in May, 1943, at a cost of £12,595.

1. Name of Work: Coastal Battery, Wanganui.
2. Locality: Languard Bluff, near the mouth of the Wanganui River.
3. Nature of Work: Construction of a 5" gun emplacement, etc. and provision of accommodation for personnel.
4. References: File: 23/651 Map: 4/A10
5. History: In April, 1942, instructions were received to construct an emplacement for a 5" Naval gun together with a battery observation post, a magazine, and a camp for artillery men.

The site, which commanded from high ground the sea approaches to Wanganui, was chosen by the military authorities. Construction of the emplacement and associated works was supervised by the Public Works Department, the actual building work being carried out by local contractors.

The land on which the gun emplacement and observation post were situated was a recreation reserve, while the camp site for the gun crew and the water supply were located on harbour board ground.

The work was commenced in June, 1942, and completed in March, 1943, at a cost of £3,950.

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1. Name of Work: Fort Opau.
2. Locality: About one mile south-west of Ohariu Bay, Wellington.
3. Nature of Work: Construction of two 6" gun emplacements, etc. and provision of accommodation for personnel.
4. References: File: 23/565 Map: 7/A9
5. History: The site for this fortification, at the top of a cliff about 600 feet high, had been selected some years previously, but it was not until April, 1941, that the commencement of the work was authorised.

A road to the site had firstly to be formed and

metalled, comprising two miles of heavy sidling and including the straightening and widening of 50 chains of existing track.

An attempt was made to design barrack accommodation in buildings dispersed in a steep, bushy gulley behind the battery site, but as the number of men to be catered for became larger than originally anticipated it was finally decided to form a headquarters and barracks area by filling in a gully about 20 chains back from the cliff face. This entailed the excavation of some 10,000 cubic yards of soft rock.

Excavations for the gun emplacements began as soon as plant could be brought to the scene of the work. A contract for the construction of the emplacements, in concrete, was let on 7 November 1941, and the guns were mounted and proofed by the following February. In the meantime, temporary accommodation for the gun crews and a temporary war shelter had been provided, along with other preliminary works, while a contract had been let for one of the barracks buildings.

It was at first intended that the battery would be serviced by an underground magazine, a war shelter, approaches, etc., but in February, 1942, Army cancelled this proposal. Searchlight emplacements were dispensed with in favour of a radar station.

The camp buildings erected included an orderly room and store, officers' quarters, NCO's quarters, four barracks, a combined mess, a recreation room, a hospital, an engine room, a drying room, and ablutions and latrines. These covered a total floor area of 22,550 square feet. They were erected by contract, and occupied by Army personnel as they became available. All excavations, roading, the construction of a 30,000 gallon reservoir, overhead cover for the guns, the provision of water

supply and drainage, and other work of a temporary nature were undertaken by the Department with its own forces. Departmental workmen also assisted the contractor for the gun emplacements.

Water supply was rather a problem, having to be carted to the site during construction and in the early period of Army's occupation. After a thorough investigation of all possible surface and spring sources within a reasonable distance of the camp, it was decided to take the supply from a permanent stream flowing into the sea about 70 chains south of the camp. Water was pumped against a static head of 650 feet to a 30,000 gallon reinforced concrete reservoir, from which it gravitated to the camp reticulation and fire service.

Sewage was treated in a septic tank, the effluent from which was discharged over the cliff well clear of the camp and battery sites.

The total cost of the work was £76,199.

FORT OPAU, WELLINGTON.

1. Name of Work: Coastal Battery, Wright's Hill, Karori.

2. Locality: Wright's Hill, Karori, a western suburb of Wellington.

3. Nature of Work: Construction of a three-gun heavy battery of 9.2 inch calibre, with all necessary buildings, underground chambers, and inter-connecting galleries for the operation of the battery; also access roads to the site and accommodation for personnel.

4. References: File: 23/700/2 Map: 8/A9

5. History: The site for a long range battery to protect Wellington city and environs from enemy Naval attack was selected as early as 1935, but it was not until March, 1942, that authority was received to proceed with the work. Following an extensive engineering survey a report and estimate was submitted to Army Headquarters in July, 1942, and while this was under consideration a start was made on the roading required and on the erection of camp accommodation. By October, 1942, construction was being pushed ahead with top priority. Towards the end of the following year, however, when the situation in the Pacific had greatly improved, the priority accorded the project lapsed and its completion was carried out in a more leisurely fashion. Indeed, the war had ended before the guns were first capable of being fired.

For the purposes of this History the project may be divided into four phases, namely :

1. Preliminary work.
2. Underground work.
3. Gun emplacements.
4. Ancillary works.

These are described hereunder.

(1) Preliminary Work: An access road to the fortress and barrack areas from the end of Campbell Street, Karori, was located, formed, and metalled. It was 1½ miles in

length, 16 feet wide, and passed over difficult terrain, the total rise from Campbell Street to the fortress area being 600 feet. This work was carried out entirely by the Department at a cost of £18,300.

It is estimated that 50,000 tons of material were carted up this road during the heavy construction period.

A camp to accommodate 160 men was erected at the end of Campbell Street, adjacent to the Wellington city waterworks reserve. It consisted of 80 two-men huts, a kitchen, dining-room, recreation-room, and the usual amenities, and cost £13,050. It was occupied in the first place by departmental workmen, then co-jointly by the workmen and Army personnel engaged on installation, and finally transferred to Army. All the buildings were made of pre-fabricated parts, assembled by the Department on the site, and erected by a firm of contractors.

A two-inch water main was laid from Messines Road reservoir to serve the Campbell Street camp, and another two-inch main was run from the city council high level reservoir at the end of Verviers Street to the fortress area. Water was pumped under a static head of 273 feet through this latter main from the reservoir to holding tanks at various parts of the fortress area. The water reticulation throughout the underground galleries and chambers and to the gun emplacements, workshop, and miniature range was finally connected to the main system of holding tanks.

At the end of the access road a barrack area was formed, the earthwork involved amounting to 75,000 cubic yards. The area was levelled, graded, and made ready for building operations, when, owing to the urgency of the work falling off, Army decided to occupy the Campbell Street camp, which was already well established. Preparation work on this area was carried out by the

Department at a cost of £19,000.

In addition to the foregoing works, access tracks were constructed to the three gun emplacements, the battery observation post, and to the various tunnel portals.

(2) Underground Work: This was commenced in November, 1942, by a firm of engineering contractors, which executed all the tunnelling, concrete lining, and some incidental work in connection with the partitioning and fitting out of the chambers and galleries.

The underground work consisted of the following :-

(a) Three magazines, 68 feet by 22.5 feet by 12.5 feet (centre arch), with shafts for ammunition hoists to gun pits.

(b) Engine-room, 51 feet by 25.5 feet by 16 feet (centre arch), with exhaust chamber 21.5 feet by 10.5 feet by 12 feet (centre arch), together with two exhaust tunnels and shafts, and a main air ventilating shaft.

(c) Oil store, 16 feet by 10.5 feet by 10 feet (centre arch).

(d) Fortress and battery plotting rooms, 51 feet by 22.5 feet by 12.5 feet (centre arch), with anteroom 18.5 feet by 10 feet by 12 feet (centre arch).

(e) Three gun stores, 20 feet by 10.5 feet by 10 feet (centre arch).

(f) Command post, 11 feet by 10.5 feet by 10 feet (centre arch).

(g) Stairways and landings to three gun pits, pump chambers, and the battery observation post. The section measured 6.5 feet wide with an 8 foot centre arch, the total length thus constructed being 425 feet.

(h) Interconnecting tunnels or galleries, 6.5 feet

Coastal Battery, Karori (Cont'd).

with an 8 foot centre arch, the total length constructed being 2,030 feet.

Connected with all these measures was the fitting out and servicing necessary to the full and complete operation of the battery. It actually comprised 40% of the underground work, including building cartridge stores and erecting stands for cartridge cases within the three magazines; erecting monorails in the shell stores and ammunition hoists in the shafts to the gun pits; lining the walls, arch, and brick partitions, surfacing the floors in the fortress and battery plotting rooms, and setting-up its independent air conditioning installation; brick partition walls between gun stores and tunnels; lining the walls and arch in the command post.

Work in the engine-room comprised the following : erecting steel bulkhead separating the main engine-room from the exhaust chamber; setting down, with cork insulation, two main engine-beds for driving two 120 KW DC generators, and one auxiliary engine-bed for driving one 24 KW DC generator; setting up engine-room and workshop gantry rails in arch, brick partition wall dividing the engine-room from the workshop; and the air conditioning installation.

Work in the oil store consisted of installing the tanks.

In the tunnels and galleries cable racks were set up along the walls; a two inch water main was carried throughout the system; a complete drainage and sub-drainage system was constructed; oil lines to a central fuelling point were installed; electric lighting and power were carried to all parts of the underground chambers; and draught proof doors were placed at all five underground entrances.

Approximately 90% of this work was carried out by

the contractor, and 10% by departmental workmen, together with some assistance, and under the direction of, an Army Repository Unit.

Towards the latter stages, much trouble was caused by water seepage through the concrete lining in the chambers and tunnels impeding the installation work. Owing to the elevated locality of the fortress, the possibility of this predicament was not considered at the outset, and even during the driving of the tunnels (which took place in the summer of 1942-43), the country appeared comparatively dry. The matter was finally cleaned up by chasing the joints and leading the water to the underground drainage system, but not without loss of time, trouble, and expense.

The air-conditioning installations in the engine-room and plotting rooms were found to be unsuccessful, and after a period of trial and research were replaced by a more elaborate system (as mentioned later herein).

The magnitude of the underground work may be gauged from the following figures:-

Excavation	:	12,200 cubic yards
Concrete	:	3,800 " "

The contractor completed his work on 30 June 1944, and the departmental workmen at the end of 1945.

The total cost was made up as follows:-

Contract	£89,580
PWD	17,420
Total	£107,000

(3) Gun Emplacements: This work consisted of the excavation and concreting entailed in the formation and construction of three gun emplacements and pump chambers, together with all incidentals connected with the installation of two pieces of 9.2 inch calibre.

The excavation, comprising three circular pits of

56 feet diameter, and varying in depth from 16½ feet in the centre to 11½ feet at the outside, together with the excavation for a pump chamber at each emplacement of dimensions 26 feet by 17 feet by 17½ feet deep, was carried out by the Department.

On 13 April 1943 a contract for the concrete work in the gun pits and pump chambers was let to the tunnelling contractors, and completed by them in December of the same year. At this stage the contractors were short of labour, and assistance was given to them by the Department by way of men and machines. Excellent progress was made in spite of the elevated situation (1,050 feet above sea-level) and boisterous winter weather conditions. By carefully planned operations, quantities of mass concrete up to 128 cubic yards were placed in an eight hour shift, from an assembly of three ½ cubic yard capacity mixers.

The fabrication of the steel work was let to various sub-contractors, and included such items as gun pit platforms, doors to the ammunition recesses, trolley tracks, runways for the travelling gantry, and the 28 ton gantry itself.

The Department assembled the gantry and runways and assisted the Army Repository Unit in the mounting at Nos. 1 and 2 emplacements. This was quite an extensive and interesting task in itself.

A host of small jobs completed the emplacements and the mounting and proofing of the two pieces. Air ducts to the pumpchambers and magazines, with suitable blast-proof covers at their intakes, were also provided.

No. 3 emplacement was not finished to the same extent as Nos. 1 and 2, for the reason that, owing to the improvement in the Pacific war situation, the third gun was diverted elsewhere. However, the pit was subsequently [illegible] the gantry, and other

Coastal Battery, Karori (Cont'd).

repository gear.

Quantities and costs on the gun emplacements were as follows :-

Excavation	:	5,500 cubic yards
Concrete	:	4,083 " "
Contract cost	:	£25,169
PWD cost	:	£24,831
Total cost	:	£50,000

(4) Ancillary Works: The following works were carried out at various times during the construction of the fortress area:-

War Shelters - at four of the five tunnel portals to the underground. These consisted of reinforced concrete buildings each with a floor area of 690 square feet, comprising a shelter and lavatories, the whole structure being of solid, splinter-proof construction. They were erected by the contractors, the Department carrying out the necessary excavation.

Battery Observation Post: This reinforced concrete splinter-proof structure was erected at the eastern end of the fortress area, and connected to the underground system of tunnels. It commanded a fine view of Cook Strait. The excavation was carried out by the Department, while the contractor erected the building.

Battery Workshop - Temporary: As gun parts and various other military equipment began to arrive soon after the commencement of construction, it was found necessary to build a temporary workshop and store almost immediately. The site selected was on the extreme top of the hill adjacent to No. 2 gun emplacement, and accordingly a very substantial building of wood and iron, with concrete floor and upstand wall, was erected by the Department at a cost of £1,220.

It was intended to remove this building after the

permanent store and workshop had been erected at a lower level and adjacent to the tunnel portals.

Battery Workshop & Store - Permanent: This building had a floor area of 1,850 square feet, being partitioned off for a workshop, blacksmiths' shop, instrument shop and testing-room, and RA store. It had a concrete floor throughout, wooden walls, and roof trusses with corrugated iron roofing.

It was built by the contractor, the Department doing the preliminary excavation and the interior fittings for machinery, gantry, etc.

The cost was £3,250.

Miniature Range: This was erected in the barrack area adjacent to No. 3 gun emplacement. It consisted of a two-storeyed wooden building with corrugated fibrolite roofing. Its function was to enable artillery officers to obtain practice in observing and plotting the course of a moving target and directing the guns on to it. For this purpose Army installed instruments and remote-controlled moving models of various types of ships.

The building was erected by the contractors, the Department carrying out the preliminary excavation and ground improvements around the building.

The cost was £1,800.

Air Conditioning: In spite of the preliminary air-conditioning of the engine room, plotting rooms, and pump chambers, it was found that condensation of moisture existed throughout the underground system for days at a time. The outcome of this was an investigation and report by the Department of Scientific & Industrial Research upon the cause and prevention of this moisture. Consequent upon the investigations, a revised and considerably enlarged system of air-conditioning was installed. This consisted of a reinforced concrete

blast-proof building on the top of the hill adjacent to the engine room air shaft, containing the various air filters to serve the engine room and tunnels.

Special water heaters were installed near each magazine for the purpose of controlling the temperature in the shell and cartridge stores, and tubular power heaters were installed in the pump-houses behind the gun pits.

The excavation for and construction of the air-filter building was carried out by the Department, while the ventilation contractors completed the installation of filters, fans, ducting, and water heaters.

This work, including the original and amended schemes, cost £5,500.

Other works around the fortress area carried out by the Department consisted of a parade ground, stormwater drainage, septic tanks (two), and a high tension power line to the fortress transformer station. The work ceased in January 1946, when the fortress came under a care and maintenance basis.

The cost of the whole project, excluding Army equipment and installation, was £250,000.

COASTAL BATTERY, WRIGHTS HILL, [illegible]INGTON

TOP: Two views of the work under construction.
LOWER LEFT: The plotting room. RIGHT: Wrights Hill from [illegible] looking across to the entrance to Wellington Harbour.

1. Name of Work: Fort Ballance.
2. Locality: Watts Peninsula, facing the entrance to Wellington Harbour.
3. Nature of Work: Construction of gun emplacements, etc. and provision of accommodation for personnel.
4. References: File: 23/118 Map: 8/A6
5. History: Fort Ballance had been abandoned as a fort and was being used solely for storage purposes when war broke out.

In February, 1941, instructions were received to construct two new 4" gun emplacements and ancillary works such as searchlight emplacements, engine rooms, a battery observation post and a command post, and a war shelter, as well as barrack huts and other buildings to accommodate personnel.

In February, 1942, the construction of emplacements for a twin 6-pounder battery together with the necessary war shelter, command post, and extra accommodation was authorised.

All these works were carried out by contract, except for excavation, roading, and water and sewerage services, etc., which were undertaken by the Department with its own labour.

The cost was £37,706.

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1. Name of Work: Coastal Battery, Palmer Head.
2. Locality: Palmer Head, Cook Strait.
3. Nature of Work: Construction of gun emplacements, etc. and erection of accommodation for personnel.
4. References: File: 23/[illegible]10 Map: 8/A19
5. History: During the period between the two wars, a new battery of two 6" guns had been constructed on Palmer Head.

On the outbreak of World War II, this battery was able to operate, but not at full efficiency on account

FORT BALLANCE (GORDON POINT), WELLINGTON.

FORT DORSET, WELLINGTON.

of shortage of accommodation and in the absence of forward observation posts and other auxiliaries.

The accommodation problem was solved by the prompt provision of temporary sleeping huts and phase one amenities. These were replaced as soon as possible by more permanent and commodious barrack huts, messes, stores, a recreation hall, and a laundry and drying room, etc. Later, accommodation and facilities for 100 WAACs were provided.

Forward observation posts and wireless telephone rooms were established at Baring Head, Beacon Hill, and Sinclair Head, complete with accommodation for the detachments manning them.

In August, 1941, it was decided to construct underground plotting and wireless rooms. This work involved the construction of an access road, 250 feet of access tunnel, a shaft 85 feet deep, a gallery 60 feet long, two plotting rooms 19 feet by 15 feet and 19 feet by 23 feet respectively, an engine room 19 feet by 14 feet and two wireless rooms each 12 feet by 9 feet.

The site for a third gun was surveyed in April, 1942.

Approval to proceed with this was given in September, 1942, and the work (except for mounting of the gun, which was undertaken by Army) was carried out by contract and completed early in 1943. The contract covered excavation for and concreting the gun emplacement, constructing an underground magazine 36 feet by 20 feet, a shaft for the shell hoist, 105 feet of access tunnel, and a war shelter.

Reinforced concrete overhead covers were provided for the three guns, but trouble was experienced in designing a steel gun shield to suit the conditions at the site. One was fitted for trial and experiment but was eventually abandoned.

Expenditure incurred at Palmer Head during the war amounted to £103,239.

COASTAL BATTERY, PALMER HEAD, WELLINGTON.

TOP: *A comprehensive view of the whole fort.*
LOWER: *Showing the effects of camouflage. The two guns, clearly discernable in the top photograph, are to be seen to the left and slightly below the buildings.*

1. Name of Work: Fort Dorset.

2. Locality: On the western side of the entrance to Wellington Harbour.

3. Nature of Work: Construction of gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/314 Map: 8/A18

5. History: Fort Dorset, an old established defence post, was in operation before and during World War I.

On the outbreak of World War II the fort was already equipped with barracks, offices, stores, and other buildings. As, however, it was also the headquarters for the heavy artillery regiment which manned all the Wellington forts, and had to accommodate temporarily many of the personnel from the new fort at Palmer Head, the existing facilities were not sufficient for the purpose.

A canvas camp with phase one cooking and ablution amenities was therefore constructed on Seatoun Park. This served until a more permanent type of accommodation could be provided within the precincts of the fort.

Contracts were let for the construction of new barrack huts, cookhouses and messes, a sergeants' mess, a recreation room, and lecture rooms, etc. These were occupied as they reached completion and eventually the camp on Seatoun Park was closed.

Further additions and alterations were made to the accommodation from time to time, and in September, 1942, quarters for WAACs were also prepared.

The water and sewerage systems had to be reconstructed, while roads were formed and sealed.

An Army engineer unit commenced work on gun emplacements for a new 12-pounder battery but it was called away for other duties when preliminary action only had been taken. Construction was completed by a contractor under the supervision of the Public Works Department.

War shelters, magazines, and a battery observation

Fort Dorset (Cont'd).

post were also erected for the 12-pounder battery. Other batteries were brought up-to-date by the construction of new fire commander's posts, battery observation posts, searchlight emplacements, etc., and the provision of steel shields and reinforced concrete overhead covers for the guns.

During the war period a considerable amount of maintenance work was also carried out on the old and the new buildings.

The cost was £106,626.

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1. Name of Work: Coastal Batteries, Marlborough Sounds.
2. Locality: Maud Island and Post Office Point, Pelorus Sound; Blumine Island (2); Tory Channel; and Maraetai, Queen Charlotte Sound.
3. Nature of Work: Construction of gun emplacements, etc. and provision of accommodation for battery personnel.
4. References: File: 23/633 Map: Maud Island: 9/A5
   Post Office Point: 9/A4
   Blumine Island: 9/A2
   Tory Channel: 9/A1
   Maraetai: 9/A3

5. History: The construction of gun emplacements and accommodation buildings at the entrances to the Marlborough Sounds was one of the most difficult defence works undertaken in the northern portion of the South Island, owing chiefly to the extreme remoteness of the sites and their general inaccessibility. Some of the sites were on islands and others at points where roads were non-existant. Materials had to be delivered by sea, and for this purpose two scows and a number of punts were hired by the Department.

The work was authorised early in February, 1942, and an immediate start made on the gun emplacements (a 5" gun covering the entrance to Tory Channel and 6" guns at the other five points). These were required complete

Coastal Batteries, Marlborough Sounds (Cont'd).

with overhead covers and ammunition recesses, together with the customary battery observation posts, command posts, and war-shelters - all of concrete, splinter-proof construction.

The emplacement work was carried out by the Department with its own forces, and finally completed in December, 1942, though the guns were actually in position (and were test-fired) in July. Access was improved considerably by the erection of landing jetties and the formation of roads. Water supply, sewerage, drainage, and electricity (from generating sets) were provided, and by October, 1942, the erection of the accommodation buildings was able to proceed. Most of this was undertaken by contract, under the master schedule system, reaching completion in February, 1943.

The total cost of the project was £230,150.

COASTAL BATTERIES, MARLBOROUGH SOUNDS
LEFT: WHEKENUI, TORY CHANNEL RIGHT: MARAETAI, QUEEN CHARLOTTE SOUND
LEFT: MAUD ISLAND, PELOROUS SOUND RIGHT: [illegible] ISLAND

1. Name of Work: Coastal Battery, Nelson.

2. Locality: Port Hills, Nelson.

3. Nature of Work: Construction of gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/652 Map: 9/A10

5. History: The construction of two 5" Naval gun emplacements on a site selected on the Port Hills, Nelson, was authorised in April, 1942. These were required complete with overhead cover, battery observation post, war shelters, magazine, etc., as well as accommodation for battery personnel. In June it was decided to supply 6" guns instead of 5", and the necessary alterations were made to the design. Only one gun was eventually delivered, however, a dummy being installed in the other emplacement.

Preliminary work was carried out by the Department with its own forces, the balance by contractors under the master schedule system.

Accommodation erected for battery personnel consisted of huts, mess-room, kitchen, showers, ablutions, latrines, guard-house, and ration store. Later, additional quarters were provided for WAACs. The camp was connected to existing electrical, water supply, and sewerage mains.

The work was substantially completed in January, 1943, the total expenditure amounting to £12,000.

1. Name of Work: Coastal Battery, Westport.

2. Locality: On the south spit of Westport harbour.

3. Nature of Work: Construction of a 5" Naval gun emplacement, etc., and provision of accommodation for personel.

4. References: File: 23/724 Map: 10/A1

5. History: The installation of a 5" US Naval gun on a site commanding Westport harbour was commenced in June, 1942. The emplacement was of the Colchester type, giving a 220° arc of fire, complete with a magazine, a battery observation post, and camp accommodation for about 40 men. The camp was built out of old public works huts transferred from the Westport-Inangahua Railway and consisted of a cookhouse, shower, ablution rooms and the usual facilities.

The battery observation post was so designed as to be permanently usuable as an office and observation post for the Westport harbour signalman - replacing an old wooden signal building.

Road access to the gun and camp sites was provided by removing the disused railway line along the harbour training wall for a distance of approximately 1½ miles, and metalling the railway formation.

No fresh water was available at the site, but a supply of slightly brackish water, good enough for showers and washing, was obtained by pumping from Bradshaw's Creek at low tide. The pump was located about a mile from the camp, on a tidal reach of the stream. Drinking water was obtained by catching rain water from the roofs of the huts.

Latrines were of the pit type, the waste water being disposed of in soakage pits.

Electricity was supplied from the Westport Borough mains.

Except for minor improvements and alterations to the camp, the work was completed in October, 1942. The battery observation post and signal station was

Coastal Battery, Westport (Cont'd).

not, however, commenced until February, 1943. It was completed in May of that year.

The total cost of the project was £9,125.

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1. Name of Work: Coastal Battery, Greymouth.
2. Locality: Cobden, Greymouth.
3. Nature of Work: Construction of a 5" gun emplacement, etc. and provision of accommodation for personnel.
4. References: File: 23/726 Map: 10/A2
5. History: The installation of a 5" US Naval gun at Greymouth was authorised in June, 1942.

A master-schedule contract was let for the gun mounting and overhead cover. This was later extended to cover the erection of accommodation buildings such as ablutions, drying rooms, latrines, and stores. Sleeping and messing quarters for officers, gun crew, and WAACs were provided by taking over the local convent hall and altering it to suit requirements.

Excavations for the gun emplacements, battery observation post, and magazine involved the removal of 1,850 cubic yards of clay and papa. The construction of the emplacement, combined overhead cover and war shelter, and the battery observation post entailed nearly 200 cubic yards of concreting.

Water and electricity were laid on and a drainage system installed. Sewerage facilities were made available by extending the main sewerage system at a cost of over £5,000. This work was carried out by the Greymouth Borough Council, subject to payment of a Government subsidy of £1,400.

Expenditure by the Public Works Department on the battery project as a whole amounted to £10,908.

1. Name of Work: Coastal Battery, Godley Head.

2. Locality: Godley Head, on the northern mainland at the entrance to Lyttelton Harbour.

3. Nature of Work: Construction of gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/247/5 Map: 11/A12

5. History: For many years a defense reserve reserve had existed on Godley Head. This was connected with the main Lyttelton road by a narrow track giving access to Godley Head lighthouse.

The first step to develop the reserve into an important fortification area designed primarily to protect Lyttelton harbour was taken in 1938, when Army requested that the existing track be widened into a road capable of carrying heavy traffic. This work was completed by the end of the year, resulting in a road 16 feet wide over a distance of 4½ miles.

In February, 1939, the construction of emplacements, etc. for a two gun 6" battery was authorised, a contract being let shortly after the outbreak of war in September of that year. The guns had not arrived by the time the emplacements were ready early in 1940, so alternative armament was installed as a temporary measure. The provision of an emplacement for a third 6" gun was approved in June, 1942. Concrete overhead covers had been built for the original two emplacements, but the third one - designed, with the benefit of experience overseas under actual service conditions, to fire through a 360° arc - limited protection of the crew to the gun shield, although concrete covers were erected around the emplacement. The magazines for the first guns were heavy concrete structures built into the ground with the roofs and bursters at surface level, whereas in the case of the third gun the magazine was excavated underground, its floor being 40 feet below ground level.

Coastal Battery, Godley Head (Cont'd).

Concrete battery observation posts were constructed, also emplacements for searchlights. The searchlights were at water level, at the foot of high cliffs. Steep tracks had to be built, and a small tunnel 400 feet long and with a grade of one in seven was driven for the purpose of giving access from Godley Head to the site of the searchlights.

The establishment of the battery meant that the Godley Head lighthouse had to be moved to another location. The lighthouse tower and keeper's residence were accordingly demolished and re-erected elsewhere, the light being placed half way down the cliff. Due to possible interference of blast with the delicate mechanism of electrical equipment, it was decided to use an old type of mantle lighting.

It was originally intended that accommodation for battery personnel would be of a permanent nature, and officers' quarters, sergeants' and men's messes, and stores were accordingly built in concrete. As the number of men expanded, however, other buildings were erected in wood, including dormitories, recreation rooms, garages, and additional stores. Hutments were also provided for WAACs, together with two buildings originally built for the National Military Reserve and taken over for this purpose.

Simultaneously with the construction of the gun emplacements and ancillary structures, the Public Works Department was proceeding with the installation of water supply, electricity, and sewerage facilities. As no natural source of water was available on Godley Head, arrangements were made for the Sumner Borough Council to supply 5,000 gallons a day from their reservoir at Taylor's Mistake. Water was taken from this point in three stages, viz:

COASTAL BATTERIES, GODLEY

TOP LEFT: A comprehensive view of the defence area. RIGHT: Two [illegible] installed.

LOWER LEFT: The army comp. RIGHT: One of the underground [illegible]

Coastal Battery, Godley Head (Cont'd).

(i) By a gravity pipe line to a 10,000 gallon reservoir at Black Point.

(ii) From Black Point it was pumped against a static head of 550 feet to a 2,000 gallon reservoir on Lyons Main.

(iii) From Lyons Main to the Army camp by gravity.

As the establishment at Godley Head increased it became necessary to enlarge the Black Point and Lyons Main reservoirs to storage capacities of 30,000 and 10,000 gallons, respectively.

A sewerage system was installed, but neither a treatment plant nor septic tanks was required in the main camp, drainage and sewage being discharged over the cliff. At a later stage septic tanks were provided to serve several isolated buildings.

Electrical power was obtained from the Sumner Borough system, Army arranging delivery from the terminal point on Scarborough Head. About 2½ miles of power line were erected, and a small transformer built.

The total cost of the work carried out in connection with the Godley Head fortifications was £145,581.

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1. Name of Work: Coastal Battery, Battery Point.
2. Locality: On the northern side of Lyttelton Harbour, about three miles from the harbour mouth.
3. Nature of Work: Construction of 4" gun emplacements, etc. and provision of accommodation for personnel.
4. References: File: 23/247/7 Map: 11/A13
5. History: Battery Point derived its name from a battery located there many years ago. The old magazines, roads, camp sites, and water supply facilities were brought into use at comparatively little cost, and neither the installation of electricity nor of a sewerage system presented any difficulties.

Coastal Battery, Battery Point (Cont'd).

A contract for the work required was let in November, 1938. This consisted of a simple type of emplacements for two 4" guns (on deck mountings), a magazine, war shelter, an engine room, and alterations to an old observation post. Heavy concrete structures were built into the hillsides. As the contractor was late in starting the work it did not reach completion until September, 1939. In 1942 concrete overhead protection was added to the gun emplacements.

Accommodation for personnel was erected on terraces which had at one time been occupied by the original battery. The principal buildings provided were officers' and sergeants' quarters, recreation rooms, cookhouses, ablutions, drying rooms, and dormitories.

Expenditure incurred on the Battery Point establishment totalled £35,717.

* * * *

On the opposite side of Lyttelton Harbour, an existing gun battery located on Ripa Island was brought into use to cover an area which was dead water to the Battery Point guns. The refitting of the guns (these were of the disappearing type dating from before the turn of the century) and renovations and repairs to the old barrack room quarters were carried out by the Department at a cost of under £2,000.

BATTERY POINT, LYTTELTON HARBOUR.

A A BATTERY, WHARF ST., DUNEDIN.

1. Name of Work: Coastal Battery, Akaroa.

2. Locality: About one mile from Wainui, a settlement on the western side of Akaroa Harbour.

3. Nature of Work: Construction of 6" gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/653 Map: 10/A15

5. History: The site for a two-gun 6" battery at Akaroa, commanding the entrance to the harbour was approved by Army in July, 1942, and the work commenced a few months later. Gun emplacements were of the Colchester pattern, embodying overhead protection. Construction was in concrete, as also were the battery observation posts, engineering rooms, searchlight emplacements, and other battery structures.

The usual phase one accommodation buildings were provided, including mess rooms, recreation rooms, drying rooms, etc. Huts served as sleeping quarters.

Access to the camp involved the formation and metalling of some 71 chains of road, also 21 chains of track to give access to the searchlight emplacements (though the installation of the searchlights was not proceeded with).

Water was gravitated to the camp from a dam in a small creek, through 2,600 feet of $1\frac{1}{2}$" pipe line. A further 1,800 feet of $\frac{3}{4}$" pipe were used for reticulation within the camp.

Earth latrines were installed.

Electric power was obtained from the Banks Peninsula Power Board's system.

Expenditure amounted to £18,240.

1. Name of Work: Coastal Battery, Timaru.

2. Locality: In the grounds of the NZ Refrigerating Co. Ltd. at Smithfield, approximately ½ mile north of Timaru.

3. Nature of Work: Construction of 6" gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/654 Map: 10/A20

5. History: The establishment of a 6" two-gun battery at Timaru was decided upon in April, 1942, the site chosen providing an excellent field of fire and adequately covering the harbour.

Emplacements were of the Colchester pattern. One observation post only was built. These were all of concrete construction.

The usual accommodation was erected for battery personnel, to phase three (semi permanent) standard, and consisted in the main of mess-rooms, washhouses, stores, orderly rooms, etc. Huts were supplied as sleeping quarters.

Some 10 chains of access roading were formed.

Water was obtained from the Timaru Borough system, supplemented by a new 12,000 gallon reserve reservoir.

A septic tank system was installed.

Electric power was laid on from the lines of the local power board.

The work was completed in December 1942.

1. Name of Work: Coastal Batteries, Taiaroa Head.
2. Locality: Taiaroa Head, Otago Peninsula.
3. Nature of Work: Construction of gun emplacements and provision of camp accommodation for battery personnel.
4. References: File: 23/77 Map: 13/A1
5. History: At the outbreak of war the entrance to Otago Harbour was already covered by a 6" gun battery located at the northernmost tip of Taiaroa Head, and by two six-pounders at Harrington Point.

Pilot Beach Camp: Early in 1940 a site at Pilot Beach was selected for a new camp to accommodate battery personnel, and a few months later, in April, 1941, an expenditure of £14,400 was authorised for this purpose. During the interim, temporary accommodation was made available in an old stone building at the lighthouse, supplemented by tents.

The work to be carried out included a new roof to the battery observation post and a cover for the gun pit. This was entrusted to the local railway workshops. Tenders were invited for the construction of the new camp and a contract let to a Dunedin firm in May, 1941. The contract covered, in addition to the buildings (huts, mess-rooms, cookhouse, administration block, ablution block, latrines, QM store, etc.), drainage, internal electrical reticulation, preparation of site, an access road, and galleries at Taiaroa and Harrington Point. As the contract progressed, further buildings required to provide for increased personnel were added to it, the total area of all buildings erected being 19,750 square feet. Pilot Beach was in a very exposed locality, and special measures had to be taken to protect the camp site from sea erosion. Sewerage and stormwater drainage did not present any difficulties, a full system being installed with septic tank disposal and the effluent discharging into the sea. Electricity was generated by

Coastal Batteries, Taiaroa Head (Cont'd).

the existing fortress accommodation buildings at Harrington Point were carried out in June, 1941, the cost being included in the Pilot Beach camp contract.

In August, 1941, it was decided to establish a new anti-motor torpedo boat battery at the point, comprising two six-pounders, with searchlights, for the purpose of protecting the channel at the harbour entrance. Concrete gun emplacements with overhead covers, ammunition recesses, and a war shelter were constructed by the Department, and a contract let for the searchlight emplacements. Only one, however, was completed. Due to the improved war situation, the AMTB installation was not proceeded with, the existing two Nordenfelt six-pounders remaining in commission.

* * * *

With camps at Pilot Beach, Rerewahine, and Harrington Point, and with the Navy also in occupation of some accommodation on Taiaroa Head, the demand for water so exceeded the supply that on occasions it had to be carted from Dunedin. To supplement the available supply from springs, salt water was pumped from the harbour for use in ablution and lavatory blocks and for fire fighting reserves.

A large programme of roading was embarked on to meet military requirements on Taiaroa Head, principally with the object of connecting Harrington Point, Pilot Beach, and Rerewahine.

The total expenditure incurred by the Department on military works at Taiaroa Head amounted to £133,012.

COASTAL BATTERIES, OTAGO PENINSULA.

TOP: REREWAHINE. LOWER: PILOT BEACH CAMP, TAIAROA HEAD.

1. Name of Work: Coastal Battery, Tomahawk.

2. Locality: On the high ground between Tomahawk and Smailes beach, approximately three miles south-east of the port of Dunedin.

3. Nature of Work: Construction of a two-gun battery of 6" P.III Naval guns to provide protection for the port of Dunedin and adjacent vital points from Naval bombardment.

4. References: File: 23/77 Map; 13/A5

5. History: In March, 1942, staff officers from Southern Military Command, in company with a representative of the Public Works Department, made a reconnaissance of the foreshore from Cargill's Castle to Maori Head with a view to selecting a site for a battery of two 6" guns, as part of a comprehensive programme of coastal defences. A site at Tomahawk was subsequently decided upon and a master schedule contract arranged for the emplacement for one gun, complete with battery observation post and magazine. A second gun was authorised in July, and its installation added to the contract, which eventually amounted to £5,643 and was completed on 15 September 1942.

The emplacements were of the Colchester pattern, with overhead covers, magazines, and battery observation posts. Originally, two cottages were purchased and three rented for the accommodation of personnel, but as this had increased to as many as 89 by the end of the year, and included 26 WAACs, a number of buildings had to be erected. These comprised two latrines, a men's laundry, showers, etc., a women's laundry and drying room, men's ablutions, a recreation room, mess-rooms for officers, sergeants', men's and WAAC's kitchens, washing-up quarters, food and fuel stores, accommodation for WAACs, and a hairdressing salon. An orderly room and QM store were added later, bringing the total floor area of all buildings

COASTAL BATTERY, TOMAHAWK, DUNEDIN.

COASTAL BATTERY, HARRINGTON POINT, OTAGO PENINSULA.

to 6,554 square feet. A contract for the erection of the buildings, also the necessary drainage, was let under the master schedule system and amounted to £10,428.

The preparation of the site, construction of roading (25 chains of deviation were necessary to divert civilian traffic) and the installation of a water supply were carried out by the Public Works Department. As the battery was located in steep sand hills, a major problem encountered was securing sufficient stabilisation. This was overcome by the addition of suitable clay during construction, while all batters were turfed or supported by stone walls.

The final cost of the fortifications and camp was £29,955.10. 6.

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1. Name of Work: Coastal Battery, Oamaru.
2. Locality: Cape Wanbrow, to the south-east of Oamaru.
3. Nature of Work: Construction of a 5" gun emplacement.
4. References: File: 23/655 Map: 12/A1
5. History: In June, 1942, Army authorised the construction of an emplacement and overhead cover for a 5" American Naval gun, complete with a magazine and battery observation post. The emplacement was to be of the Colchester type, except that the block for the gun was to be rectangular in shape, with the ammunition recesses and a war shelter at the rear.

The location, selected a few months earlier, was about a chain behind and above the lighthouse and dwelling on Cape Wanbrow. When the gun went into action the residence had to be vacated and an alternative site found for the light.

Widening and metalling the existing road access

Coastal Battery, Oamaru. (Cont'd).

(1½ miles) was carried out by the Waitaki County Council, and completed in July, 1942, at a cost of £702. The ½ inch water pipe supplying the lighthouse being insufficient, a 1 inch main was installed, bringing water from Oamaru to a steel 1,200 gallon tank above the camp site. To this the mess block and other buildings were connected. Electric power reticulation was entrusted to the local power board, including the laying of underground cables to the emplacement and battery observation post. Sewerage was arranged by the installation of a trough type water flushing system, treated by septic tank and connected to the waste and stormwater drains from the buildings. All water supply, plumbing, and drainage work was let as a master schedule contract, costing £1,802.

The buildings required consisted of accommodation for 32 men, and comprised a kitchen and mess block, officers', sergeants', and men's latrines and ablutions, a drying room, a shower, QM and ration stores, a recreation hut, a medical inspection room, and portable (eight-men) sleeping quarters. A contract for the buildings was allocated under the master schedule system, and amounted to £8,328. The buildings covered an aggregate floor area of 3,220 square feet.

The emplacement block reached completion on 28 July 1942 and the overhead cover on 17 October, the establishment being taken over by Army in November.

The total expenditure recorded by the Public Works Department was £17,568.

1. Name of Work: Coastal Battery, Bluff.

2. Locality: Bluff.

3. Nature of Work: Construction of a 6" gun emplacement, etc. and provision of accommodation for personnel.

4. References: File: 23/656 Map: 12/A4

5. History: After a battery site had been selected by the Army authorities, Southern Military Command in April, 1942, issued instructions for the urgent construction of an access road and a gun pit. The surveying of the access road commenced immediately and a start was made with the formation work on 1 May 1942. Owing to atrocious weather conditions and a shortage of road metal, access was not completed until 27 June 1942.

In June the Public Works Department was notified of the type of installation and buildings required, with a request that the work be proceeded with at once. This was done, and by the middle of the following month the site was ready for the gun. The strength of the concrete used in the emplacement exceeded 3,000 lbs a square inch.

The project consisted, in addition to the gun mountings with overhead cover and magazines, of a battery observation post, dispersed sleeping quarters, ablutions, wash - and bath-houses, and mess rooms and stores, complete with water supply, sewerage, and drainage, also fencing and 40 chains of metalled access roading.

The work was substantially completed by 30 September 1942, and finally so by the end of December. Erection of the buildings and the concreting were carried out by contract, the remainder of the work except the installation of electric power (which was entrusted to the local supply authorities) being undertaken by the Public Works Department with its own forces.

The total cost amounted to £15,085.

An extensive programme of magazine construction was initiated by Army in September, 1941, when War Cabinet approval to the expenditure of £355,000 was obtained. A year later a further sum of £492,600 was authorised.

The following magazines were erected during the war:

Locality.	No.
Ardmore (Papakura)	20
Ngaruawahia	55
Waiouru	45
Makomako (Pahiatua)	39
Trentham	22
Belmont	62
Hororata	16
Mt. Somers	10
Burnham	8
Winscombe (Fairlie)	9
Alexandra	9
	295

In addition to the magazines proper, there were erected at each site such subsidiary buildings as non-explosive stores, laboratories, and camp accommodation for guards.

With one exception, all magazines were designed by the Public Works Department, in collaboration with Army Headquarters.

The design and construction of magazines fell generally into two stages: the first, prior to Pearl Harbour, and the second after the Japanese had entered the war and the threat of a direct attack on New Zealand developed.

In the first stage six designs (known as A,B,C,D,E, and F) were evolved by the Government Architect. Types A,B,C, and D had brick walls and corrugated asbestos roofs. Types A and B had double walls (a man could walk between them comfortably) and were both 40 feet by 22 feet. The only difference between them was that A was equipped with an entrance porch and B was not. Types C and D had cavity walls and were respectively 22 feet by 15 feet and

50 feet by 32 feet. The variations in size and wall construction enabled different standards of temperature control to be adopted. Types E and F - designed to meet the growing shortage of bricks (and also of labour) had timber walls covered with cement and fibre boards, and corrugated asbestos roofs. Both types were 50 feet by 32 feet, but E had a single wall and F a double wall.

Using one or other of these designs, all magazines required at Papakura, Waiouru, Trentham, and Burnham were built. The designs, while sturdy enough, were only quasi splinter-proof.

When in 1942 additional magazines were authorised, the Chief Designing Engineer of the Public Works Department designed several types of structure incorporating protection against incendiary bombs, blast, and bomb or shell splinters. The designs most favoured by Army were known as type R (1,2, and 3). R 1 had concrete walls and roof; R 2 brick walls and a concrete roof; and R 3 had double walls - concrete outside and brick inside, with a space in between. The roofs in all three cases were supported on interior columns. R 1 and R 2 were 25 feet wide, R 3 23 feet wide, and they could be put up in any desired length. The remainder of the magazines erected at Ngaruawahia and Pahiatua and in the South Island were mostly to the R designs.

Special types of magazines, involving partial prefabrication, were designed for Motutapu (these were for the US Forces) and for Belmont. One of these, type M, was evolved by a consulting engineer at the request of the Commissioner of Defence Construction. It incorporated precast concrete walls and roof and was 23 feet 6 inches wide (any length), the roof being supported on interior columns. The Chief Designing Engineer produced for Belmont a design embodying precast concrete walls and a cast in situ roof (known as type P). This also had

interior columns. It was 23 feet or 46 feet wide (as desired) and could be extended to any length required.

Non-explosive stores were usually 20 feet by 30 feet, with timber walls (no lining) and asbestos roofs. Laboratories, 43 feet by 20 feet, had 11½ inch cavity walls and asbestos roofs.

* * * *

Only the construction of permanent magazines to the designs touched on above are described in the following pages, with one exception. This is the erection in Kaikorai Valley of 17 temporary, wooden structures classed as ammunition 'shelters' rather than magazines. Similar shelters (designed by the Public Works Department) were built all over the country, sometimes alongside the permanent magazines and sometimes on their own. A few of the standard, permanent magazines were also constructed in isolated localities, such as at Kirokopuni, around Nelson, and in parts of Southland.

Magazines at Papakura (Ardmore) and Trentham are referred to in the general story of camp construction - see section 1, 'Military Camps'.

Wooden magazines were provided for 200 rounds of 6" shells at coastal batteries defending the secondary ports.

Ammunition was at times stored in all sorts of places, as, for instance, in brickworks in the Auckland district.

The total floor space covered by magazines and shelters erected for Army aggregated 461,000 square feet.

Expenditure amounted to £939,189.

1. Name of Work: Magazines, Ngaruawahia.
2. Locality: Kelm's Road, Ngaruawahia.
3. Nature of Work: Construction of Army magazines.
4. References: File: 23/317/8 Map: 2/A14
5. History: Just prior to the war three new magazines were constructed at Ngaruawahia Military Camp, the cost, including road access, etc., amounting to £8,970.

In March, 1942, the provision of a number of additional magazines on a site at Kelm's Road, Ngaruawahia, was authorised. Preliminary work was carried out by the Department, all available mechanical plant in the district being diverted to the excavation of the sites (involving the removal of 79,000 cubic yards of material) and the formation and metalling of access roading (four miles). Over a mile of barbed-wire 'unclimbable' fencing was erected around the magazine area. The provision of electricity necessitated the laying of four miles of power lines.

As soon as the building programme could proceed a contract was let for the erection of the magazines. Only nine were commenced initially but as Army's requirements increased the contract was added to, and, later, (in March 1943) a second contract was let.

Eventually, 43 magazines were constructed, in concrete slab foundations, with tile and fibrolite roofs. They covered a total floor space of 69,300 square feet. The cost, including camp accommodation for 40 guards personnel, aggregated £177,207.

Twelve precast magazines were also erected at Ngaruawahia Military Camp at a cost of £25,924.

1. Name of Work: Magazines, Waiouru Military Camp.

2. Locality: Waiouru.

3. Nature of Work: Erection of permanent and temporary Magazines.

4. References: File: 23/406/20 Map: 4/A4

5. History: In September, 1941, Army requested that magazine accommodation be provided at Waiouru Military Camp. The site chosen was on the hills at the northern side of the Ngamatea Swamp, approximately 1 mile 30 chains from the camp.

The numbers and sizes of buildings proposed initially were one 20 feet by 40 feet double walled explosive store; one 15 feet by 22 feet and 19 32 feet by 50 feet single walled explosive stores; one 43 feet by 20 feet laboratory; and one 20 feet by 30 feet non-explosive store. Tenders were called for the formation of access roads and the preparation of sites, a price being accepted in December 1941. Work commenced immediately.

In April, 1942, it was decided to erect 16 temporary wooden ammunition stores 28 feet by 20 feet, owing to the unsatisfactory conditions under which gun ammunition was then being housed, and in view of the time it would take to complete the permanent magazines. The work was allocated to a Wanganui contractor and erection commenced at the end of April, 1942, on an area of flat land south of the camp. The contract was completed on the 18 July 1942 at a cost of £5,550.16.1.

Meanwhile, work began on the permanent double and single walled buildings. A Wellington firm of contractors was allocated on 16 April 1942 one type B 22 feet by 40 feet explosive store, one type C 15 feet by 22 feet explosive store, 11 type D 32 feet by 50 feet explosive stores, one 20 feet by 43 feet laboratory, and one non-explosive store 20 feet by 30 feet. This contract was completed on 5 February 1943 at a cost of £39,927.19.4d.

In September, 1942, an increase in the number of this type of magazines was authorised. A Patea contracting firm was allocated four type F and one type D explosive stores, whilst a New Plymouth firm was allocated four type E and one type D explosive stores. These contracts brought the number of explosive stores under construction up to 23, and non-explosive stores and laboratories up to two-25 permanent buildings in all. The cost amounted to £31,199.2.6d. Both contracts were completed in October, 1943.

In November, 1942, plans were prepared for type R Magazines, 20 of which were required at Waiouru. These were buildings 25 feet long with lengths up to 70 feet. The walls were either of reinforced concrete, cavity brick, or reinforced concrete with an inner brick wall, and the roofs were flat reinforced concrete treated with bitumen asphalt. Type R1, which had reinforced concrete walls, was suitable for back filling against one wall and the roof could be camouflaged with a covering of earth, if necessary.

Further contracts were immediately let for the preparation of the necessary sites and the formation of the roads, whilst in February, 1943, the erection of five type R1, 14 type R2 and one type R3 magazines was allocated to three contractors. Work was pushed ahead on these magazines, five type R1 being completed in October, 1943, five type R2 in March, 1944, and nine type R2 and one type R3 in May, 1944. The total cost of this type of magazine was £60,999.19.7d.

The total cost of erecting the permanent and temporary magazines, including roading, levelling of sites, power reticulation, and a guard house with dormitory was £197,488.6.7. Fortyfive permanent and 16 temporary buildings were erected. The average number of men employed was 50.

RET

MAGAZINE AREA, WAIOURU.

MAGAZINE AREA, MAKOMAKO (PAHIATUA).

1. Name of Work: Magazines, Makomako (Pahiatua).

2. Locality: Lower Mangahao Valley.

3. Nature of Work: The construction of large magazines for Army in the foothills of the Tararuas.

4. References: File: 23/634 Map: 6/A10

5. History: Work on the construction of a large magazine area commenced on 8 March 1942. The site selected was in a remote locality, where bombing would be difficult and camouflage practicable, but at the same time within easy distance of military camps and establishments in the southern half of the North Island.

The work consisted of the construction of brick and concrete magazines, widely disposed and camouflaged, together with roading and other necessary engineering services.

The first requirement was access roading, and for this purpose plant was transferred from several districts and worked 24 hours a day. This locality had a high rainfall and during the winter conditions for the roading work were unusually bad, the machines being bogged on many occasions. It was finally necessary to completely fascine the roads before metalling.

Sites for magazines were excavated from road sidlings to give protection and to assist with camouflage. Material encountered varied from clay to hard rock. The 39 magazines were of various types, mostly of reinforced concrete construction and brick, with a few of wood. Some of the roofs were flat, with neuchatel surfacing, while others were of fibrolite. The flat roofs were covered with clay and rock to give added protection and a camouflaged effect. But as this filling put a strain on the roofs and caused some leakage it was later removed. The magazine floors were so heavily loaded that in some cases the foundations settled slightly causing cracks in the brick walls. Despite precautions taken in the

Magazines, Makomako (Cont'd).

preparation of the sites, considerable trouble was experienced with bad slippage of batters round the magazines.

In addition to the magazines, a small guard camp was built to phase one standard, also a laboratory, MT workshop, stores, etc. The building work was carried out by a Napier firm assisted by local builders and sub-contractors. Difficulty was experienced in keeping up the supply of such a large quantity of bricks, which had to be procured from various districts. Electric power was brought into the area and reticulated to all buildings. Water was supplied by pumping from a small creek, the intake giving trouble at times. Sewage disposal from the camp was a simple matter.

The chief difficulties encountered during construction were due to very wet ground conditions experienced in the locality.

The project was completed in March, 1943, at a cost of £192,750.

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1. Name of Work: Magazines, Belmont.
2. Locality: On a hill above Belmont, in the Hutt Valley.
3. Nature of Work: Erection of magazines.
4. References: File: 23/862 Map: 7/A4
5. History: The site for these magazines was selected by Army as being conveniently close to the port of Wellington, having reasonable road access, and at the same time being clear of close settlement.

On 30 October 1942 the Quartermaster-General advised that the construction of the magazines was approved and that roading and excavation work was to be started immediately. The intention was to erect buildings covering an area of approximately 96,000 square feet.

Magazines, Belmont (Cont'd).

The first step taken was to improve and metal the Belmont Hill Road, while simultaneously survey work on road extensions and magazine sites was put in hand.

A contract was let for the erection of a camp, which included a cookhouse, mess-room, ablutions, showers, washup, recreation room, etc. totalling 3,340 square feet in area, plus 50 two-men pre-fabricated sleeping huts which were ordered from the South Island. This camp was meant for use eventually by the magazine staff and guards, but was to house the contractors' men during the construction of the main buildings.

The site for the camp was laid out by the Army Camouflage Unit. Sleeping huts were erected under a row of trees, so as to be out of sight from the air, while the other buildings were grouped to represent a poultry farm. This siting resulted in many complaints about the dampness and unsuitability of the quarters, and arrangements had been made to move the camp to another site when the war ended.

In the meantime consideration was being given to the type of magazine to be adopted. Eventually reinforced concrete buildings with precast walls and columns and cast in situ floor and roof were decided on. (Known as type 'P') These were 25 feet wide and were built in units 50, 60 or 100 feet long and on some sites double width.

In December, 1942, a contract was allotted for the erection of the magazine buildings, the roadwork, excavation and traversing of sites, etc. being undertaken by the Department with its own labour.

The contractors had great difficulty in maintaining reasonable progress owing chiefly to adverse weather conditions and to manpower shortage - so much so that at one stage Army had sufficient ammunition in dumps outside and under canvas to fill the magazines had they been

Before the original contract was completed, instructions were received to erect a further 10 magazines of 'M' type. These were also of precast concrete, 20 feet wide. The precast sections were sent down from Auckland.

The whole of the work was eventually completed at the end of October, 1944, and consisted, in addition to the camp already mentioned, of the following :-

Widening and metalling 3 miles of existing road.

Forming and metalling 3½ miles of new road.

Erecting 62 magazines, also laboratory, office, etc., of a total floor area of 130,000 square feet.

The decision to adopt the 'P' type magazines was evidently influenced by the necessity for quick erection, but considerable trouble was experienced in making them weather-tight. Experience indicated that to render them really suitable for storage of explosives they should have had an inner wall of brick or other suitable material built in and porches provided over the doorways. Only two of the magazines had inner walls.

The total cost of the work was £203,260.

BELMONT MAGAZINES.

1. Name of Work: Magazines, Hororata.

2. Locality: Wairiri Valley, 4½ miles from Glentunnel, in Selwyn County.

3. Nature of Work: Construction of magazines and provision of accommodation for personnel.

4. References: File: 23/621 Map: 10/A5

5. History: The construction of magazines in the Hororata area was commenced in January, 1942.

Army's requirements were 16 magazines, a non-explosive store, a laboratory, and quarters for 20 men.

Sites for the magazines were excavated into the hillsides, each being isolated from its neighbour. The first nine magazines were of brick, and the remaining seven of timber and fibrolite. The laboratory was a brick building, while the non-explosive store and the men's mess and kitchen were of timber construction.

To give access to the magazine area and to each of the magazines (these were dispersed over the hillside), 140 chains of roading were formed and metalled.

Water was pumped from a nearby stream into a 3,000 gallon tank, whence it was reticulated through ¾ inch piping, of which 27 chains were laid.

Earth closets were built. Waste water and storm-water from the buildings discharged into a neighbouring gully.

Electricity was obtained from existing power lines.

The work was completed in August, 1943, at a cost of £65,290.

1. Name of Work: Magazines, Mt. Somers.

2. Locality: 4½ miles from Mt. Somers railway station, in Ashburton County.

3. Nature of Work: Construction of magazines and provision of accommodation for personnel.

4. References: File: 23/886 Map: 10/A12

5. History: The work involved in this project consisted of the construction of ten magazines, a laboratory, a non-explosive store, and accommodation for personnel.

The magazines were erected in brick, six with concrete roofs, and four with fibrolite roofs. They were dispersed over a wide area. The laboratory, store, mess, and other accommodation buildings were of timber construction.

Fifty-two chains of roading were formed and metalled to provide access to the magazine area and to each magazine.

Water was pumped from a nearby stream into an 800 gallon storage tank, whence it was distributed through four chains of ¾ inch piping.

Earth closets were used. Waste and storm waters discharged into an adjoining gully.

Electricity was supplied from the existing power system.

The work was completed between January and March, 1943, at a cost of £49,764.

1. Name of Work: Magazines, Burnham.

2. Locality: North of Burnham Military Camp.

3. Nature of Work: Construction of magazines.

4. References: File: 23/313 Map: 10/A10

5. History: Associated with the construction of the new military camp at Burnham was the provision of magazines in the manoeuvre area lying north of the actual camp site. The work consisted of the erection of eight magazine buildings, with a laboratory and guard-house, and all necessary engineering services.

Owing to the flat nature of the surface, the usual type of hillside excavation was out of the question, so that to conform to safety requirements earth traverses were built. Three main traverses were constructed, with spurs running from the outer ones : thus each building was completely isolated from its neighbour. The gravelly nature of the ground provided good drainage, so the site was excavated some six feet below the existing ground level and the material so obtained was used to construct the traverses.

The magazines and laboratory were of brick construction, and consisted of an outer and an inner shell. This enabled an even temperature to be maintained.

A guardhouse was erected for the guard personnel, but when not on duty the men lived in the main camp.

Water supply and electricity were laid on from the main camp system. A small septic tank met sewerage requirements.

Provision of road access involved the construction of 22 chains of roading, also 16½ chains of internal roading. These roads were later sealed.

The cost of the magazines was £21,303.

Camouflage was effected by painting the buildings and erecting small additional structures with a view to making the magazine area resemble a small settlement.

1. Name of Work: Magazines, Winscombe (Fairlie).
2. Locality: Winscombe, two miles south of Fairlie.
3. Nature of Work: Construction of magazines and provision of accommodation for personnel.
4. References: File: 23/900 Map: 10/A18
5. History: The construction of nine magazines together with a laboratory, barracks, mess-room, etc. in the Fairlie area was authorised by Army in December, 1942.

The magazines were erected in reinforced concrete and brick, with fibrolite roofs. Accommodation for personnel was provided in the form of the usual wooden huts, mess-room, etc. Adjacent plantations helped to camouflage the buildings.

Access involved the formation and metalling of 20 chains of roading.

Water was obtained from a well and pumped into an 800 gallon tank, whence it flowed to the buildings by gravity.

Electricity was laid on from the existing power circuit.

Earth closets were installed. Disposal of storm and waste waters presented no special problem.

The cost of the work aggregated £41,934.

1. Name of Work: Magazines, Kaikorai Valley.

2. Locality: Kaikorai Valley, Dunedin.

3. Nature of Work: Erection of buildings for the storage of ammunition and explosives.

4. References: File: 23/744 Map: 13/A2

5. History: A site for an Army magazine area in Kaikorai Valley was selected early in 1942. It was at first proposed to erect the more permanent type of magazines in brick and reinforced concrete, but Army later decided to build these in Central Otago instead and to use the Kaikorai site for wooden ammunition shelters of temporary (phase one) construction. Six such structures were authorised in November, 1942, and a contract for their erection allocated under the master schedule system.

Prior to this, however, access roading to the site had been constructed and a contract let for a bridge over the Kaikorai Stream. Eighty-eight chains of roading were formed and metalled in the magazine area itself.

In June, 1943, Army requested that 11 additional shelters of the same type be provided, also five explosive stores. These, too, were erected by master schedule contract.

Accommodation for guards and other Army personnel was made available by the transfer to and re-erection at Kaikorai of buildings no longer required at other camps in the district. These comprised a mess-room, meat and vegetable stores, and ten huts for sleeping quarters.

Water and electric lighting were supplied from the city mains.

The total floor space of all buildings erected in the magazine area was 5,830 square feet.

Expenditure aggregated £17,913.

1. Name of Work: Magazines, Alexandra.

2. Locality: On a gravel ridge lying approximately 2 miles north-east of Alexandra, on a side road away from any centre of population, aerodromes, etc. and within three miles of the railway station.

3. Nature of Work: Construction of magazines to provide safe storage of ammunition supplies in Otago and Southland.

4. References: File: 23/899 Map: 12/A2

5. History: A site for magazines on the outskirts of Alexandra was selected by Army officers in October, 1942, and the Public Works Department shortly afterwards received instructions to commence a survey and prepare a lay-out for ten explosive magazines, one non-explosive magazine, and a laboratory. Earthworks were put in hand (excavation and roading) and on 22 December 1942 a master schedule contract was let for the erection of the buildings. These finally consisted of nine explosive magazines (brick and concrete), 60 feet by 25 feet, one non-explosive magazine (timber), 30 feet by 20 feet, and a brick laboratory, 43 feet by 20 feet. Supplies of steel were arranged by the Department. The contract was completed on 24 November 1943 at a cost of £31,804.11.5.

The guard personnel (20 men) were accommodated in a cottage located on the site, together with two three-roomed public works married quarters. The buildings used by the contractors as a kitchen and mess-room were retained, and ablutions, showers, and latrines erected.

A water supply, comprising two 11,000 gallon concrete tanks, was drawn from the Manuherikea irrigation race.

Seventy-five chains of roading and 77 chains of fencing were constructed.

The total cost of the project amounted to £39,470.

4. HOSPITALS AND CONVALESCENT DEPOTS

The story of the work carried out at military camps (section 1 of this part of the Official War History) includes a description of or a reference to the hospital accommodation provided therein. Camp hospitals of various sizes, complete with quarters for nurses, were erected at each of the new mobilisation bases - Papakura, Waiouru, and Burnham; also at Linton, Delta, and Westerfield.

The existing hospitals at Narrow Neck and at Trentham were enlarged - extensively so in the case of the latter.

Field hospitals containing 30 beds were erected at Ohaeawai, Maunu (Whangarei), Warkworth, Paerata, and on the Awapuni race-course, Palmerston North.

Large convalescent depots (300 beds) were authorised for each military district. The northern one was located at Ravensthorpe, near Papakura camp, and the southern one within the precincts of Burnham camp. What was commenced as a convalescent depot for Central Military District - at Silverstream - became a hospital for the US Forces.

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The following pages deal specifically with hospital works which were carried out more or less independently, i.e. they were not part of a military camp or other defence project.

On the North Auckland peninsula the field hospital at Ohaeawai was complemented by a 180-bed military hospital at Kaikohe, intended for the 12th Brigade. It was, however, never used as such (owing to the improved war situation) and it eventually became a school. A base hospital for the 1st Brigade was established in the Boys' High School, Whangarei, where 320 beds were made available. Ward blocks for soldier T.B. Patients were erected alongside the civilian hospitals at Kawakawa, Kaitaia, and Rawene, but fortunately these also were not required for that particular purpose.

In Auckland city a 150-bed military block was built in the Domain, adjacent to the Auckland Hospital. Another emergency hospital was established on Ellerslie race-course early in the war. This later became a clearing hospital for personnel returning from the Pacific.

A large new military hospital (300 beds) was constructed at Middlemore. This was never used by the Services and was eventually purchased by the Auckland Hospital Board for civilian purposes.

A 'services convalescent hospital' containing 160 beds was erected at Rotorua, a private hotel in the borough being taken over as accommodation for the nursing staff. A military camp was set up on the Rotorua race-course for the express purpose of providing 'remedial treatment' for soldiers (see under 'Military Camps'.)

A military annexe, consisting of a new four-ward block complete with a nurses' home, was built alongside the Palmerston North Hospital.

The facilities of Wellington Hospital were also extended by the erection of a 100-bed military annexe. For the reception of sick and wounded troops returning from overseas, a clearing hospital was provided on Aotea Quay, Wellington. A large portion of the main grandstand buildings at Trentham race-course was occupied by the Wellington Hospital Board for the treatment of infectious diseases contracted by servicemen (reference to this is made under 'Works for the United States Forces', as the Americans for a time had the use of the race-course buildings for malaria cases).

Hospital construction in the South Island was limited to Marlborough and Canterbury. A new ward and administrative block was built adjacent to the Wairau Hospital, and, associated with this, a kitchen block and staff dining quarters, etc. were erected at Marlborough College

arising out of the temporary use of the college as an emergency military hospital.

A new male massage block was constructed at Queen Mary Hospital, Hanmer Springs, as a charge against the War Expenses Account.

The accommodation at two Christchurch hospitals was augmented by the erection of a soldiers' block at each, together with quarters for nurses. These were the Cashmere Sanatorium and Burwood Hospital.

1. Name of Work: Military Hospital, Kaikohe.

2. Locality: Kaikohe.

3. Nature of Work: Erection of a hospital.

4. References: File: PW 24/3117 Map: 1/A11

5. History: The erection of a hospital for the 12th Brigade troops deployed in the Kaikohe area was commenced in September, 1942, the work being allocated to a contractor under the master schedule system. Construction was planned in two stages, viz: phase one, to meet immediate requirements, followed by phase two - a more permanent and better finished structure. In March, 1943, however, it was decided that in view of the reduced numbers of troops stationed in the north the second phase need not be proceeded with.

Completed in October, 1943, the project comprised 30 six-bed wards, with all the usual facilities and amenities of a modern hospital, including accommodation for nurses and for the military staff. It covered a total floor area of 37,950 square feet. Water was taken from the Kaikohe Town Board's supply after this had been augmented by the construction of a new reservoir and the replacement of some of the mains.

The total cost of the hospital was £75,780. By the time it had been completed the war situation had improved to such an extent that the hospital was not required, and it was never brought into use. It was converted into a school after the war.

1. Name of Work: Emergency Hospital, Whangarei.
2. Locality: Boys' High School, Whangarei.
3. Nature of Work: Conversion of high school to a hospital.
4. References: File: 31/820 Map: 1/A16
5. History: In January, 1942, War Cabinet authorised the conversion of the Boys' High School (and Hostel) Whangarei, into an emergency hospital for 1st Brigade troops. The work commenced immediately, and by the end of January the hostel was ready for occupation by patients, followed shortly afterwards by the school buildings themselves.

Owing to urgency, the conversion was carried out by 'cost-plus' contracts, one being awarded for the carpentering and electrical work and another for the plumbing work. An administration block was erected adjacent to the school, also a number of six-men huts as an annexe to take any overflow of patients during seasonal epidemics. Altogether 320 beds were made available.

Pupils were accommodated in various halls throughout Whangarei.

Expenditure by the Public Works Department on the emergency hospital amounted to £21,451.

The property was handed back to the high school authorities in August, 1944.

* * *

With the assistance of substantial subsidies from the War Expenses Account, ward blocksfor tubercular patients, together with staff accommodation, were erected at Kawakawa, Kaitaia, and Rawene Hospitals between October, 1942, and April-May, 1943. These were intended for soldier patients initially, but were never so required.

The bulk of the work was carried out by master-schedule contracts, the Department itself preparing sites

and arranging engineering services such as roading, drainage, water supply, fencing, etc.

The total expenditure by the Public Works Department was: Kawakawa, £14,140 Kaitaia, £9,831 and Rawene, £ 7,793.

References: Kawakawa : File 24/3133 Map: 1/A10
Kaitaia : " 24/3121 " : 1/A2
Rawene : " 24/3132 " : 1/A13

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1. Name of Work: Emergency Hospital, Ellerslie.
2. Locality: Ellerslie Race-course, Auckland.
3. Nature of Work: Conversion of existing buildings and construction of new ones.
4. References: File: 23/972 Map: 3/A16
5. History: An emergency hospital was established on Ellerslie race-course in July, 1940, practically all the racing club's buildings being occupied for this purpose as well as most of the grounds.

The Public Works Department was not consulted in the matter until October, 1943, when a proposal to utilise the hospital facilities as a clearing hospital for New Zealand personnel returning from the Pacific was under consideration. The main requirements were stated to be medical and Army buildings (with covered ways) estimated to cost nearly £6,000. War Cabinet approved this expenditure on 21 February 1944.

About the middle of 1945 it was decided to relinquish possession of the race-course premises. No rental was charged for their occupancy, but restoration costs amounted to £856 plus the handing over to the club of assets valued at £569.

1. Name of Work: Emergency Hospital, Auckland Domain.

2. Locality: On the northern slopes of the Auckland Domain.

3. Nature of Work: The erection of a large military hospital.

4. References: File: 24/2952 Map: 3/A12

5. History: Towards the end of 1940 the erection of a 150-bed Army hospital was authorised on a site selected on the northern slopes of the Domain, overlooking the harbour and adjacent to the Auckland Public Hospital.

Owing to the sloping nature of the site, fairly extensive excavation work was necessary. Advantage was taken of the natural contours of the land by designing the building with an additional storey on the lower half. This was later used for occupational therapy.

The hospital was built on an H plan, with all wards facing north, and service rooms for sterilisers, X-rays, etc. on the south side. The six wards each accommodated from one to 12 patients. Two operating theatres were provided, also X-ray and dark rooms, a pathological laboratory, and the usual facilities of a modern hospital.

The buildings were of timber frame construction, on concrete foundations. Exterior walls were sheathed with cement board and wire netting, plastered with fibrous finish plaster, and finally coloured. Roofs were covered with Marseilles tiles, spouting and downpiping being of fibrolite. Interior finishes were mainly fibrous plaster on the walls, with five ply rimu dadoes in all corridors and lounges. Terrazzo floors coved to terrazzo dadoes were installed in all workrooms and in the operating theatres. Ceilings throughout were either in gibraltor board or fibrous plaster.

All necessary services (steam, gas, electricity) were supplied from the Auckland Public Hospital.

The whole area surrounding the buildings was laid

out in lawns, and planted in shelter trees, ornamental shrubs, flowers, and oranges and lemons.

Including excavation, and a circular road from the Public Hospital, the emergency hospital cost a total of £93,834. It was completed in June, 1941. The design adopted allowed for its conversion to a children's hospital at a later date.

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1. Name of Work: Middlemore Hospital.
2. Locality: On the Middlemore golf links at Otahuhu, adjacent to Mangere Railway Station.
3. Nature of Work: The erection of a 300-bed hospital intended for use by New Zealand troops from the forward Pacific areas.
4. References: File: 24/1647/3 Map: 3/A17
5. History: Middlemore golf links, containing an area of 38 acres of level land, with good road access and adjacent to the Mangere Railway Station, was selected as the site of a large military hospital authorised in July, 1943.

Preparation of the site commenced in August under winter conditions, large quantities of scoria having to be spread to permit building operations to proceed.

A very full set of plans and specifications was prepared and in the interests of urgency (as casulties in the Pacific campaign were anticipated) arrangements were made for a number of builders to form a combine for the purpose of undertaking the project under the master schedule system. Work was started with two building firms as the principal contractors, while a number of others joined forces to carry out such sections of the construction programme as were allotted to them. The buildings were dispersed over a wide area and divided up into various units; consequently, this arrangement with

the various contractors worked admirably and no friction occurred amongst them at any stage.

The buildings, with the exception of the boiler house, mortuary, and inflammable store, are all of timber frame construction on concrete foundations. Exterior walls were sheathed with cement board and wire netting, plastered with texture finish plaster, and finally coloured. Roofs are covered with Marseilles tiles and spoutings and downpipes were of fibrolite.

The boiler house, mortuary, and inflammable store were constructed in brick and concrete, with tiled roofs.

Interior finishes were mainly fibrous plaster on the walls, with five-ply rimu dadoes in all corridors and lounges. Terrazzo floors coved to terrazzo dadoes were installed in all workrooms and operating theatres. Ceilings throughout were either in gibralter board or fibrous plaster.

The installation of the various services - steam, hot water, gas, electric, telephones, etc., etc., was given much more consideration than had been the case in existing hospital institutions. Starting from the boiler house, a concrete duct was constructed, which carried through under the corridors of all buildings. Access to this duct had been provided for by stairs internally and door openings from the exterior. Full headroom and lighting were provided and everything possible done to minimise the difficulties usually encountered with maintenance work on such services. The ducts had a total length of over 4,000 feet.

The buildings consisted of:-

1. Administration, casualties, physio-therapy, and laboratory sections.
2. Ten wards with accommodation for 300 patients.
3. X-ray building.

Middlemore Hospital (Cont'd).

4. Operating theatres with necessary workrooms, etc.
5. Main kitchen and tutorial block.
6. Linen store.

These buildings are all connected with covered ways and service corridors, and four lifts were installed to take trollies, etc.

7. Male orderly staff accommodation for 22.
8. Boiler house.
9. Garage.
10. Non-resident male staff.
11. Workshop building.
12. Inflammable liquids store.
13. Domestic quarters accommodation for 87.
14. Nurses' home accommodation for 187, complete with kitchen and service rooms.
15. Public shelter and waiting rooms.
16. Three doctors' residences.

The whole area surrounding the buildings was laid out in lawns, and planted with shelter trees, ornamental shrubs, flowers, and oranges and lemons.

Road access from Massey Road was constructed to a high standard. A circuit road with access branches to all buildings was laid and all roads kerbed and channelled. Parking space for 300 vehicles was provided for in the roading programme. Altogether 39,000 square yards of roading were laid, while footpaths in concrete and pre-cast flagging in court yards aggregating 8,300 square yards were provided.

The plans included building a weir across the upper reaches of the Tamaki stream, (the southern boundary of the area), to hold a supply of water for fire fighting purposes.

Other services included stormwater sewers, sewer mains, holding tank with pumps, and a digester for

Middlemore Hospital (Cont'd).

sewerage.

Some idea of the huge quantities of materials used in a project of this nature may be gained from the following figures relating to Middlemore:

Floor area of buildings	284,034	square feet
Timber used	2,500,000	super feet
Concrete laid	8,700	cubic yards
Plastering of walls	26,033	square yards
Plastering of floors	2,867	" "
Fibrous plaster	54,000	" "
Gibralter board	198,891	square feet
Flat fibrolite	70,834	" "
Pinex	62,437	" "
Plywood	137,144	" "
Roof Tiles	200,000	
Wintex Roofs	1,500	square yards
Fabric roofs	1,500	" "
Fibrolite gutter	11,500	lineal feet
Fibrolite downpipe	6,000	" "
Terrazzo floors	3,220	square yards
Terrazzo walls	31,100	square feet
Terrazzo coves	10,000	lineal feet
Floor sanding	204,000	square feet
Floor polishing	18,612	square yards
Linoleum and underlay	14,113	" "
Painting	208,000	" "
Glass	40,000	square feet
Stainless steel benches	752	lineal feet
Terrazzo benches	175	" "
Cost of joinery	£50,000.	

The total cost of the buildings, including all services and layout of grounds, was £839,634.

Fortunately the need for such a military hospital never arose, and it was purchased on completion by the

MIDDLEMORE HOSPITAL.

CONVALESCENT HOSPITAL, ROTORUA.

1. Name of Work: Convalescent Depot, Ravensthorpe.
2. Locality: South of Auckland, near Bombay.
3. Nature of Work: Erection of a convalescent depot for Northern Military District.
4. References: File: 23/457/27 Map: 2/A12
5. History: A large convalescent depot was erected at Ravensthorpe between January, 1942, and April, 1943. This was laid out over nearly 200 acres and contained every facility for the treatment of something like 400 patients. In addition to the usual hospital buildings and some extra recreational amenities, the depot included a fully equipped theatre and swimming pool, while a spacious area was levelled out for games and sports. A self-contained block was provided for members of the WAAC.

The depot had an independent water supply, pumped from bores 186 feet deep to a reservoir 125 feet above ground level, also a storage tank of 80,000 gallons capacity.

The cost of the convalescent depot was £122,435.

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1. Name of Work: Services' Convalescent Hospital, Rotorua.
2. Locality: On the lake front, Rotorua.
3. Nature of Work: Erection of a 160 bed hospital for convalescent servicemen.
4. References: File: 24/3007 Map: 5/A3
5. History: The erection at Rotorua of a convalescent hospital for servicemen was authorised in April, 1941. Preparation of the site, including levelling, roading, and drainage, was carried out by the Public Works Department. The site, on borough council land overlooking the lake, was an exceptionally favourable one, combining the agreeable climate of Rotorua with a recreational facilities available in

Services' Convalescent Hospital, Rotorua (Cont'd).

the nearby Government gardens (golf, tennis, bowls, swimming) and on the lake (fishing and yachting). All the famed thermal attractions of the district were within easy reach. It was envisaged that after the needs of convalescent servicemen had been fulfilled, the building would be suitable for use as a childrens' health camp.

A contract for the erection of the hospital was let in July, 1941. It consisted of a single storey structure, of timber construction, with exterior finish of fibrolite. There were four main wards and a number of smaller ones; a recreation room; an occupational therapy block; a special treatment block; a gymnasium; and a dining and kitchen block; as well as the usual appurtenances and equipment of a modern hospital. A bore was driven and supplies of thermal hot water and steam taken into a pool for therapeutic purposes.

After the building had been completed, paths, lawns, and gardens were laid by the Department, the whole institution being ready for use by the end of March 1942.

The aggregate floor area of the hospital and out-buildings was 62,532 square feet.

The total cost amounted to £108,436.

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Pending the erection of a new hostel for nurses employed at the services' convalescent hospital, a private hotel known as 'Arawa House' was taken over, renovated, and altered. The use of this property had been offered free of rent.

The work was carried out between November, 1941, and March, 1942, at a cost of £1,314.

'Arawa House' was still in use as a nurses' home when the war ended.

TWO PHOTOGRAPHS OF THE ROTORUA CONVALESCENT HOSPITAL UNDER CONSTRUCTION.

1. Name of Work: Military Annexe, etc., Palmerston North Hospital.

2. Locality: Palmerston North.

3. Nature of Work: Provision of accommodation for Services patients at Palmerston North Hospital, primarily by the construction of a new four-ward block.

4. References: File: 24/1856 Map: 6/A6

5. History: The concentration of Army and RNZAF personnel in and around Palmerston North during the war overtaxed the existing hospital accommodation. It was therefore decided in the latter half of 1942 to build a new four-ward block at Palmerston North Hospital, to increase the accommodation for nurses, to re-construct the main kitchen block, and to erect a new boiler house with a chimney and water tower. Later, a new ambulance barn and a new outpatients' block were also provided.

The work commenced in November, 1942.

There was no accurate plan available showing existing services at the hospital, so it was firstly necessary to carry out detailed surveys and prepare plans showing sewers and water mains, to enable buildings to be accurately located. Eventually a site plan was completed, covering the whole of the hospital and services.

The wards and nurses' home were two storied buildings of timber framing on concrete foundations, with plaster finish; the boilerhouse, water tower, and chimney were of reinforced concrete; and the outpatients' block was of three stories in reinforced concrete with brick veneer. The kitchen block was strengthened and the interior remodelled. Large concrete service ducts were constructed from the new boilerhouse to the new buildings and to the existing duct under the main corridor. These carried all services except sewers.

A large water softener was installed in the water tower and, besides linking all buildings to the city

Military Annexe, etc., Palmerston North Hospital (Cont'd).

sewers, a complete new stormwater system was constructed. A ramp to carry vehicular traffic to the first floor of the outpatients block was built and new paths and roads were laid down and sealed. All the work was of a high standard and was carried out in rapid time. Manpower employed reached a peak of about 400.

The ward block, kitchen, and nurses' home were completed in April, 1943, and the remainder of the work approximately 12 months later. The total expenditure (chargeable to the War Expenses Account) amounted to £250,138.

SOME OF THE PUBLIC HOSPITALS TO WHICH ADDITIONS WERE BUILT FOR DEFENCE PURPOSES.

TOP LEFT: PALMERSTON NORTH RIGHT: WELLINGTON

BELOW LEFT: WAIRAU HOSPITAL, BLENHEIM RIGHT: CASHMERE SANITORIUM, CHRISTCHURCH

1. Name of Work: Clearing Hospital, Wellington.

2. Locality: Aotea Quay, Wellington.

3. Nature of Work: Erection of a hospital building for the reception of sick and wounded servicemen returning from overseas.

4. References: File: 24/2999 Map: 8/A4

5. History: In February, 1941, instructions were received by the Department to prepare plans for a holding or clearing hospital on Aotea Quay, Wellington. The site selected was opposite a wharf where hospital ships could berth and was also adjacent to the railway line.

The building was designed to accommodate 300 patients for short periods (while they were being medically boarded, classified, and taken care of pending transport to their homes or to other institutions). It was equipped with all facilities for heating, cooking, X-ray examination, and the general treatment of patients, and contained, in addition to its six wards, offices, board rooms, a kitchen, dining rooms, a recreation room, and stores, etc. The total floor area extended over 56,000 square feet.

A railway siding was constructed along the back of the building, together with platforms, to enable patients to be wheeled from the wards into hospital trains.

Erection of the clearing hospital was carried out by contract. It was completed in September, 1941, at a cost of £66,289.

1. Name of Work: Emergency Ward Block, Wellington Hospital.

2. Locality: Wellington Hospital, Newtown.

3. Nature of Work: Erection of a military ward block.

4. References: File: 24/2953 Map: 8/A14

5. History: In June, 1940, Cabinet authorised the erection at Wellington Hospital of emergency hospital accommodation for sick and wounded servicemen. A two-storey 100-bed ward block was designed by the Department, each floor to comprise a ward of 50 beds in four-bed and two-bed rooms, also a sister's office and all necessary service rooms. The building, constructed of timber and cement-asbestos sheets, covered a total floor area of 17,600 square feet. It was completed by contract in May, 1941, after some delay due to difficulty in procuring materials and fittings. Heating services, lifts, and special kitchen, sterilizing, and sanitary fittings were installed before the block was handed over to the Wellington Hospital Board.

Office accommodation for administrative and recording staffs was at first provided in the Hospital Board's offices, but this arrangement was not convenient, so four eight-men huts were erected and suitably fitted-up in the hospital grounds. Early in 1945 the huts were replaced by an administration building transferred from Mt. Victoria camp.

The cost of the new ward block and associated work was £24,989.

1. Name of Work: Emergency Block, Wairau Hospital.

2. Locality: Blenheim.

3. Nature of Work: Erection of a two-storey ward and administration block to the east of the existing hospital, also a new wing to the nurses' home and associated work.

4. References: File: 24/2812 Map: 9/A6

5. History: The presence of thousands of soldiers and airmen located in training camps and aerodromes adjacent to Blenheim in the early months of 1942 necessitated increased accommodation at the local hospital. The Department of Health accordingly obtained War Cabinet's approval to the erection of a new ward and administration block as a charge against the War Expenses Account, and in March, 1942, the Public Works Department was authorised to proceed with the project.

A contract was let forthwith to a local builder, and the work was put in hand almost immediately. It was hoped that the new block would be ready by January, 1943, but owing to shortages of skilled labour and of materials it was not completed until the end of June, and even then the lift had not been installed.

In September, 1942, further works were authorised, comprising a two-storey extension to the west of the existing nurses' home; a new boiler house; a hospital kitchen and change room (in brick); additions to the kitchen in the nurses' home; strengthening the nurses' home; a laundry in the nurses' home; and bicycle and fuel sheds. These were entrusted to the original contractor, but as his organisation could not cope entirely with the whole programme another firm was engaged to assist.

Some of the work was supervised during construction by the architects to the Wairau Hospital Board.

Although the new block and associated projects were accorded the highest degree of priority, and work proceeded

at full pressure, it was not until February, 1944 that the Hospital Board was able to take over the additions.

A 100,000 gallon ground reservoir was later constructed, as a safeguard against the borough water supply failing during a fire or other emergency. A 10,000 gallon elevated supply tank was also built to provide a pressure feed to all parts of the hospital. These services were completed in early 1945 at a cost of £6,248.

The total cost of the ward and administration block, nurses' home extension, etc. was £168,658, of which £26,169 (representing the cost of the boiler house, the strengthening of the nurses' home, part of the cost of the nurses' home extension, and the kitchen and change room) was refunded to the Government by the Wairau Hospital Board.

1. Name of Work: Emergency Hospital, Marlborough College.

2. Locality: Blenheim.

3. Nature of Work: Erection of a kitchen and staff dining quarters block, and additional lavatory accommodation.

4. References: File: 31/465 Map: 9/A7

5. History: As the existing hospital accommodation in the Blenheim area was inadequate in view of the large number of servicemen stationed in that district, the Marlborough College premises were taken over early in 1942 for use as an emergency hospital.

The Department of Health obtained War Cabinet's approval on 2 March 1942 to the erection of a new kitchen and staff dining quarters block, 96 feet by 27 feet, at the college, this to be so designed as to meet the needs of the emergency hospital while at the same time being acceptable as permanent additions to the college afterwards. The provision of additional lavatory accommodation was also authorised.

A contract for the work (under the master schedule system) was allocated in July, 1942, and construction commenced. Progress was slow, however, and the project was suspended when the kitchen and dining block was in a half-finished state. Operations were later resumed and the building completed on 17 August 1943. It was never put fully into the use for which it was intended, owing to the favourable turn of events in the Pacific theatre of war.

The cost of the work was £6,176.

1. Name of Work: Soldiers' Block, Cashmere Sanatorium.
2. Locality: Cashmere Hills, Christchurch.
3. Nature of Work: Erection of a soldiers' block and nurses' home.
4. References: File: 23/261 Map: 11/A6
5. History: To accommodate soldier-patients suffering from tuberculoses contracted on active service, the Government decided in February, 1941, to erect as a charge against the War Expenses Account a new block and nurses' home in the grounds of the Cashmere Sanatorium.

Two separate contracts were let - one for the soldiers' block, a single storey building containing 32 beds, and the other for the nurses' home, which was two-storied. Both buildings were of timber construction.

Electricity, sewerage, water supply, and roading facilities were, of course, already available.

The new buildings were officially opened in November, 1942.

Expenditure aggregated £34,221 - £8,419 for the nurses' home and £25,802 for the soldiers' block.

1. Name of Work: Military Hospital, Burwood.

2. Locality: In the grounds of the existing civil hospital at Burwood, a suburb of Christchurch.

3. Nature of Work: Erection of a military hospital.

4. References: File: 24/2951 Map: 11/A1

5. History: The Government decided early in 1940 to erect in the grounds of Burwood hospital a new hospital block for the treatment of sick and wounded servicemen. The intention was that this would revert to civilian use when no linger required for military purposes.

A contract for the new block, also for a nurses' home and matron's cottage, was let in September, 1940, the scheduled time for completion being five months, with a bonus payable to the contractor for every week saved.

The hospital block, which provided accommodation for 62 patients, was a two-storied structure of timber frame, with an outer sheathing of fibrolite.

About ten chains of roading were constructed. Water supply, sewerage, and electrical facilities were already available.

The cost of the work totalled £28,893.

5. ANTI-AIRCRAFT BATTERIES

Apart from batteries located on Mt. Victoria, Auckland, and Mt. Victoria, Wellington, both of which were installed on the outbreak of war, no AA defences were in existance in the Dominion prior to Japan's entry into the conflict. A large programme of construction in respect of both heavy and light AA batteries was embarked on in the early months of 1942, but before it had reached completion the threat of Japanese attack had receded, and many of the proposed works were abandoned.

The work at each heavy battery consisted of the construction of gun emplacements and auxiliary structures (shell recesses, observation and predictor posts, etc.) and the erection of accommodation for personnel. The sites selected usually had to be levelled; sewerage, drainage, and water supply provided; and access roading formed. In the initial stages underground quarters for the gun crews were excavated in some cases, but as these proved unsatisfactory the usual type of wooden, surface buildings was adopted - dormitories, mess-rooms, ablution and drying rooms, stores, orderly rooms, cookhouses, etc.

Administrative headquarters of AA units were generally set up in residential houses taken over by Army and converted to suit requirements.

The main concentrations of heavy AA guns (3.7") were around Auckland and Wellington, and, to a lesser extent, at Christchurch and Dunedin.

In Auckland a camp for AA personnel was established in 1940 at the foot of Mt. Victoria (the site of the original heavy battery). Later, in 1942, heavy batteries were placed at Belmont, Orakei, Northcote, Bayswater, Chamberlain Park, Ponsonby, Te Atatu, and Alexander Park, in the Auckland Domain, and adjacent to the Hobsonville and Whenuapai aerodromes.

The capital city was protected by heavy batteries

at Mt. Victoria, Mt. Crawford. Wadestown, Brooklyn, Johnsonville, and on Somes Island.

Of four batteries proposed around the Lyttelton harbour area, only one was completed. This was on Mt. Pleasant.

Dunedin's only heavy AA battery was located on reclaimed land at Wharf Street.

* * * *

Although a good deal of the work involved in the construction of heavy AA batteries was carried out by Army, an endeavour has been made to cover the whole story of each project in the notes which follow.

Typical of what happened in some other localities is the account given of heavy AA gun emplacements started in the Nelson district and abandoned after the expenditure of £3,000. This, of course, was simply the price which had to be paid for preparedness, although in this particular instance mobile guns were substitued. In the Auckland area more than one site excavated for gun emplacements when enemy attacks seemed imminent were not finally used at all.

* * *

Light AA batteries (Bofors and light machine guns) were placed in strategic positions to protect important military and civilian objectives such as aerodromes, Naval bases, railway stations, oil tanks, and other likely points of attack. Most of these were located in the vicinity of Auckland and Wellington. As the work entailed was of a relatively minor nature, no specific details are given herein.

1. Name of Work: Anti-aircraft Battery, Mt. Victoria, Auckland.

2. Locality: On the Devonport side of the Auckland harbour, close to North Head.

3. Nature of Work: The establishment of a headquarters camp for an AA battery.

4. References: File: 23/520 Map: 3/A8

5. History: In October, 1939, when a mobile, heavy anti-aircraft unit was established on the top of Mt. Victoria, building work of a minor nature had to be undertaken to house the personnel stationed there. In particular, the local Manual Training School building was taken over and adapted to meet their requirements.

A site for the headquarters camp was decided upon early in 1940, at the base of the mountain. The work entailed extensive excavation to provide sites for the various buildings, and in the case of the combined mess meant a cutting of over 14 feet at one end and a fairly high flight of steps at the other end. The location of the buildings was determined by the contours, and this in turn made the provision of roading a very complicated matter. Drainage around the buildings had to be carefully planned in order to take care of the large volume of surface drainage which required to be dealt with.

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1. Name of Work: Anti-aircraft Batteries, Auckland.

2. Locality: The heavy AA defences of Auckland were located on the outer perimeter of the city, viz: Belmont, Orakei, Northcote, Bayswater, Chamberlain Park, Ponsonby, Te Atatu, The Domain, and Alexandra Park, and also in close proximity to the air fields at Hobsonville and Whenuapai. (Of these, the defences at Ponsonby, Te Atatu, The Domain, and Alexandra Park were constructed by Army).

The light AA defences were installed in the inner

areas to give protection to shipping at the wharves, to Devonport Naval Base, to Kauri Point magazines, to the air fields at Hobsonville and Whenuapai and to similar important military targets.

3. Nature of Work: Installation of guns and provision of accommodation for personnel.

4. References: File: 23/632/4 Map: Belmont: 3/A6
Orakei : 3/A11
Northcote: 3/A4
Bayswater: 3/A5
Chamberlain Park: 3/A13

5. History: The sites adopted for both heavy and light AA batteries were designed to give maximum protection to the city as well as guarding vital military objectives.

The heavy AA installations consisted of emplacements for 44 3.7" guns arranged in batteries of four guns to each site, together with the necessary camp buildings to accommodate personnel.

The work involved in connection with each battery comprised the construction of four concrete gun emplacements complete with shell recesses, observation and predictor posts, and underground plotting rooms and accommodation for gun crews. Later it was found that the subterranean sleeping quarters for the gun crews were not satisfactory, so nearby hut accommodation was substituted. The actual gun-mounting base and platform were depressed into the ground some six or seven feet, so that when the gun was mounted and the barrel horizontal it would just clear the surrounding ground.

The location of the battery sites was determined by the Army authorities and in some cases the excavation of the gun-mounting bases or drums was undertaken by Army with their own working parties. Shortly after Japan's entry into the war Army commenced construction of the first post at Belmont, close to Narrow Neck Beach, under a 'cost-plus' contract by arrangement with a local firm

of contractors. The job was pushed on with all speed, working a seven day week, from daylight to dark. However, Army soon found themselves in difficulties regarding the supervision of the contract and the Public Works Department was asked to take control of it and of all subsequent work on the AA gun emplacements. Six of the original sites were abandoned after having the drums excavated, (representing 24 holes in all), and, as the excavated material had been carefully removed and inconspicuously disposed of - in most cases some distance away, additional excavation became necessary - also a goodly distance away, to enable the holes to be filled in to the original ground level.

Two of the batteries, at Belmont and Orakei, were, owing to their location - overlooking the entrance to Auckland harbour - altered during construction to enable the guns to be depressed for use against sea-craft, if necessary.

At six of the sites, viz: Hobsonville, Northcote, Belmont, Bayswater, Chamberlain Park, and Orakei, additional excavation and levelling of an extensive area were carried out adjacent to the emplacements, in order to make provision for the installation of radar equipment.

As the gun emplacements were mostly located on fairly level country and were built below ground level, disposal of surface and sub-surface water presented considerable difficulty and necessitated the installation of hundreds of feet of field tiles and pipes, also vast quantities of scoria.

In the construction of the eleven heavy AA positions some 12,000 cubic yards of material were excavated and disposed of at a distance, 2,500 cubic yards of high grade, quick setting concrete were placed, and the total cost was somewhere in the vicinity of £110,000, excluding

the cost of buildings on the various sites.

The buildings were designed to suit the actual localities. At Bayswater, Northcote, and Chamberlain Park, for instance, residential types of accommodation were adopted, while at Hobsonville and similar outlying positions larger buildings were erected.

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Light anti-aircraft defences (Bofors and LMG) were located at Whenuapai, Hobsonville, North Head, the Devonport Naval Base, Narrow Neck, Kauri Point, Castor Bay, Whangaparaoa, Motutapu Island, Melrose, the Eastern Tide Deflector, Princes Wharf, the Western Reclamation area (Oil Tanks), and on the roofs of the Farmers Freezing Co. Building and Endean's Building. These posts followed a definite plan of covering all key positions around the city, as well as protecting aerodromes, the Naval base, wharves, and similar establishments.

Work on both the heavy and light AA posts was accorded a high degree of priority and large teams of builders were employed with a view to completion in the shortest possible time.

Use was made of natural camouflage, buildings being designed as farm houses, barns, etc. to conform to the surroundings, with very successful results.

The erection of accommodation on the roofs of city buildings was a very awkward job, as all materials, including the Bofors guns, had to be hauled up the outsides of the buildings and swung in over high parapets.

The total cost of all anti-aircraft work in and around Auckland city amounted to £270,365, spread out over a period of 13 months from April, 1942.

1. Name of Work: Anti-aircraft Batteries, Wellington.

2. Locality: Mt. Victoria, Brooklyn, Wadestown, Mt. Crawford, Somes Island, and Johnsonville.

3. Nature of Work: Construction of gun emplacements and provision of accommodation for personnel.

4. References: File: 23/632/11 Map: Brooklyn : 8/A11
Mt. Victoria : 8/A8
Wadestown : 8/A3
Mt. Crawford: 8/A5
Johnsonville : 7/A8
Somes Island : 8/A2

5. History: Immediately upon the outbreak of war two semi-mobile AA guns were set up on Mt. Victoria. A canvas camp was erected for the battery personnel but this was soon converted into phase one buildings and huts.

In March, 1942, plans were received for emplacements for 3.7" AA guns which were on order from Britain. By this time the various sites had been selected and surveyed, and the way was clear for a start on the construction work involved. Four reinforced concrete gun emplacements were required at each site, together with a command post and camp accommodation complete with water and sewerage services, access roading, etc. Each emplacement consisted of a gun foundation 13 feet in diameter and 5 feet deep; an octagonal surround 41 feet 6 inches across - to provide a working area around the gun and on which were built ammunition recesses; and wings outside the octagonal for the war shelter, magazine, and lavatory. The command post was a reinforced concrete structure approximately 44 feet by 21 feet, on two levels, and allowing for a telephone room, a war shelter, an accumulation room, and platforms for the range finder, predictor, telescope, and commander's position.

At Mt. Victoria the work was sufficiently advanced by the beginning of June, 1942, to permit the guns to be mounted and to furnish facilities for training officers and gun crews. The existing living accommodation had to

ANTI-AIRCRAFT BATTERIES, WELLINGTON.

TOP LEFT: MT. VICTORIA RIGHT: WADESTOWN (also Radio ZLW)

LOWER LEFT: BROOKLYN RIGHT: TINAKORI HILL.

be extended and altered considerably to provide for a total personnel of 176, including regimental headquarters.

Expenditure incurred amounted to £38,683.

Similar work (109 personnel) was carried out at Brooklyn at a cost of £25,309. An access road was constructed, and, as the site was higher than the Brooklyn service reservoir, water had to be pumped to the camp.

At Wadestown the emplacements, command post, and quarters for 151 personnel accounted for an expenditure of £22,621. Water was pumped to the site and a certain amount of roading was undertaken.

The cost of the Mt. Crawford battery (109 personnel) was £16,993.

All concreting materials for the Somes Island emplacements had to be transported from the mainland.

At this site a considerable amount of excavation for roading was necessary. Accommodation was already available on the island, although alterations and renovations were required. Expenditure aggregated £13,572.

At Johnsonville the foundations for the four guns were completed and the guns mounted, but owing to the improved war situation the remainder of the work was confined to only two emplacements and a portion of a third. No accommodation needed to be erected. Water for construction purposes was carted up the hill. The cost was £8,463.

* * * *

The total expenditure incurred on the six heavy AA battery projects amounted to £125,641. In addition, a number of Bofors AA guns were mounted on buildings and elsewhere in and about the city. In most cases personnel were accommodated in rented premises so that the work involved on gun foundations, etc. was of a minor nature, costing in all no more than £6,940.

ANTI-AIRCRAFT BATTERIES, WELLINGTON.

TOP LEFT: JOHNSONVILLE LOWER LEFT: SOMES ISLAND.

ABOVE: PT. HALSWELL, *showing Women's Borstal Institution in background*

1. Name of Work: Anti-aircraft Battery, Nelson Aerodrome.

2. Locality: Nelson Golf Course, four miles from Nelson.

3. Nature of Work: Erection of camp accommodation for an AA battery.

4. References: File: 23/527/44 Map: 9/A11

5. History: In May, 1942, the Public Works Department was requested to proceed with the construction of emplacements for two heavy anti-aircraft guns on the Nelson golf course, and of camp accommodation for the battery personnel.

A start was made on the emplacements, but when one had been completed and over £3,000 had been spent on this work Army directed that it be abandoned, as mobile guns were being supplied instead of the type calling for fixed bases.

Contracts for the erection of the accommodation buildings were allocated under the master schedule system. These consisted of the usual phase one 'service' buildings, including quarters for WAACs. Water supply, drainage, electric lighting, roading, and paths were attended to by the Department with its own staff and workmen.

Expenditure totalled £21,000.

1. Name of Work: Anti-aircraft Battery, Mt. Pleasant.

2. Locality: Just below the trig station on Mt. Pleasant, between Lyttelton and Christchurch.

3. Nature of Work: Construction of gun emplacements, etc. and provision of accommodation for personnel.

4. References: File: 23/632/15 Map: 11/A11

5. History: In the early months of 1942 surveys were carried out with a view to the establishment of four fixed AA batteries around the Lyttelton harbour area, but as the threat of enemy attack receded it was decided to proceed with the construction of only one battery. This was located on Mt. Pleasant.

Contracts under the master schedule system were allocated in November, 1942, for the concrete work involved (emplacements and command post) and for the accommodation buildings. It was intended to sink the emplacements into the ground, but this was not done as exceedingly heavy excavation into rock would have been necessary and adequate drainage would have presented a considerable problem. The command post was, however, excavated into the ground to provide the maximum protection for personnel and instruments.

A camp was built adjacent to the gun sites. It was of phase three (semi-permanent) construction, and comprised cookhouses, mess-rooms, drying rooms, recreation rooms, medical huts, etc., as well as accommodation for WAACs. Huts were provided for sleeping quarters.

The only roading required was 3/4 mile giving access from the Summit Highway to the battery site, and 15 chains of spur road to the camp site.

A water supply system connecting with the Heathcote county reticulation was installed, and a 2,000 gallons reservoir constructed. Owing, however, to the non-arrival of plumbing plant the system was never brought into use, and water had to be carted from Cooke's Farm

(where a fortress camp was located), 1½ miles away.

Drainage from the camp buildings was reticulated to one common outfall and piped to a point about 100 yards below, whence it was distributed in numerous gravel or metal filter pits. Septic tanks were installed, the effluent being brought to these filter pits also. It then flowed down the hill to a natural watercourse.

Electric power was laid in through feeder lines from the main Christchurch-Lyttelton line. The line was so routed that if necessary it could have been extended to Godley Head to serve as an alternative source of power to the coastal fortifications there.

The completed cost of the work at Mt. Pleasant was £43,038.

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1. Name of Work: Anti-aircraft Battery, Dunedin.
2. Locality: Wharf Street, Dunedin.
3. Nature of Work: Construction of a heavy AA battery to protect the city and port of Dunedin from aerial attack.
4. References: File: 23/694 Map: 13/A4
5. History: The site selected in May, 1942, for a heavy AA battery in Dunedin was located on land which had been reclaimed from the sea by the pumping in of harbour mud. At the time it was being used as the city rubbish dump. It was decided by Army, however, that the military advantages of the site outweighed the obvious engineering disadvantages, and instructions were accordingly issued to proceed with the construction of the gun emplacements. Preparation of the site and excavation for the foundations commenced forthwith (this was at the end of May, 1942). As was anticipated, the excavation of the foundations presented a difficult engineering problem owing to the unstable marine mud lying for a considerable

Anti-aircraft Battery, Dunedin (Cont'd).

depth under the filling of rubbish.

A contract for the four gun (3.7inch) emplacements and a command post was let on 6 August 1942 - under the master schedule system - and completed on 8 October, at a cost of £13,155. Tenders were invited for plumbing and drainage, the contract price, plus additions subsequently authorised, amounting to £8,739. The buildings, comprising two laundries, a drying room, shower blocks, two ablution blocks, three latrine blocks, two mess-rooms, a cookhouse, two washing-up rooms, stores for rations, meat, milk, and fuel, an orderly room, a battery commander's post, a regimental aid post, and a QM store were also erected under a master schedule contract. Including women's lavatories at the gun site and a recreation room and canteen - which were later asked for by Army, the total floor area of the buildings erected was 13,381 square feet and the expenditure thereon £8,270. Sleeping quarters were provided by Army in the form of portable huts.

After the initial programme of work had been completed, various further buildings and services were authorised between September, 1942, and May, 1943.

Water supply, electric power, and sewerage were made available from Dunedin city's services.

The total cost of all work carried out by the Public Works Department was £40,257, while the portable huts supplied by Army as sleeping quarters cost an additional £11,580.

Over £100,000 was spent on the provision of bulk petrol reserves for Army. The principal works comprised the erection of storage tanks at Ngaruawahia (600,000 gallons), Waiouru (850,000 gallons), and Burnham (600,000 gallons), also the construction of compounds at these localities and at Papakura and Trentham for the storage of 44-gallon drums.

The construction of underground storage tanks at mobilisation centres was first proposed in July, 1940. Owing to the prevailing shortage of structural steel, consideration was given to a reinforced concrete design involving the water flotation principle (such a tank had already been erected at Woodbourne aerodrome), but early in 1941 a decision was reached to proceed with the construction of steel tanks.

Tenders were invited based on a design submitted by a Christchurch consulting engineer (who was paid a fee for his services.) His engagement, incidentally, arose from the fact that one of the oil companies to which he acted as engineer had agreed to hand over to the Government supplies of steel it had imported for the erection of tanks. The tanks were made of welded steel plates, and were set in shallow emplacements. Site preparation, including excavation work, was undertaken by the Department.

Contracts for the erection of the three tanks were let in September, 1941, completion being called for by 1st December.

Rail access to each tank was provided, and stand pipes for filling and discharging from rail tank wagons were installed. The 600,000 tanks were equipped with six stand pipes and the larger one with eight. These would have enabled the tanks to be emptied rapidly (by gravity) in the event of an emergency.

7. RANGES (RIFLE, GRENADE, MORTAR, AFV ETC.)

Most of the works carried out by the Department in connection with ranges were of a comparatively minor nature. Only three exceeded £5,000 in cost and these - Papakura, Waiouru, and West Melton, are described briefly in the following pages.

At each of the big new ranges (known as 'classification' ranges) provision was made for 30 yard testing or miniature ranges, rifle ranges from 100 to 1,000 yards, and grenade and mortar ranges. At Waiouru, a 2-pounder anti-tank range was also provided, together with an AFV moving target range. The existing ranges at Trentham were repaired and extended, and grenade ranges added.

New ranges were constructed all over the country, including Rotorua, Tauranga, Taumarunui, Gisborne, Wairoa, Palmerston North, Dannevirke, Delta, Burnham, and Washdyke. Sundry others were repaired.

1. Name of Work: Classification Range, Papakura.

2. Locality: About 3 miles east of Papakura.

3. Nature of Work: Formation of a rifle, mortar, and grenade range primarily for the use of troops stationed in Papakura Military Camp.

4. References: File: 23/457/19 Map: 2/A10

5. History: An area of 1,200 acres of rough, hill country, with a valley running through it, was chosen for a classification range in the vicinity of Papakura camp.

Initially, the construction of a rifle range on 800 acres of land was authorised early in 1941. An additional area was taken over later, when the scope of the work required had increased.

The butts (for 30 targets) were built in concrete, sited at the head of the valley with the hills rising up steeply behind them. Firing mounds for ranges from 100 to 1,000 yards were formed across the valley.

A considerable amount of excavation was required, also culverting, fencing, land clearing, and the provision of access roading.

Buildings erected consisted of a workshop, store, shelter-shed, and a warden's residence - all of timber. The residence was built on high ground at the entrance to the valley and overlooking the range.

The bulk of the work was carried out during 1941-42 at a cost of upwards of £30,000 (included in the expenditure on Papakura camp).

1. Name of Work: Moving Target Range, Waiouru.
2. Locality: Waiouru.
3. Nature of Work: Provision of a moving target range for tanks.
4. References: File: 23/406/28 Map: 4/A5
5. History: In January, 1943, investigations were commenced at the request of Army into the possibility of constructing a two-pounder target range at Waiouru Military Camp.

Three alternative schemes were submitted:-

(1) An electric traction unit with remote control.

(2) A cable-operated unit with a double surge drum internal combustion engined winch.

(3) A traction unit with a truck mounted internal combustion engine and provision for semi-remote control.

After all three schemes had been carefully investigated, No 1 was decided upon.

The site chosen for the range was in a remote valley beyond the magazine area. The target run had a grade of 1 in 60 on 30 lb rails, the track being of 48 inch gauge. Excavation of the site to house the target and generator shed commenced in May, 1943. An access road 100 chains in length along the side of the valley was formed. The formation of the target tracks and the protective mound were also put in hand. However, several difficulties were experienced. When the excavation of the target and generator shed was completed on the eastern side of the valley, it was found that several springs had been opened up. After due consideration it was decided to transfer the building to the western side of the valley. This entailed the erection of a bridge across the stream, the construction of banks to stop erosion, and the building up of further banks as a fire protection for the operators.

The electric traction unit was designed in Wellington and consisted of a four-wheeled bogie complete with motors and low overhead equipment for remote control. The conductors, or collector wires, (of which there were four), were mounted on arms at the side of the tracks only 2 feet 6 inches above rail level. Two two-wheeled trailers were built, one to be fitted each side of the traction unit with a solid connecting bar. This allowed for three targets to be used at a time. The targets themselves were 8 feet above the top of the chassis and 12 feet wide.

The traction bogey was fitted with an automatic soleroid operated brake and from a speed of 20 MPH the unit could be pulled up in approximately 100 feet.

The total length of the firing range was 1,500 yards.

The range was completed in February, 1944, at a cost of £10,031.10.11.

1. Name of Work: Rifle Range, West Melton. 573

2. Locality: Paparua County.

3. Nature of Work: Construction of a rifle range.

4. References: File: 23/570 Map: 10/A4

5. History: The existing rifle range at Redcliffs, which had been in use for many years, was subject to severe flooding and, moreover, the locality had become more populated with the passage of time.

It was therefore decided to construct a new range at West Melton, where the land was of poor quality (for farming) and where the Waimakakariri River bed offered excellent facilities for this purpose.

The work was authorised in February, 1942. It consisted of the construction of the rifle range proper, including butts, firing mounds, and stop-butt, and the erection of a number of buildings to accommodate personnel undertaking rifle training.

The engineering work involved the use of over 11 tons of reinforcing steel.

About ½ mile of roading was required to give access along the mounds and to the stop-butt.

The range was connected with electricity and a water supply laid on.

The camp for personnel was erected from buildings salvaged from vacated military establishments.

The cost of the work carried out by the Department amounted to £20,418.

8. COMBINED HEADQUARTERS.

When the threat of a Japanese attack on New Zealand became more than a possibility in the early months of 1942, War Cabinet's authority was obtained to the provision at the four main centres of operational shelters to enable Combined Headquarters (Army, Navy, and Air) to carry on secure from bombing or artillery fire.

The Dunedin proposal was not proceeded with, while at Wellington and Christchurch work was discontinued before it reached completion, owing to the improved state of the war.

In the following pages an account is given of the construction of operational centres at Auckland, Wellington, and Christchurch. A similar project undertaken at Khandallah, Wellington for Army Signals is touched on in the story of 'Fortress Camps, Wellington Fortress Area' (section 1).

The excavation of underground operations rooms at certain RNZAF stations is dealt with in the separate section of the War History concerning defence works for that arm of the Services.

1. Name of Work: Combined Headquarters, Auckland.

2. Locality: Adjacent to the Teachers' Training College, Epsom.

3. Nature of Work: Erection of a heavily reinforced building for combined operations of Army, Navy, and the RNZAF.

4. References: File: 23/687 Map: 3/A14

5. History: Early in 1942 the Auckland Teachers' Training College, Epsom, was taken over for use as a combined headquarters for the three Services in northern military district. Extensive alterations were carried out to the college buildings, and a number of new structures erected in the grounds to accommodate personnel. This work cost upwards of £18,000, most of it being undertaken by contracts arranged by Army on the basis of cost plus a percentage.

To enable combined headquarters to continue functioning in the event of the premises being damaged or destroyed, a two-storey operational centre was constructed in a disused gravel pit adjoining the college, close to the road. (Two emergency telephone exchanges had already been built here). The building was 52 feet wide by 103 feet long, with 18 inch reinforced concrete walls and a heavy concrete roof. On the ground floor was a large operations room, 24 feet by 27 feet, and reaching the full height of the building.

The whole building was to have been covered with 10 feet of earth, but this proposal was not proceeded with. Indeed, owing to the improved war situation the combined operational centre was never made ready for use, although the structural part of the building was completed and furniture and fittings for it specially designed.

Expenditure amounted to £45,835.

1. Name of Work: Combined Headquarters, Wellington.
2. Locality: Dominion Museum, Buckle Street, Wellington.
3. Nature of Work: Alterations to museum building, erection of a camp, and construction of an underground operational centre.
4. References: File: 23/687/4 Map: 8/A10
5. History: In June, 1943, the Dominion Museum and Art Gallery building was taken over for use as a combined headquarters for the three Services.

Extensive alterations were carried out to the building, while a camp complete with all services and amenities was erected in the grounds to accommodate 90 personnel.

In August, 1942, the construction of an underground shelter for 'Fighter Sector Control' was authorised. This was to consist of a reinforced concrete chamber, 55 feet by 45 feet, 20 feet 3 inches high inside, and divided into two stories and partitioned to suit Service requirements.

Access to the shelter was to be (1) by tunnel from the Museum building, (2) by a connecting tunnel from adjacent raid shelter tunnels excavated by the City Council, (3) by a level entrance to ground facing Taranaki Street, and (4) by a shaft and trapdoor to the ground level above.

Construction was by 'cut and cover' method, the excavation being done by the Department. The reinforced concrete structure was erected in the open by a contractor and then filled over.

The shelter was nearing completion in March, 1943, when, owing to the improved war situation, a decision was made that furnishings and communication appliances, etc. were not to be installed, nor was the tunnel to the Museum building to be driven. Otherwise, however, the work was completed, and the space provided proved useful for storage purposes.

Combined Headquarters, Wellington (Cont'd).

The total cost of altering and fitting out the Museum building, erecting the camp in the grounds, and constructing the FSC shelter was £26,154.

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1. Name of Work: Combined Headquarters, Christchurch.
2. Locality: Cracroft-Wilson Estate, Hackthorne Road, Cashmere.
3. Nature of Work: Construction of an underground operational centre for combined headquarters of southern military district.
4. References: File: 23/687/2 Map: 11/A10
5. History: In the early months of 1942 the Cracroft-Wilson homestead was taken over and adapted for use as a combined headquarters. Extensive alterations were carried out to the homestead and numerous buildings were erected in the grounds.

Protection for the headquarters staffs was provided by a series of chambers excavated underground. Two adit drives, 9 feet by 8 feet, and 170 feet and 220 feet long, respectively, led into the principal chambers. The first of these was 87 feet long, 20 feet wide, and 17 feet high. In the rear of this, and at right angles to it, was a cross chamber 78 feet long, 28 feet wide, and 21 feet in height. This joined a further chamber constructed parallel to the first one, containing a section 38 feet long by 27 feet wide by 21 feet, the remainder being 50 feet long, 22 feet wide, and 17 feet 6 inches high. The three chambers were connected by an underground stairway to the cellar of the headquarters house. This was formed by driving a tunnel 7 feet 6 inches high by 5 feet wide by 380 feet long. Some portions of the chambers were lined with concrete and precast concrete rough members.

An air shaft was provided from the main chambers to the surface. This was lined with pipes six feet in diameter.

Work was stopped before the underground centre had been finally completed. Up to that time expenditure amounted to £35,204, while a further £21,769 had been spent on alterations to the homestead, new surface buildings, and roading, sewerage, drainage etc, making a total of £56,973.

9. INTERNMENT AND PRISONER-OF-WAR CAMPS

Apart from minor work carried out on Somes Island, the provision of a holding compound for prisoners-of-war at Avondale, and the erection at Ikamatua of a small camp for the detention of Italians, the only projects coming under this heading were the construction of an internment camp for enemy aliens at Pahiatua (this was later converted into accommodation for Polish refugees) and the erection at Featherston - on the site of the World War I mobilisation base - of a camp for Japanese prisoners-of-war.

The former was necessitated by the inadequacy of the existing barracks on Somes Island, and the latter by the placing in the hands of the New Zealand forces of Japanese captured in the Solomons.

Both works are described in the following pages.

1. Name of Work: Internment Camp Pahiatua. (Later used as a camp for Polish children).

2. Locality: Pahiatua Race-course, on the main Eketahuna-Pahiatua road.

3. Nature of Work: Construction of an internment camp to provide accommodation under guard for enemy aliens.

4. References: File: 23/504/2 Map: 6/A11

5. History: The construction of an internment camp for enemy aliens on Pahiatua race-course was authorised by War Cabinet on 23 February 1942. As the existing race-course buildings were not of much use for this purpose, it was decided to erect new mess-rooms, dormitories, ablution blocks, staff quarters, etc, to provide accommodation for 1,000 males (inclusive of guards and internees). A standard of construction and comfort equal to that enjoyed by New Zealand troops was envisaged.

The work commenced in July, 1942.

Ground conditions at the site combined with bad weather conditions rendered progress very difficult and expensive in the early stages. The area was low lying, with poor natural drainage, and heavy traffic made the ground like a quagmire.

The building work was carried out under the master schedule system by a Wellington contractor assisted by other contractos and sub-contractors, while some of the engineering services work was undertaken by the Public Works Department. This arrangement worked fairly satisfactorily. In addition to the buildings and usual services, two 12 feet high barbed wire fences had to be built right round the internees' area, together with four watch towers. In camps of this type services had to be duplicated to some extent.

The flat gradient made the disposal of sewage difficult. A large septic tank was constructed and the

effluent piped to the river. The provision of an adequate water supply did not present any trouble as the Pahiatua borough main passed the race-course and a 500,000 gallon concrete reservoir was constructed near the borough headworks to ensure that the draw-off did not seriously affect the townspeople. As the pressure was too low for fire fighting, booster pumps were installed. The water was extremely hard and occasioned very heavy maintenance on boilers and pipe reticulation due to deposits of lime. A water softener was later installed.

The steam services gave considerable trouble. The mains were originally put underground in ducts but owing to bad drainage conditions the losses were very heavy.

The camp was completed and ready for occupation in December, 1942, though the internees were not moved in until February, 1943.

In July, 1944, the Government decided to return the enemy aliens to Somes Island, and to convert the Pahiatua race-course camp into quarters suitable for the accommodation of some 800 Polish refugees (mostly children.

The barbed wire fences were removed and a number of additional buildings erected, including dormitories, cottages for married couples, class-rooms, a recreation hall, a hospital annex, etc., together with necessary roading and associated services. This work was also carried out by one contractor with the assistance of others. Most of the contractors' men along with public works employees were accommodated in the camp, and catered for by Army. Sewerage, drainage, and water supply extensions were completed by the Public Works Department with its own forces. An extra boiler was added and

Internment Camp Pahiatua (Cont'd).

steam ducts were taken up and placed on concrete trestles. This increased the efficiency of the steam services by 40 per cent.

Pre-fabricated buildings were used in the construction of most of the new structures.

The camp was ready for the Polish refugees by December, 1944. Further work was carried out during 1945.

The cost of the work was:

Internees' Camp:	£118,383. 0. 0
Polish Camp:	62,095. 0. 0
TOTAL:	£180,478. 0. 0

TOP: INTERNMENT CAMP FOR ENEMY ALIENS, PAHIATUA.

LOW: THE SAME CAMP AS ALTERED AND EXTENDED IN 1945

1. Name of Work: Prisoner-of-War Camp, Featherston.

2. Locality: Featherston.

3. Nature of Work: Erection of a POW camp, also organising and equipping factories and a pig farm.

4. References: File: 23/122 & bar Nos. Map: 7/A2

5. History: The activities of the Public Works Department at the POW Camp, Featherston, fell under two main headings: (a) the construction and fitting out of the camp, and (b) organising and equipping factories and a pig farm to enable prisoners to be employed on productive work.

Erection of Camp. On 4 September 1942 War Cabinet approved the selection of the old Featherston military camp area as a site for a prisoner-of-war camp. Notice from the American authorities was received by NZ Army Headquarters on 8 September 1942 that accommodation for 450 prisoners would be required by the evening of the 11th of that month.

A wire compound fence was hastily erected round an area (on which were a few existing buildings that were served by the old water and drainage systems), temporary cooking and ablution shelters, etc. were erected, and tents were provided for sleeping quarters. An adjacent canvas camp was made available for guards' accommodation.

This urgent preliminary work was carried out by Army personnel.

On 14 September 1942 the Quartermaster-General advised the Engineer-in-Chief of developments to date and requested that the Public Works Department prepare estimates and proceed with the construction of the permanent camp.

The first lay-out of the camp allowed for six compounds, two being occupied by guards' quarters, administration buildings, and a hospital, etc., and four as accommodation for prisoners. Two more prisoner

Prisoner-of-War Camp, Featherston (Cont'd).

compounds were added later. The guards' quarters provided for 250 all ranks, with all the amenities of a permanent camp, while the hospital contained accommodation for 200 bed patients and staff. Each prisoners' compounds had timber buildings for cooking, messing, recreation, ablutions, etc. and portable huts for sleeping accommodation. The camp held approximately 1,000 prisoners, and at one stage preparations were being made to accommodate a further 1,000, but the proposal was cancelled.

Various sources of water supply were investigated. The scheme adopted comprised cleaning out and repairing the old camp river intake, filter, and race, and pumping the water into elevated tanks to serve the various compounds.

The possibility of tropical intestinal diseases being introduced by the prisoners gave the Department of Health a great deal of concern, and methods of sewage disposal to avoid this danger were discussed with that Department. A system of primary sedimentation was decided upon, the liquid being led to tile drains and soaked away into the country. On occasions when the ground water level was too high for this, provision was made for chlorination of the liquid before it passed to the Tauherenikau River. Designs were prepared for final treatment through trickling filters in case this was found to be necessary later. The sludge was treated in a digestion tank and finally in drying beds.

Factories and Pig Farm. In order to provide employment for the prisoners and at the same time produce goods that were in short supply, work of various kinds was organised. The Department was entrusted with the organising of furniture and concrete products' factories and the establishment of a pig farm.

For the furniture factory, a building 500 feet by 50 feet was erected. The products of the factory included such items as office furniture of all kinds as well as furniture for Government hostels and institutions. The Department of Education was so satisfied with the desks and chairs manufactured for the Polish childrens' camp that they placed an order for 6,000 desks and 6,000 chairs for NZ schools.

Two buildings each 100 feet by 50 feet and one 50 feet by 50 feet were used for the concrete products' factory. The chief items manufactured here were house blocks, kerb and channel blocks, chimneys, fire surrounds, and washing coppers for the Department of Housing Construction, also fence posts for the Department of Lands and Survey (for rehabilitation farms), and 'Holostone' blocks for house building.

Distribution of the products of both factories to Government Departments was handled by the Department's stores branch. These were transferred at cost price, while a private firm engaged in the class of business concerned acted as selling agent for some of the concrete articles, which were made available to private buyers at ruling market rates.

The pig farm was run in conjunction with the Department of Agriculture, which advised on and assisted in the management of stock, etc. The Public Works Department supervised all work and dealt with the purchase of supplies and the sale of stock. The pig farm was not taken over by the Department until 1 April 1944 and before it could be placed on a sound footing roading and metalling had to be done, pens and buildings repaired, new fattening pens built, and new breeding stock bought.

The total cost of the camp, including factories, etc. was £227,582.

Credits-in-aid from the Department's activities amounted to £63,189 from the factories and £4,786 from the pig farm, but, of course, the indirect benefit to the Dominion as a whole of the production of goods in short supply was incalculable.

P. O. W. CAMP, FEATHERSTON.
(On the site of the World War I camp).

ARMY RADIO STATION, KHANDALLAH.

10. ARMY COLLEGES AND SCHOOLS.

The extent of the work carried out at the district schools of instruction - northern, central, and southern, is touched on in the stories of the projects of which (from the public works point-of-view) they formed part, viz. Narrow Neck (under 'Coastal Batteries') and Dannevirke and Burnham (under 'Military Camps'). Similarly, no attempt has been made to separate the AFV school at Waiouru and the Army school at Trentham from the description given under 'Military Camps' of the construction work undertaken at those bases.

There remain only the Army staff college at Palmerston North and the artillery school at Melrose, Wellington. These are the subject of brief reviews in the following pages.

1. Name of Work: Army Staff College, Palmerston North.

2. Locality: Caccia Birch Estate, Palmerston North, and at Massey Agricultural College.

3. Nature of Work: Conversion of Caccia Birch Estate into a staff college, and provision of residential accommodation at Massey Agricultural College.

4. References: File: 24/2986 Map: 6/A5

5. History: The Caccia Birch Estate, in Te Awe Awe Street, Palmerston North, comprising a two-storey house of 18 rooms with out-buildings, a well laid out garden, and eight acres of land, was offered to the Government in June, 1940, on condition that the property would be used to assist in the prosecution of the war.

Towards the end of 1941 authority was given to carry out alterations and additions to the Caccia Birch property, for the purpose of making available offices and lecture rooms for an Army instructional staff, and providing living quarters (in huts), ablutions, mess-rooms, cooking facilities, etc. for a number of service personnel. It was also proposed to erect a new dormitory block at Massey College for the use of officer students.

The work at Caccia Birch was completed in March, 1942. Supplementary to the building programme, a new septic tank and sewerage connections were constructed, also a tank for fire fighting purposes. Expenditure amounted to £4,837.

The property was vacated by Army in March, 1944. It was later converted into a convalescent and rest home for nurses, under the control of the local hospital board, at a cost of £3,650.

The erection of a dormitory block for officer students at Massey College was not proceeded with until April, 1943. The Department was also requested to build a two-storey annexe to the existing kitchen block, re-model the kitchen, erect a new ration store, effect improvements

to the ablution facilities, and carry out other incidental work arising out of the accommodation of Army personnel at the college. The new dormitory provided quarters for 76 students, as well as a warden's flat and study rooms.

The work was completed in November, 1943, at a cost of £40,692. The buildings were vacated by Army some six months later, and handed over to the college authorities. They had been designed to fit in with future expansion by the college.

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1. Name of Work: School of Artillery, Wellington.
2. Locality: Karitane Hospital, Melrose (later removed to Plimmerton).
3. Nature of Work: Provision of accommodation for an Army School of Artillery.
4. References: File: 23/664 Map: 8/A17
5. History: Owing to the increased possibility of air raids after the entry of Japan into the war, the patients and staff of the Karitane Hospital were evacuated to temporary quarters in a Wairarapa homestead, their Melrose premises being taken over by Army for the purpose of establishing a school of artillery.

Alterations and additions to the hospital were authorised in April, 1942.

The first step was the construction of two lecture rooms, each 40 feet by 25 feet, a lavatory and ablution block, and the provision of four 15 feet by 8 feet portable huts in the grounds.

This was followed by alterations to the kitchen and other portions of the hospital building, and the erection of a further 16 portable huts. Accommodation was then available for 80 cadet-officers, together with the school establishment of administrative staff, instructors,

ARMY STAFF COLLEGE, PALMERSTON NORTH.

SCHOOL OF ARTILLERY, MELROSE, WELLINGTON.
(KARITANE HOSPITAL).

catering staff, etc.

In July, 1942, Melrose Park, near the hospital, was taken over as part of the school of artillery, and on it was erected a gun park and store (2,600 square feet), also accommodation for a guard unit. Later in the year a lecture room, 30 feet by 20 feet, was added.

Water, sewerage, and electricity services for the new buildings were drawn from the city systems. Access roads, vehicle parks, and gun drill areas were formed and metalled.

In July, 1943, it was decided to move the school of artillery to a camp at Plimmerton which had been occupied by an amphibious unit of the US Marine Corps, thus allowing the Karitane Hospital to re-occupy its own premises at Melrose.

Preparation of the Plimmerton camp for this purpose consisted of the erection of the following buildings, which were transferred from Melrose and elsewhere:

3 lecture rooms, each 40 feet by 30 feet.

1 lecture room, 30 feet by 20 feet.

A 20 foot extension to an existing 40 feet by 30 feet building.

A store 48 feet by 20 feet.

A gun park 48 feet by 24 feet.

An ante room 48 feet by 20 feet.

A servery.

A WAAC ablution and latrine block.

For sleeping quarters 300 portable huts were transferred from other camps (the US Marine Corps had used tents for this purpose).

The change-over was made during the latter part of 1943, the hospital being finally vacated by Army in December, 1943, although it was some time later before restoration work was completed. The total expenditure incurred in connection with the school of artillery was

Guard Posts

Immediately upon the outbreak of war guard posts were established by Army at vital points throughout the country, notably at ammunition dumps, power stations, radio transmittors, oil tanks and depots, and similar important objectives which it would have been to the enemy's advantage to destroy or sabotage.

Small camps were erected at each of these points by the Public Works Department, consisting chiefly of huts and tents for sleeping quarters, cooking and messing facilities, laundries, ablutions, and latrines and, in some cases, recreation rooms. Water, power, sewerage, and drainage were provided as required.

The cost averaged between £1,000 and £3,000 per post, depending mainly, of course, on the number of men accommodated.

The total expenditure incurred by the Public Works Department was £92,611.

Coast Watching Stations

A large number of coast watching stations was set up early in the war at strategic points along the coast-line, as an aircraft, submarine, and shipping warning service. These were located at Breem Head; Cape Colville; Makariki; Ahipara Bay; Albatross Point; Westshore; Bare Island; Cape Turnagain; Cape Runaway; Tokomaru; Gisborne; Mahia Peninsula; Signal Point; Waimarama; Flat Point; New Plymouth; Paekakariki; Cape Terawhiti; Nelson; Hokitika; Jackson's Bay; Le Bons Bay; and Invercargill. Accommodation for personnel was erected by the Public Works Department, usually in the form of huts for sleeping quarters, complete with facilities for cooking, messing, laundry, ablutions, and latrines.

In some districts the Public Works Department undertook on behalf of Army a fairly substantial programme of road construction and improvements to facilitate movements of troops and equipment and for general tactical reasons. The cost was met out of the War Expenses Account.

The principal road works carried out were as follows:

Bay of Islands

In order to afford better communication for fortress troops stationed in this area, the existing road from Tikiora (on the main Russell road) to Tapu Point (opposite Opua) was improved and metalled. This traversed a distance of between three and four miles. (References: File: 33/92 Map: 1/A7)

A new road was constructed to provide a direct link about four miles in length between Opua and Paihia. This included 200 feet of bridging over tidal estuaries. By arrangement with the Air Department, the initial road formation was undertaken by an aerodrome construction unit, being later completed by the Department. The bridging was carried out by contract. (References: File: 33/368 Map: 1/A8)

Roads leading south of Opua and north of Kawakawa were reconstructed and extended to form a new direct route between these two points. A more circuitous road already existed but it was narrow and winding and followed the top of a high ridge for a considerable distance. It would have been difficult to improve to a satisfactory standard and was in any case rated as too exposed to meet military requirements. A 160 feet bridge over the Kawakawa River was erected, also three smaller bridges and some culverting. As in the case of the Opua-Paihia Road, initial construction was entrusted to an

aerodrome construction unit. (References: File: 33/685 Map: 1/A8)

Road work in the Bay of Islands was carried out between October, 1942, and April, 1944, at a total cost of £36,012 (Public Works Department expenditure). Altogether 11 miles of new roads, 18 feet wide, were provided.

The Kawakawa-Paihia Road ultimately became a very popular route for visitors to the Bay of Islands.

Onehunga-Kumeu. (References: File: 34/3945 Map: 2/A6)

At a cost of £26,507, a new road was built from Onehunga to Kumeu to provide a through route for military vehicles proceeding from south to north of Auckland, and vice versa. This was to avoid congestion on the Auckland-Helensville State highway and on other roads in the metropolitan area. The work, which consisted of reconstructing, widening, and metalling 18½ miles of inter-connecting sections of various existing roads and highways, was commenced in November, 1942, and completed in May, 1945.

Waiouru-Tokaanu. (References: File: 39/53 Map: 4/A2)

The construction of this road, known locally as the 'Desert Road' had proceeded intermittently since 1936. In June, 1940, instructions were issued that the reconstruction and metalling of the road were to be speeded up, since it provided not only a quick route to the more populated cities and towns to the north of Waiouru Military Camp but gave access to vast artillery practice and tank battle training grounds on the desert between the National Park mountains and the Kaimanawa Ranges.

The work carried out during the war consisted of completion of formation and culverting, metalling 12 feet wide, the erection of six new bridges varying in length from 40 feet to 80 feet, the widening of one bridge and the strengthening of another - all designed to carry

heavy military traffic, including 28-ton tanks on tank transporters.

The total expenditure chargeable to the War Expenses Account (including reinstatement of damage done by military vehicles) amounted to £57,452.

Waiouru-Taihape. (References: File: 70/8/29/1 Map: 4/A6)

In June, 1940, Army requested that the road from Waiouru to Taihape (a section of the Horopito-Bulls via Taihape State highway) be improved to make it suitable for fast, heavy traffic. The existing road, 17½ miles in length, was narrow and tortuous.

Reconstruction commenced in September, 1940, the work being carried out partly by departmental labour and partly by using the services of contractors. The erection of a 120 foot bridge over the Hautapu River at Hihitahi was let by contract. Bad weather hampered the progress of the work, as also did the necessity to transfer much of the mechanical plant to Waiouru, where a large new military camp was in course of erection. It had been hoped that the new road would be ready by March, 1941, but so many vicissitudes arising chiefly out of war-time conditions were experienced that it did not reach completion until 1943. As finally reconstructed, the road had a formation width of 24 feet, of which 18 feet were metalled.

Expenditure, including the erection of the Hautapu Bridge, amounted to £128,470. Only £12,720 of it was recovered from the War Expenses Account, the greater part being met out of the Main Highways Account.

Napier-Taihape. (References: File: 40/21 Map: 5/A7)

In August, 1941, War Cabinet authorised minor improvements to the alignment and metalling the worst sections of the Napier-Taihape Road, a vital link between the central portion of the North Island (including Waiouru camp) and the east coast. The work involved 65,000

cubic yards of excavation, 8,000 cubic yards of metalling, and the construction of numerous culverts aggregating 515 feet in length. Several bridges were repaired and strengthened.

The cost of the work, including subsequent maintenance, was £23,813.

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Detour Roads: Military detour roads were constructed for Army in the Taranaki-Wanganui area late in 1942, for the purpose of enabling mechanised units to reach (and cross) railway bridges in the event of road bridges being destroyed by enemy action. The principal works carried out under this heading were at Whenuakura (cost £5,040), Patea (£4,500) and Waitotara (£1,330).

* * * *

Damage to Roads. Notwithstanding that in the vicinity of large military camps, aerodromes, and other important defence establishments many existing communication routes were widened, strengthened, metalled, sealed, and raised in standard generally, considerable damage was done to certain roads and highways by heavy military traffic, notably in the Auckland district. The cost of necessary reconstruction, sealing, patching, repairs, etc. was substantial, amounting to as much as £21,550 in the case of the Birkenhead-Maungaturoto State highway. Reinstatement of damage was carried out both by the Public Works Department and by local bodies, the cost being a charge against the War Expenses Account.

* * * *

Classification of Roads and Bridges. In July, 1941, Army Headquarters requested the Public Works Department to supply the Department of Lands and Survey (for the purpose of preparing military maps) particulars of the location of all roads and bridges in use and their classification. The maps were to indicate the traffic

carrying capacity of highways and roads and to incorporate such details as the nature of surfaces, width, and type and condition of bridges. Roads were to be classified in the following categories:

(a) Two-way concrete and bitumen roads, surface suitable for fast traffic.

(b) Two-way metalled roads, suitable for normal traffic.

(c) Two-way roads, thinly metalled, unmetalled, or subject to extensive slips under wet weather conditions.

(d) One-way metalled roads, suitable for normal traffic.

(e) One-way roads, thinly metalled, unmetalled, or subject to extensive slips under wet weather conditions.

(f) Partly formed roads, unfit for wheel traffic.

(g) Bridle tracks.

(h) Foot tracks or routes.

(i) Fords.

Note: Instructions issued at the time to District Engineers[1] amplified the meaning of some of these categories, e.g. 'suitable for fast traffic' referred to surface conditions and had no relation to traffic speeds as governed by the alignment of the road.

Bridges were to be classified in accordance with military loading, those over 16 feet in width between wheelguards being regarded as two-way bridges. These were divided into categories capable of carrying loads of up to (a) 18 tons (b) 12 tons (c) 9 tons and (d) 5 tons. Similar classifications were fixed in the case of one-way bridges.

The Public Works Department was responsible for collecting all the requisite information, the services

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(1) Circular memo of 28 July 1941 on [illegible]/3421/1

of county engineers being co-opted in respect of main highways and county roads. Particulars required were mostly available from existing records, although where necessary inspections had to be made.

The classification of bridges was a little more difficult than in the case of roads. Very few (if any) road bridges in the Dominion were, for instance, specifically designed to carry a load of 18 tons, though many of the modern ones doubtless could do so. It was accordingly decided in a later instruction to District Engineers(1) to show on the maps as such all bridges capable of taking first class civil loading (i.e. 16 ton traction engine). Other queries which arose out of differences between military and civilian classifications had to be straightened out before the information finally went forward to the Department of Lands and Survey.

Signs indicating the military loading classification were subsequently put up at all bridges.

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Bridge Strengthening. In June, 1942, at the request of Army Headquarters, District Engineers of the Department were authorised to proceed with the strengthening of bridges in certain areas with a view to permitting the movement of 16 ton tanks. The public works districts concerned were Whangarei, Auckland, Taumarunui, Wanganui, Napier, Wellington, and Christchurch. As an alternative to the strengthening of road bridges, Army were at the same time arranging with the Railways Department for the use of railway bridges in some localities. (Approaches to these were constructed by the Public Works Department).

The gross weight of the tank loaded on its transporter was 23 tons - much in excess of normal traffic requirements. Consequently, in the absence of alternative

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(1) Memo of 28 August 1941 on 32/5421/1

crossings (fords, detours, railway bridges) a large number of road bridges had to be strengthened to varying degrees - sufficient where practicable to carry a loaded transporter or, failing this, to take a tank under its own power. In the Auckland district, for example, no fewer than 57 bridges were strengthened, and in North Auckland 39.

Several bridges were completely re-built.

With the limited number of troops at our disposal, it was obvious that the whole of the New Zealand coastline could not possibly be defended in strength against the threat of enemy landings. It was accordingly decided early in 1942 to proceed urgently with the construction of what were known as 'field defensive works' around ports, aerodromes, beaches, and other tactical localities throughout the country. These took the form of road blocks, pillboxes, anti-tank ditches, beach wiring, gun pits, trenches, dugouts, and similar works designed to delay the enemy's progress - particularly the movements of mechanised units - until divisional troops could be rushed up to engage him. Included in the programme were measures to deny the enemy the use of aerodromes and to prepare strategic roads and bridges for destruction by high explosives.

Procedure: In January, 1942, discussions took place between Army, Public Works, and Treasury with a view to formulating a modus operandi which would permit the works to be carried out without the usual hold-ups attendant upon obtaining monetary authorities and routing requests through the normal channels of communication. As the Chief of the General Staff pointed out to the Minister of Defence in a report dated 10 January, 1942(1) 'The time has arrived when the peace-time methods of carrying out work no longer serves our purpose. It will not be possible to submit proposals and obtain financial authorities. Private property must be entered upon at short notice for the construction of trenches, wire entanglements, and other works'. He went on to say that a proposal for the utilisation of the Public Works Department as an engineer organisation behind the

(1) Copy on 23/112 P.2.

fighting services was being submitted by the Chiefs of Staff (Note: this was a reference to the Defence Engineer Service Corps - see part 1 chapter 8). This plan, he said, would enable the available resources of the country to be directed as the situation demanded and allow the normal work of the Department to proceed with the least interference.

For the next three months at least, continued the Chief of the General Staff, troops would devote their time to concentrated training for war, and would not be available in large numbers for engineer works.

The materials available - cement, reinforcing steel, timber, nails, etc. - must, he added, be allocated on a tactical basis, with due regard to stocks in the country.

His proposals for dealing with the situation were:

(a) Commanders of formations to carry out the works required by their defence plans, by their troops to the extent that training requirements permit.

(b) Public Works Department District and Resident Engineers to undertake defensive works required by formation commanders, on request without further authority.

(c) and (d) dealt with a suggested procedure whereby formation commanders might obtain supplies of materials through the Public Works Department. This suggested procedure was the subject of further discussion between the Permanent Head of the Public Works Department and the Quartermaster-General, the instructions, as finally issued on 3 February 1942 to military districts and on the following day to District Engineers,(1) reading as follows:

(a) 'All materials required by Formation Commanders are to be requisitioned for through the Public Works Department on public works form PWS 1. Public Works Department will make the purchase and arrange delivery in accordance with the instructions conveyed on the requisition.

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(1) Copies of Army and PW circulars on 23/112 P.2

(b) Except that in isolated instances where materials are required urgently and no Public Works Department Officer is available, the purchase may be made by the Formation Commander or his 2 i/c, using Public Works Department emergency order forms. This method will be used only when it is not possible to contact a public works officer'.

The same circulars detailed the steps which must be taken to record all work undertaken by the Public Works Department in the form of monthly reports prepared by District Engineers and certified by Formation Commanders.

The issue of departmental emergency order forms (PWS 5) to Army officers was, of course, an entirely new departure. Their use was meant to be strictly limited, but in North Auckland opportunity was taken by Army personnel to order all sorts of supplies, including materials for the erection of military camps and other projects which had no connection with field defensive works. Apart from this incident, which was taken up with Army Headquarters as soon as a report in the matter reached the Public Works Head Office, the system functioned satisfactorily and greatly simplified what would otherwise have been a complicated procedure.

Construction of Works: War Cabinet on 17 February 1942 authorised an initial expenditure of £100,000 on field defensive works(1) and the way was thus clear for an immediate commencement. The works were accorded No. 1 priority by the Commissioner of Defence Construction, who on 23 March 1942(2) instructed the Quartermaster-General to arrange with the three military districts for construction to be put in hand on the 30th of that month. The Commissioner directed that wherever possible mechanical plant was to be used, and that the use of cement (which was in short supply) was to be restricted to a minimum. District Engineers were authorised, where they

(1) Army memo of 20 Feb. 1942 on 23/112 P.2
(2) 32/9025/4

so desired, to utilise the services of local bodies within the local bodies' own areas. Many local bodies had already expressed their willingness to co-operate.

A copy of the Commissioner's memo was forwarded to District Engineers on 26 March 1942.(1) The Engineer-in-Chief mentioned in his covering memo that lists of works indicating their relative priority had been supplied by Army Headquarters to all military districts.

* * *

Field defensive works were carried out by troops, by the Home Guard, and by local bodies as well as by the Public Works Department and its own military organisation, the Defence Engineer Service Corps. There was naturally the closest collaboration between departmental officers and Army Commanders in planning and supervising the construction of the works. Army's requirements fell generally under six headings, namely:

1. Beach defences: Concrete MMG posts; protective wiring; tactical wiring; dummy posts and dummy wire; battle HQ, OP, RAPs; and concreting of beach posts.

2. Fixed defences: Protective wiring; slit trenches for gun crews; overhead covers; and camouflage of works and buildings.

3. Reserve positions in depth: Construct and revet posts; protective wiring; reserve concrete MMG posts; tactical wiring; and concreting of reserve posts.

4. Home Guard defensive positions: Construct and revet posts; protective wiring; tactical wiring; concrete posts at vital points.

5. Road blocks.

6. Anti-tank defences: Improving existing streams; dry ditches and scarfing hillsides; inundations.

The Public Works Department concentrated mainly on

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(1) 32/9025/4

the construction of road blocks and anti-tank ditches. Various types of road blocks had been developed, including (a) concrete sockets in roads and highways (usually at or near bridges) into which bent rails could be set and fastened, (b) earthenware pipe sockets to take timber posts, (c) concrete pillars placed across the road, into which rails or steel joists were fitted, and (d) the use of rollers five feet in diameter which could be rolled across the road on a specially prepared bed and fixed in position.

Anti-tank ditches were excavated or, in some cases, consisted merely of widening existing drains.

Chambers for holding large charges of gelignite were tunnelled under important roads, while railway and road bridges were similarly prepared for demolition by fixing in position the correct sized explosive containers. Aerodromes would likewise have been rendered unusable by the enemy.

* * * *

On 30 November 1942(1) the Quartermaster-General advised the Engineer-in-Chief that War Cabinet had directed, before authorising any additional expenditure on field defensive works, that the whole position be reviewed. Up to this date £200,000 had been authorised. Returns from District Engineers disclosed that the total expenditure recorded amounted to £276,454, and that the sum required to complete all works in hand was £119,926. The work continued into 1943, the total expenditure incurred finally reaching over half a million pounds.

In October, 1943, when it was clear that the danger of invasion had passed, the Government decided that field defensive works which were considered a danger or a nuisance could be removed. This applied particularly to barbed-wire around popular bathing resorts and to

(1) 23/112/15 P.1

blocks on the main roads and highways that constituted a hazard to traffic. Due to the labour shortage, removal operations proceeded slowly in the face of public agitation, and it was not until towards the end of the war that these grim reminders of how near New Zealand stood to becoming a battleground disappeared from view.

PART 3

DEFENCE WORKS FOR THE NAVY

(1) Naval Bases.

(2) Naval Barracks, Schools, etc.

(3) Armament Depots.

(4) Mine Bases and Stations.

(5) Harbour Booms.

(6) Wireless Stations.

(7) Signal Stations.

(8) Anti-submarine Fixed Defence Stations.

(9) Degaussing Ranges.

(10) Bulk Fuel Storage.

(11) Naval Radar Stations.

(12) Plastic Armour.

PART 3

DEFENCE WORKS FOR THE NAVY.

The principal defence works carried out for the Navy during the war fell generally under the following headings:

(1) Naval bases
(2) Naval barracks, schools, etc.
(3) Armament depots
(4) Mine bases and stations
(5) Harbour booms
(6) Wireless stations
(7) Signal stations
(8) Anti-submarine fixed defence stations
(9) Degaussing ranges
(10) Bulk fuel storage
(11) Radar stations
(12) Plastic armour

In the review of Naval works given in the following pages the emphasis is naturally on the engineering and architectural side of this phase of the Dominion's defence programme. No attempt has been made to outline the overall Naval strategy lying behind the construction of these works (this rightly belongs to the official war history of the RNZN), although in a short introduction to some classes of work an indication is given in broad terms of the purpose for which they were required.

In many cases the name of the work is self-explanatory, e.g. W.T. Station, Waiouru. For this reason and in the interests of security the more secret classes of work were given code names (and numbers) during the course of construction. Only a handful of public works officers knew, for instance, that 'Naval Station J.O.2' (as it was referred to in official correspondence) was a controlled mine station on Great Barrier Island. Similarly, radar stations were known simply as 'Naval posts' - the

location being indicated by a code number - and anti-submarine fixed defence stations as 'Naval observation posts'.

Whereas Army works were located all over the country, most of the Naval defences were concentrated around the principal ports (especially Auckland and Wellington) and in the Marlborough Sounds. A notable exception was radar stations, which were sited on headlands and outlying islands extending from the North Cape to the Bluff.

Only works costing upwards of £5,000 are specifically described herein, although to avoid endless repetition the story of all radar stations and of all mine stations has been told in one article. Bulk fuel storage has also been treated as a self-contained subject.

The provision of office, storage, workshops, etc. accommodation for the Navy, both rented and in the form of new buildings, is covered fully in a separate chapter of part 5 of this History. Camouflage, the splinter-proofing of oil tanks, and the construction of pre-fabricated huts are likewise dealt with comprehensively in part 5.

The total expenditure by the Public Works Department on defence works for the Navy was as under:

1939-40	: £74,981
1940-41	: £64,665
1941-42	: £273,870
1942-43	: £906,226
1943-44	: £892,904
1944-45	: £667,896
1945-46	: £577,957
	£3,458,499

1. NAVAL BASES

What started as a moderate expansion of Devonport Naval Base in 1940-41 became, as the war went on - and particularly after Japan's entry into the conflict brought with it, on the one hand, a threat of invasion, and, on the other, the greatest aggregation of allied warships ever assembled in the South Pacific - a huge development programme costing more than 1½ million pounds.

The erection of Naval barracks early in the war replaced the veteran training ship 'Philomel'; dredging (for extra berthing space) and reclamation (for increased space ashore) were carried out in the vicinity of the Base; and the Calliope graving dock was lengthened a second time and the Calliope wharf extended. An area of land in Shoal Bay, behind the Base, was reclaimed and used for the erection of large new stores. A complete motor launch base was set up in the dockyard. In the later stages of the war, a commencement was made on the construction of a boilershop and a breastwork of unique design for repairs to warships of up to the destroyer class.

These works are described in the following pages. Elsewhere in this section of the war history the construction of underground oil fuel tunnels at Devonport is dealt with, also the development of the armament depot at Kauri Point.

In Wellington a new Naval Base was built at Shelly Bay primarily for servicing the lighter classes of Naval vessels.

1. Name of Work: Naval Base, Devonport.

2. Locality: Between Devonport and Stanley Bay, overlooking the Waitemata Harbour.

3. Nature of Work: Development of the existing Naval Base, and associated works.

4. References: File: 23/368 & bar Nos. Map: 3/N6.

5. History: HMS 'Philomel'.

Prior to the war the Naval authorities had realised the necessity for establishing ashore a Naval training station to replace HMNZS 'Philomel', which, permanently moored at the jetty since 1921, had outlived its usefulness. Training huts to augment the shipboard space had already been built ashore, and these and the larger permanent buildings which followed continued to be known as HMNZS 'Philomel'.

On 20 December 1940 War Cabinet authorised the expenditure of £125,865 on 'erection of necessary buildings at the Naval Base, Devonport, for squadron service and also for buildings to replace HMS "Philomel".'
The building programme decided upon, and the order in which it was to be undertaken, was:

Block F : Training Division
" G : General "
" H : Galley Block
" D : Officers' Quarters
" E : Petty Officers' Block
" B : Gymnasium and Chapel
" A : Canteen
" 1 : Stores
" C : Regulating Office

The work was given a high priority and was accorded urgency at all stages. A contract had been let previously for a hospital ('sick quarters') - a large H-shaped two-storey building with accommodation and all modern facilities for the treatment of 38 patients. This was already

under construction and eventually cost upwards of £30,000.

The erection of the new buildings was also carried out by contract. They were of timber frame construction, with exterior finish of plaster board and plaster, and fibrolite roofs.

HMNZ Dockyard: The nucleus of the dockyard or Naval Base proper (as distinct from HMNZS 'Philomel') already existed at the outbreak of war in the form of a dockyard central offices building; machine, electrical, and testing shops; and a radio station. As well as the major projects outlined herein and which formed the greatest part of the development of the Base, a large programme of works of a miscellaneous nature was carried out, including roading, drainage, the provision of a sizeable recreation area at the eastern end of the dockyard, the erection of various new buildings, and alterations and extensions to existing ones. When the WRNS was established in 1944, for instance, accommodation for women had to be found in the vicinity of the Naval Base. This was arranged by taking over from Army the battery camp at Mt. Victoria, a short distance away, and converting it to quarters suitable for WRNS.

Dredging and Reclamation: The war-time expansion of the Naval Base necessitated a considerable amount of dredging and reclamation from 1940-41 onwards, partly to provide additional berthing facilities for newly commissioned minesweepers and partly to make room for more shore facilities. The 10½ acres basin behind Calliope Wharf was dredged, and a total of 9 acres in Stanley Bay reclaimed from the sea bed. In Ngataringa Bay 22 acres were reclaimed, together with 11 acres at Shoal Bay.

Spoil obtained from dredging and from excavating oil fuel tunnels was utilised for reclamation purposes.

Fairmile Boatshed: The Navy having acquired a fleet of small ships, including a number of Fairmiles and harbour

Naval Base, Devonport (Cont'd).

defence motor launches, a commencement was made early in 1943 on the provision at the Naval Base of facilities for the servicing of these craft. Two slipways and a boat-shed were erected. The boat-shed covered an area of 3,000 square yards.

A large shipwright's workshop and a motor launch workshop (mechanical and electrical) was erected, a portion of the building being fitted out for the servicing of Naval radar equipment. A fuelling installation was provided. The larger slipway, capable of handling vessels up to 120 tons, was built in a cofferdam.

The work was completed towards the end of 1944.

Store Buildings, Shoal Bay (References: File: 23/368/21
Map: 3/N5)

Owing to the greatly congested state of the storage accommodation in the dockyard, it was decided in October, 1942, to develop for storage purposes a portion of Shoal Bay known as Melrose Park, in an area north-west of the Base and immediately behind Stanley Bay. This involved reclaiming an extensive area of mangrove mud flats (which was done with the help of spoil recovered from the sea bed in the course of dredging operations at the dockyard wharfage area).

Although located adjacent to Devonport Naval Base, the new buildings were required to meet the Navy's Dominion-wide storage needs. Moreover, additional space at the dockyard was urgently wanted for development of the workshops facilities.

The work at Shoal Bay was undertaken in three stages. The first, phase 'A', commenced in 1944 and comprised the erection of a large clothing and victualling store and a two-storied office. This store was of timber frame construction and covered a floor area of 26,500 square feet. It was framed up with heavy timbers, with a truss roof divided into six bays. The exterior of the walls and

the roof were covered with fibrolite. Phase 'B' consisted of an open timber rack, oil drum stowage space, a store for inflammable goods, and a garage. The third phase, 'C', started in 1945, comprised the erection of a huge general store, 400 feet long by 290 feet wide, and containing a floor area of 116,000 square feet. It was built in two sections, in permanent materials, with a 50 foot roadway through the centre.

The work carried out at Shoal Bay included, in addition to the erection of the buildings, the usual engineering services such as roading, drainage, water reticulation, etc., also a certain amount of dredging and reclamation. An air-raid shelter tunnel running from the Naval Base to Shoal Bay was enlarged to traffic size and lined with concrete.

Ship Repair Facilities: After Japan's entry into the war, it was anticipated that increased facilities would be needed at the Naval Base for the repair of destroyers, sloops, corvettes, etc. The construction of a new quay some 800 feet in length was accordingly authorised. It consisted of a reinforced concrete slab, as a deck, the forward edge being supported on reinforced concrete sheet piles. It was anchored back by both tie rods and raker piles. The quay was the first of its kind to be built in New Zealand and perhaps in the Southern Hemisphere. It was also believed to be the heaviest of its type thus far constructed. Work on the quay commenced in 1944 and reached completion towards the end of the following year.

Simultaneously, a large new boilershop was erected immediately behind the quay. It covered an area of 1½ acres and was equipped with the latest machinery for undertaking heavy structural repairs to warships. It was also capable of handling structural steel work and steel plate work for civilian purposes. Construction of

the boilershop began in December, 1944, and it was finished, complete with the installation of all available machinery, by August, 1945.

The breastwork and boilershop projects involved the driving of 922 reinforced concrete piles, and the use of 1,500 tons of reinforcing and structural steel. Four thousand cubic yards of concrete were poured.

Roads capable of carrying mobile cranes across recently reclaimed land had to be constructed, and underground installations laid for fresh and salt water, storm-water and sewerage drainage, compressed air, fuel oil, electricity (both AC and DC), high pressure hydraulic power, gas, and telephones.

Calliope Graving Dock: At the request of the US Forces in February, 1943, steps were taken to extend the floor of the Calliope Graving Dock a distance of 40 feet to allow for the docking of American heavy cruisers.

Extensions and repairs to Calliope Wharf (undertaken by the Auckland Harbour Board) were carried out during the war.

Dome Teacher (References: File: 23/368/19 Map: 3/N8 The construction of a dome teacher for the Navy was a unique achievement. The requirements were a semi-hemisphere upon which could be projected moving pictures for the training of Naval gunnery crews, the whole to be enclosed in a building located on the roof of a wharf cargo shed.

The project presented many problems. The construction of the screen, which had a diameter of 30 feet, was by no means a simple matter. As the films were accompanied by all the sound effects of actual warfare and as every effort had to be made to simulate actual shipboard conditions within an enclosed sphere, the acoustical treatment required special attention. Lighting and

DEVONPORT NAVAL BASE.

NGATARINGA BAY, DEVONPORT.

82 acres were reclaimed here for the Naval Base.

Naval Base, Devonport (Cont'd).

ventilation were also important and had to be given special treatment. Quite apart from technical considerations, the design of a fairly large enclosing building, exposed to high wind pressures and merely tied down to the roof of another building, was also an unusual problem. This building stood 38 feet high to the ridge of the roof and was tied down by braces, carried through each side of the building, and bolted through the concrete roof of the wharf shed. (A similar dome teacher was constructed at HMNZS 'Cook', Wellington).

Expenditure: The total expenditure by the Public Works Department at the Devonport Naval Base, including the Shoal Bay stores and all other associated works, from February, 1940, to the end of the war, amounted to £1,597,380.

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1. Name of Work: Naval Base, Shelly Bay.
2. Locality: Evans Bay, Wellington, on the western side of Watts Peninsula.
3. Nature of Work: Construction of a base for the operation, servicing, and overhauling of light Naval craft, and the provision of an armament depot with dispersed magazines.
4. References: File: 23/688 A bar Nos. Map: 8/15.
5. History: The first stage in the development of a new Naval Base at Wellington was the construction of magazines for an armament depot. With the assistance of labour from nearby Mt. Crawford Prison, preliminary work was carried out early in 1942, consisting chiefly of clearing trees and excavating into the hillsides for each magazine site. A contract was let in April, 1942, for the erection of ten magazines, a laboratory, an office, a garage, and a house for an ordnance officer. A mine store was constructed at Mahanga Bay, on the opposite

side of the peninsula.

The total floor space covered by the armament depot buildings was 20,845 square feet. The Navy was in occupation by the end of 1942.

In the meantime, following discussions between the Navy, the Public Works Department, and the Wellington Harbour Board, instructions to commence the construction of the Naval Base proper were issued in May, 1942. The design of the wharves, etc. had already been prepared by the Harbour Board's engineering staff.

An immediate start was made with the reclaiming of Shelly Bay and of the bay lying to the north of it. This was done by utilising material excavated from adjoining hillsides. A total area of 6½ acres was reclaimed and levelled. Two dredges were employed on dredging the wharf and berthing area, but progress was fairly slow, since much of the material to be removed was rock and this had to be bored and shot before it could be lifted.

An order was placed in Australia for hardwood timber for the wharves.

The construction of the wharves commenced in October, 1942, 15 of the contractors' employees having been released from the Army for this purpose. When completed the wharf and breastwork extended over an area of 37,200 square feet, and provided 1,200 feet of berthage with a minimum depth (at SWST) of 20 feet.

Slipways to take 'Fairmile' launches were erected, complete with side slipping ways and extra cradles, a main hauling winch, and side slipping winches.

By the close of 1942 reclamation was far enough advanced to enable the building programme to begin. A contract was let for the first accommodation block, other buildings and works following as labour and space became available. These were taken over by the Navy as they

reached completion. The buildings erected comprised accommodation blocks for ratings and for CPOs; a mess block; a recreation hall and canteen; a hospital; a laundry; two boiler houses; a store; a workshop; a shipwright's shop; an administration block; and officers' quarters. These covered a total floor area of 69,050 square feet.

The usual engineering services were installed, including a stormwater system; a sewerage system (with sewage pumps and a pump house); and steam heating and cooking facilities. Four thousand feet of kerbing and channelling were laid, while 2,050 feet of retaining walls and wall faces were constructed of concrete or of stone and concrete. Forty six thousand square yards of streets, paths, etc. were sealed. A comprehensive water supply and fire fighting system was provided, involving 16,000 feet of 6 inch supply main from the city reticulation at Miramar Wharf, and the construction of a 100,000 gallon reservoir, with the requisite pumping equipment. The base was connected with the city electrical system, supplemented by Diesel driven standby generators.

The expenditure incurred by the Public Works Department on the whole project aggregated £390,250.

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TWO VIEWS OF SHELLY BAY NAVAL BASE, WELLINGTON.

In the lower the Massey Memorial may be seen on the tip of Pt Halswell.

The construction programme carried out at the Devonport Naval Base included the provision of accommodation for the main Naval barracks in New Zealand (HMNZS "Philomel"). Similarly, HMNZS "Dolphin" at the Shelly Bay Naval Base became the chief Naval barracks for the port of Wellington.

The work undertaken at these establishments has already been touched on in section I, "Naval bases".

There follows a description of the setting up on Motuihi Island, in the Hauraki Gulf, of a Naval training school known as HMNZS "Tamaki"; of a school for anti-submarine training on the Petone foreshore; of barracks (HMNZS "Leander") erected at Lyttelton to accommodate personnel stationed at that port; and of the erection of RNZN Headquarters at Dunedin (used later as a training centre).

Also included in this section is the story of the construction at Clyde Quay, Wellington, of headquarters for a Naval auxiliary patrol service, an anti-submarine maintenance base, and a mine sweeping store.

The total accommodation available for personnel at the four principal barracks was as follows:

HMNZS "Philomel"	:	650
" "Tamaki"	:	517
" "Dolphin"	:	450
" "Leander"	:	192

1. Name of Work: HMNZS 'Tamaki', Motuihi Island.

2. Locality: An island in the Hauraki Gulf.

3. Nature of Work: The construction of a Naval training school for personnel to man destroyers and similar small craft.

4. References: File: 24/431 Map: 3/N3.

5. History: Motuihi Island was chosen by the Navy as a suitable site for the new school, since the western end contained buildings of an old quarantine station, while two adjoining beaches, facing north and south respectively, were ideal for sea training purposes. The 22 existing buildings formed the nucleus for the training school. Various alterations were carried out to these buildings and 15 new ones covering a total floor area of 63,500 square feet were erected.

The new buildings included a provision store, a Naval and clothing store, a canteen, a gymnasium and chapel, a school, a signal instruction building, a hospital, a dental clinic, and four large dormitories. All were constructed in timber frame, with weatherboard exterior finish and fibrolite roofs. Interiors were lined and finished to a fairly high standard.

For the water supply, new bores were sunk and connected to an existing reservoir. A 30,000 gallon concrete tank was installed to collect rainwater from the roofs. Salt water was also pumped to a water tower for use in latrines, etc., and for fire fighting purposes.

Roads, paths, and parade grounds were formed and sealed and a football field and a tennis court were constructed.

Practically the whole of the Motuihi Island project was carried out by the Public Works Department with its own carpenters and labourers. The men were puzzled at first by the Naval officers' references to floors as 'decks', and partitions as 'bulkheads'. They even spoke

HMNZS 'TAMAKI', MOTUIHI ISLAND, AUCKLAND.

NAVAL ARMAMENT DEPOT, KAURI POINT, AUCKLAND.

of the 'port' and 'starboard' side of the buildings. To the Navy the island was a ship and everything appertaining to it was discussed in nautical terms, somewhat to the amusement and, occasionally, embarrassment of the men on the job.

The work was commenced in July, 1942, and completed in May, 1943, at a cost of £53,350.

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1. Name of Work: Naval Electrical School, Petone.
2. Locality: Esplanade, Petone, with three hostels at 56 and 132 Richmond Street and 327 Jackson Street, Petone.
3. Nature of Work: Erection of new buildings and alterations to existing buildings.
4. References: File: 23/711/12, 47 & 48 Map: 7/N2.
5. History: An anti-submarine training establishment, known (to conceal its true purpose) as a Naval electrical school, was set up on the Petone foreshore in 1942.

The Heretaunga Boating Club's club-house was taken over in July, 1942, at a rental of £221 per annum, including the use of furnishings. This was altered to suit the Navy's requirements, while a new building containing 4,760 square feet was erected alongside it. This was partly single storied and partly two storied. A concrete air raid shelter was also constructed. Later, in March, 1943, the erection of an additional lecture room, 875 square feet, was authorised, together with alterations to the older part of the school.

To provide accommodation for personnel a block of six flats at 56, Richmond Street, Petone, was occupied by the Navy (under the Accommodation Emergency Regulations) at a weekly rental of £9.12.6. Three eight-men huts were erected on the property. A large house in the

same street (No. 132) was purchased in October, 1942. This was converted into a hostel for WRNSs, and two 20 feet by 8 feet huts were added.

Early in 1942 a house and land at 327 Jackson Street, Petone, were acquired for the accommodation of officers. Minor alterations only were required in this case.

The total expenditure by the Public Works Department on the training school and on accommodation for personnel (apart from rentals and purchase prices) was £9,688.

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1. Name of Work: Naval Auxiliary Service Headquarters; Anti-submarine Maintenance Base; and Mine Sweeping Store, Wellington.
2. Locality of Work: Clyde Quay, Wellington.
3. Nature of Work: Erection of buildings and a camp.
4. References: File: 23/636 Map: 8/M4.
5. History: The first work undertaken for the Navy in the Clyde Quay area was the installation of a petrol tank and pump to serve the private launches which had been taken over by the Navy and were being manned by the Naval Auxiliary Patrol Service. These were moored at the western end of the boat harbour.

On 31 January 1942, the Naval Officer-in-Charge, Wellington, asked for an estimate of the cost of a store and battery building 40 feet by 16 feet, proposed to be erected on Harbour Board land to the west of the approach to Clyde Quay Wharf. This store was intended for the mine sweeping service and before it had been completed approval was received for a 16 feet by 16 feet addition for use as a W/T store.

In the meantime, the Naval Auxiliary Patrol Service was working under difficult conditions, a boatshed having to serve as headquarters, armoury, quarters for duty officer, etc. On 1 July 1942, approval was given to

erect a building suitable for these purposes at the western end of the boat harbour.

By the end of 1942, Fairmile and harbour defence launches were arriving and temporary facilities were necessary for servicing and operating them until the Shelly Bay Base was available.

Accordingly, workshop, stores, and fuelling facilities were installed and a phase one camp erected at the end of Chaffers Street. The buildings consisted of messrooms, lecture rooms, galley, laundry and drying room, stores, office, workshop, ward room and duty officer's accommodation, WRNS's rest room, ablutions, etc., totalling 5,000 square feet floor area, together with sixteen 20 feet by 8 feet portable huts for sleeping accommodation.

The cost was £11,759.

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1. Name of Work: Naval Barracks, Lyttelton (HMNZS 'Tasman').

2. Locality: On reclaimed land in the vicinity of the western mole, Lyttelton.

3. Nature of Work: Erection of Naval barracks.

4. References: File: 23/735 Map: 11/N5

5. History: In December, 1942, the erection of Naval barracks to accommodate personnel engaged on boom defences and on coastal defence patrol craft in the vicinity of Lyttelton was authorised. This was in substitution for an earlier proposal to house the men in portable huts.

Erection of the buildings was at first entrusted to the Department of Housing Construction, but the Public Works Department took over before these had been completed. The very poor bearing capacity of the site - on reclaimed land - necessitated the laying of specially designed concrete foundations, in order to spread the load as much as possible. Buildings were of timber construction with fibrolite roofs, but later additions, such as the hospital, had malthoid roofs. Covering a total floor area of 29,536 square feet, the buildings comprised four dormitories, two messes, an administration block, a YMCA, a garage, an ablutions block, a boiler house, and a hospital. The hospital was built out of materials dismantled from a barracks at Godley Head.

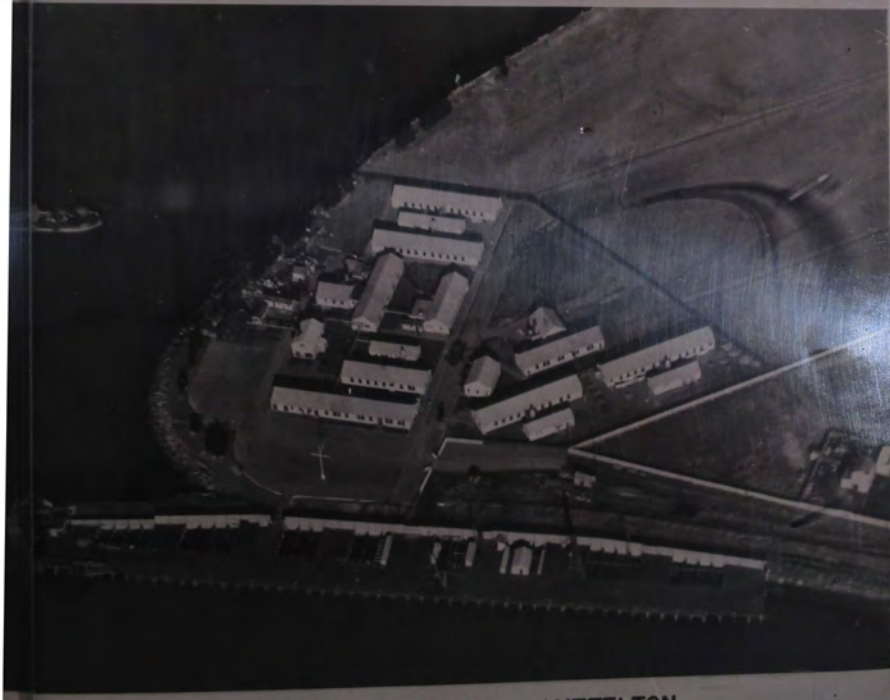
Water for the new barracks was taken from the Lyttelton borough mains, the reticulation involving some 1,400 feet of 4 inch pipe and 800 feet of 1½ inch and smaller sizes. Sewerage was discharged into the sea.

Electricity was supplied from the existing mains. Steam heating was installed throughout the barracks.

Eighteen chains of roading were constructed and sealed - an expensive item (nearly £1,900) owing to the nature of the ground.

The work was completed between May, 1943, and April, 1944, at a cost of £62,370.

LYTTELTON HARBOUR.
Showing the Port at left and Godley Head in the left background.



NAVAL BARRACKS, LYTTELTON.

Naval Barracks, Lyttelton (Cont'd).

The use by the Navy of No. 4 wharf, Lyttelton, necessitated the erection of several small stores, also the installation of a generating plant. Ablutions and mess-rooms were provided at the graving dock for the use of personnel whose ships were under repair.

The cost of this work was £6,520.

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1. Name of Work: RNZNVR Headquarters, Dunedin.
2. Locality: St. Andrew Street, Dunedin.
3. Nature of Work: Erection of a RNZNVR Headquarters Building and additions thereto.
4. References: File: 23/385 Map: 13/N1
5. History: The erection of a Naval headquarters building and training hall at St. Andrew Street, Dunedin, was authorised prior to the war, but it did not reach completion until November, 1940. The building was a brick and concrete structure, with steel roof trusses. It covered a total floor area of 8,800 square feet, of which 6,000 square feet was taken up by the training hall, the remaining space consisting of offices, ward rooms, a galley, lavatories, etc.

In October, 1941, the Navy contemplated using the training hall as sleeping and messing quarters for ratings. As, however, the existing cooking and messing facilities were inadequate for this purpose a new kitchen and mess-room were built on the site of the rifle range, adjoining the hall. This addition, an area of 840 square feet, was ready in January, 1942. Later, extra lavatory and ablutions facilities were provided, while the hall was partitioned to form two lecture rooms. Further accommodation for officers and petty officers, including ward rooms, a sick bay, a galley, showers, etc. was made available by erecting a new storey over the office portion of the building.

RNZNVR Headquarters, Dunedin (Cont'd).

The total cost of the land and building amounted to £16,010, of which £3,402 was spent out of the War Expenses Account on alterations and additions.

3. ARMAMENT DEPOTS

The existing armament depot at Kauri Point, Auckland, was expanded during the war, as per details appended hereto.

The story of the construction of the Shelly Bay Naval Base includes a reference to the provision there of a new armament depot.

A third depot was established at Cass Bay, Lyttelton, as described in the following pages.

The total magazine accommodation available at the three armament depots was:

Kauri Point : 26 magazines

Shelly Bay : 10 "

Cass Bay : 10 " (Three of these were used by Army).

Fifteen of the magazines at Kauri Point were originally erected for the US Navy, and were taken over by the RNZN when no longer required by the Americans.

1. Name of Work: Armament Depot, Kauri Point.

2. Locality: Kauri Point, on the northern coastline of the Waitemata Harbour.

3. Nature of Work: Construction of magazines, stores, and other buildings.

4. References: File: 23/416 Map: 3/N4

5. History: The existing Naval Armament depot at Kauri Point was considerably expanded during the war. In 1941 a mine depot near the wharf was constructed at a cost of £36,000. This was followed by a new store, an office block, seven magazines, a shell store, an examination room, and a detonator room, while sundry alterations and extensions were made to existing buildings. This expansion programme involved extensive excavating (for the magazine sites), and the formation of access roading.

The total expenditure incurred was £87,414.

In addition, magazines were provided at Kauri Point for the US Navy (see part 4).

1. Name of Work: Armament Depot, Cass Bay.

2. Locality: About two miles from Lyttelton, adjacent to the Lyttelton-Motukarara main highway.

3. Nature of Work: Construction of magazines and ancillary accommodation.

4. References: File: 23/857 Map: 11/NW

5. History: The site finally chosen for Naval magazines in the vicinity of Lyttelton was at Cass Bay, in a land-locked valley which lay close to the main highway, was free from settlement, and could be reached by shallow draught boats and barges.

Ten magazines were constructed, one in concrete and the others in brick - all with fibrolite roofs. They were sited in excavations cut out of the hillside, in order to localise any explosion which might occur. In this connection care was also taken to ensure that magazines were not built directly opposite each other in the valley. The ancillary structures - a laboratory, an office, and a caretaker's residence, were of timber construction. The whole area was surrounded by a 'climb-proof' fence.

Metalled access roading aggregating 62 chains in length was provided.

Water was obtained from a nearby stream, by gravity, with an extra feed from the borough mains to supplement the supply, since the stream was inclined to dry up. For fire fighting purposes two gunited storage tanks were constructed, of 18,000 and 40,000 gallons capacity, respectively. A 4 inch pipe-line, 76 chains long, was provided.

Sewage was disposed of in three small septic tanks. Electric power was drawn from the Lyttelton borough mains.

The work was carried out between January, 1943, and July, 1944, at a cost of £48,496.

4. MINE BASES AND STATIONS

The principal work carried out under this heading was the construction on Rangitoto Island, Auckland, of a large base where the controlled mining stores of the Dominion were held. A mine depot was also erected at Te Kao Bay, Akaroa Harbour. (This was transferred to Army in November, 1943, for the storage of artillery equipment).

Early in 1942 the provision of accommodation both for personnel and for supplies and equipment was undertaken at a number of control and observation mine stations. This consisted of the usual type of barracks, mess-rooms, etc. for the personnel, complete with drainage, water supply, electricity, and any necessary access roading or other engineering services. Special reinforced concrete structures were required for the equipment, known variously as control towers (surface observation and underground) power stations, look-out posts, and cable terminal stations. These were of heavy construction and their erection involved a considerable amount of underground excavation.

The mine stations concerned were:

Locality	Cost	References: File	References: Map
Whangaroa Harbour	£9,650	23/722/1	1/N1
Bay of Islands (2)	25,394	"	1/N2
Great Barrier Island (2)	31,000	23/722/2	2/N2
Whangaparaoa	8,917	"	2/N7
Worser Bay, Wellington	23,632	23/722/3	8/N7
Queen Charlotte Sound	20,000	23/722/4	9/N4
Lyttelton (Godley Head)	7,515	23/722/5	11/N2
Akaroa (Wainui)	11,265	"	10/N2
	£137,373		

1. Name of Work: Controlled Mine Base, Rangitoto Island.

2. Locality: On the eastern side of Rangitoto Island, at the entrance to Islington Bay.

3. Nature of Work: To provide storage accommodation for mines and cable, etc.

4. References: File: 23/722/2 Map: 3/N2

5. History of Work: An old Harbour Board quarry which had not been used for 15 years was selected by the Navy as the site for this base. The quarry contained sufficient space for the large stores, etc. required but its clearing and levelling was a difficult task owing to the extremely rough nature of the ground. This involved a considerable amount of blasting.

The buildings erected included the main mine depot, a mine store, and two magazines, covering a floor area of 61,000 square feet, also a generator house, barracks, two cable tanks, and the mine manager's residence. The total floor area aggregated 71,700 square feet. The barracks were already available, having been built previously for Army personnel.

The Auckland Harbour Board constructed a new wharf at Rangitoto, complete with a Butler's crane, for access purposes and for the handling of heavy cable, but to begin with the old wharf had to be repaired and strengthened to enable materials to be landed.

Water supply was provided from the roof catchment area and was stored in an 80,000 gallon storage tank. Salt water was also used for fire fighting and for latrines. During the progress of construction, water had to be transported by barge from Auckland for general camp use as well as for concrete mixing.

A generating plant was installed to provide electric power and lighting.

The project was carried out between April, 1942, and May, 1943, at a cost of £105,209.

CONTROLLED MINE BASE, RANGITOTO, AUCKLAND.

HARBOUR BOOM AND ANTI-SUBMARINE NETS, AUCKLAND.

Entrance from North Head to Bastion Point.

1. Name of Work: Mine Depot, Te Kao Bay.

2. Locality: An inlet on the western side of Akaroa harbour.

3. Nature of Work: Construction of a depot for the loading, servicing, and storage of controlled mines.

4. References: File: 23/682 Map: 10/M1

5. History: Te Kao Bay was originally selected as a site for a mine and Naval armament depot, but it was subsequently decided to construct the magazines at Cass Bay, Lyttelton harbour.

Considerable difficulty was experienced in finding a site for the depot. No suitable site was available in Lyttelton harbour (which would have been preferred by the Navy for administrative reasons). Owing to the quantities of explosives involved, the locality had to be isolated and at the same time have a sufficient depth of water to permit the anchorage of mine laying vessels. Te Kao Bay met these requirements, though its remoteness from Lyttelton meant heavy cartage over the hills from Little River.

The principal work carried out at Te Kao Bay was the erection of a depot building with a concrete floor covering an area of 24,500 square feet. This and the accommodation buildings etc. were of timber construction, but the mine magazine, examination room, and primer magazines were of brick.

A wharf also had to be provided. As the water at the landward end of the wharf was shallow, an earth fill joined the timber structure to the land. This served as a dumping place for excavated spoil as well as speeding up the construction of the wharf.

A new road 53 chains long was formed and metalled, while 34 chains of existing road were metalled.

Water was gravitated from a small spring to a holding tank of 600 gallons capacity. From this tank 3,850 feet

of ¾ inch pipe gravitated the water to two 600 gallon storage tanks, whence it was reticulated to the camp by 1,200 feet of 1 inch and 400 feet of ¾ inch pipe.

Sewerage was disposed of by septic tanks.

Electricity was drawn from existing power lines.

The work was carried out between July, 1942, and September, 1943, at a cost of £69,174.

The depot was transferred to Army in November, 1943, for the storage of artillery equipment.

5. HARBOUR BOOMS

Pile booms to prevent the entry of unauthorised shipping were erected across the entrances to Auckland and Wellington harbours. A gate boom did similar duty at the entrance to the inner harbour at Lyttelton.

A depot was built at Waikawa for the servicing of a boom defence at the head of West Bay, Queen Charlotte Sound, Marlborough, but the construction of the boom was not proceeded with.

1. Name of Work: Pile Boom, Waitemata Harbour.

2. Locality: Stretching across the entrance to the harbour, from North Head to Bastion Point.

3. Nature of Work: Provision of a pile boom and gate nets (known technically as 'anti-boat obstruction') to protect the Waitemata Harbour against enemy submarine attack.

4. References: File: 23/539 Map: 3/119

5. History: The construction of a pile boom across the entrance to the Waitemata Harbour, with gate nets for the entrance of shipping, was authorised in 1941. The boom, which was built by the Auckland Harbour Board, was 4,440 feet long, and involved the driving of 1,050 hardwood piles varying from 30 feet to 60 feet, together with the necessary waling and bracing to support the piles. This entailed the use of 81,500 super feet of timber. Steel anti-torpedo nets protected the opening in the boom. Two hundred five ton concrete blocks were cast by the Public Works Department as anchors for the nets. Two concrete slabs, 42,900 square feet in area, were constructed at the Western Reclamation for the purpose of effecting repairs to the nets.

Expenditure by the Public Works Department on the boom and associated works totalled £31,171.

1. Name of Work: Pile Boom, Wellington Harbour.

2. Locality: Stretching across Port Nicholson from Eastbourne to Ward Island and thence to the beacon south-west of Ward Island.

3. Nature of Work: Erection of a piled barrier which, together with nets, (placed across the main channel), completely closed the entrance to the inner harbour.

4. References: File: 23/607 Map: 8/N6

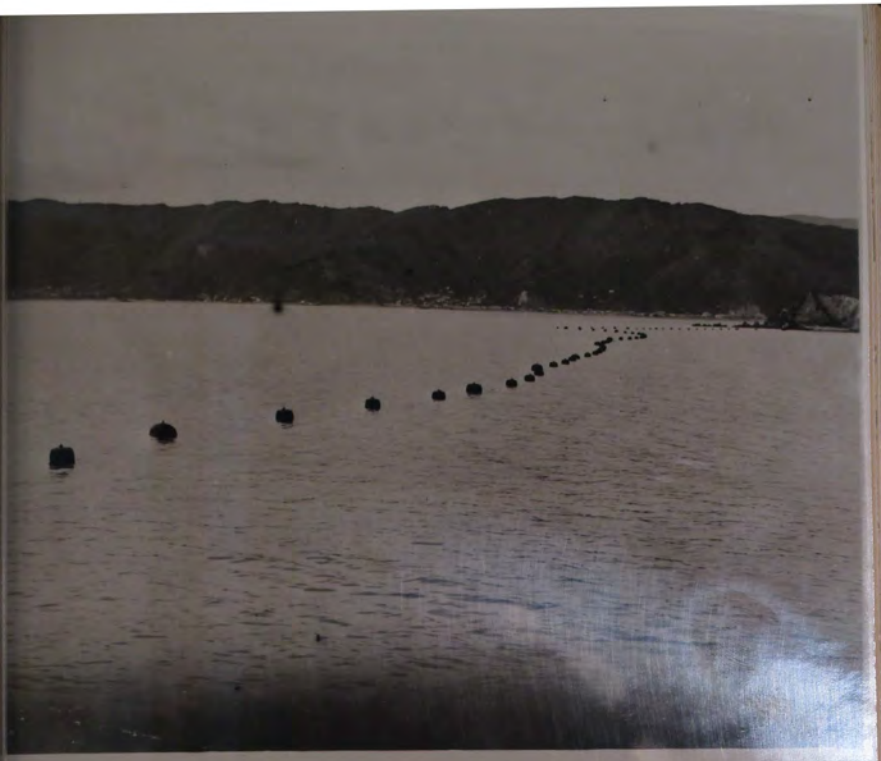
5. History: A proposal to protect Wellington harbour from the entrance of hostile submarines or torpedo boats, etc. was first discussed with the Public Works Department early in December, 1941. A few months later the purchase of hardwood piles and other materials was authorised.

A contract for the construction of a pile boom was let in June, 1942, to a contractor specialising in bridge and wharf building, and the work commenced shortly afterwards. Progress was slow at first owing to difficulty over procuring punts and a tug. When the work was in full swing the contractor was operating one large floating pile-driving plant and three plants from staging. Heavy weather at times delayed operations, and also caused damage to the contractor's plant.

The total length of the boom was 6,050 feet, necessitating the driving of 1,614 piles and the fixing of 12,100 feet on walings, as well as temporary braces, caps, and a catwalk, etc.

The gap across the channel was filled by nets laid by the Navy. A yard and store were provided on Aotea Quay, Wellington, for this purpose, and cranes were erected on a punt.

Including this work, the total cost of the project amounted to £85,576. It was completed in April, 1943.



WELLINGTON HARBOUR BOOM.

TOP: A close-up of the net floats between Ward Island and Kau Point, Watts Peninsula: LOWER: Looking from Pt Halswell, the pile boom appears as a thin white line between Ward Island and Eastbourne (the line of nets is faintly

1. Name of Work: Boom Defence Depot, Waikawa.

2. Locality: Queen Charlotte Sound, Marlborough.

3. Nature of Work: Erection of a workshop and repair shop.

4. References: File: 23/754 Map: 9/N6

5. History: The erection of a depot for the purpose of servicing boom defences proposed at West Bay, Marlborough Sounds, was put in hand in November, 1942. The construction of five magazines at this site was also contemplated. Owing, however, to the improved war situation neither the magazine nor the boom defences were proceeded with, and the depot served as a repair shop and store in respect of other defence activities in the West Bay area.

The site selected was partly tidal and therefore swampy. Drainage and filling were the principal items of work carried out, together with the erection of the workshop and the provision of a water tank and a pumping station.

The depot was completed in July, 1943, at a cost of £7,000.

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1. Name of Work: Boom Defences, Lyttelton Harbour.

2. Locality: At the entrance to the inner basin of Lyttelton Harbour.

3. Nature of Work: Erection of winch houses, crew shelters, etc., and the driving of piles to carry the hauling ropes of the boom.

4. References: File: 23/902 Map: 11/N7

5. History: The work carried out by the Department in connection with the provision of a 'gate' boom across the entrance to the inner harbour at Lyttelton was of a relatively minor nature. Buildings of phase one construction were erected on the wharf - bunk houses, mess-rooms, lavatories, etc., also a rigging loft and store. Personnel manning the boom defences were quartered at HMNZS 'Tasman'.

Winch houses were built and piles driven to support the hauling ropes. The work was carried out between Jan- [illegible] at a cost of £4,452.

6. WIRELESS STATIONS

The Post and Telegraph Department was more closely associated with the RNZN in the provision of facilities for radio transmission and reception, and the matter will no doubt be dealt with fully in that Department's Official War History.

The Public Works Department was responsible for the erection of the main Naval W/T Station at Waiouru. This, from a construction point of view, was a 'combined' project undertaken on behalf of both the Navy and the RNZAF, although each arm of the Service functioned separately.

A radio receiving station erected at Pureua for the US Forces was taken over by the RNZN in December, 1944. Some of the port signal stations were equipped with radio (see section 7, 'Signal Stations').

1. Name of Work: Wireless Telegraphy Station, Waiouru.

2. Locality: At the foot of Mt. Ruapehu, on the southern side : 15 miles north of Taihape.

3. Nature of Work: Erection of a Naval and RNZAF wireless telegraphy station.

4. References: File: 23/406/27 Map: 4/N1

5. History: The construction of a combined Naval and RNZAF wireless station with accommodation for about 200 personnel was first contemplated in June, 1942, and, after preliminary investigation to determine the suitability of the site selected, construction commenced in October of that year.

The main part of the station occupied an area of 30 acres, but the receiving aerials covered about 400 acres. Sufficient land was acquired for the permanent camp.

The project was built at an altitude of 2,500 feet, and consisted of an accommodation camp with a receiving station 3/4 mile away. Two transmitting stations were located some seven miles to the north of the camp.

Water, sewerage, and electrical reticulation were provided. All the work, with the exception of the erection of the aerials, telephone installation, and some cable laying, was carried out by the Public Works Department.

The receiving and transmitting portions of the station were connected by telephone with separate exchange systems. Auxiliary power houses were built at both the receiving and transmitting ends. Naval personnel to work their own transmitting sets were transported each day from the main camp at Hihitahi.

During the early life of the station the Air Force men and women lived with Naval personnel at the Hihitahi Camp, but later separated and moved to the military camp at Waiouru and each day RNZAF operators were conveyed to and from their work.

The Chief Surveyor, Lands and Survey Department, co-operated with the Public Works Department and the two Service Departments in fixing the positions of the station aerials, etc.

In June, 1946, the RNZAF ceased operations at Waiouru and withdrew, leaving the station wholly to the Navy.

The principal items of work carried out were as follows:-

Buildings erected.	58	
Floor area of buildings.	45,600	square feet
Roads formed and surfaced.	5	miles
Sewer mains.	36	chains
Water mains.	227	"
Water tank, concrete, 20,000 gallons.	1	
Septic tanks.	7	
Telephones.	49	

Most of the building work supervised by the Department was undertaken on the master schedule basis.

Pumice dust from the Waiouru plains created a certain amount of trouble in the receiving and transmitting sets in the early stages as also did fine volcanic ash from Ruapehu, but effective methods of coping with the nuisance were adopted. It might be mentioned that volcanic ash from the mountain penetrated the working parts and bearings of internal combustion engines and other machines, thereby causing anxiety for a time.

Construction of the station commenced in June, 1942, and was completed for all practical purposes later on in the same year.

The total expenditure by the Public Works Department on the project amounted to approximately £100,000, excluding, of course, work done by other Departments, such as the erection of aerials, telephone reticulation, cable laying, and installation of equipment.

AVY CAMP ON WHANGAPARAOA PENINSULA, AUCKLAND.

The coastwatching organisation in New Zealand was the responsibility of the Naval Board. In early 1943 as many as 80 stations were being operated in collaboration with Army, harbour boards, and lighthouse personnel. Of these only the Naval radar stations and what were known as war or port war signal stations were manned by RNZN personnel.

Construction work undertaken at the port war signal stations was of a comparatively minor nature, consisting mainly of the erection of the station building, power house, etc. and the provision of accommodation for a small number of men.

Typical of the Department's activities in this respect are the descriptions given in the following pages of the work carried out at Tiritiri Island (Auckland District), at Baring Head, Pt. Halswell, and Beacon Hill (Wellington), at Godley Head (Lyttelton) and, in the Marlborough Sounds area, at Wedge Point and West Head, Queen Charlotte Sound.

1. Nature of Work: Port War Signal Station, Tiritiri Island.

2. Locality: An island in the Hauraki Gulf, opposite the Whangaparaoa Peninsula.

3. Nature of Work: Construction of a signal station, complete with accommodation for personnel.

4. References: File: 23/471 Map: 2/N6

5. History: A Naval port war signal station was established on the eastern side of Tiritiri Island in February, 1940. Materials for the station building and for living quarters for personnel were landed on the western side of the island, hauled up from the steeply sloping beach, and then taken across undulating farm paddocks, using tractors and sledges, to the site of the work - almost a mile away. A few months earlier, on the outbreak of war, repairs, alterations, and additions had been effected to a house and signalling tower belonging to the Auckland Harbour Board, an engine shed had been erected, and a generator set installed.

In December, 1942, the re-siting of the signal station on the north-western side of the island was authorised, owing to mines having been laid in the gulf. The buildings were dismantled, transported across the island, and re-erected in the new position - all without interfering with the continuous operation of the station.

The total cost of the work carried out for the Navy on Tiritiri Island amounted to £4,770.

1. Name of Work: Naval Signal Stations, Wellington.

2. Locality: Baring Head, Beacon Hill, and Point Halswell.

3. Nature of Work: Erection of signal masts and accommodation.

4. References: See below.

5. History: A port war signal station was established at Baring Head immediately after war broke out. Others followed at Beacon Hill and Point Halswell in June, 1942.

In each case the station consisted of a signal mast, a wind break, an office, and accommodation for eight men.

In February, 1944, alterations and additions were effected to the accommodation at the Point Halswell station for the purpose of providing quarters for members of the WRNS.

The cost of work carried out by the Department was as follows:

Station	Cost	References File	References Map
Baring Head	£915	23/466	7/N3
Beacon Hill	719	23/419/1	8/N8
Point Halswell	1245	23/734	8/N3

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1. Nature of Work: Harbour Signal and WT Station, Wedge Point.

2. Locality: Queen Charlotte Sound, Marlborough.

3. Nature of Work: Erection of a Naval signal station for the control of shipping entering Picton harbour.

4. References: File: 23/739 Map: 9/N7

5. History: This project commenced in August, 1942, and, as local contractors were all engaged on other defence works, it was carried out in its entirety by the Department's own forces.

The site had been chosen by the Navy because the point covered all entrances to the harbour and to Queen Charlotte Sound. Access was difficult and had to be

PORT WAR SIGNAL STATION, BARING HEAD.

The signal mast may be seen immediately to the rear of the lighthouse.

PORT WAR SIGNAL STATION, PT. HALSWELL.

This appears slightly to the right of the Massey Memorial (left foreground). Also in the picture are an AA battery, Army barracks, and, at right, Fort Ballance.

Harbour Signal and WT Station, Wedge Point (Cont'd).

improved by the formation and metalling of a road leading off the Picton-Havelock via The Grove main highway.

The harbour station was erected first, and equipment installed, the WT station following (though it was never equipped for service). After the main station buildings had been completed, accommodation was provided for personnel, including sleeping quarters, mess-rooms, and recreation facilities. Water was supplied from a stream 300 feet below and pumped to the station.

The work was completed at the end of November, 1942, at a cost of £12,000.

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1. Name of Work: War Signal Station, West Head.
2. Locality: Queen Charlotte Sound, Marlborough.
3. Nature of Work: Provision of buildings and services for a signal station controlling shipping in Tory Channel, one of the entrances to the Marlborough Sounds.
4. References: File: 23/739 Map: 9/N2
5. History: The location of this station was chosen on account of its wide range of observation. The site was particularly difficult of access: all materials had to be transported by sea and hauled up to the top of a cliff by means of a wire rope and power winch.

A contract was let for the erection of the buildings. All other work, including drainage, sewerage, electrical reticulation, etc. was carried out by the Department. Water was supplied from a source 1½ miles away.

The work commenced in July, 1942. Progress was slow owing to the inaccessibility of the site and bad weather, but the project reached completion in May, 1943.

The expenditure incurred aggregated £7,200.

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NAVAL DEFENCES IN THE MARLBOROUGH SOUNDS

TOP LEFT: HARBOUR SIGNAL STATION, WEDGE POINT. RIGHT: PORT WAR SIGNAL STATION, LONG ISLAND.
BELOW LEFT: WAR SIGNAL STATION, WEST HEAD, TORY CHANNEL. RIGHT: BOOM DEFENCE DEPOT, WAIKAWA BAY.

THER PHOTOGRAPHS OF THE MARLBOROUGH SOUNDS DEFENCES
POST OFFICE POINT, PELORUS SOUND. LOWER: GUN ON

War Signal Station, West Head (Cont'd).

A similar signal station was established on Long Island, at the northern entrance to Queen Charlotte Sound.

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1. Name of Work: Port War Signal Station, Godley Head.
2. Locality: Godley Head, at the entrance to Lyttelton harbour.
3. Nature of Work: Construction of a signal station and barracks.
4. References: File: 23/476 Map: 11/M1
5. History: Immediately after the outbreak of war a signal station for recognition of shipping approaching Lyttelton harbour was erected on Godley Head. This comprised a small poilite building from which watch was kept, and which also provided sleeping accommodation for one rating when off watch.

Barracks for the crew were constructed adjacent to the signal station. These contained accommodation for six men with all necessary facilities under the one roof.

Sewerage from the barracks was discharged over the cliff. Water and electricity were supplied from the Army fortress camp on Godley Head.

In 1942 the site occupied by the signal station was required by Army for the installation of two 6" guns. The station was therefore shifted about 300 yards along the cliff. A new accommodation block was built for 13 Naval personnel, the increase in size being due to the fact that a Naval radio station was at this time transferred from Harewood to Godley Head. The new barracks were accordingly made large enough to accommodate personnel from both the signal station and the radio station. (Army took over the original building).

The erection of the second barracks block necessitated

the formation of about 12 chains of access roading. Sewage was disposed of by connecting to the Army camp system.

The total cost of the port war signal station and barracks amounted to £5,843.

8. ANTI-SUBMARINE FIXED DEFENCE STATIONS

In the Auckland area two anti-submarine fixed defence stations were commissioned in November, 1943 - one at Motutapu Island and the other at Takapuna. At the latter, Naval personnel shared the Army camp (at North Head) and no work of any consequence was carried out by the Department.

A similar station was erected at Whangaparaoa, alongside the degaussing range there.

A two-storey barracks building erected at Worser Bay, Wellington, served as quarters for personnel manning both the anti-submarine fixed defence station and the mine station established in that locality.

An anti-submarine fixed defence station was also constructed on Long Island as a protection against enemy submarines attempting to operate in Queen Charlotte Sound.

1. Name of Work: Anti-submarine Fixed Defence Station, Motutapu Island.

2. Locality: An island in the Hauraki Gulf.

3. Nature of Work: Provision of a control station, powerhouse, underground fuel storage, and accommodation for personnel.

4. References: File: 23/413/5 Map: 3/N1

5. History: Between April and June, 1943, a Naval anti-submarine fixed defence station was established on Motutapu Island, comprising a control station and a powerhouse (in concrete) and quarters for personnel, and including the usual engineering services by way of a water supply, electricity, and a septic tank. Two 500 gallon fuel tanks were installed underground.

The cost of the work amounted to £8,310.

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A similar anti-submarine fixed defence station was also erected at Whangaparaoa, alongside the degaussing range there. (References: File: 23/525 Map: 2/N8).

1. Name of Work: Anti-submarine Fixed Defence Station, Long Island.

2. Locality: Queen Charlotte Sound, Marlborough.

3. Nature of Work: Provision of buildings and services for an anti-submarine fixed defence station.

4. References: File: 23/723/2 Map: 9/N1

5. History: In June, 1942, the Public Works Department was requested to proceed urgently with the construction of buildings and engineering services for an anti-submarine fixed defence station at Long Island. The site was selected by the Navy on account of its excellent coverage of the northern entrance to Queen Charlotte Sound and its protected position from enemy gun-fire.

The principal requirements were a control station building, a power station and pump house, a landing stage, concrete reservoirs, and accommodation for personnel. The last mentioned consisted of standard public works hutments adapted for use as sleeping and living quarters, a mess-room, a kitchen and drying room, and a store room.

The engineering work involved was of a highly specialist nature, and necessitated the continued attendance of technical experts throughout the period of construction.

The greater part of the installations was completed by October, 1942, although minor works were carried out right up to the abandonment of the establishment in January, 1944.

The total expenditure incurred was £80,000.

ANTI-SUBMARINE FIXED DEFENCE STATION, LONG ISLAND,
MARLBOROUGH SOUNDS.

BELOW: Looking east

9. DEGAUSSING RANGES

Two ranges for testing the degaussing installations on ships (to render them innocuous against magnetic mines) were established at the approaches to Auckland - one off the Whangaparaoa peninsula and the other off Takapuna Point.

A similar range was located off Somes Island, in Wellington Harbour.

The extent of the work carried out by the Department relative to buildings, etc. erected on shore at Whangaparaoa and Somes Island is outlined in the accompanying notes.

could be employed on the island.

A large amount of under-water work was necessary in connection with the laying of cables, buoys, anchors, and other special equipment. This part of the project was undertaken by the Wellington Harbour Board, who had the requisite divers and plant available.

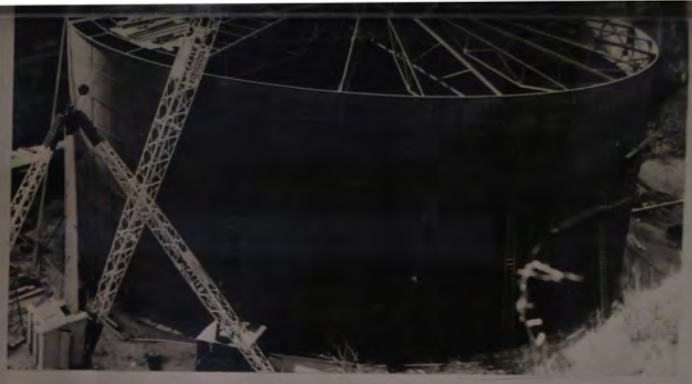
Departmental expenditure amounted to £4,066.

At the outbreak of war all the Navy's bulk fuel oil reserves were stored in three steel surface tanks at the Devonport Naval Base - one of 12,000 tons and two of 4,600 tons.

Wellington (References: File: 23/447 and bar Nos. Map: 8/N2).

Since 1938 consideration had been given to the erection of a new tank in the Kaiwarra Gorge, Wellington, with a capacity of 12,000 tons (about 3,000,000 gallons). The site acquired for this purpose had natural advantages in that it was beyond the reach of shelling from ships and would be very difficult to bomb. Approval to proceed with the construction of the tank was given in February, 1940. The site was prepared by the Public Works Department, involving excavation and filling, drainage, access roading, the deviation of existing sewers, and the building of a large earthen dam to retain the oil in the event of the tank's bursting. As soon as steel plates ordered from Australia were to hand, a contract for the erection of the tank (to a standard British Admirality design) was awarded a Wellington firm. Further contracts were let for (1) the manufacture of an 18 inch steel pipe-line for connecting the tank with Aotea Wharf and of 12 inch pipe-line to be laid under the breastwork of the wharf, and (2) for laying the main pipe-line. The 18 inch pipe-line had filtering equipment installed at a point along it. It terminated at a valve chamber adjacent to Aotea Wharf and from there onwards the fuel was carried by 12 inch piping to a number of oiling points. The flow from the tank to the oiling points was by gravity; using the same pipe-lines the tank was filled by pumping from the tanker.

By November, 1941, the tank and pipe-lines were ready for the Navy to take over, though special fire



NAVAL BULK FUEL-OIL STORAGE, KAIWARRA, WELLINGTON

TOP (LEFT AND RIGHT): *A tank under construction.* LOWER LEFT: *The pipeline to the wharf.* RIGHT: *An aerial view of the tanks (left centre). Commercial tanks may be seen on the other side of the Kaiwarra Gorge Road.*

fighting equipment on order from England had not then arrived. Subsequently, a complete foam, fire fighting plant was installed, the pumps and foam compound drums being housed in a reinforced concrete fire station.

The new tank had no sooner been placed in service than a second one on the same site was authorised. This was to be a replica of No. 1 and its construction was carried out similarly - preparation of site, bunding, etc. by the Public Works Department and the actual erection of the tank by the same firm of contractors. The second tank was completed towards the end of 1943. Necessary extensions were made to the pipe-line system, and additional fire fighting equipment was provided.

Only No. 1 tank was splinter-proofed.

Orders were placed in USA for the supply of pumping apparatus to enable fuel oil to be transferred between the tanks in an emergency, but this did not come to hand until after the war.

The total cost of both tanks, including pipe-lines and fire fighting equipment, was £170,744.

Auckland (References: File: 23/447/8 Map: 3/N7).

In the latter half of 1942 the Navy was concerned at the presence within the precincts of Devonport Naval Base of three surface tanks containing fuel oil. It was at first proposed to transfer the larger tank (12,000 tons capacity) to Shoal Bay, erect a similar sized one there also, and remove the two smaller ones to other ports. To demolish and re-erect the tanks would, however, have presented almost insuperable difficulties, and after investigating various alternatives the Engineer-in-Chief recommended in February, 1943, that a series of underground storage tunnels be excavated into the cliff face at the rear of the Naval Base. This project was not approved until September, 1943, by which time the possibility of Japanese attacks had become fairly remote;

nevertheless, the underground storage was required as a part of the long term development of the base, and particularly to make available for other purposes the space occupied by the oil tanks.

A commencement was made towards the end of 1943 with the construction of four underground tunnels each capable of holding 6,000 tons of fuel. The general features of the design were based on plans supplied by the British Admiralty, adapted to suit local site conditions. The project was a unique one so far as New Zealand was concerned, and involved many novel engineering features.

Each tunnel or chamber had to be excavated in solid sandstone - of horse-shoe shape, 400 feet in length, 30 feet across at the arch springing and 26 feet in height from the floor to the intrados of the arch. They were to be lined with 15 inches of concrete (unreinforced). To overcome the effects of shrinkage due to changes in temperature and to ensure that the lining was oil-tight, the concrete was poured in 20 feet panels, leaving gaps (or contraction joints, as they were called) of 18 inches between adjoining panels. These gaps were filled after the concrete in the panels had aged to about three months and its temperature, which had risen to over 100 degrees, had returned to normal. As a final precaution against leakage, the whole of the interior surface was given a four coat treatment of sodium silicate.

In addition to the four storage tunnels, an underground pumping station was excavated to house transfer pumps, ventilating fans, oil filters, and electrical equipment. All underground electrical equipment was of a special flame-proof type. Access galleries were driven, while a system of pipe-lines connected the tunnels with Calliope Jetty and with the existing surface tanks.

The project was an immense one, entailing the

excavation of 54,000 cubic yards of sandstone and the placing of 13,000 cubic yards of concrete lining. Sixty tunnellers, working three shifts under co-operative contract, were constantly engaged for 2½ years. The war ended whilst the work was still in progress, and at 30 November 1945 the original estimated cost of £200,000 had, owing to shortage of labour and increased prices generally, risen to £323,500.

Lyttelton. (References: File: 23/447/5 Map: 11/N6)

Additional facilities for fuel oil storage at Lyttelton was recommended by the Chiefs of Staff in June, 1943. Two months later War Cabinet approved the construction of two underground tunnels each capable of holding 6,000 tons of oil. These were driven 500 feet into solid rock, the dimensions being 20 feet 6 inches wide by 32 feet 9 inches from the floor to the crown of the arch. The work was about 37% complete (excavation 70%) when construction was stopped in September, 1944. The expenditure incurred amounted to £68,291.

Other Ports. Materials were procured from overseas for the erection of oil tanks at Napier and Dunedin and sites were investigated, but the proposals were abandoned. Surplus materials, including a number of pre-fabricated, bolted tanks from USA, were eventually disposed of to the US Forces. A small bulk fuel installation was, however, provided to service the Shelly Bay Naval Base, Wellington.

For security purposes the chain of Naval radar stations established along New Zealand coast line from early in 1942 onwards were referred to as 'Naval posts'.

Whereas Army's radar installations were in close proximity to coastal and anti-aircraft batteries guarding the main centres, the sites selected for Naval stations were chiefly noteworthy, from a constructional point-of-view, for their extremely difficult access. Four of them were in the elevated portions of outlying islands, and most of the other nine were on the high parts of inaccessible headlands.

The supply and installation of radar equipment for the three Services was a joint venture involving several Departments. The Public Works Department's responsibility covered the design and construction of each station and involved the erection of masts and rotating aerials; the provision of special control gear boxes and electrical generating sets; making arrangements regarding fuel; erecting buildings to accommodate personnel; installing water supply and sewerage facilities; and forming access roading, etc.

Some of the technical problems which had to be surmounted are touched on in part 1 chapter 5 (Chief Designing Engineer's office). Typical of the construction difficulties encountered were those experienced in carrying out radar installations on islands in the Hauraki Gulf.

The biggest obstacle was getting materials from the mainland to the island, landing them on the island, and then hauling them to the site of the work. To the vicissitudes of tides and weather were added the trials of rough country. A regular supply of rations had to be obtained for the working parties, and the men generally kept as contented as reasonably possible in the face of

trying conditions and prolonged absences from home.

Materials were carried in barges towed by small launches, usually under adverse weather conditions. Trips were mostly made at night, across minefields, in order to start unloading at daybreak; otherwise the morning breeze from the land would quickly work up a rough sea. Storms were frequently encountered, while on at least one occasion trips were made through enemy minefields (en route to Cuvier Island) unknown at the time, of course, to the personnel concerned.

But the trouble really began when the time came to unload materials from the barges. At Mokau Hinau Island, for instance, the only landing facility was a concrete block, 12 feet square, jutting out from a low cliff, and unless the weather was unusually calm a vessel could not be moored alongside. The procedure followed was for the barge to lie in as close as possible and jettison its load (timber and other materials) into the tide. To retrieve the materials, men had to wade in, clad in bathing suits, and often with the waves breaking over their heads. Even a stone crusher and a bulldozer were landed on Mokau Hinau, though not without great difficulty.

Landing conditions at Cuvier Island were even worse. This island, 65 miles by sea from Auckland, lies 17 miles to the south of Great Barrier Island. It is roughly circular in shape, about one mile in diameter, and some 600 feet high. The whole coast-line is rock bound, and rises almost vertically from the sea. The only landing facility was a small concrete block, 15 feet by 10 feet, near the south-eastern end of the island. Materials had to be hand winched on to this block and then power winched up a steep slope to the only piece of level ground available. Unloading was carried out with a considerable swell running. The impact of one barge against the landing block discharged a stack of timber which carried

a departmental overseer into the sea between the barge and the block. With great presence of mind he dived beneath the barge, thus saving himself from being crushed by the next surge of the vessel. As it was he sustained a leg injury which necessitated his return to Auckland.

Among the supplies unloaded at Cuvier was a ten ton bulldozer. This was accomplished in a very confined space between rocks, where it was possible to rest the barge at low tide. The bulldozer had to be helped up the adjacent slope by block, tackle, and winch.

After the materials had been landed on Cuvier Island, a track had to be formed to the site of the work and a camp established. The camp site was on the highest point of the island, nearly a mile from the landing block, and all supplies had to be laboriously dragged on sledges by the bulldozer up steep grades approaching, in some places, one in three. Although the quantity of materials involved was comparatively small, their sledging to the site took almost three weeks.

* * * *

Naval radar stations were located as follows:

Locality	Cost	References File	References Map
Cape Brett	£10,658	23/588/3	1/N3
Bream Head	7,037	"	1/N4
Mokau Hinau Island)		23/588/4	-
Cuvier Island)	11,203	"	2/N4
Great Barrier Island	13,829	"	2/N1
Cape Rodney	13,262	"	2/N3
Cape Colville	12,855	"	2/N5
Paekakariki	3,738	23/588/11	7/N1
Baring Head	15,282	"	7/N3
Stephen's Island)	26,588	23/588/12	9/N3
Cape Campbell)		"	9/N5
Godley Head	10,704	23/588/15	11/N3
Bluff	2,605	23/588/1	12/N1
	£127,761		

In addition, materials for three radar stations were despatched to Fiji in January, 1942. One of these was a Naval installation, another for Army and the third for the RNZAF.

NAVAL RADAR STATIONS

TOP LEFT: CAPE BRETT RIGHT: CAPE REINGA LOWER LEFT: STEPHENS ISLAND RIGHT: TURAKIRAE HEAD

Although these pictures show little in the way of the actual [illegible] work carried out, they illustrate the difficult problem of access referred to in the text.

12. PLASTIC ARMOUR

At the request of the Navy in September, 1941, the Public Works Department undertook to arrange for the manufacture in New Zealand of plastic armour invented by the British Admiralty. This was required for the protection of bridges, gun emplacements, and other exposed positions on merchant ships from machine-gun and cannon attacks by enemy aircraft. The plastic armour was made in small slabs of various sizes, and supplied to the Navy for fitting to ships. These were provided with a backing of steel or wood, but when new steel became difficult to procure old ship plates were utilised.

The actual manufacture of the slabs was carried out by a company trading in asphalte, one of the basic ingredients of the plastic armour, the other main ingredient, crushed stone, being supplied by the Department along with timber, steel, reinforcing mesh, etc.

Thousands of slabs were manufactured under the Department's supervision, the total expenditure incurred being £8,000 in Auckland and about £20,000 in Wellington.

PART 4.

WORKS FOR THE UNITED STATES FORCES

PART 4

WORKS FOR THE UNITED STATES FORCES

When the decision was made to establish a US Naval operational base at Auckland and to use the Dominion as a training and 'rest and recuperation' centre for combat troops, it is doubtful whether the American authorities expected much more from the New Zealand Government than co-operation and a free hand to attend to their own accommodation requirements. It is certainly no exaggeration to say that it was with surprised gratification that the Americans found at their disposal such a comprehensive and experienced constructional organisation as the Public Works Department.

Coming at a time - in the early months of 1942 - when the Department was already inundated with defence works for the Dominion's own forces, the added task of meeting the Americans' needs in the way of camps, barracks, hospitals, stores, offices, hotels, houses, garages, training and manoeuvre areas, etc. etc. placed a severe strain on its resources. Nevertheless, all requests were dealt with promptly and willingly, and, in effect, the US Forces were treated precisely the same as our own Army and Navy and the RNZAF. Indeed, so urgently were some of their works wanted that they were accorded the highest degree of priority and in building them new records were set for speedy construction and co-ordination of all available supplies of labour and materials.

The first major project carried out was the erection near Wellington of camps complete in every detail for the accommodation of more than 20,000 Marines. These were put up in less than six weeks - one of the most spectacular constructional feats of the whole war. Hotels and suites of offices were taken over in both Auckland and Wellington at little more than a moment's notice, large barracks and hospitals sprang up in city parks and

reserves, and almost overnight huge blocks of stores made their appearance in and around the two metropolitan centres.

The central authority for the US Army and Navy was the 'US Armed Forces, South Pacific Area, Joint Purchasing Board', through which all requests for works and services were submitted. These were considered by an Administrative Planning Committee, a body comprising representatives of United States and New Zealand Services and of other New Zealand Government authorities. If concurred in by the Administrative Planning Committee the requisitions were passed on to the appropriate Government Department for action. Thus requests for works and services reached the Public Works Department (on requisitions known as ASC orders) and were acted upon forthwith.

The Government had decided that the cost of works and services carried out for the US Forces was to be charged to the War Expenses Account (Reverse Lend-Lease). Formal authority to incur the expenditure involved in each proposal had therefore to be obtained from War Cabinet, notwithstanding the Administrative Planning Committee's approval in principle. However, the committee's approval was usually sufficient for the Department to take preliminary action or to proceed still further if the interests of urgency so dictated.

Accommodation: In part 5 chapter 1 of this Official War History the subject of accommodation acquired for the use of the US Forces (as distinct from works constructed) is dealt with in detail. As mentioned therein, the total accommodation rented for the Americans was:

Office:	Auckland district:	49,547 sq.ft	@ 8,854.15.6	p.a.
	Wellington "	21,814 "	" 3,619.10.0	"
	South Island "	576 "	" 102. 0.0	"
		71,937 sq.ft	@ 12,576. 5.6	p.a.

Storage, Garage, etc:

Auckland district:	319,723 sq.ft	@	£30,643.12. 6 p.a.
Wellington "	135,120 "	"	12,577.14. 0 "
	454,843 sq.ft	@	£43,221. 6. 6 p.a.

Residential:

Auckland district:	£35,741. 12. 5	per annum
Rotorua "	18,081. 0. 0	" "
Wellington "	11,753. 16. 0	" "
	£65,579. 8. 5	per annum

Cool Storage:

			per annum
Auckland district:	2,214,071 cub.ft	@	£163,018. 5. 8
Wellington "	578,471 "	"	52,240. 4. 0
	2,792,542 cub.ft	@	£215,238. 9. 8

The location and floor areas of the new blocks of stores erected for the Americans are also touched on in the same chapter, namely, 1,624,760 square feet in the Auckland district, and 752,480 square feet in the Wellington district. Some particulars relative to the construction of these stores are given in the following pages. In the main, however, this section is devoted to a review of projects undertaken for the US Forces other than the provision of offices and stores. Practically all such works were located in and around Auckland and Wellington.

The total expenditure incurred by the Public Works Department on works and services for the US Forces was as follows:

1941-42	:	£40,291
1942-43	:	2,313,788
1943-44	:	2,617,235
1944-45	:	715,369
1945-46	:	151,448
		£5,838,131

erection of a store on Motutapu Island.

When units of the US Army arrived in September, 1942, headquarters was established in the Dilworth Building, and Army officers were quartered in the Waverley Hotel (see under 'Accommodation'). In October the erection of Barracks on the Outer Domain for 750 'other ranks' Army personnel was begun. (This was also used as a convalescent depot). The erection of a 1,500-bed hospital for the US Army was put in hand in Cornwall Park. Camp accommodation vacated by the Marines was taken over by the Army, but a new USMC camp at Waikaraka Park was commenced. Other projects started during October were 50 magazines on Motutapu Island (linked up with the store already under way); stores at Mangere Crossing; a camp at Tamaki; and a fuel tank farm at Northcote.

The larger works started during 1943 comprised: January, magazines for the US Navy at Kauri Point; February, a camp for 5,500 Marines at Cambria Park; April, a huge block of stores at Sylvia Park and a large new Naval hospital at Avondale; July, extensions to Calliope Dock (referred to in part 3 'Defence Works for the Navy', under 'Devonport Naval Base'), and a rest home for Air Force personnel at Maungakiekie, One Tree Hill.

The extent of barracks accommodation and aviation facilities made available for the US Forces on aerodromes in the Auckland district (Ardmore, Seagrove, and Whenuapai) will be touched on in the Official History of the Aerodromes Branch. As stated, the subject of rented accommodation is also covered in another section of this Official War History. Excluding these, and omitting smaller miscellaneous works which made up the balance of the programme of activities undertaken on behalf of the Americans, the story of each project appears in the following pages in the order shown:

Brigade camps, Auckland district
Military Camp, Mechanics Bay
" " Inner Domain) also used as convalescent
" " Outer Domain) depots.
" " Victoria Park
" " Cambria Park
" " Waikaraka Park
" " Tamaki
" " Mangere Crossing
" " Western Springs
Hobson Park Hospital
Cornwall Park Hospital
Avondale Hospital
Sylvia Park Stores
Mangere Crossing Stores
Tamaki Stores
Old Dock Site Stores (also Jellicoe Street and King's Drive)
Halsey Street Stores
Medical Store Building, Mt. Hobson
Fuel Tank Farm, Northcote
Radio Stations, Auckland
Magazines, Motutapu Island
" Kauri Point
Maungakiekie Rest Home

Including the barracks-cum-convalescent depots on the Inner and Outer Domains, the total number of US personnel for whom camp and barracks accommodation was provided in the Auckland district was 29,510, contained in 4,421 buildings covering an aggregate floor area of 1,113,316 square feet. The three hospitals provided accommodation for a total of 4,500 patients, contained in 251 buildings covering an aggregate floor space of 1,005,000 square feet. The new blocks of stores comprised 174 different buildings of a total area of 1,733,467 square feet, of which 1,624,760 was storage space.

Altogether a grand total of 4,965 buildings was erected in the Auckland district, covering a floor space of 3,939,146 square feet.

WELLINGTON:

When advice reached the Department in April, 1942, that a large contingent of the US Marines would arrive in Wellington within six weeks, no accommodation for them was in sight. The story of how a number of camps were erected in the Paekakariki area in sufficient time to enable the Americans to march straight into them as soon as they arrived in the Dominion is told in the following pages. This was the first major request made by the US Forces, and the manner in which it was dealt with ranks high in the war-time constructional achievements of the Department. The camps concerned were:

Name of Camp	Capacity
Paekakariki	5,200
Russell	4,850
McKay's Crossing	4,650
Judgford	3,800
Pahautanui	2,000
Titahi Bay	1,500
Plimmerton	482
Paraparaumu	200
	21,682

The total floor area of all accommodation provided in these camps, including buildings (2,728), huts (1,590), and tents (3,401), covered an aggregate area of 2,083,633 square feet.

Further camps for the Marines were established at:

Hutt Park (race-course)
Kaiwarra Park
Anderson Park, Wellington
Central Park, "
Memorial Park, Masterton (including a camp hospital of 80 beds)
Solway Showgrounds, Masterton

The number of personnel accommodated fluctuated according to requirements. Anderson Park, for instance, began as a camp for 400 men, but a few months later a complete hospital was erected on an adjoining site for the US Navy, accommodating 400 patients plus a staff of 115. Similarly, the camp at Central Park was originally built for 400 men, but increased soon afterwards to 540.

Twelve hundred men were accommodated at each of the Masterton camps.

Excluding the Paekakariki camps, the total number of US Marines for whom camp or barracks accommodation was erected in the Wellington district was 4,860. This was provided by utilising existing buildings (as at Hutt Park) and by erecting 748 tents (at Masterton), 315 new buildings, and 436 huts. The new accommodation covered an aggregate area of 422,292 square feet.

Thus the grand total of camp and barracks accommodation was 4,149 tents, 3,043 buildings, and 2,026 huts, covering a floor area of 2,505,925 square feet.

A new hospital erected at Silverstream - intended for use as a NZ Army convalescent depot - was enlarged and handed over to the US Authorities. This accommodated 1,600 patients in 46 buildings of a total floor area of 143,800 square feet. The hospital at Anderson Park (400 patients) comprised nine buildings and 99 huts covering an area of 42,061 square feet. A temporary hospital established in the Trentham race-course buildings, augmented by 16 huts and four new buildings (5,480 square feet) provided bed space for 340 patients.

Altogether, therefore, provision was made for the hospitalisation of 2,340 patients, in 59 buildings and 115 huts of a total floor space of 191,341 square feet, plus, of course, the existing premises made use of on the race-course.

Large hotels and office and storage buildings were taken over for the US Forces in Wellington (see part 5, chapter 1 'Accommodation'), while on the waterfront, in the Hutt Valley, and in the Paekakariki area new stores containing a total floor space of 752,480 square feet were erected.

These were located at:

Petone		
Waterloo	78,400	square feet
Park Road	92,900	" "
Seaview Road	291,280	" "
Paremata	150,000	" "
Paekakariki Area	7,700	" "
McKay's Crossing	32,200	" "
Aotea Quay	3,000	" "
	97,000	" "

Areas of open land were made available in various parts of the Wellington district for storage and training purposes, ranging from four acres in Petone Park to 1,670 acres in and around the camp sites north of Paekakariki.

Receiving barracks for the US Navy were built over the boat harbour at Oriental Bay, providing accommodation for 350 personnel in buildings covering a floor area of 21,910 square feet. A garage was erected for the Marines in Whitmore Street, Wellington.

* * * *

Summary:

Excluding rented accommodation, the Public Works Department provided the following quarters for the US Forces in New Zealand:

Camps and Barracks:

Auckland district:	29,510	
Wellington "	26,542	56,052

Hospitals:

Auckland	4,500	
Wellington	2,340	6,840

Stores:	square feet	
Auckland district:	1,624,760	
Wellington "	752,480	2,377,240 square feet

Most of the works constructed were also maintained by the Department, the expenditure under this heading amounting (in a typical year, ended 31 March 1944) to £39,600 in respect of the Auckland district and £17,229 in the Wellington district.

The restoration of camp sites, etc. after vacation by the Americans was an expensive item, the cost being taken into consideration, along with the residual value

of buildings and other assets, when the settlement of Lend-Lease accounts was finalised with the American Government.

Under the formula adopted in assessing the value of services rendered by the Public Works Department - not necessarily coinciding with the actual expenditure - statements prepared set out the 'cost of accommodation' (apart from rented premises) as follows:

Auckland district	:	£4,671,339. 1. 11
Wellington "	:	£2,404,621. 10. 4
Other districts	:	109. 0. 0
		£7,076,069. 12. 3

1. Name of Work: Brigade Camps, Auckland District.
2. Locality: Warkworth and Pukekohe areas.
3. Nature of Work: Erection of camp accommodation for troops.
4. References: File: 23/824 & 23/751 Map: 2/A2 & 2/A11
5. History: As stated in part 2 'Defence Works for the Army', these camps were originally built for New Zealand troops, but were taken over entirely by the US Forces, for final training before proceeding to the Pacific.

Very little additional work was required to adapt the camps for use by the Americans, beyond alterations to headquarters buildings and the addition of one or two new buildings in each area. As finally constructed, the camps contained accommodation for 12,460 men (Warkworth, 5,000; Pukekohe, 7,460).

The total expenditure recorded in respect of these brigade camps was:

Warkworth : £191,029

Pukekohe : £163,627

1. Name of Work: Military Camp, Mechanics Bay.
2. Locality: On reclaimed land east of the main wharf area, Auckland.
3. Nature of Work: Provision of accommodation for 500 Naval shore personnel and Naval aviation personnel.
4. References: File: 23/718 Map: 3/US8
5. History: This accommodation was erected in record time. On 28 May 1942 instructions were received to proceed with the construction of a barracks block of buildings covering an area of 40,620 square feet. On 28 June, precisely one month later, the Americans moved in, to find everything ready for them, including steam up to pressure in the boilers and meals being prepared in the galley.

The buildings consisted of extensive H type dormitories for men, each accommodating 112, together with lavatory facilities, a large combined mess and galley, a chief petty officers' dormitory, an officers' dormitory, an administration building, a recreation block, and a ration store, etc. Altogether 12 buildings were erected, of a total area of 51,204 square feet.

The camp not only provided quarters for personnel based permanently in Auckland, but was used extensively by ratings off ships held there for repairs.

After the Americans had left the Dominion, the camp was taken over by the New Zealand authorities and was used partly as a headquarters depot and partly to provide transit accommodation for service personnel returned from overseas.

The total cost of the work carried out at Mechanics Bay was £83,575.

U S CAMP, MECHANICS BAY, AUCKLAND.

The same camp (in the foreground), looking across to the Auckland Domain.

1. Name of Work: Military Camp, Inner Domain.
2. Locality: Auckland Domain, adjoining George Street.
3. Nature of Work: Erection of a convalescent depot for patients from Hobson Park Hospital. (This was used also to provide accommodation for Naval shore personnel).
4. References: File: 23/757 Map: 3/US9
5. History: The buildings erected at the Inner Domain camp were similar in type to the barracks at Mechanics Bay, and consisted of eight large H type dormitories, each accommodating 122 men, a chief petty officers' dormitory, a hospital, an administration building, a mess and galley, a recreation building and sundry smaller structures. These were built on concrete foundations, with timber frame, and sheathed with flat fibrolite on the walls. The roofs were made of fibrolite. A total of 18 buildings was erected, covering an area of 85,346 square feet.

Accommodation for 1,000 personnel was provided.

A considerable amount of formation work had to be carried out to provide drives and paths. Hundreds of yards of scoria were rolled into the turf and large areas around the buildings sealed.

The work was carried out between July, 1942, and June, 1943, at a total cost of £131,116.

- - - - - - - - -

1. Name of Work: Military Camp, Outer Domain.
2. Locality: Auckland Domain, almost in front of the War Memorial Museum.
3. Nature of Work: Provision of living quarters for personnel employed at the Auckland Headquarters of the US Army, and also for use as a convalescent depot.
4. References: File: 23/867 Map: 3/US10
5. History: The site selected for this camp, which was practically a replica of the Mechanics Bay barracks, was on the corner of two roads, with easy access to the

Military Camp, Outer Domain (Cont'd).

buildings. Accommodation was made available for 750 men in 15 buildings spread over 53,005 square feet.

The work was carried out between October, 1942, and March, 1943, at a cost of £65,528.

The rental arranged for land occupied by the Americans in the Auckland Domain (inner 8 acres, outer 5 acres) was £200 per annum.

U S CAMP, VICTORIA PARK, AUCKLAND.

U S CAMPS, AUCKLAND DOMAIN

1. Name of Work: Military Camp, Victoria Park.
2. Locality: Victoria Park, Auckland.
3. Nature of Work: Provision of accommodation for 1,200 men.
4. References: File: 23/786 Map: 3/US5
5. History: The Victoria Park camp was constructed on a somewhat different principle from those at Mechanics Bay and the Inner Domain, although the central block of buildings, consisting of two officers' dormitories, an administration building, a recreation block, a boiler house and laundry, a mess and galley, and a 26-bed hospital, was of similar design. The accommodation for men was, however, provided in 20 feet by 8 feet huts. A total of 196 huts was erected, these being lined with pinex and with bunks and lockers built into each. The 205 buildings provided covered an aggregate floor area of 74,323 square feet.

Drainage for the camp was a major problem, as the park was on reclaimed ground only a few feet above sea level. The council's main drain was over 20 feet deep, so pumps had to be kept working the whole time to keep the water in check.

The formation of roading and paths was also a difficult task, owing to the soft nature of the ground. Thousands of cubic yards of scoria had to be rolled in to form a base for sealing. After the camp had been vacated and the buildings removed, all this scoria and hard filling had to be gathered together (by bulldozers) and disposed of. Several hundred cubic yards were sold to local bodies for road filling, but the majority of it was carted away and dumped into low lying areas. Top soil was then procured to re-level the playing areas, which were re-sown with grass seed.

Expenditure at Victoria Park amounted to £95,520. The work commenced in August, 1942, and was completed in April, 1944. The rental payable was £1,000 per annum.

1. Name of Work: Military Camp, Cambria Park.

2. Locality: Puhinui, a few miles south of Papatoetoe and adjoining the Puhinui Railway Station.

3. Nature of Work: Provision of 'key' buildings for a camp for 5,500 men.

4. References: File: 23/916 Map: 2/US1

5. History: A camp site at Cambria Park was chosen for US troops in February, 1943. The project entailed the provision of 'key' buildings only, consisting of large kitchens and mess buildings, showers, ablutions, and latrines. Ten blocks of these were erected to serve the ten tented areas in which the troops were quartered. The Department was requested to complete the buildings, including roading, drainage, water supply, etc., within two months. Contracts were immediately let for the buildings, and a start was made on the roading and drainage within 24 hours.

Before the troops had arrived the programme was, in April, 1943, substantially completed.

Sixty-four buildings were erected, covering a floor area of 94,440 square feet. Thirteen acres of land were levelled for the building sites and two miles of roads and streets formed and sealed.

The only available water supply was from Papakura Military Camp, necessitating the laying of 13,000 feet of 6 inch water mains. The sewerage system consisted of 11,200 feet of mains and a large Imhoff digester.

The camp was extensively used by the United States Forces, both as a main training centre and later as a rest camp.

The cost of the work amounted to £126,352.

1. Name of Work: Military Camp, Waikaraka Park.

2. Locality: Onehunga.

3. Nature of Work: Provision of accommodation for US Marines.

4. References: File: 23/866 Map: 3/US21

5. History: Originally, Waikaraka Park was laid out as a tented camp, with ablutions, latrines, and shower buildings erected close to the stone wall on the north side, and cookhouses and messes at the western end. A total of 68 buildings had been erected up to that stage, with approximately 3,500 Marines quartered in tents.

Towards the end of 1943, however, it was decided to provide dormitory accommodation and for this purpose arrangements were made to demolish buildings at the brigade camps in the Whangarei area and to use the salvaged materials at Waikaraka. Auckland builders were accordingly sent to Whangarei to demolish the buildings (in sections or otherwise), the Public Works Department at Whangarei attending to all questions of freight.

Thirty-two dormitories each 80 feet by 27 feet were erected, also a number of huts for officers and nurses, making a total of 57 buildings (35,870 square feet) providing accommodation for 2,500 personnel.

Expenditure on the camp at Waikaraka Park totalled £73,435.

Later, the site was taken over as a camp for industrial workers.

1. Name of Work: Military Camp, Tamaki.
2. Locality: Tamaki, adjacent to Glen Innes Station.
3. Nature of Work: Provision of accommodation for personnel guarding storage areas.
4. References: File: 24/3105/6 Map: 3/US16
5. History: Similarly to Waikaraka Park Camp, a small guards camp was erected at Tamaki, with the personnel accommodated chiefly under canvas, though a number of 20 feet by 8 feet huts was provided for the permanent staff.

Early in 1944, when it was decided to develop the area into a much bigger camp, arrangements were made to demolish buildings at camps no longer required in the Kaikohe, Paihia and Kaeo areas and to use the salvaged materials at Tamaki. A large galley and mess, four H type dormitories, officers' quarters, a hospital, a recreation building, and a boiler house, etc. were erected by this means.

The total cost of the work was £112,143.

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1. Name of Work: Military Camp, Mangere Crossing.
2. Locality: Adjoining Mangere railway station and adjacent to Otahuhu.
3. Nature of Work: Provision of services for the accommodation of 5,000 personnel.
4. References: File: 23/864 Map: 3/US22
5. History: At very short notice the Public Works Department was requested to prepare a camp site of 80 acres for a tented area to accommodate 5,000 US troops. Twenty six temporary cookhouses, together with ablutions, showers and latrines were erected, complete with a water supply involving 21,120 feet of mains. Other services included 135 chains of sealed roads, 17,600 square yards of building surrounds, a sewerage treatment plant with

7,920 feet of sewers, and a stormwater drainage system entailing the use of 31,625 feet of concrete pipe from 9 inch up to 42 inch diameter.

It was later decided to develop the area into a permanent camp. Two large kitchen and mess blocks, 45 dormitories, officers' quarters, nurses' quarters, an officers' mess, an administration building and a number of smaller buildings were erected, making a total of 55, covering an aggregate floor space of 115,328 square feet.

The total expenditure incurred amounted to £164,690.

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1. Name of Work: Military Camp, Western Springs.
2. Locality: On the Auckland City Council's motor-camp at Western Springs.
3. Nature of Work: Provision of hutted accommodation.
4. References: File: 23/825 Map: 3/US13
5. History: In July, 1942, the Western Springs motor-camp was taken over by the US Forces, at a rental of £500 for the first year and £250 per annum thereafter.

The principal work carried out by the Department consisted of providing a number of 100-men mess-huts, with a cookhouse and kitchen, and complete with all necessary electrical and plumbing services.

In 1943 an additional hot water system was installed, also a building 20 feet by 40 feet containing shower, lavatory, and toilet facilities. Later, a recreation hut was added, and various extensions carried out to existing buildings.

Altogether 31 buildings covering an area of 34,140 square feet were erected, providing accommodation for 600 men.

The total expenditure by the Public Works Department amounted to £6,286.

After being vacated by the Americans, the buildings at Western Springs were converted into residential accommodation, and the camp became a transit housing centre under the control of the Auckland City Council.

U S CAMP, WESTERN SPRINGS, AUCKLAND.

U S CAMP, WAIKARAKA PARK, AUCKLAND

Later converted into an industrial workers' camp.

1. Name of Work: Hobson Park Hospital.

2. Locality: Hobson Park, (the main hockey ground in Auckland) situated in Market Road, between Remuera Road and Great South Road, Remuera.

3. Nature of Work: Erection of a 1,000-bed hospital ('Mob. 4') for the United States Navy.

4. References: File: 23/784 Map: 3/US14

5. History: The first hospital project undertaken in Auckland for the United States Forces was known as 'Mob.4' and was built for the Navy. In all, 68 buildings were erected, covering an area of quarter of a million square feet and providing accommodation for 1,000 patients.

The Americans brought a large number of pre-fabricated steel buildings with them, some of which were erected on the site as barracks and wards. The balance of the buildings were built of local materials and consisted of H type wards (each holding 88 beds), an administration building, staff quarters, a nurses' home, a recreation building, and numerous subsidiary structures, all constructed to a fairly high standard.

The whole of the hockey grounds were covered with hospital buildings, while the nurses' quarters were located on the adjoining courts of the Remuera Tennis Club.

Stormwater and sewer drains were laid to connect up all buildings and to discharge into the city council mains. Thousands of cubic yards of scoria were used to form roads and paths, which were later tar sealed.

The site was finally laid out with lawns surrounding the buildings and, with flowering shrubs planted, the whole area was made very attractive.

The hospital was built between July, 1942, and April, 1944, at a total cost of £311,524.

After being vacated by the U.S. authorities in 1944 the establishment was taken over by the RNZAF for use as a control depot.

1. Name of Work: Cornwall Park Hospital.

2. Locality: On a portion of Cornwall Park, One Tree Hill, facing on to Green Lane Road and adjacent to the main public drive.

3. Nature of Work: Erection of a 1,500-bed hospital ('39th General') for the United States Army.

4. References: File: 23/813 Map: 3/US17

5. History: Early in October, 1942, a decision was reached to erect a 1,000-bed hospital at Auckland for the US Army, the site selected being a comparatively level area, lying well to the sun and handy to the city.

The whole project was noteworthy for the speed with which the hospital was constructed. Work commenced on 30 October and, despite a break of ten days during the Christmas period, occupation for a staff of 62 doctors, 143 nurses, and 500 male staff was given on 4 February 1943, the first 500 patients being admitted on 8 February, four days later. In all, 123 buildings were erected, covering 367,000 square feet. The main hospital block was inter-connected by means of covered ways approximately 2,600 feet in length. This consisted of 48 wards; administration offices; receiving rooms; an infirmary; a clinic and surgery; a dental clinic; two patients' mess halls and kitchens; two patients' recreation halls; two canteens; and nine stores. There were also eight nurses' barracks, five officers' barracks, separate recreation halls for both officers and nurses, a mess hall, a laundry, and a bicycle shed. Other buildings were a refrigeration store, a fire station, a workshop, a destructor, a steriliser house, a boiler house, a garage, a morgue, and two guard houses. The non-commissioned staff were quartered in 17 barracks, with a detachment office, recreation and mess halls, kitchen, laundry, and ablution and latrine buildings.

The foregoing buildings included extensions to the

The foregoing buildings included extensions to the

Cornwall Park Hospital (Cont'd).

original proposals, bringing the total available patient accommodation to 1,500 beds.

Buildings were erected on concrete piles, of wood framing with plaster board exterior plastered to a stucco finish. Roofs were covered with Marseilles tiles, excepting the mess and recreation halls, the clinic and surgery, stores, the boiler house and the covered ways, which were roofed with fabric material. Window frames were mounted on a track externally, thus allowing the sashes to be moved sideways and giving the maximum amount of ventilation. The entire hospital was heated by means of steam circulated through radiators. The interior of the buildings was covered with plywood dadoes and plaster cored boards above, and with fibrous plaster ceilings and cornices. Colour finishes throughout were varied.

Adequate water supply, sewerage, and electric power were provided. The whole area was ringed with sealed roads and paths to all buildings and the remaining areas laid down in lawns and flower beds.

At the peak of the building operations, which were carried out by a combination of four of the city's main building contractors, assisted by a number of smaller contractors, 798 men were employed on the site at one time.

The buildings followed the contours of the site; consequently the covered ways were built at various levels and in no case was it necessary to construct high basements.

The cost of the complete hospital was £593,470. It was purchased after the war by the Auckland Hospital Board.

U S HOSPITALS, AUCKLAND

TOP LEFT: HOBSON PARK. RIGHT: CORNWALL PARK.

LOWER: AVONDALE

1. Name of Work: Avondale Hospital.

2. Locality: An area at Avondale bounded by Holly Street, Victor Street, and Rosebank Road.

3. Nature of Work: Erection of a second large hospital ('Mob.6') for the United States Navy.

4. References: File: 24/3150 Map: 3/US15

5. History: Early in 1943 instructions were received to prepare plans for a second Naval hospital. As the site chosen for the hospital was on Education Board land reserved for a future school, it was decided to design the main buildings as permanent structures suitable for ultimate use as an intermediate and technical high school.

The hospital was to contain 2,000 beds.

Construction by the Public Works Department commenced on 5 May 1943, although the advance party of an American Naval construction unit had arrived about a week earlier and begun erecting pre-fabricated steel storage buildings. With the aid of mechanical equipment such as bulldozers, graders, etc. temporary roadways were formed and clearing and levelling carried out. The whole site was ringed with a 4 inch water main, with provision made for numerous branches at regular distances. Sewerage sub-mains were laid, connecting up with the main sewer crossing the area. Stormwater mains, ranging from 9 inches up to 27 inches were also laid, discharging into a tidal creek at the rear of the site.

Supplementing the permanent (school) buildings were a large number of buildings of a temporary nature. Those forming the main hospital block, including both permanent and temporary buildings, were all connected up by means of covered ways, in such a manner that access could be gained from any part of the block to another without venturing into the open.

Buildings incorporated in the main structure were the school itself (comprising offices, auditorium, gymnasium,

39 class rooms, passages, lavatories, etc.), 22 wards with 11 lavatory blocks, a mess and galley, a clinic and surgery, accommodation for physio therapy, occupational therapy and X-ray treatment, a dental clinic, sick officers' quarters, a ships' service room, a post office, and quarters for the American Red Cross.

The remaining buildings were made up of 17 single and two double unit houses of State house standard, (used as officers' quarters); two nurses' home blocks with accommodation for 60 nurses; an officers' club (a large existing residence renovated and added to); a laundry; a boiler house; a generating house; a morgue; garages; a fire station; and a brig and crews recreation quarters.

In addition 16 barracks, 14 stores, and a guard house were built from pre-fabricated steel units.

Altogether, 60 buildings were erected, covering a total floor area of 388,000 square feet.

The permanent buildings comprising the school proper were constructed on concrete foundations, with timber framing covered externally with brick veneer up to sill height and rusticated weather boarding above. Fabricated wooden truss roofing was sarked and covered with corrugated fibrolite. The interior was panelled in plywood to dado height with fibrous plaster above and pinex ceilings.

The temporary buildings were mainly constructed on concrete piles, and were of timber framing, with an 8 foot stud, covered externally with plaster board and plastered with a stucco finish. The roofs were supported on pre-fabricated wooden trusses fixed at 4 foot centres, with intermediate rafters, battened and tiled with Marseilles tiles. The covered ways were roofed with fabric material. Interiors were finished with plywood dados, gibralter board walls, and fibrous plaster ceilings.

The surgeries - of which there were four, forming

Avondale Hospital (Cont'd).

part of the clinic and surgery, were of similar design externally, with a 12 foot stud. Windows were of southerly aspect. Concrete floors were finished in terrazzo with terrazzo coving, and walls up to door height. The remaining walls and all ceilings were finished in fibrous plaster and enamelled.

The first patients were admitted on 21 October 1943, 15½ months after the commencement of building operations. The maximum number of patients in occupation was 1,050.

In April, 1944, instructions were issued for all work of a temporary nature to cease, and work was then confined to completion of the permanent school. Shortly afterwards, the majority of the temporary buildings were demolished and the salvaged materials utilised as the basis of a housing scheme. The roofs and internal partitions were dismantled and the walls and floors, with joists attached, were cut into various sized sections and transported and placed in new positions on prepared understructures. This was done by means of portable cranes handling the sections at both ends. By this method 67 flats (from one to three bedrooms) and 37 houses (from one to six bedrooms) were constructed.

The mess and galley building was also demolished, moved in sections, and reconstructed to form the manual training wing of the new technical high school. Similarly, the combination of the central portion of the ships service and the laundry block was demolished and reconstructed as a home science wing. The crews' recreation building was moved in its entirety to a new location, becoming the school engineering workshop

During the peak of operations 450 men were employed, including approximately 150 of the US Naval construction unit, which assisted with the steel buildings.

The cost of the whole project, excluding the demolition work, was £641,727.

1. Name of Work: Sylvia Park Stores.

2. Locality: Sylvia Park, on the main highway between Otahuhu and Mt. Wellington.

3. Nature of Work: Erection of a large block of stores for the US Joint Purchasing Board.

4. References: File: 24/3124/9 Map: 3/US20

5. History: The site at Sylvia Park selected for this project, although low lying and subject to flooding, enjoyed good road and rail access. To drain the area, a ring drain of 52 chains was excavated, involving the excavation of 5,660 cubic yards of spoil. The outlet drain was enlarged and deepened to the sea.

Altogether, 48 stores, each 150 feet by 120 feet were erected, together with smaller buildings such as a benzine store, a mess building, a guard room and 12 offices and latrines. The floor area of all these buildings (a total of 64) aggregated 873,174 square feet, of which 864,000 comprised storage space.

The buildings were constructed on concrete foundations, with concrete floors, timber framing, and fibrolite on walls and roofs. Trusses, each spanning 60 feet, were spaced at 6 foot centres.

The preparation of the 40 acre site was a major undertaking in itself. Excavation with mechanical plant commenced under winter conditions, and, after levelling, 110,000 cubic yards of scoria were spread to allow contractors to proceed without delay with the erection of the buildings. Stormwater from the watershed was carried under the site through a 4 foot diameter concrete pipe culvert 1,368 feet in length.

The large area of roofing, covering a total of 20 acres, required a very extensive stormwater system. Concrete pipe mains aggregating 41,000 feet in sizes from 4 inches to 18 inches diameter were laid throughout the site. A sewerage system involving 10,000 feet of pipes

U S STORES, SYLVIA PARK, AUCKLAND.

TOP LEFT: A ground-level panorama. RIGHT: From the air.
LOWER: Two views of stores under construction.

from 4 inches to 12 inches diameter, with an Imhoff digester tank for treatment, was installed.

Ninety-six thousand square yards of roading were sealed. A two mile railway siding with a back-shunt was laid into the centre of the area.

The work was completed between April, 1943, and May, 1944.

The total cost of the stores, which was the largest group built in Auckland, amounted to £425,922.

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1. Name of Work: Mangere Crossing Stores.
2. Locality: Mangere Crossing, adjacent to Mangere Railway Station.
3. Nature of Work: Erection of stores buildings.
4. References: File: 23/864 Map: 3/US22
5. History: The Mangere Crossing site for a block of stores was chosen for a similar reason to Sylvia Park, i.e. ready accessibility to road and rail.

Six stores were erected, as follows: two 300 feet by 120 feet; and one each, 300 feet by 60 feet, 360 feet by 120 feet, 200 feet by 240 feet, and 200 feet by 120 feet; giving a total storage area of 190,200 square feet. Three ancilliary buildings brought the aggregate square footage to 207,600. The stores had concrete floors, wooden framing, and fibrolite on walls and roofs. Erected in October, 1942, this stores depot was used extensively until vacated by the Americans in 1944.

The whole area of 80 acres, including the camp site, was level and very little formation work was required. A railway siding extended into the block gave easy access to all buildings.

An adjacent portion of the site was used for oil storage in drums and as a vehicle park.

The stores cost a total of £93,521.

US CAMP AND STORES, CAMBRIA PARK, AUCKLAND.

U S CAMP AND STORES, MANGERE CROSSING.

1. Name of Work: Tamaki Stores.

2. Locality: Tamaki, adjacent to the Glen Innes Railway Station.

3. Nature of Work: Erection of stores buildings for the handling of repair and maintenance work on vehicles returned from the Pacific.

4. References: File: 24/3105/6 Map: 3/US15

5. History: The site selected at Tamaki was chosen partly for its suitability as an ammunition dump but mainly for its road and rail access. A group of eight stores was erected on both sides of a railway siding. The buildings covered an area of 303,580 square feet and were built to a similar design to the stores at Sylvia Park and Mangere Crossing. They were used very extensively and were among the last to be vacated.

The total cost amounted to £197,752.

The work was completed between August, 1942 and May, 1944.

1. Name of Work: Old Dock Site Stores, Auckland.

2. Locality: An area bounded by Sturdee, Hobson and Quay Streets, Auckland.

3. Nature of Work: Erection of storage space for the US Navy.

4. References: File: 24/335/4 Map: 3/US7

5. History: The first store building erected for the US Forces in Auckland was located on the site of an old graving dock which had been filled in. This was right opposite Prince's Wharf. The land was owned by the Auckland Harbour Board, which made it available free of charge. A contract (under the master schedule system) was let in June, 1942, and the work proceeded as a matter of urgency. The store comprised a triangular shaped steel frame building, covering a floor area of 79,000 square feet, with asbestos sides and roof and a concrete floor. It was constructed in bays, each bay being fitted with overhead gantries.

The total cost of the building was £96,668.

It was purchased from the Crown after the war by the Auckland Harbour Board.

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Other stores were erected for the US Forces in Jellicoe Street, Auckland (5,200 square feet) and in King's Drive, Mechanic's Bay. The latter consisted of four wings to the Ministry of Supply's steel store, containing a floor area of 93,200 square feet. A garage at the corner of Swanson and Federal Streets (behind the Star Hotel, Albert Street) was also erected, comprising 7,300 square feet.

1. Name of Work: Halsey Street Stores.
2. Locality: Halsey Street, Auckland, adjacent to Victoria Park, Freemans Bay.
3. Nature of Work: Erection of storage space for foodstuffs.
4. References: File: 24/3105/32 Map: 3/US6
5. History: The sites for these two stores were selected on account of their close proximity to the waterfront and to the Auckland wharfs and railway, with a view to reducing transport to a minimum. Between September, 1942, and January, 1943, buildings were erected, one on each site, giving a total floor area of 50,280 square feet. The stores were of standard design - timber frame, trussed roof, sheated with asbestos-cement, and having concrete floors.

The cost aggregated £34,128.

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1. Name of Work: Medical Store Building, Mt. Hobson Domain.
2. Locality: At the foot of Mt. Hobson Auckland, on the south-western side.
3. Nature of Work: Erection of a medical store building.
4. References: File: 23/784 Map: 3/US12
5. History: The lower slopes of Mt. Hobson were selected for a medical store building, owing to their central position and close proximity to the three main American hospitals.

The building was erected in 1942 at a cost of £44,700. It had a concrete floor, with the framing in timber and the walls and roof covered with asbestos cement. It covered an area of 32,000 square feet.

U S STORES, TAMAKI.

HALSEY ST. STORES.

OLD DOCK SITE STORES.

1. Name of Work: Fuel Tank Farm, Northcote.

2. Locality: Northcote, on the slopes above Shoal Bay.

3. Nature of Work: The provision of a fuel oil storage depot and distributing centre for the US Navy.

4. References: File: 23/679 Map: 3/US3

5. History: With the establishment by the US Navy of an operating base at Auckland - which became a depot and distributing centre for the initial stages of the South Pacific campaign, one of the first requirements was for facilities for the bulk storage of some 20,000,000 gallons of oil fuel.

Of the three sites selected for separate tank farms, a commencement was made in mid-1942 by the Public Works Department on work at Northcote. Plans were firstly approved by Washington. The proposal was to provide for 50 tanks, spaced about 300 feet apart, and set into the country on an irregular line following the foreshore. Excavation was to be carried out so that each tank (55 feet in diameter) would stand on solid ground. All materials for the project, including piping, pumps, etc., was supplied to the Department by the Americans.

A 12 inch leader line and separate pumps were to connect each tank, with a six inch line providing a foamite fire fighting service over the whole area. To patrol and control the farm adequately, a service road was formed, winding around each tank site and joining up with the site of the proposed control office.

Twin six inch steel pipes were to connect the fuelling point at Stanley Bay Wharf with the farm. These lines were located across two arms of the harbour and also over the Bayswater peninsula, the total length being approximately two miles. Owing to the long length of flat grade, it was necessary to arrange for booster pump installation on the Bayswater peninsula to enable

Fuel Tank Farm, Northcote (Cont'd).

the required rate of fuelling to be obtained.

At Stanley Bay suitable mooring facilities were required to enable overseas oil tankers to discharge to the farm and also to facilitate the re-fuelling of ships. The existing wooden Stanley Bay ferry jetty was to be used as part of the structure and a reinforced concrete tee, called by the US Navy a 'key mooring', capable of accommodating the largest ships, was to be so constructed as to give 30 feet of water at low tide. This would be connected in timber to the ferry jetty. The twin fuel mains were to be laid along the timber jetty to the key mooring, where the necessary connections would be installed for receiving from or delivering fuel to ships. Direct line telephone communication from the mooring to the farm was to be installed.

Owing, however, to the favourable trend of the war in the Pacific, the building of the tank farm was cancelled after about nine months' work. During this period the construction carried out included 200,000 cubic yards of excavation for 25 tank sites, the placing of 60 foot diameter circular concrete foundations for 25 tanks, the erection and testing of six 350,000 gallon bolted steel tanks, and the partial erection of a reinforced concrete booster pump house at Bayswater. The concrete key mooring was completed, with a connecting timber jetty to the existing Stanley Bay jetty, this being undertaken by the Auckland Harbour Board under the Department's supervision. All necessary materials for the project were collected ex ship at Auckland and transported to the site, and when the work was abandoned, these had to be returned to the Americans for re-shipment overseas.

The cost of the work amounted to £138,797.

1. Name of Work: Radio Stations, Auckland.

2. Locality: (a) Receiving Station, Purewa
(b) Transmitting Station, Mt. Albert.

3. Nature of Work: Construction of radio stations, with all necessary accommodation and services.

4. References: File: 23/748 & 23/749 Map: Purewa 3/US11
Mt. Albert 3/US18

5. History: Early in 1942 the construction of a radio receiving station at Purewa was authorised. The work comprised the erection of the station building; hutted temporary quarters, galley, mess-hall, and lavatory facilities for 30 men; permanent barracks for 60 men, including galley, mess-hall, and recreation room; boiler installations; and garages, etc. In all, seven buildings were erected, covering a total floor space of 9,537 square feet. Roading, fencing, fire protection, and other engineering services were also provided.

The work was completed in December, 1942, at a cost of £21,651.

Simultaneously, a radio transmitting station was constructed at Mt. Albert, involving the erection of eight buildings covering 1,782 square feet and entailing an expenditure of £9,663.

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The Purewa station was taken over by the RNZ Navy in December, 1944.

1. Name of Work: Magazines, Motutapu Island.

2. Locality: An island in the Hauraki Gulf.

3. Nature of Work: Erection of magazines.

4. References: File: 23/413/4 Map: Magazines 3/US1 Stores 3/US2

5. History: Sites for 50 magazines were chosen in undulating country on the western side of Motutapu Island, near the head of Islington Bay. Excavation of the sites (into the hillsides) involved the removal of 64,000 cubic yards of material, while the 6 3/4 miles of road access required entailed the excavation and filling of an additional 59,000 cubic yards.

The magazines were of precast reinforced concrete, each being 80 feet by 20 feet. After they had been erected - by contract - field tile and scoria drains were put in behind them and then covered with earth, leaving only the fronts showing.

A camp built for the contractors to accommodate their workmen was later taken over and enlarged by the US Marine Corps. A large store, 360 feet by 120 feet, similar in design to the buildings erected on the mainland and containing a floor area of 33,200 square feet, was erected at Home Bay and connected to the magazine area by road.

The total area of the 90 structures erected on Motutapu Island was 180,000 square feet.

Although the programme of work authorised was fully completed, the magazines were never actually required, and were eventually used for wool storage.

The cost of the project, which was carried out between September, 1942, and July, 1943, came to £188,292. This included a new wharf at Islington Bay (on Rangitoto Island).

U S MAGAZINES, MOTUTAPU ISLAND.

MAUNGAKIEKIE REST HOME, AUCKLAND.

1. Name of Work: Magazines, Kauri Point.

2. Locality: Kauri Point, on the northern coastline of the Waitemata Harbour.

3. Nature of Work: Erection of magazines for the US Navy.

4. References: File: 23/416 Map: 3/US4

5. History: Fifteen brick magazines for the US Navy were constructed between January, 1943 and April, 1944, on an area adjacent to the RNZN armament depot at Kauri Point. A new road giving separate access to these was formed.

Including an ancilliary building the total floor area of all structures was 16,380 square feet.

The expenditure incurred amounted to £63,383.

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1. Name of Work: Maungakiekie Rest Home, Auckland.

2. Locality: Adjacent to and including the Maungakiekie golf house, on the One Tree Hill Domain.

3. Nature of Work: Providing accommodation for a rest home for US Air Forces officer personnel.

4. References: File: 23/787/1/1 Map: 3/US19

5. History: The existing golf house building was taken over and altered to provide lounges, kitchen, and dining accommodation. Seven dormitory blocks were built, each divided into cubicles and with lavatory wings adjoining. A boiler house and a store building were also erected.

The rental of the land and buildings was £6.10.0 per week.

The project was completed for the US Air Forces by November, 1944, but owing to the progress of the war in the Pacific it was never used by them.

After the termination of hostilities, the property was purchased for use as a home for blinded New Zealand servicemen and as such it became the NZ St. Dunstans.

The cost of the work carried out for the Americans was £11,810.

1. Name of Work: Military Camps, Masterton.

2. Locality: Memorial Park and Solway Showgrounds.

3. Nature of Work: Enlarging and improving existing camps for use by US Forces as rest camps.

4. References: File: 23/908 & 23/930 Map: Memorial Park 7/US1
Solway Showgrounds 7/US2

5. History: In January, 1943, the Department received instructions to proceed with a programme of work designed to convert into rest camps for the US Marine Corps the brigade camps established on Memorial Park and on Solway Showgrounds for New Zealand Forces during the previous year.

The work consisted of providing additional roading, water, and sewerage services, etc., as well as the erection of a number of extra buildings and tent decks.

At Memorial Park 262 tent decks and 51 buildings were erected, covering a total floor area of 87,000 square feet. The corresponding figures in respect of Solway Showgrounds were 486 tent decks and 60 buildings, of an aggregate floor space of 138,400 square feet.

Each camp accommodated 1,200 personnel.

The expenditure incurred was:

Memorial Park : £24,678

Solway Showgrounds : £28,619

Included in the cost of restoring the properties was a payment of £3,000 towards the replacement of the Memorial Park grandstand, which was destroyed by fire before the park had been handed back to its owners.

U. S. M. C. CAMPS AT MASTERTON.

TOP: MEMORIAL PARK. LOWER: SOLWAY.

1. Name of Work: Military Camps, Paekakariki Area.
2. Locality: See below.
3. Nature of Work: Erection of camp accommodation for units of the US Marine Corps.
4. References: File: 23/112/4 Map: See below
5. History: One of the most spectacular achievements of the Department during the war was the erection at short notice of a series of camps for the US Marine Corps in the Paekakariki area, north-west of Wellington. The six weeks' notice given the Department would have been totally inadequate had ordinary constructional methods been followed. Moreover, at this time - April 1942 - both constractors and departmental employees were fully engaged on a huge programme of defence works required for the Dominion's own Forces.

To quote from chapter 5, part 1, of this History (section 3, 'Architectural Branch'). 'Perhaps the most graphic illustration of the practical success of standardisation plus pre-fabrication was in respect of the large camps built for the US Forces in the Paekakariki area. When word was received by the Government Architect that 20,000 men would be arriving within six weeks, the camp sites were, with the exception of a few buildings, empty paddocks on which sheep were grazing. To the surprised gratification of the Americans their troops found three complete camps in readiness for them, with hot and cold water laid on and drainage installed and cooking facilities all ready for use. This had largely been achieved through the various buildings having been pre-fabricated in the South Island and marked, numbered, and shipped to the North Island for assemblage by North Island contractors'.

An immediate start was made on the preparation of camp sites, including roading, streets, and paths, water supply, sewerage, electric power, and vehicle parks, etc.

U S M C CAMPS NEAR WELLINGTON

TOP: PAEKAKARIKI CAMPS,(LOOKING EAST) MIDDLE: LOOKING WEST
LOWER: CAMPS RUSSELL (IN FOREGROUND) AND MC KAY'S CROSSING

Military Camps, Paekakariki Area (Cont'd).

All available plant and machinery was pressed into service, with upwards of 150 departmental tradesmen and others engaged. At McKay's Crossing the camp site was owned by the Wellington Hospital Board, so an Imhoff sewage treatment plant was installed with an eye to its possible use afterwards for servicing hospital buildings. The sewage from Pahautanui camp was run into holding tanks that discharged into Porirua Harbour on the ebb tide. Other camps were provided with soak pits and pan systems.

Water was obtained either by gravity from hill creeks or by pumping from shallow wells. The quality of the water was checked periodically by officers of both the US Forces and the New Zealand Department of Health.

Meantime, as the pre-fabricated buildings came to hand from the South Island, teams of builders rushed ahead with their assembly. Over 700 contractors' employees were engaged on the project.

The camps were of phase one standard, with timber buildings for cookhouses, messes, stores, etc. Practically all sleeping accommodation was in the form of tents erected on timber decks.

The first camps reached completion in time for occupation by the Marines on 16 June 1942. The remainder were ready about the middle of July.

Early in 1943 the original camp at Paekakariki (on the golf links) was increased to provide accommodation for an additional 2,800 men. A new camp for 4,850 men was built on the opposite side of the railway line from the existing one. It was known as Camp Russell. Accommodation for a further 600 men was also erected at Pahautanui in 1943.

The erection of a number of recreation halls, each 90 feet by 30 feet, was commenced in April, 1943. These were distributed among the larger camps.

Military Camps, Paekakariki Area (Cont'd).

As finally completed, the camps were as follows:

Locality	No of Men Accommodated	Map Reference
Paekakariki	5,200	7/US5
Russell	4,850	7/US4
McKay's Crossing	4,650	7/US3
Judgford	3,800	7/US9
Pahautanui	2,000	7/US8
Titahi Bay	1,500	7/US13
Plimmerton	482	7/US10
Paraparaumu (aerodrome)	200	-
	21,682	

The total floor area of all accommodation provided in these camps, including buildings (2,728), huts (1,590), and tents (3,401), covered an aggregate floor area of 2,083,633 square feet.

FOUR OF THE BIG USMC CAMPS NEAR WELLINGTON

TOP LEFT: PAHAUTANUI

LOWER LEFT: TITAHI BAY

RIGHT: PAREMATA

RIGHT: JUDGEFORD

1. Name of Work: Military Camp, Hutt Park.

2. Locality: Hutt Park, Lower Hutt.

3. Nature of Work: Conversion of existing buildings and provision of additional camp accommodation for the US Marine Corps.

4. References: File: 23/793 Map: 7/US18

5. History: In July, 1942, instructions were received to prepare a camp for 600 Americans on Hutt Park. By the end of the month 200 men were accommodated in the existing buildings.

This was accomplished by using the totalisator buildings for dormitories; the old grandstand for a kitchen, mess and store rooms, etc.; the stewards' stand for officers' quarters and administration; the bar under the new stand for a canteen and store; and by converting the loose boxes for use as a boiler room, showers, laundry, drying room, brig, workshop, etc.

Further sleeping accommodation was then provided by erecting huts on the lawn and on the oval inside the trotting tracks. When sufficient huts to hold the full 600 men were ready the main totalisator house was converted into a recreation hall.

The septic tank system at the park was found to be inadequate for such a camp, so a connection was made to the Lower Hutt city sewer on Seaview Road, by constructing a sewer under the Waiwhetu Stream.

Water mains and electric services were extended as required, and a steam heating system installed.

By July, 1943, the personnel accommodated in the camp had increased to 1,200 and a large new recreation hall had been built. Forty-seven buildings and 229 huts had been erected, covering an aggregate floor area of 46,934 square feet.

At this stage the US authorities requested that provision be made for a further 650 men, but owing to

U.S. CAMP, KAIWARRA, WELLINGTON.

U.S. CAMP, HUTT PARK (TROTTING COURSE)

Stores at Seaview (RIGHT) and Park Road (LEFT) may be

Military Camp, Hutt Park (Cont'd).

the improvement in the war situation in the Pacific, this additional work was not carried out.

The total expenditure was £42,850, plus £11,642 to cover rent and the cost of restoration of the grounds and buildings.

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1. Name of Work: Military Camp, Kaiwarra Park.
2. Locality: Hutt Road, Kaiwarra.
3. Nature of Work: Erection of camp accommodation.
4. References: File: 23/743 Map: 8/US1
5. History: In June, 1942, the provision of a camp on Kaiwarra Park for the US Marine Corps was authorised by War Cabinet. This consisted of the usual phase one buildings and was erected quickly by contract. Shortly afterwards a recreation hall, 40 feet by 30 feet, was added.

Early in 1943 extra shower, laundry, and ablution blocks were provided, also a sick bay and medical office, a new kitchen and mess, and a steam boiler for cooking and hot water purposes. Further improvements were effected in May, 1943, some of the existing buildings being re-arranged, while dormitory blocks were built.

In May, 1944, after the US Forces had left, the camp was occupied by members of the NZ Territorial Force transferred from a camp at Hataitai Park. Arising out of this, further alterations were made to the Kaiwarra Camp. Finally, in March, 1945, when an Army signals unit was also moved to the Kaiwarra Camp (from Nairnville Park), more minor alterations were carried out, principally in the form of seggregating a portion of the camp for the accommodation of WAACs.

As completed, the camp contained buildings covering a total floor area of 27,000 square feet. Expenditure amounted to £42,875.

1. Name of Work: Military Camp, Anderson Park, Wellington.

2. Locality: Anderson Park, Tinakori Road, Wellington.

3. Nature of Work: Erection of a camp and hospital for the US Forces.

4. References: File: 23/732 Map; 8/US4

5. History: In June, 1942, the Public Works Department was requested to proceed urgently with the erection at Anderson Park of a camp to accommodate some 400 personnel of the US Navy. The site was prepared by the Department, including drainage, roading, paths, and the provision of a water supply, while the erection of the buildings was allocated to a contractor under the master schedule system.

The buildings (18 in all) included a cookhouse and mess block, ration and QM stores, a guard room, an orderly room, a canteen, a recreation hut, a boiler house, latrines, and ablutions, together with 119 portable four-men huts as sleeping quarters. These were followed some months later by a convalescent and clearing hospital, which took up the remaining space in Anderson Park. The hospital provided accommodation for 400 patients, with the necessary medical and administrative staff, and consisted of the usual wards, kitchen, mess, operating theatre, administration buildings, recreation hall, staff quarters, etc.

The buildings (27) and huts erected at Anderson's Park covered a total floor space of 50,161 square feet.

The US Forces vacated Anderson Park in January, 1944, and the buildings were shortly afterwards occupied by the RNZAF as a base camp and demobilisation depot. For this purpose increased accommodation was required, huts and other buildings being moved from the camp at Central Park.

Anderson Park was eventually released in April, 1946. No rental was paid for its use, the City Council being content to accept some of the buildings as compensation

U S CAMP, ANDERSON PARK, WELLINGTON.

U S CAMP, CENTRAL PARK, WELLINGTON.

Military Camp, Anderson Park (Cont'd).

for the cost of restoring the playing fields.

The total cost of the work carried out amounted to £101,029.

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1. Name of Work: Military Camp, Central Park, Wellington.
2. Locality: Central Park, Brooklyn Road, Wellington.
3. Nature of Work: Erection of a camp for the US Marine Corps.
4. References: File: 23/870 Map: 8/US6
5. History: Early in October, 1942, instructions were issued to erect at Central Park, Wellington, a camp to accommodate 16 officers and 400 men of the US Marine Corps.

The site was prepared by the Department, and the contractors to whom the erection of the buildings had been allocated were instructed to work overtime and concentrate on the most essential buildings so that the camp could be occupied by 22 November 1942.

Immediately after they had moved in, the US Marine Corps requested that additional accommodation be provided. As this work proceeded, certain additions were made to the original buildings.

By the time the camp was finally completed in July, 1943, it contained all the necessary buildings and facilities for administration, messing, recreation, and medical and dental treatment, as well as stores, ablutions, a laundry, latrines, etc. Water, sewerage, electricity, and steam heating services were installed. Sleeping accommodation consisted of 2-men and 8-men huts which had been pre-fabricated in the South Island and were erected on the site by the contractors. Altogether, 25 buildings and 116 huts of a total floor area of 81,040 square feet were erected, providing accommodation for 540 personnel.

The cost of the work was £35,000, to which would have to be added approximately £5,000 for restoration of the park after the camp had been removed.

1. Name of Work: Silverstream Hospital.
2. Locality: Silverstream, Hutt Valley.
3. Nature of Work: Erection of a military hospital.
4. References: File: 23/109/1 Map: 7/US11
5. History: The construction of a convalescent depot and hospital adjacent to Trentham Military Camp was authorised early in 1941, the site chosen being at Silverstream, on a terrace overlooking the Hutt River and lying well to the sun.

After the site had been prepared, a contract for the buildings was let. These covered a total floor area of 66,500 square feet, and provided accommodation for 450 patients. Water was supplied by pumping from a well near the river bank to two 30,000 gallon reservoirs, 300 feet above the river, and by gravitation from there to the hospital. Sewage disposal was by septic tank with effluent piped to the river. The buildings were heated by steam.

The construction of the hospital had commenced in September, 1941, and the buildings were nearly completed and in course of being furnished in May, 1942, when instructions were received that the institution was to be handed over to the US Navy and enlarged to accommodate 1,200 patients. This figure was later increased to 1,600.

The extra building work was put in hand immediately on land which had been intended for use as playing fields.

The completed hospital consisted of 46 buildings with a total floor area of 143,800 square feet. All services had to be increased in proportion. For example, two further 30,000 gallon reservoirs and one of 250,000 gallons were constructed, while the existing septic tank was found to be inadequate and a bio-filtration plant similar to that at Trentham was installed. One hundred H.P. of boiler capacity were installed for heating purposes.

The hospital was in use by the US Navy from August,

SILVERSTREAM HOSPITAL.

UPPER LEFT: Some of the buildings. LOWER LEFT: Before construction commenced. (Note the same tree in the upper picture) ABOVE: A comprehensive view of the hospital, showing the Hutt River and Western Hutt Road in the background.

Silverstream Hospital (Cont'd).

1942, to April, 1944, during which period some 20,000 patients were treated. For short rush periods the accommodation was taxed to such an extent that the gymnasium, part of the staff quarters, and even part of the theatre block were pressed into use as wards.

During occupation by the US Navy, all maintenance work and operation of services at the hospital were carried out by the Public Works Department.

The total cost of the work was £293,000.

The institution was later taken over by the Wellington Hospital Board for the accommodation of long term patients.

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1. Name of Work: Temporary Hospital, Trentham Race-course.
2. Locality: Trentham Race-course.
3. Nature of Work: Adapting the race-course grandstand for use as a temporary hospital.
4. References: File: 23/103/31 Map: 7/US7
5. History: In March, 1943, a portion of the grandstand at Trentham race-course was occupied by the US Marine Corps for the treatment of malaria cases. Previous to this, the premises had been taken over from the racing club by the Wellington Hospital Board.

Lavatory and shower blocks were provided, also 16 two-men huts and four stores buildings of a total area of 5,480 square feet. The number of patients accommodated was 340.

The work carried out on behalf of the Americans cost £8,503. No rent was paid for the use of the grandstand, but a settlement of £650 was made in respect of restoration of the property.

1. Name of Work: US Navy Barracks, Oriental Bay, Wellington.

2. Locality: Boat Harbour, Oriental Parade, Wellington.

3. Nature of Work: Construction and fitting out of barracks.

4. References: File: 23/789 Map: 8/US5

5. History: When the US Navy and Marine Corps came to Wellington in 1942 a large number of assult craft were used for training and patrol work. It became necessary, therefore, to provide facilities for servicing and repairing these craft, and for this purpose part of the boat harbour was taken over.

Storage tanks for different kinds of fuel and fuelling points for servicing craft were quickly installed. In the meantime plans were being prepared for living and working accommodation for the personnel concerned.

The buildings were erected on the harbour side of the wall dividing the footpath from the harbour and were partly single storied above the existing boatsheds (which were used for servicing and repairs), partly two storied (with the lower floor used for repairs, etc.), and partly both floors (used for living quarters).

The work was let in three main contracts. The first covered men's quarters and working space, an area of 13,950 square feet, the second CPOs' quarters, mess and recreation rooms, etc., an area of 6,400 square feet, and the third was for a dispensary and sick bay, 1,560 square feet in area.

Accommodation was provided for a total of 350 personnel.

After the US Forces had left New Zealand, the buildings were taken over as a hostel for the accommodation of junior officers of the Public Service.

The cost of the work was £41,832.

U.S. NAVY BARRACKS, ORIENTAL BAY, WELLINGTON.

TOP: *Looking across the boat harbour to Oriental Parade.*
LOWER: *A closer view of the three buildings: the centre one was erected over existing boat sheds.*

1. Name of Work: Stores for US Forces, Wellington District.

2. Locality: See below.

3. Nature of Work: Erection of stores buildings.

4. References: File: 24/989/3 Map: See below

5. History: In Wellington city new stores for the use of the US Forces were erected along Aotea Quay. Two of these, each covering a floor area of 36,000 square feet, were built on Harbour Board land, adjacent to the wharf, at a cost (excluding timber) of £89,922*.

On the other side of Aotea Quay an annexe to the transit store was erected for use as a US commissary store and offices. This covered 25,000 square feet and cost £26,436*.

Bulk food stores to serve the American camps between Titahi Bay and Paraparaumu were built alongside the Paremata and Paekakariki railway stations. These were 39,900 square feet in area and cost £25,543*.

Near Petone railway station four stores were erected in McKenzie Street, covering a total floor area of 78,400 square feet and costing £43,494*.

On railway land at Waterloo station, Lower Hutt, five stores were constructed. These covered 92,900 square feet and cost £60,082*. They were eventually dismantled and re-erected at Trentham Military Camp (Ordnance Depot).

Thirteen stores were built at Park Road, Gracefield, at a cost of £183,424*, and providing 291,280 square feet of space.

Of the 18 stores erected on reclaimed land at Seaview Road, East Petone (414,320 square feet) some 150,000 square feet of space was allocated to the US Forces. The total cost of all stores in this area, including services, preparation of site, roading, etc., was £225,042.

U S STORES IN THE HUTT VALLEY.
TOP: PARK ROAD. MIDDLE: PETONE (Army vehicle reception depot may also be seen in photo) LOWER: WATERLOO.

Stores for US Forces, Wellington (Cont'd).

Map References

Aotea Quay	:	8/US2
Commissary Store	:	8/US3
Food Store Packakariki	:	7/US6
" " Paremata	:	7/US12
Petone	:	7/US17
Waterloo	:	7/US14
Park Road, Gracefield	:	7/US15
Seaview Road, East Petone	:	7/US16

* Except in the case of Seaview Road, these expenditure figures exclude the cost of timber, which was ordered through the Timber Controller in bulk.

U S STORES, SEAVIEW *(Erected on reclaimed land at the mouth of the Hutt River)*

U S STORES, AOTEA QUAY, WELLINGTON.

PART 5 : ACCOMMODATION

CHAPTER I : OFFICE STORAGE, AND RESIDENTIAL ACCOMMODATION.

(1) Policy and Procedure.

(2) Rented Accommodation for the Armed Forces.

(3) New Storage Accommodation.

(4) Emergency Office Accommodation.

(5) War-time Accommodation for Civilian Departments.

(6) Wool Storage.