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by
JOSEPH GREENOUGH

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South Magazine, Halifax Citadel, A Structural History

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Abstract

The design of the south magazine evolved out of a proposal to provide the Citadel with subterranean casemated magazines first advanced in 1832. Although the story of the evolution of the design is quite complicated, the magazine as finally constructed in the mid-1840s was little altered subsequently. It is, in fact, one of the best preserved buildings in the Citadel. The present paper discusses the evolution of the design and describes the structure as built.

Introduction

The present Citadel has had three main magazines. All three figure in this paper. The first (built in 1812 and demolished in 1847) is included largely for academic interest. The other two were, in the design stage at least, entirely identical. Although differences crept in in the course of construction, they remained virtually identical until one (the north magazine) was partially demolished and converted into a canteen in 1901. With these magazines we are therefore dealing with near-identical twins, and in the narrative section of this paper the plural is most frequently used. All facts supplied for the magazines in the pre-1901 period apply to both unless otherwise specified. Occasionally, in fact, the author has been unable to determine which magazine is being discussed in a document.

This paper is divided into two chapters. In the first, the story of the Citadel magazines is treated as a narrative from the construction of the earliest magazine in 1812 until the conversion of the surviving magazine into an art gallery in 1966-67. In the second chapter, the structure of the south magazine is analysed.

The purpose of the first chapter is threefold. It explains the reasons why the identical-twin magazines were felt necessary, describes at length the evolution of the structures after construction with special reference to the south magazine. As this last involves a lot of conjecture, the author has included his reasoning behind each conjecture in the narrative. The author has let the original documents speak for themselves as much as possible. This accounts for the lengthy and admittedly boring but - indispensable - quotations.

In the second chapter, a structural analysis of the magazine, area, retaining wall and shifting room is provided. This chapter is extensively sub-divided for reference purposes and the table of contents provides the best guide for its use.

A number of difficulties had to be overcome in the preparation of this manuscript. These problems, involving research documentation, are treated

in the first chapter. These aside, one of the major problems was the lack of any as-found drawings of the magazine, at the time of writing. As is noted in the second chapter, it is virtually impossible to do a thorough examination of the building interior until the art gallery is removed. The author did his own amateur as-founds of the exterior. These proved of some use in the writing of this report but were not useful enough to warrant inclusion in the illustrations.

A Brief History

The first stone magazine to be erected on Citadel Hill was built by Captain Gustavus Nicolls RE in 1812.[1] As Nicolls later incorporated this magazine into his design for the present Citadel, as it stood on the site until 1847[2] and as the design of this building sheds some light on magazine construction in the early nineteenth century, this early magazine is of some interest. It was a simple arched gable-roofed structure aligned on a (roughly) north-west south-east axis behind the north end of the east curtain of Straton's third citadel (in the vicinity of the re-entrant angle where the south east salient meets the redan in the present fort). The dimensions were as follows:

Exterior: 62 feet X 30 feet

Interior: 50 feet X 16 feet

Arch thickness: 3 feet

The whole was built of rough rubble masonry with a brick arch.[3]

The two most interesting features of the building were the means of access and the arrangement of the powder barrels in it. The only access was in the south end of the building. Here a double door led from a porch into the magazine. A small window on each side of the porch and a somewhat larger one in the north end provided light and ventilation. Additional ventilation was provided by double shafts broken by two masonry pillars in the middle of the side walls. The powder was arranged on either side of a 3 foot 10 inch aisle running the length of the magazine. A second small aisle ran across the middle of the building. The barrels were stacked three deep and seven high. It is clear from plans that the racks employed to hold the barrels were considerably simpler than the ones used in the present magazine, but it is not entirely clear exactly how they were constructed. It appears that the barrels rested on the four sleepers and were held in place by uprights at approximately 12 foot intervals. The total capacity was 1344 barrels.[4]

This magazine lasted far longer than the fort it was built to supply.

As early as 1814, the fort was reported incapable "of making any defence": the magazine being "in perfect good order."[5] And so it was reported year after year.[6] When Nicolls, by then a Colonel, set about designing the present Citadel in the autumn of 1825, his old magazine was still in fine condition and he incorporated it into the new design.[7]

While it must have been perfectly obvious to Nicolls that the old magazine was of questionable utility in the new work, he carefully refrained from pointing out its deficiencies to his supervisors in London. There were three principal faults: the old magazine was inconveniently sited; it was too small (each of the two magazines which replaced it had a larger capacity); finally, it was the highest object in the fort. This last arose from the fact that Nicolls proposed to cut down the crest of the hill in the interior of the new fort, leaving the old magazine a full ten feet higher than the level of the new parade and the ridge of the magazine roof marginally higher than the top of the parapet of the east curtain ramparts next to it.[8] Although all these faults were easily spotted - the more so as the plans Nicolls despatched with his estimates clearly illustrated two of them - no one is London remarked upon them, and Nicolls' plan was approved in July 1828.[9]

Nothing further was heard on the subject of magazines until Colonel Boteler arrived on the scene in 1831. By then the work was in serious difficulties owing to the failures of Nicolls' escarp walls and, Boteler, appalled by the mess he had inhereted, immediately set about outlining the problems in a series of letters to his superiors in London. In one of the first of these, the magazine was noted in passing as a comparatively minor source of difficulties. The Citadel, Boteler noted, had no "other magazine than the one built in 1812 for 1344 barrels of Gunpowder, but now standing on ground 10½ feet above the level of the interior of the fort". This was not, Boteler admitted, a problem of importance.[10]

Sir Alexander Bryce (the Inspector General of Fortifications) misunderstood - perhaps willfully (he had been Deputy Inspector General when Nicolls' plan had been approved) - Boteler's objection to the old magazine. He observed, in his report on Boteler's letter written for the Master General, that Boteler had

"an impression that the Magazine built in 1812, before the Fort was erecting was planned, will have to be removed to admit of further casemated accommodation for the troops." A little later in the same letter, Sir Alexander expressed his opinion that many of Boteler's difficulties could be solved by the use of casemates.[11] The letter sent to Halifax in reply to Boteler's report was more explicit on this point:

> Sir A. Bryce wishes you also to consider and report whether you can by [casemating] ... provide additional magazine accommodation under the Ramparts in situations capable of thorough ventilation.[12]

Sir Alexander's suggestion was directly responsible for the design of the two Citadel powder magazines, although Sir Alexander (who died in 1833) would probably have been surprised at the result. It is obvious from the correspondence that he did not consider the magazine problem as being very serious and that his suggested casemates were intended primarily to relieve the loading pressure on the escarp walls and only secondarily for any other purpose. It is clear, in addition, that he intended any magazine space thus erected as auxiliary to the 1812 magazine.

As Bryce (probably willfully) misunderstood Boteler, so Boteler (probably willfully) misunderstood Bryce. While Bryce was telling his superiors that nothing serious was wrong and requesting inexpensive (and cosmetic) solutions from Boteler, the latter was drawing up two full scale estimates for the completion of the Citadel: estimates in which the original cost was greatly exceeded. In both of these, Boteler made provision for subterranean magazines in both west demi-bastions. The magazines were each to consist of two casemates, each 18 feet wide, covered by 3 foot, 120° segment brick arch. Access to the magazines was provided by an arched passage along each side which may also have doubled as a lamp passage (the surviving plans are unclear on this point). Each casemate and adjacent passage shared a masonry dos d'ane, while a gutter ran down the valley between the two casemates. The cost for each magazine was estimated at £ 3128.2.5½. The total cost of the proposal was thus £ 6256.4.11.[13]

Each of Boteler's magazines was intended to hold 1500 barrels of powder. Although it is nowhere explicitly stated and although Boteler did not provide an estimate of the demolition cost of the 1812 magazine, it is clear that Boteler's magazines were intended to entirely supercede the 1812 magazine.[14] That this was not immediately apparent and commented upon was due to the circumstances which attended the presentation of Boteler's estimates. Boteler had intended to present them in person. He drowned en route to London early in 1833.[15] When London finally saw Boteler's Proposals, they were included in an enormous mass of paper dispatched by Boteler's interim successor, Captain Loyalty Peake, in June 1833. Boteler's proposals were, in consequence, never closely examined by the authorities in London. They did, however, exert a considerable influence over Lt. Col. Rice Jones, the officer sent out from England to replace Boteler.

Part of the enormous mass of paper dispatched by Captain Peake was a set of his own estimates for the completion of the Citadel. These had not been requested by London and were largely ignored. These are interesting in the present context solely because they represented the last attempt to salvage the 1812 magazine for the new fort. Peake, like Nicolls, considered the prominence of the old magazine to be a comparatively trivial problem. He considered that all that was required was a retaining wall to secure the drop between the level of the magazine and the level of the new parade square.[16]

In March 1834, Lt. Col. Jones submitted his estimate for completing the Citadel. This combined elements of both Boteler's estimates and carried over long stretches of Boteler's calculations almost verbatim. One item repeated Boteler's proposal for casemated magazines in each of the western demi-bastions. The basic structure was identical to that proposed by Boteler although Jones had managed to pare a few pounds off the cost; he estimated £ 6154.11.2 for both.[17]

Jones was somewhat more explicit than Boteler on the necessity of building new magazines:

> ...no provision was made in the original Estimate for Magazines in lieu of the present one which it is essential should be removed being most inconveniently placed

> encumbering the Interior, above the level of which its floor is 10 feet high and its roof exposed 4 feet above the Parapet, whilst the brickwork of the arches is no more than 2 feet 6 inches in thickness,* and the masonry not of the best description.[18]

Nor with Bryce dead, was anyone in the Inspector General's office about to quibble with Jones' description. The new Inspector General (Robert Pilkington) did, however, have some objections:

> I do not approve of placing the Magazines in the body of the Rampart as shown in Plan No. 1 and Item 111 of the Estimate, because there is so much difficulty in affording them sufficent ventilation unless the passages are a ciel ouvert, so that I have to recommend that they be left open.[19]

Jones, obliged to act on Pilkington's suggestions, used it as an excuse to completely redesign the magazines. He probably considered that Boteler's design was unsuitable for a free standing structure. His own design called for two large, arched, free-standing buildings, each consisting of a single room, entered by a door in the north end. It was proposed to locate the magazine in spaces excavated from the gorges of both of the western demi-bastions: one magazine in each. In both cases, it was proposed to separate the magazines from the ramparts by means of a retaining wall. On the east side of each magazine, a free-standing perimeter wall was proposed to separate the magazine from the parade square.[20]

In designing the magazines, Jones followed Vauban in providing the buildings with external buttresses. When his estimate arrived in London, one of the first persons to examine it was Edward Fanshawe, the Assistant Inspector General of Fortifications. Fanshawe had a number of peculiarities, one of which became sufficiently famous to merit a mention in the official Aide-Memoire, published in the following decade. "Major-General Fanshawe," the

*according to the 1811 plan, the arch was supposed to be 3 feet thick

See above.

editor noted, "appears not to approve of Vauban's or Muller's external buttresses, but would prefer having the external lines free from corners." [21] It is not too surprising, that one of the few quibbles London had with the revised estimate concerned the buttresses:

> In respect to the plans, Section etc., the Inspector General considers it will be better to do away with Buttresses to the Magazines, and to make a corresponding addition to the thickness of the abutment."

The Inspector General?

Once again, Jones revised his estimate and submitted it. The magazine buttresses were dispensed with: 8 inches were added to each of the pier walls and some alteration (it is not clear exactly what) was made in the boundary wall. [23] In a balance sheet submitted at about this time, Jones demonstrated that the substitution of free-standing buildings for subterranean ones would result in a saving of £ 338.12.8½. This saving was, however, partly illusory as, in an earlier item, an additional expense of £ 152.12.10.3/4 was estimated for the construction of the rampart retaining wall around the magazines. [24]

In memorandum on the revised (1836) version of Jones' estimate, the Surveyor of the Ordnance deplored the lack of detail in the information Jones had provided:

> The Plans and Reports on the several Items of the Estimate do not afford the information required by the regulations, nor do they contain sufficient to enable an examination of all the details .... [25]

In fact, the Surveyor was rather better off than the modern historian in that several of the plans drawn for Jones' estimate - notably a ground plan of the fort - are no longer available. It is thus difficult to be precise about all parts of Jones' proposals for the magazines. As most parts of the magazines and surrounding retaining walls were built to Jones' specifications this is in some ways unfortunate. It is quite clear, however, what in a general way Jones intended.

As designed by Jones, each of the two magazine areas consisted of three main elements: the magazine itself, the boundary wall separating it from the parade square and the retaining wall holding back the ramparts. The last presents the most problems for a structural historian as it is no where explicitly mentioned in the estimate. Instead, a single brief item covers the estimated expenses for all retaining walls in the north, west and south fronts.[26] In addition to this, we possess two (contradictory) sections of the retaining wall as proposed behind the magazines. Finally, it would appear from later correspondence, that the rounded angles of the west side of the area wall as it now stands were not proposed until later. In Col. Jones' design, the area was probably rectangular and the two angles in question were probably right angles.[28]

The lack of hard information on the retaining wall is further complicated by the fact that it was one of the items which Jones adopted from Boteler and later changed at the request of the Inspector General. As Boteler had originally designed it, the retaining wall was to have been a thick stone wall buttressed in the rear.[29] Jones carried over the idea, into the first version of his estimate but modified it by reducing the size of the buttresses and arching over the intervening space.[30] The Inspector General, however, felt that a more efficient use of the same basic method was possible:

> In this case, if the Arches be worked through the Front and the walls of each cell built at their Rear, each of these Cells would become a material aid towards becoming splinter Proof covers.[31]

And thus was born the structures known subsequently and variously as cells, recesses, or demi-casemates.

While the revised versions of Jones' estimate is reasonably explicit about the manner in which he proposed to erect the retaining wall, there are anomalies in the plans of the magazine and area, which may or may not have been draughtsman's errors. In the plans drawn for the items dealing with the retaining wall, the wall itself is shown as being a uniform 3 feet thick (except that portion above the level of the terreplein which was only 2 feet 6 inches thick): the pier walls as being a uniform 2 feet 6 inches thick and

placed a uniform 11 feet 6 inches apart (centre to centre); the whole resting on foundations 6 inches wider than the wall above and between 5 and 6 feet deep. The demi-casemates were all shown as being 9 feet across by 7 feet deep and unfloored.[32] The two sections accompanying the magazine portion of the estimate, however, tell another story. In one, the demi-casemate is shown in section as having a masonry floor, but no rear wall. In the other, an end wall is shown as well as a masonry floor, and the depth is given as 7 feet 6 inches.[33]

Faced with this rather confusing situation, one can only echo the *Surveyor of the Ordnance in wishing that Jones had been more explicit in* providing details. The two variant sections included with the magazine sections are probably draughtsman's errors. As far as is known no demi-casemates in the south magazine area have masonry floors (some, however, do have concrete ones), and all have end walls. It should be noted, however, that although all demi-casemates in the Citadel appear similar in most particulars, there are many minor variations, some of which may go back to their initial construction and that, in the absence of explicit information, any idiosyncrasy discovered in a demi-casemate ought not to cause surprise.

As for Jones' magazine itself, this appears to have been intended to be a slightly larger version of Nicolls' 1812 building. The dimensions were as follows:

Exterior: 68 feet X 42 feet 4 inches.

Interior: 60 feet X 25 feet.

Arch thickness:3 feet.

The magazine was entered by a double door in the south end. Flanking the door were two small windows for light and ventilation. This north end wall was entirely blank and this was, in fact, the only major difference between Jones' and Nicolls' designs. There may have been other minor differences, but there is insufficient evidence.

It would appear that the construction of the magazines had still not commenced when Jones was replaced by Lt. Col. Patrick Calder in 1842. Calder quickly came to the opinion that the unexpected portions of Jones' revised

estimate could do with some improvement and, in January 1843, he made a number of suggestions to the Inspector General. Two of these concerned the magazines:

> ... it does not appear that the doors of the magazines are to be protected by porches, nor is any provision made for shifting the powder or coopering the barrels: considering both essentially necessary I have shown ... how they may be provided ... I beg also to submit, whether for the greater security and better ventilation of the magazines, it would not be advisable to do away with the windows ... and construct a doorway on the opposite end of the building ...[34]

Before deciding on Calder's proposals, the Inspector General submitted them to Jones for an opinion. While in agreement with many of Calder's suggestions, Jones did not think much of his plans for the magazines:

> I am not aware of the necessity of Porches to the magazines, but should they be essential, I would recommend a portion of the interior space adjoining the doorway being built up for the purpose, rather than erecting exterior porches, in order that the whole may be under one unbroken roof which is best adapted for preventing snow and consequent damp. Shifting rooms may be rapidly built as proposed if required: or some of the archways in the surrounding walls (?) [sic] might be adapted to the purpose without adding to the expense. -
> ... Windows are proposed to be placed in the magazine towards the South for the benefit of getting the greatest light and warmth and I consider them preferable to Doors to the North which is the aspect to be most avoided in that climate.[35]

Confronted with Jones' objections, the Inspector General temporized:

> The Inspector General acquiesces in shifting rooms being provided for the Magazines in the manner you propose subjecting to your confirming upon this point and, in respect to the Magazine Porches and Doors, with the Commanding Officer of Artillery and the Ordnance Storekeeper.

If his colleagues agreed, Calder was instructed to include the magazine porches

in a general estimate.[36]

Calder had his submission ready within weeks of receiving authorization. In the course of consulting with his colleagues, his ideas on useful additions to the magazine and area reached their final form:

> ... Of the Shifting rooms and porches for the magazines... I have conferred with the Commanding Officer of Royal Artillery and the Ordnance Storekeeper who are of opinion they should be constructed without the magazines as suggested, and with reference to Lieut. Col. Jones' objections to the formation of doors in the North ends of these buildings. I beg to state that all the magazines at Halifax stand North & South and each of them have doors in both ends. I beg further to submit for your approval the construction of a small window (say 3.0 X 2.6) in each end of the magazine, above the porches, to admit light when the men are at work in them these windows to be secured by strong shutters covered with copper.
>
> ... I propose to round the angles of the area wall next the Bastions in order to facilitate the communication along the ramparts by increasing the distance between its parapet and that of the area of the Casemates of defence to 20 feet, which alteration will not be attended with additional expense.[37]

Although it was not explicitly stated, the change in the shape of the area wall probably was in response to Col. Jones' objections to another of Calder's proposals: the substitution of ramps for steps as access to the ramparts on the west front. Jones had considered ramps "objectionable from interfering with and curtailing the breadth of the Rampart at the flanks."[38] Eventually, the matter of access to the ramparts was settled with a compromise: Calder built his ramp in the south west demi-bastion and the steps remained in the north west demi-bastion.

The estimate which Calder prepared to accompany this submission contained three items which related to the magazines:one for the shifting rooms, one for

the porches and additional doors and one for the additional expense to be incurred in altering the method proposed in the 1836 estimate for constructing the roofs of the magazines. Costs were estimated at £ 439.1.5 for the first, £ 169.11.5 for the second and £ 81.16.0 for the third.[39] As with most Citadel estimates, the detail given in each item is less than one might wish and, in fact, the estimate shows every sign of having been composed in haste. There is, for example, no mention anywhere in the estimate of the two windows Calder proposed in his covering letter.

London approved Calder's estimate with remarkable speed. Mulcaster dispatched it for the consideration of the Board of Ordnance on 1 July 1843. While admitting that the estimate had not been examined by the Surveyor, Mulcaster requested that the estimate be approved as speedily as possible.[40] The Board did so twelve days later[41] and permission to proceed was dispatched to Calder on 18 July.[42]

Although the changes to Jones' design approved in 1843 altered the external appearance of the proposed magazines and area, the changes seem more dramatic than they in fact were. The proposed magazines were still slightly enlarged versions of the 1812 building although the provision of porches and doors at both ends tended to hide the basic similarity. The provision of the shifting rooms and the rounded corners to the area altered the physical appearance of the area and necessitated the abandonment of at least one of the proposed demi-casemates in each but again, no fundamental structural changes in the retaining wall were proposed. The magazines as finally constructed (in the mid 1840's) were thus basic Jones with Calder details.

This marriage of Jones and Calder was not without problems, some of which stemmed from the insufficient details provided by Jones in his revised estimate. One of the magazines (it is not clear which) was commenced as soon as the authorization to proceed was received in the summer of 1843 and, by the end of September, it was quite well advanced. The Surveyor of the Ordnance, on examining the progress report for the summer work and comparing it with the information provided in Jones' revised estimate noted several discrepancies which, he felt, required comment. These are interesting, partly because they shed some light

on the manner in which the building was constructed and partly because the correspondence demonstrated how the Ordnance bureaucracy worked (or, on occasion did not work).

The Surveyor noted three main discrepancies, of which two had to do with the arch and the third with the doors and windows. The last was no real problem, as the Surveyor admitted that the alterations proposed appeared to be authorized:

> Instead of doors & windows being all at one end, a door and window over each end is the arrangement adopted, but this appears to be sanctioned by the letter of the I.G.F. dated 3 March 1843.[43]

In fact, the Surveyor got the date wrong (the real authorization was Byham's letter of 12 July), but his comments are interesting in that they are the sole indication we possess that Calder's small windows in the magazine gables were probably constructed.

The problems with the arch required more attention. In the first place, the drawing in the progress report seemed to indicate that a 112° segement 3 foot 6 inch thick arch with a span of 25 feet 6 inches was being constructed instead of a 120° segment 3 foot thick arch with a 25 foot span proposed by Col. Jones. Calder attributed this to draughtsman's error:

> ... the Magazine is constructed according to the Section in the Estimate dated 1st February 1836 namely 25 feet wide, the segment of its arch 120° and the Brick arch what is called 3 feet thick being composed of 4 bricks.[44]

The other problem with the arches was, however, comparatively major. As the Surveyor interpreted Jones:

> The principle of construction [is] that the arch shall be carried the whole length [of the building] having the ends to be merely filled in but according to the Progress Plan, it is being executed thus ... [a sketch of the magazine]. The difference being that the arch is not carried from end to end but only between the end walls.[45]

The root of the problem was the text of Jones' estimate which stated that the magazines were 60 feet by 25 feet without specifying that these were in fact, the interior dimensions. Elsewhere in the same estimate, Jones stated that the length of the arch was 68 feet.[46] Calder, in his rebuttal, explained the problem at some length:

> ... from the Report on Item 14 of the revised Estimate dated 1st February 1836, it is evident that the construction [of the arch] was intended as executed.
>
> There the internal dimensions of the magazine are given 60' X 25'.
>
> The length of the Brick arch 60 feet with a span of 25 feet.
>
> The length of the Building is 68 feet and the flooring is stated to be 60' X 25' hence the arch was not to be "carried" from end to end but only between the walls.

In fact Calder thought that he had exceeded the original specification:

> In the execution however I have carried it (i.e. the arch) 9 inches over the interior face of the end walls which I think will add to its security, though I conceive were the ends "merely filled in" without the connection with the side walls, and a straight joint all the way round them, the construction would be extremely defective.[47]

As far as is known, the Surveyor never called Calder to task for the ommissions and lack of detail in his own estimate. Certainly Calder was not free from blame in this regard. As we have already seen, the 1843 estimate reads as if it had been written in haste and many minor points are unmentioned. (eg. the gable windows). A more serious ommission, at least for the structural historian, is the matter of casemate linings and casemate ventilators. In none of the casemate items of the 1843 estimate is the use of brick in the lining of the casemates mentioned. Neither is any information provided on ventilation. When, however, Calder supplied detailed accounts for the casemates in the north front (Nos 24-30) in the annual estimate for 1844-45, he noted that these casemates were to be "lined with 4½ inch of Brick work set in mortar,

every 4th course being headers bonded into the masonry." He also noted that each casemate was to be provided with "4 cast iron ventilators 12 X 9 and ½ inch thick each perforated with 140 holes each 3/8 inch in diameter." The grates were covering for air shafts, arranged in pairs, one pair leading from the exterior of the retaining wall under the floor;the other pair at the opposite end of the casemate, leading from under the floor to the upper part of the casemate. The arrangement of the rear ventilators varied. Most commonly they were in the side walls but, occasionally, they were in the rear wall.[48]

The casemate items of the 1844-45 estimates are the only detailed accounts which have survived of the structure of Calder's casemates as built. There is therefore no direct evidence that Calder installed similar ventilators and linings in the shifting rooms. There are, however, linings or traces of linings in both and Calder-type ventilators in one (the south) so the problem has to be faced.

The north shifting room was constructed up to the spring of the arch prior to June 1844 and most probably in the summer and autumn of 1843.[49] It was almost certainly the first of Calder's casemates to be built, as Calder specified the casemate interior dimensions are 15 feet X 20 feet and as the casemate currently measures 14 feet X 19 feet, and as it shows no signs of a Calder-type ventilation system, it is reasonable to assume that this shifting room was originally built without either lining or ventilators. The fact that the ruins of the lining now visible are not an integrated part of the wall supports this contention.

The south shifting room, however, physically resembles the other Calder casemates. It is reasonable to assume that it was built in 1844 or later to the same general specifications as those proposed for the north front casemates. In this context, it is worth nothing that the present dimensions of the casemate are in fact 15' X 20' (± 1") which makes it unlikely that the lining was added later. The lining, moreover, appears to be an integrated part of the wall and the dimensions of the granite ventilator frames and the ventilator grates in the rear wall are identical to those of similar grates and frames in other Calder casemates. It should be noted, however, that no plan

earlier than 1882 actually shows the brick lining and no plan shows the ventilators.

The 1843 estimate was thus inadequate in matters of detail. It was also, in some ways, incomplete. After a few years, it became apparent as the magazines neared completion, that not all final details had been settled. In 1846, Calder submitted yet another Citadel estimate, and once again additional magazine items were brought forward including lightning conductors and flagging for the areas. The latter was estimated at £ 713.0.2½ and the former at £ 13.18.9. The magazine items of the 1843 estimate were noted under the heading "Services ordered to be brought forward as excess," although no information was provided for these items other than their estimated cost, which was the same for each item as had been calculated three years earlier. [50]

Only one of these items excited comment. Of the proposal to flag the area, the Inspector General noted: "The object appears desirable but I submit that Asphalte or concrete be substituted for granite flagging." [51] Calder was slightly dubious about the counter proposal but did not directly contradict the Inspector General:

> Asphalte has not been tried in this command but this would afford a good opportunity to do so, as should it fail, flagging can be had recourse to. - Its expense is not known, consequently the Estimate will have to be revised at Pall Mall, and it will be desirable to have the department furnished with full instructions for its application. [52]

Someone, presumably in London, did in fact alter the estimate. Asphalt was slightly cheaper than flagging and the cost for the two areas was now projected at £ 563.17.1¼. [53]

It is clear from the wording of the 1846 estimate that the magazine revisions proposed in the 1843 estimate had not yet been carried out, although construction was probably well advanced on both magazines. It is not clear when the buildings were finally finished. At least one must have been ready before the old magazine was finally demolished in April 1847. By April 1848, both

were in use, although their capacities were somewhat less than originally intended:

> The new Magazines in the Citadel are also well ventilated and filled with Bays which give every facility for inspection & issue. - There is no cultivation in the yards of these Magazines.
>
> In the original Plan of the Citadel* they were put down to contain 1500 barrels each, but when fitted up by the Commanding Rl. Engineer finding the Bays would only [sic] 1320 (one tier being inconveniently high) he inserted them in his Annual Report for 1400, supposing the difference might be piled in the passages upon emergency. - But as the Master General and Board have been pleased to instruct us to "revise the capability of each magazine" concerning it would be better to leave the passages unencumbered at all times by which the circulation would be increased, and that it would be advantageous to have a spare bay to facilitate the shifting of powder, we humbly submit that these Magazines should not be considered to hold 1200 barrels each.[54]

The fact that a spare bay in the magazines was felt to be necessary for shifting purposes is interesting. One wonders what was wrong with the shifting rooms. It would be tempting, given the history of the casemates, to speculate that the shifting rooms were too damp for use, were it not for the fact that an inspection report of 30 November 1848 stated that both shifting rooms were then dry. The same report noted that the dos d'ane of the north magazine shifting room was flagged while that of the south magazine shifting room was flagged and hipped. The writer went on to comment that experience had indicated that casemates which had been flagged and hipped had invariably been staunch. Casemates which had been merely flagged had usually leaked, and, in this instance, the north shifting room was rather exceptional.[55]

*not the original plan but the revised estimate [author's note].

This letter marked the only occasion on which the shifting rooms were included in the many reports and letters on the problems involved in staunching the casemates. They are not included in Col. Savage's 1849 staunching estimate, [56] nor are they listed in the casemate inspections of 1854 and 1856. [57] There is every evidence, in fact, that they were undisturbed from the time of their construction until 1863. [58] To the author, this suggests one of two things. Either they were perfectly dry throughout this period (which, given the history of the casemates and the type of covering used on the shifting rooms seems unlikely), or, despite Col. Calder's arguments, they had not been particularly necessary in the first place and it was only later, as magazine practices became more elaborate, that the army came to appreciate their usefulness. The latter seems to the author to be the more probable. One has the suspicion, then, that in the 1850's the rooms were either empty or used to store those bits of magazine gear which were impervious to damp.

There also is the possibility that, with so much else going wrong in the period 1844 - 1856, the engineers simply never had the time to worry much about the shifting rooms. Few of the difficulties encountered during this period directly concerned the magazines. Three, however, did: one trivial, the other more serious.

The trivial problem concerned the covering of the areas around the magazines. As we have seen, Col. Calder originally wanted to flag the areas, but had been overruled by General Burgoyne, who wanted to use asphalt. When the time came for the area covering to be inserted in an annual estimate, however, Calder had been replaced by Savage. The latter either misunderstood his predecessor's intentions or (more likely) did not possess a revised version of the 1846 estimate. In any event, he repeated the flagging proposal. The Surveyor of the Ordnance (Mr. Owen) objected: his records showed that asphalt had been agreed on. It was then Savage's turn to be upset:

> In a warm Climate, or even a moderately cold one, I am equally an advocate for asphalte as Mr. Owen, having seen it used in large quantities with great success both at the [sic] Mauritius & Gibraltar, but in severe climates like Canada, Nova Scotia or New Brunswick, I am of opinion it never

> will answer except it is well covered over, and secured from the influence of the atmosphere ....[59]

In reply, the Assistant Inspector General informed Savage that the asphalt proposed for use, "Claridge's Patent Seyssel Asphalte," had never been tried in Canada, noted that Calder had been disposed to make the experiment, and asked if there were any specific objections to "the Experiment."[60] At this Savage relented and requested that:

> ... a quantity sufficient (allowing for waste) to cover the area around one of the Magazines at the Citadel ... should be immediately sent to this place, together with the requisite articles for laying it on: and, also, a Book of Instructions for the use of the same....[61]

One suspects that Col. Savage ultimately came to regret having given in so early. The first problem he encountered was in obtaining an adequate supply of asphalt. The authorities in England were dilatory and none arrived in Halifax until 6 August 1849. The Ordnance in Halifax was equally slow, and the stuff was not finally delivered to the Citadel until 4 September.[62] The Ordnance then commenced to lay it in the area of the south magazine. Owing to the lateness of the season, only about half the area was covered but the work that was finished was done in compliance with the asphalt company's instructions:

> The foundation was first executed to the depth of 18 inches ... and drains were built ... above the drains, shale was laid to a depth of eleven inches, and over which two thicknesses of concrete, the first of course concrete four inches thick; and the second of fine concrete two inches thick, agreeably to the directions of the Seyssel Asphalte Company, over which the Asphalte was laid in two thicknesses of half an inch each. -

When the work was stopped on account of the weather, Savage had the exposed ends carefully secured and awaited events.[63]

Nothing happened until February 1850. On 6 February the temperature fell below zero. On the following day, the asphalt was:

> ... cracked in two places ... one of them adjacent to the

> shifting Room and the other opposite the South East Door of the Area: the gutter at this time was cracked in three places .... and the surface of the Asphalte adjoining the gutter next the boundary wall was raised or heaved up, as well as a portion of the Asphalte that was first laid down under the two arches [ie. demi-casemates, probably the two to the east of the shifting room] ... about 3/4 of an inch, but not broken or cracked.

On 11 February the situation worsened, and continued to do so over the winter. By May, there were many heaved and, although no crack exceeded 1/8 inch, there were many of them.[64]

Savage was disposed to continue the experiment, but he was not hopeful of ultimate success:

> I propose during the hot summer months Asphalting the remainder of the area round the magazine as a further experiment. I am however of opinion that Asphalte in this country will never answer where there is a possibility of any water or damp getting under that is in reach of the frost which penetrates in this country from four to five feet.[65]

The Surveyor of the Ordnance, on examination of Savage's report, was considerably more optimistic about the ultimate success and was critical of some of the proceedures used in Halifax.[66] The Surveyor's comments provoked a long technical letter from Halifax in which Savage defended his methods.[67] The experiment continued.

It is not clear exactly what was done in the 1850 season, but it seems likely that the whole of the area was asphalted. At the same time, asphalted bricks were being manufactured for use in the construction of the water tanks. The shed used for this purpose was somewhere around the south magazine boundary wall. It had been placed there in the summer of 1849 and had been used during the working season ever since.[68] After 18 months, it came to the attention of Mr. Ince, the Ordnance Storekeeper, who wrote to Savage expressing his concern:

> It is, of course, impossible while men are in the shed of

> complying with the standing orders of the Dept. to open the windows or air ports of the magazine every fair day.[69]

Savage was quite properly astonished by Ince's belated display of concern: the more so as the south magazine was, at the time, empty.[70] Ince's letter is, however. interesting as it can be interpreted as an indication that Calder's gable windows were, in fact, built.

In the end Savage's opinions on the utility of asphalt in the area were shown to be correct. In a memorandum on the use of asphalt in the Citadel drawn up by Lt. Parsons RE in February 1854, the whole history of the "experiment" was summed up in two succinct paragraphs.

> The Magazine Yard was covered in 1849 with Seyssel Asphalte of the fine quality laid 1¼ inch thick on a bed of concrete, and having a fall from the magazine to a gutter turned in the Asphalte. -
>
> Asphalte fillets were laid against the Magazine and Area Walls. - Each winter(till the present Year 1854) when occasional mild weather rendered it practicable to remove the frozen snow and examine the Asphalte, many and extensive cracks were found in it, and the general level of its Surface appeared considerably elevated by the frost, the gutters in several places so much as to throw the water from them towards the Magazine, and the fillets were found to be loosened from the surface. - The defects so discovered in the Asphalte were thoroughly repaired each year, before the commencement of the cold weather, - but invariably with the same result each succeeding winter.[71]

Notwithstanding this, it is not clear, when, exactly, the engineers finally gave up on the use of asphalt in the magazine areas, and the annual patch up almost certainly continued for years after 1854.

Of more consequence to the functioning of the magazines in this period were the alterations made, partly in consequence of failures, to the interiors of both in 1852-3. In the early 1850's, preparations were under way for the

installation of the Citadel armament and it was at this time that a proposal was advanced to increase the capacity of the magazines. As we have seen the magazines, as originally fitted out, were only rated to hold around 1200 barrels each (one source puts the figure as low as 1168).[72] In July 1852, Savage reported that, with revised accommodation, the magazines could be expected to hold 1470 barrels each.[73] In the annual estimate for 1853-4, dispatched to London on 29 September, Savage inserted two items. One, ammounting to £ 105.13.1 was for "Renewing the Floor, joists etc. of the North Magazine." The other, amounting to £ 6.12.0 was for altering portions of the bays in both magazines.[74]

It will be noted that Savage framed his estimate for renewing the floor of the north magazine at least three weeks before the floor actually failed. On 19 October, Mr. Ince reported that, "the door of the North Magazine will not open in consequence of something having fallen against it."[75] Savage was comparatively unperturbed, believing that he had the situation well under control:

> ... upon examination of the North Magazine at the Citadel, I found that the floor which was previously in a decayed state, had suddenly given way, from the weight of the Powder & the decay of the joists.

He had, he went on, already inserted an item for the repair of the floor in the annual estimate for the forthcoming year and he thought that the work could be carried out immediately and the expense covered "by savings on Items authorized in the Ord. Annual Estimate 1852-3, that have been executed."[76] It is interesting to note that Savage did not speculate on the reasons why a floor, which was less than ten years old, should have decayed so soon.

In reporting the whole business to London, Savage emphasized the need for haste:

> As much inconvenience will exist, if not damage to the powder from the present state of the floor, I would therefore beg to suggest as there will be a saving on the present year's estimates more than sufficient to cover the expense of the renewal of the floor amounting

> to £ 105.13.1 ... that (this service) should be authorized ...[77]

London agreed, but only after Savage's letter had been circulated all over both the Fortifications and Ordnance offices.[78]

By the following spring, the work had been done, but, by then, the south magazine floor was giving trouble. Moreover, when the authorization to proceed with the work proposed in the annual estimate for 1853-54 arrived from London Savage discovered that, notwithstanding the fact that the work had already been done, funds were authorized for the north magazine floor and powder bays for the coming year. What was more, the Surveyor of the Ordnance had actually proposed an alternative method of proceeding with the re-flooring: he wanted to use asphalt.[79]

The result of this confusing situation was a rather confusing letter from Savage to his superiors. He began by noting the problems with the south magazine floor:

> I was lead from the appearance of a depression in the Surface of the floor, to examine its state beneath, when it was found that the joists, plates and boarding throughout were in the last stage of decay, evidently from the same cause that rendered necessary the removal of the floor in the north magazine, and which makes it absolutely necessary to renew this floor before the bays can be arranged or the powder again stored therein . -

He therefore proposed that the money which had been approved in the annual estimate for 1853-4 for the reconstruction of the north magazine floor, be re appropriated for the renewal of the south magazine floor and, moreover, that the

> revewal should be executed according to the mode suggested by the Surveyor ... viz to substitute fine Seyssel asphalte without grit in lieu of the joists and planking, which substitution I consider may be effected as an experiment, as it is probable from the Asphalte in this situation not being

> exposed to the direct action of the weather, it may be found to answer the desired end....

He had, in fact, prepared a special estimate amounting to £ 158.5.0 to show the expense to asphalting the floor.[80]

The Inspector General, who had been responsible for the asphalte experiment in the first place, disagreed with Savage and the Surveyor:

> I recommend that the South Magazine floor be renewed in the same manner as that of the North ... and no Asphalte (the suitableness of which for a magazine floor in Nova Scotia is questionable) will be required to be sent out.[81]

The south magazine floor was renewed in the traditional manner, probably in the summer of 1853. During the period in which it was used to store munitions, the south magazine always, in fact, had a wooden floor, although it is not known how often it was renewed after 1853.

It would appear, from the rather meagre documentation available, that the new floor was virtually identical with the old. The real change made during the alteration was in the type of powder rack employed. As originally built, the bays were arranged rather strangely, in three aisles with two large racks, each two barrels deep and running almost up to arch, arranged on either side of the main aisle which ran up the centre of the magazine; two smaller aisles running behind the main racks, and two small racks, each one barrel deep and running up to the spring of the arch, arranged along the side walls. While this arrangement allowed maximum access to the barrels, it was particularly efficient and the new racks were layed out in a much less fussy manner, consisting simply of two racks, each three barrels deep by seven high, running on either side of the narrow central aisle, with sufficient room between rack and side walls to allow rear access.[82]

The next things to fail in the magazines were the lightning conductors. These, it will be remembered, had been provided in the 1846 supplementary estimate. It is not clear when they were installed, nor is it clear exactly when they failed. As originally intended, each magazine was to have two copper gilded wrought iron conductors, one on each gable coping.[83] An 1852

plan, however, shows a rod raised over the boundary wall which may or may not have been the lightning conductor.[84] There is thus a possibility that the original arrangement had failed as early as 1852.

It was not until 1858, however, that the engineers took steps to deal with the problem. In that year, a proposal was put forward for the replacement of the lightning conductors on all the magazines in Halifax:

> These Magazines are at present fitted with Iron Conductors all of which, with the exception of the Naval Magazines, are detached from the Buildings. - The Conductors to the Citadel Magazines, terminated in Water tight tanks. -

It was proposed to use copper in all fittings for the new conductors. The Citadel magazines, in addition to the conductors, were also provided with "copper gutters and down pipes," although it is not clear whether these were already fitted or whether they were being provided in the estimate.[85] The proposal was accepted and there is no reason to doubt that the conductors were installed in the summer of 1859.

The plan drawn to accompany this estimate is of some importance as it is the earliest drawing we possess of the gable end of the magazine. One item conspicuously absent from this plan is the gable window. There is no way on the available evidence of deciding whether or not this was simply a draughtsman's error. On one hand the drawing is not particularly accurate on matters of detail (the porch window is the wrong shape); on the other, the drawing shows one of the conductor wires running across where the window would have been. If in fact the absence of the window was a draughtsman's error, it seems remarkable that the draughtsman did not spot the error, nor did Lt. Dawson (who signed the drawing) nor did Col. Nelson or General Trollope (both of whom would have examined the estimate), nor did anybody in the Fortification office. The author thinks it likely that the gable window did exist in 1859 and that its absence from the drawing was an error, but admits that the case can be argued either way and the evidence is inconclusive.

Although the provision of new lightning rods was the only service performed on the magazines between 1853 and 1861 for which we have records, the

powder racks may have been altered again during this period. In 1861, the deputy military storekeeper noted that:

> The North and South Citadel Magazines each contain 2170 barrels, the fittings of these were altered a few years back to carry out the suggestion for better preservation of the powder by allowing space between the bays [?] and the wall for more ventilation.[86]

One wishes the writer had been more specific than "a few years back". The changes he described sound like those done in 1852-3 but, if this is the case, where does the figure 2170 come from? Alternatively, the racks may have been altered sometime between 1853 and 1861 to enlarge the holding capacity of the magazines by almost 700 barrels. It should be noted that the official rating of each magazine continued to be 2170 barrels down to at least 1882, and that a plan, drawn in the latter year, shows a different design of rack to that shown in the 1852 plan.[87] It would seem likely, therefore, that the racks were altered between 1853 and 1861, but, once again, the evidence is inconclusive.

Throughout the 1850's, there is no record of anything major being done to either of the shifting rooms. £ 27.17.5 was authorized in 1857 for the renewal of the south shifting room floor,[88] but it is not clear whether or not this was done. In all probability it was not. When alterations were next proposed for the shifting room, three years later, they were both extensive and expensive and included another estimate for replacing the south shifting room floor.

The renovations proposed in 1861 included a thorough staunching in addition to the replacement of the floor. This was held to be necessary as "rain water [soaked] through the walls and arches to such an extent as to render the rooms useless for any purpose whatever." The proposed alteration involved a complete reworking of the drainage system and extensive use of cement and concrete. The total cost was estimated at £ 296.6.9 for both rooms.[89] As the external manifestations of the system proposed in this estimate (the ventilators in the shifting rooms themselves and the weepers in the demi-casemates adjoining each shifting room) are still visible, it seems likely that the provisions of this part of the estimate were executed. It would seem that, in the south shifting

room, the new ventilators superceded the old Calder system. It is nowhere stated why this was felt necessary (in fact nowhere is it acknowledged that the Calder ventilators existed) but the most obvious explanation is that the alteration in the floors rendered the old system ineffectual.

> The other proposed renovation involved the decayed floor boarding in the Citadel ... and substituting a floor of Seyssel Asphalte Concrete ... the existing floor having become quite decayed from dampness and want of ventilation. [90]

It seems very unlikely the floor in question was the one authorized in 1857. The tone of the estimate in fact suggested that the shifting rooms had been left unattended for some time. In any event, the floor proposed in 1881 was installed and traces of it are still visible.

The attempt to staunch the shifting rooms was, however, less than entirely successful. Five years later, yet another proposal was put forward for uncovering the rooms and rendering them in cement at an estimated cost of £188.17.0. The service was deemed necessary as "both the Shifting rooms ... leak," and the magazines were "full of powder." [91] It is not clear whether this particular proposal was carried out, but it is likely that the shifting rooms were plagued with dampness problems. It is probable that the dos d'ane coverings were replaced or altered at least twice between 1861 and 1882, and possibly several times more. The 1882 plan, for example, shows the south shifting room as possessing a dos d'ane covering that cannot be accounted for in any documentation presently available. [92]

Apart from the problems with the shifting rooms, it would appear that only routine maintenance was carried on at the magazines during the 1860's. It was proposed in the annual estimate for 1864-5 to paint the external woodwork, which had not been done since 1846. It was estimated that £ 2.18.9 was required for "2 coats common colour." [93] It is not, unfortunately, entirely clear what the military meant by "common colour".

The change from repair and renovation to routine maintenance is significant. By the early 1860's the magazines (but not the shifting rooms) were in satisfactory working order. Thereafter, there was little need for significant

change. A report on the military buildings in Halifax done in 1862 provides the following information:

> South Magazine: Capacity 2170 barrels. Contents 1659 barrels.
> North Magazine" Capacity 2170 barrels. Contents 1231 barrels.
> Shifting rooms: Leaking.[94]

Twenty years later, the ratings were unchanged and, to all appearances, the magazines had not been substantially altered in the intervening period.[95]

Appearances, unfortunately, are all we have to go on. The amount of information available declines after 1855 (the year the Board of Ordnance was abolished): after 1870 there are no documents available at all. Our only source of information about the magazines between 1870 and 1885 is a single plan drawn in 1882. From a structural point of view, the 1882 plan, is in fact, the only important source for the south magazine for the period 1866-1943.

The 1882 plan is, fortunately of very high quality. It consists of a plan of each magazine, a site plan, two photographs of the north magazine, a longitudinal section of the south magazine and a transverse section, presumably of the south magazine although this is not entirely certain. It is large scale and according to the legend the drawings were

> made from actual measurement where possible, otherwise from existing drawings & information received from men employed on them at their construciton.

Finally, the plan is coloured, each colour representing a different material. Although no colour key is provided, it is possible to distinguish masonry, brick, wood, copper, concrete, slate and (possibly) asphalt among the materials.[96]

The transverse section differs in some details from earlier transverse sections but, as much of the detail involved could not possibly have been measured in 1882, (the thickness of the arch, for example). It is impossible to judge the accuracy of all the figures given on the plan. The same is true of some of the details on the longitudinal elevation. In general, however, the basic figures are similar to those given in the original estimates.

There are, however, details shown on the plan and sections for which we

have no documentation and which were most likely carried out between 1870 and 1882. The most conspicuous of these concern the shifting room, which is shown as having a concrete wedge placed over the arch, (apparently substituting for the original dos d'ane); a brick lining; wainscotting over the brick lining up to the springing of the arch; and a zinc lining over the interior of arch. Of these, the brick lining is the only item which probably formed part of the original fabric of the casemate (See above). Even for this, there is a tenative possibility. Proposals had been made in the late 1860's to provide certain casemates with brick lining, but, as far as we know, the shifting rooms had not been included among them.[97] It is possible, therefore, that the brick lining was added after 1870, but this is not likely. We know nothing at all about the origin of the other alterations shown on the plan.

The other unaccountable items on the 1882 plan included concrete dos d'anes for the demi-casemates, brick linings and wainscotting in the porches, and a roof over and a wooden floor in the open space between the south porch and the shifting room. The brickwork in the porches, like the brickwork in the shifting rooms was probably part of Calder's original plan. We have no way of dating the wainscotting and the roof. In addition to these, both the floors and the powder racks are quite different from those shown on earlier plans. As we possess no plans of the racks and floor for the period 1852-1882, and as the rating of the magazine had consistently stood at 2170 barrels since at least 1861, it is possible that, as far as the racks are concerned, the type shown on the 1882 plan may have been in use for the preceeding decade or more. This is not the only possibility however. The 1882 plan shows a masonry sub-floor, but no joist wall. This suggests that yet another major renewal of the floor had taken place sometime after 1870. If this supposition is correct, and as any renewal of the floor would have necessitated a rebuilding of the racks, the arrangement shown on the plan might have been of quite recent origin. In fact, there is a good possibility that the plan was drawn as a record plan after modifications had been made to the magazine; but there is no way of proving this.

The 1882 plan is also interesting for the information it provides on the area surface. Although the material is not specified, it is clear from the plan that the same material is used on both the floor of the shifting room and as a

covering in the area. As asphalt was authorized for the shifting room floor and as there are traces of the asphalt floor still visible, it seems likely that the material shown in the area is asphalt. The section shows a concrete base. This suggests one of two possibilities: either the asphalt had been patched and repaired annually for over thirty years, or, after a period in which some other material was used, ashphalt was again experimented with in the early 1880's. The author leans towards the first explanation, but this in turn raises questions. Was Lieutenant Parsons exaggerating the difficulties with asphalt in the Halifax climate when he wrote his memo in 1854? If, as seems likely, he was not, what did the much-patched asphalt area look like by 1882?

One last difficulty concerns the surface gutter. It is shown on the plan, but not on either of the sections. This last omission may be a draughtsman's error, but, if so, it is rather strange that, on a meticulously drawn plan, the draughtsman somehow continued to omit the same item in four different places.

One final point of interest on the 1882 plan concerns the lightning conductors. Assuming that the draughtsman was in fact colour-coding the plan to show materials used, it would seem that the down pipes and gutters on both the magazines and the porches were of copper (rods, down pipes and gutters are all shown in the same colour). This confirms a point raised in the estimate for replacing the conductors in 1857.

This lengthy description of the 1882 plan ought not to blind the reader to the fact that the alterations described are essentially minor, especially with regard to the magazines proper. In fact, the single most striking characteristic of both magazines down to 1900 is the comparative lack of change over the years. The north magazine was, of course, drastically altered after 1900. The south magazine, however, was but little altered even after the turn of the century. The structural history of the south magazine, therefore, encompasses a long period in which virtually nothing was altered, and, even over its entire history, most alterations were of detail and not of structure.

The comparative stability was a reflection of the diminishing importance of the Citadel in the Halifax defences. By the mid-1880s, the magazines in the Citadel were ceasing to be particularly useful. When the Inspector-General of Artillery visited the city in 1885, he recommended that one of the magazines

be used to store small arms ammunition, the implication being that the main magazine (near Wellington Barracks) was sufficient to hold the powder needed for the city defences. The Inspector General noted that, "a considerable amount [sic] of powder" could "if necessary" be stored in the Citadel in wartime.[98]

The Inspector General's suggestion was not immediately acted on. The early defence schemes, (the first was drawn up in 1888), did, however, follow him in deemphasizing the importance of the Citadel magazines:

> The magazines at the Citadel are convenient to the laboratory, in connection with which they are chiefly required. They are not bomb-proof, and steps should be taken to make them so if their use for storage of gunpowder is to be continued.[99]

The defence scheme recommendation was not followed either. It would appear that the Citadel magazines continued to be used as powder stores until 1893, when the Inpsector General's suggestion was partially implemented and one was used as a store for small-arms ammunition.[100] In 1898, one was listed as a small arms ammunition store and the other was reported empty.[101] In 1899, both were reported in use as small ammunition stores.[102] In 1900, one was reported as a small arms ammunition store and the other as a filled shell store.[103] In 1901, it was reported that:

> there are two ... powder magazines in the Citadel, one of which is used as a small-arms ammunition magazine. The other has been used for storage of surplus filled-shell, which, however, will soon be disposed of. Neither of these magazines is bomb-proof.[104]

Despite the wording, it is clear that the author means that the magazine and not the filled shell was to be disposed of and, in fact, the north magazine was converted into a canteen in 1901-2.

It seems likely from the above that it was the south magazine which was used as a small arms ammunition store in 1893 and was used consistently as one thereafter, although it is possible that the north magazine was the one converted: there is no way of knowing whether the magazine reported as a small arms ammunition store yearly after 1893 was always the same magazine. In any event, it is clear that after 1901, the south magazine was certainly used for the storage

of small arms ammunition. It seems unlikely, however, that this entailed any fundamental alteration to the building.

It is not clear how long the south magazine remained in use. A 1907 block plan shows it as a "Filled Shell Store". A 1908 plan lists it simply as "Magazine" and shows that gutters and down pipes were still in place.[106] In 1915, it is still listed as a magazine, but this is no guarantee that it was consistently used as one in the intervening period.[107] As late as 1922, it is still listed as a magazine in some plans.[108] The author suspects that the building was either actually used for ammunition storage, or was still fitted out for the reception of ammunition until at least the early 1930s.

By 1940, the Citadel was enjoying a brief rejunevation as a military post. During this period, the south magazine was adapted for at least two uses: first as a wet canteen[109] and later as an anti-aircraft gun operating room. The main function of the latter was as "battle HQ of the AA defences." Originally located in Royal Artillery Park, it moved to the south magazine in September 1943.[110]

During this period several alterations were made in the magazine, the shifting room, the area and the demi-casemates. These included the provision of a concrete floor for the main magazine; the division of the magazine into rooms; and the construction of three lavatories. The other ranks (male) lavatory in demi-casemate 21 was framed in with a wooden partition. The officers' lavatory was a wooden structure off the east side of the south porch and reached through the east porch door. The WACs' lavatory was off the west side of the south porch. To reach it, a door was made in the west wall of the porch. During this period the shifting room was always marked on plans as being a furnace room but further details are lacking.[111]

It should also be noted that the 1943 plans show a solid pier wall between demi-casemates 20 and 21. The door which presently exists between these two demi-casemates is thus a comparatively recent addition. As both 20 and 21 presently have concrete floors, it is possible that the other ranks lavatory was expanded to fill both some time after 1943, although this is conjectural.

The conversion of the south magazine necessitated the provision of electricity and water. It is probable that neither was available prior to 1939, although

there is always the possibility that electricity was introduced earlier. In any event, we have no information whatever on either the water supply or the electrical lines for the south magazine for the period before 1950.

After the war, the military quickly lost interest in the Citadel. Many proposals were made for the site, but is was not until 1950 that anything much was done. In that year, a submission was prepared for the Royal Commission on National Development in the Arts, Letters and Sciences which proposed that the Citadel be made an historic site. Included in the submission were estimates on the probable restoration costs. These revealed that the magazine was in reasonably good condition, the major anticipated restoration expense being the renewal of the "deteriorated" slate roof and the removal of the interior partitions. Total estimated cost was $3600. [112]

In the twenty-seven years that the Citadel has been an historic site, the alterations to the south magazine have been comparatively minor. The IODE operated a seasonal tea room in the building for 1954 [113] to 1965. [114] During this period, many superifical changes were made to the interior including the erection of partitions and the installation of kitchen equipment. It is not possible to detail the evolution of the various partitions associated with the tea room period but a 1966 sketch of the building shows it divided up into five rooms. [115] The toilets off both sides of the south porch were still in existence through most of this period also, although the one in demi-casemate 21 apparently was not. [116] It is not clear whether the whole magazine was rewired during this period, but it seems likely that it was. The exterior conduits and light fixtures are almost certainly a product of this period.

By 1965, the IODE was having difficulties finding enough volunteer help to keep the tea room open. [177] In the same year there was a minor kitchen fire. [118] While the fire damage was not serious, the smoke damage was. The IODE sold off the tea room equipment and ceased operations. [119]

In the following year, the Centennial Arts Commission expressed an interest in using Parks' buildings during the Centennial year. [120] The magazine was one of these buildings, and permission was ultimately granted to use it as an art gallery. The alterations proposed at this time were comparatively minor. A memo, written in October 1966, noted that:

> 1. All existing interior partitions would be removed.
> 2. The interior accoustic tile applied to the underside of the brick arch would be removed ....
> 3. The wall board applied to the exterior [sic] walls would be removed so as to expose the original historical plank wainscot ....
> 4. After removal of the partition side porches, it would be possible to determine the floor construction os [sic] that decision to complete the renewal of the existing linoleum could be made ....
> 5. Illumination. It was agreed that the existing electrical distribution and light fixtures would be carefully renewed prior to removal of ceiling type [sic] and that distribution system and fixtures would be replaced and effected [?] to the underside of brick arch.
> 6. Heating. It was agreed that heaters already provided by Department for use in powder magazine would be left in powder magazine and that any addition heating would be provided by Centennial Arts Commission.[121]

The writer also noted that:

> The foregoing alterations within the powder magazine are all considered to be necessary in the final restoration programme. All the materials that are to be removed are wooden and were placed there either during the Second World War ... or prior to the magazine being used by the I.O.D.E. as a tearoom.[122]

The estimated cost was $1,630, much of it for labour.[123]

A memorandum drawn up in December recorded in most detail the work done in 1966-7. From this, it appears that the mortar in the gable ends was repointed as requested; that the concrete floor was cut back near both doors to provide head room and was painted light green; that wainscot was erected to cover the historic wainscot;and that the brick arch was whitewashed. The memorandum also noted that Commander Law (of the Centennial Arts Commission) was responsible for

acquiring the electrical fixtures for the gallery.[124]

The original intention of the gallery project was to provide display space for centennial year only. In late 1967 however, the government of Nova Scotia took over from the Centennial Arts Commission and decided to keep the gallery open.[125] The magazine has remained an art gallery ever since. A simple visual examination suggests to the author that no major changes have been made in the building since it was converted into a gallery.

Besides work associated with the two conversions, the south magazine has seen some routine maintenance and some rudimentary restoration in the last twenty-seven years. The main magazine roof was relaid in 1955.[126] A modern roof was installed over both porch dos d'anes at some undetermined time.[127] The north section of the area wall was reset and pointed in 1957.[128] The lavatories on either side of the south porch were removed, probably in 1965-6.[129] And, of course, the fences barring public access to the west side of the area are modern additions.

From the above, it will be seen that nothing of substance has been done to the south magazine since the winter of 1966-7. This is, therefore, the logical place to conclude a structural history of the magazine.

There are two central facts to be noted in any consideration of the structure of the south magazine and its adjacent auxilliary structures: the comparative stability of the structures over time and the comparative quality of information on virtually all phases of structural development. Virtually all changes in the fundamental structure of the magazine, area, shifting room and demi-casemates were made in the design stage. The fundamental fabric of the walls as they now stand is unchanged since initial construction. Subsequent alterations and modifications were comparatively minor, mostly involved care and maintenance, and are mostly invisible. There are only three major mutiliations (the concrete floor of the magazine, the west door in the south porch and the door between demi-casemates 20 and 21), all are easily repairable. The south magazine is, arguably, the best preserved and best documented structure in the Citadel, and, structurally at least, ought to pose comparatively few restoration problems.

Structural Analysis

Introduction

As the south magazine, area and shifting room have changed relatively little in the last 130 years, no elaborate structural analysis is necessary. This chapter:

1. describes the basic structure as built
2. describes as far as possible the evolution of those elements in the structure which have been changed
3. accounts (where possible) for remains now visible in the structures
4. suggests work which might assist in furthering our knowledge of the magazine, area and shifting room.

The format is basically tabular, and is grouped around five basic headings: the magazine, shifting room, boundary wall, area, and retaining wall and demi-casemates. General information is given first, followed by information on particular features. The large number of sub-headings is to facilitate the retrieval of information. The best guide to this chapter will therefore be found in the table of contents.

The Magazine

General: This section deals with the magazine and porches. At the time this report was prepared, the magazine was still in use as an art gallery. The author did not, therefore, have the opportunity to properly examine the interior and the report may suffer in a few minor ways in consequence.

Fabric: The masonry for the magazine was provided for in the 1836 estimate. This document is not very informative in some ways, and it specifies only the dimensions of the walls and not the type or quality of the masonry. The specified dimensions were as follows:

> Side walls each 68 ft X 8 ft X 8 ft on a foundation 68 ft X 9ft 4 in. X 4ft.
>
> end walls each 25 ft X 4 ft X 15 ft mean height on a foundation 25 ft X 4½ ft X 4 ft.
>
> dos d'anes, each side 68 ft X 20 ft X 1½ ft [mean thickness?].[1]

As the masonry has never been substantially altered, the present granite ashlar was obviously intended in the original estimate.

The brick arch to the magazine was (apparently) intended to be 68 feet long and 3 feet thick. In fact, it was constructed 61 ft. 6 ins. long and 3 ft. (4 bricks) thick.[2] The arch therefore only goes 9 ins. into each end wall.

The porches were provided for in the 1843 estimate and again in a subsequent annual estimate. The former is lacking in detail and the latter no longer exists. The arch is of 1 ft. 2 ins. brick. The remainder of the masonry is unspecified, but the granite ashlar which presently exists is obviously original. At no point does the estimate mention the brick work now present, but this too is almost certainly original. There is no indication as to the composition of the masonry in the dos d'ane.[3]

It seems likely that there has been only one major alteration to the masonry: the west door in the south porch. This was almost certainly done ca. 1942-3 and the crude concrete work in the door frame also dates from that period.

Roof: As originally provided, the roof of the magazine was to have been Dutchess slating laid in concrete with a sheet lead ridge.[4] This, when tried on the ravelin guard houses, proved unsuccessful. As a result, the dutchess slates were laid on boards and rafters and held in place with No. 164 composition nails. The rafters were 3 ins. X 2½ ins. pine and the boards were 1 in. "rough boarding," type of wood not specified. Although it is not specified, the sheet lead ridge was probably intended.[5] Although the roof has been repaired, most recently in

1955,[6] we have no record of its replacement. At that time some new slates were mixed in with original slates. This arrangement may therefore still be in place. The slates in any case, are probably original.

The porch roofs were originally similar to the magazine roof. The present porch roofs are obviously modern, done since Parks Canada took over the site. It is not clear when the original slate roof was removed.

Gable Windows: These are sources of some difficulty. (See "A brief history"). They are not mentioned in the 1843 estimate. The author feels, nonetheless, that they were built at the same time as the rest of the magazine. As these windows were roughly the same size as the two small south end windows originally proposed by Jones, it seems probable that Calder simply appropriated the money allotted by Jones for his windows for the gable windows. He may well have even built the windows as Jones had intended to build them, although this cannot be proved. In any event, the gable windows would have been double shuttered, with at least one and probably both shutters coppered. As the windows were used for ventilation, there would have been no glass.

Jones' estimate for magazine windows called for:

> shutter frames 6 ins. X 6 ins., wood unspecified but probably oak
> shutters 3 ft. X 2 ft., 2 for each window, wood unspecified
> copper 20 oz. per foot on both sides of both shutters and on the frames.
> copper or brass hinges.
> copper shutter bolts.
> copper hooks to hold shutters open.[7]

The author feels that Calder would have used most or all of these features in his windows.

Porch Windows: About these we know absolutely nothing except that it was not intended to copper any part of them, that glass windows were intended, and that the window frames were probably pine.[8]

Magazine Doors: These present difficulties. As Jones designed them, the magazines were to have had a single door opening in the south end fitted with double doors.[9] When Calder added the porches, he estimated for "covering the doors of the Magazines with Porches and furnishing an additional door in each...."[10] How does one account for this? It seems unlikely that Calder intended for each magazine to have three doors: one in the north end and two in the south (not counting the porch doors which are another matter entirely). Possibly Calder simply misunderstood Jones. Possibly, since the south door to the magazine was, in fact, the main entrance, Calder really intended it to have a double door.

Jones' doors were to have been of 3 inch oak, covered with sheet copper (20 oz. per foot), on the outside, hung with brass hinges, secured with 12 inch brass or copper locks, opened with copper handles and held open with copper hooks.[11] Calder's estimate is lacking in detail, but it would appear that he intended his "additional door" to be of pine, probably with the same copper hardware.[12]

There are, of course, two doors presently in the magazine which show every sign of being original, and the evidence of these ought to be taken in preference to any information supplied in the estimates.

At least one copper hook has survived. This, however, is just outside the the north porch door and only complicates the matter of both the door and the copper fitments still further as, according to the estimates, it should not be there at all.

Porch Doors: There were provided in the 1843 estimate. The frames were 6 ins. X 4 ins. pine, planed and rebated. The doors themselves were 2 inch pine, "framed bead and butt, flush on both sides."[13] No mention is made of copper hardware but, as has been noted above, it would appear that the north porch door was provided with a copper hook which suggests that other copper fitments were intended.

Porch Floors: These were originally 2 inch pine plank "planed on one side, grooved and tongued, and held with dowels", on 7 in. X 4 in, pine joists placed 15 in. centre to centre.[14] There is no record of subsequent renewals

Magazine Floor: The magazine floor has been replaced a number of times. The first floor was constructed of 2 inch pine plank, resting on 40 8 in. X 4 in. pine joists. The ends of the joists rested on 8 in. X 4 in. (pine?) plates. A 2 ft. X 4 ft. rubble joist wall ran the length of the magazine bisecting it.[15] This floor was first installed when the magazine was built and renewed in 1853.[16] The renewal apparently followed the original plan.[17]

At some point between 1853 and 1882 the floor was again renewed and major alterations made. The joist wall was removed, a masonry (or conceivably concrete or asphalt) sub floor installed and the joists and floor placed on top of this. As our only information for this floor is the 1882 plan, it is impossible to be precise about the materials. Nor is it certain when the change was made. The author suspects that the 1882 plan was drawn to illustrate this and several other alterations but there is no proof. The floor may have been altered as early as 1861.

There is no record of any subsequent alterations to the floor until the 1943 floor plan. The author assumes that the present concrete floor was poured in ca. 1943 as part of one of the wartime conversions of the building.[19]

Powder Racks: There have been at least three different arrangements of the powder racks, and there may have been more.

The original specifications in the 1836 estimate called for:

> 20 studs 60 feet long 4" X 4". - 42 cross pieces 11 feet long 4" X 4". - 100 studs 8 feet long 4" X 4". - 4 plates 60 feet long 6" X 4". 8 cross, do. 25 feet long 6" X 4". 120 cross struts 11 feet long 4" X 4".[20]

This sounds as if two continous racks arranged on either side of a central aisle was contemplated.

At least ten years elapsed between the drawing up of the revised estimate and the construction of the racks. Col. Calder, who actually built them, may have dispensed with Jones' design altogether for a plan, drawn up for a renewal of the floor and the racks in 1852, shows that the system then existing as consisting of four racks: two small one-barrel deep racks running along the side walls up to the spring of the arch, and two larger two-barrel deep racks arranged on either side of a central aisle, the large and small racks on each side being separated by a small aisle.[21] As it seems unlikely that the racks had already been renewed once between ca. 1847 and 1852, it seems likely that the racks shown in the 1852 plan were those built by Colonel Calder.

The rebuilt racks, after 1853, consisted of two three-barrel deep racks arranged on either side of a central aisle. It appears that in this system, as in its predecessor, the ends of the uprights were not in fact inserted into the arch.[22]

The new racking system did not last very long either. By 1861, the returns were reporting a substantial increase in the capacity of the magazine.[23] It is not clear when the new racks were installed to increase the capacity, or what they looked like, but it is possible that they where not unlike those shown on the 1882 plan. These consisted of two racks running the length of the magazine on either side of a central aisle. In this case, the uprights were in fact connected to the arch.[24]

There is no subsequent information on the racks. As the 1882 plan gives the capacity of the magazine in both barrels and cases, there is every reason to suppose that the racking would hold both. The magazine was later used to house small arms ammunition, but as this was stored in cases, alteration in the racking may not have been necessary.

Ventilators: This is a subject about which we know very little. The magazine has eight ventilators: four consisting of a straight shaft through the side wall masonry and four consisting of a shaft broken by a masonry pillar in the middle of the side wall. It seems likely that copper grates were intended for at least one end of these shafts. The 1836 estimate, in fact, calls for

"16 lbs. of strong sheet copper in 6 gratings for air holes 12 in. X 8 in. each...", but all this proves is that Colonel Jones' ventilating system was different from that built by Calder.[25] It seems likely, however, that each ventilator shaft did have a copper grate on the outside end.

The gratings presently existing on some of the south magazine ventilators are obviously not original. There are, however, several ventilators surviving in the former north magazine (the present canteen) and these might be original.

Wainscot: The 1836 estimate called for "132 yards wainscot including furring &c in lining to walls..."[26] The 1882 plan shows the side walls wainscotted from the floor to the spring of the arch (6'3") and the end walls covered to the same height, with no wainscot above the doors. According to this plan, the upper ventilators did not open through the wainscot, and the lower ventilators opened into the air space between the floor and the sub-floor.[27] A 1966 letter states that "historic wainscot" was still extant at that time,[28] and subsequent investigations have confirmed this.

Paint: There is no information on this subject except an 1864 estimate for repainting the external wood work in "2 coats common colour."[29] Further research is needed to determine that common colour was. The author feels that the interior of the magazine was probably painted some light colour or white-washed to increase visibility. As the two gable windows and the two doors were the only source of natural light, the magazine would have been a very dark place.

Lightning Conductors: There have been at least two sets of lightning conductors on the magazine. The first set consisted simply of two copper gilded rods raised over each gable, and connected to the ground by wrought iron conductors held in place with copper holdfasts. The conductors simply terminated five feet into the ground at opposite corners of the magazine.[30]

This system failed. It is not clear when, but there is the possibility that an interim system consisting of a rod (or rods) raised over the boundary wall and grounded in the drain pit next to the outside of the wall (at roughly the mid-point) may have been installed before 1852.[31]

Another system was approved for installation in 1859. This consisted of a copper rod at each gable, copper conductors running behind the gable copings to copper rain gutters at the eaves on both sides of the magazines, with copper down pipes at the four corners of the magazine connected to an underground wire.[32] The author feels that the porches were also provided with copper gutters and down pipes.

There are no records of major alterations to this system. An 1897 plan shows two minor additions: a conductor running along the ridge of the roof and two conductors on each side running down the slope of the roof on each side to the gutter. The plan also shows a "3½" G. I. Cable" running underground along the base of the south retaining wall from the porch to just past the re-entrant angle where it grounded on the main water main. This was apparently connected to the lightning conductors on the magazine, but it is not clear where or how. Apart from these changes, the conductors shown on the 1897 plan seem similar to those approved in 1859.[33]

Extant Remains: As has been previously mentioned, the writer has been handicapped by the fact that the magazine is still in use at the time of writing. The only interior feature commented on in this section is the rack holes in the arch. These, as we have seen, were almost certainly added after 1852 and before 1882. The author feels that they may date from as early as 1860. For further comment on the interior See "recommendations" below.

The west wall of the magazine contains the following features (as of July 1977):

1. a power conduit running the length of the side just under the eaves.
2. holes in vertical pairs about 8 in. apart at 60 in. to 70 in. intervals in the top course just below the eaves.
3. holes in third and sixth courses (from the top) at either end near the edge.
4. perforated metal plates, with wood frames or parts of wood frames in all four ventilators.[34]

Of these, the perforated plates are almost certainly not original and may have been added as late at the last war. The holes probably once held the gutter and down pipes. No plan exists, but an 1882 photograph shows part of the gutter on the east side of the north magazine and this will be of some help in determing the shape of the gutter and the supports.

The west wall of both the north and south porches have similar patterns of holes which again were probably used to hold a gutter and down pipe. In addition the south porch has two electrical conduits and a door. The electrical conduits, both here and along the west wall, dates from the 1950s: the door from ca. 1943.

On the east wall of the magazine, the same pattern of holes as on the west wall can be observed, and these were certainly for the same purpose as those on the west wall. On this wall, all but one of the ventilators are empty. The porch walls on this side also display the remains of the gutter and down pipe holdfasts. The porch doors are in their original locations, but it seems unlikely that the existing doors or frames are original.

On the south wall of both the magazine and the south porch, there are no items needing explanation. The electrical conduit and the metal louvered grill on the gable window are both modern.

On the north wall of the magazine and the porch, there are a number of features. All electrical conduits are modern, although on this wall there are several conduits, at least one of which may date back to the 1940s. The hold fasts on the west side of the porch not associated with electrical conduits probably once held a wireless antenna (1943-5). The copper hook on the east side of the porch is almost certainly original and somewhat mysterious as it suggests copper fitments (nowhere specified) for the porch door. The author cannot identify the pair of holes to the east of the porch between the 5th and 6th courses from the bottom.

It should be noted that there is a reglet apparently for the porch roof cut into the wall of the magazine.

Recommendations: The most important thing to be done before anything further can be discovered about the state of the magazine, is the removal of the art gallery. Once this is gone:

1. the present wall board ought to be carefully removed to find out if the wainscot is still present.
2. the floor ought to be removed. Of interest here is the composition of the present floor (as it is not possible to date it precisely)

and the remains of earlier floors underneath. Does any trace remain of the wooden flooring or the joist wall?

3. any trace of paint or whitewash on the arch or the wainscot (if it exists) should be studied.
4. as an experiment, an attempt should be made to see just how much light enters the magazine through the gable windows and the open doors. This might be useful when it comes time to try and discover what form of artificial light was employed.

Shifting Room

Fabric: Our only source for the shifting room is the 1843 estimate which is not very helpful as it is not very detailed and, as we have seen (See "A Brief History") it is probably wrong in many particulars. The author is inclined to believe, on the evidence of the extant remains, that the casemate was constructed following the same techniques used in casemates Nos. 24-30 on the north front, and the brick lining, the granite-framed ventilators on the rear wall and part of the ventilators on the front wall were all built there when the casemate was first constructed. The author has therefore used the estimate for Nos. 24-30 when describing the fabric of the shifting room although there is no evidence, except appearance that it was constructed in the same manner.

The walls and foundations were of rubble masonry, lined with 4½ in. brick set in mortar, every fourth course being headers set into the masonry. A course of granite ashlar was used at the spring of the arch. On the front wall, the door and window surrounds were of granite. The brick arch was 2 ft. 3 in. thick. The rubble dos d'ane was covered with flagstones set in cement.[35]

Assuming that the casemate was constructed in this manner, the only change involved the dos d'anes (See below). Otherwise the shifting room is much as built.

Floor: There have been at least two floors. The original floor consisted of 2in. pine boards, "planed on one side, grooved & tongued, and fixed with dowels" set on 10 in. X 4 in. joists placed 15 in. apart.[36] This may have been renewed

in 1857, but most likely it was not.[37]

In 1861, an asphalt floor was authorized. This consisted on a 1 in. layer of asphalt laid in two ½ in. thicknesses on a bed of concrete of unspecified thickness.[38] The present floor (or what is left of it), either is this floor, or is very like it.

Door: The only door for which we have a record was a 2 in. pine, bead and butt, flush on both sides, with a frame 6 in. X 4 in. pine, secured with a 12 inch copper stock lock and hung on a pair of 6 in. copper butt hinges.[39] This was the first door installed ca. 1847.

Window: We have no information whatever on the window. We do have a description of the windows constructed in casemates 24-30:

> Pine window frames prepared for 2 inch single huge bevelled bar sashes 3 X 10½ X 2' 6, with brass faced pully boxes, patent sash line, Iron weights, spring fasteners and glazed .... The frames to be wrought framed rebated and beaded pine 4 X 3 ins. and fixed to the masonry.[40]

As the shifting room is similar to casemates 24-30 in several important aspects, the shifting room window may have been similar to this.

Ventilation: The original ventilation system in the casemate was a typical Calder air circulation system similar to that installed in casemates 24-30 and virtually identical to that installed in casemate 7.[41] The principle object of this system was the free circulation of air both within the casemate and under the floor. It consisted of two ventilation shafts which passed through the retaining wall and emerged in the air space under the casemate floor. At the rear of the casemate two more air shafts led up from openings under the floor, behind the rear wall, emerging through the rear wall of the casemate near the top.

In most Calder casemates, another ventilator above the door in the retaining wall completed the system. This does not exist in the shifting room, probably because it is so much smaller than a standard casemate: it was probably considered that the window alone would be sufficient.

As far as can be seen, the ventilators conform to this arrangement, but further investigation is necessary (See below, "recommendations"). In any case, the whole Calder system was either altered or rendered superfluous by alterations made in 1862.[42] At that time, whe whole casemate was uncovered and a new ventilation system installed. This consisted of an air shaft along the ridge of the dos d'ane served by two airshafts, put through the crown of the arch at opposite ends of the casemate, a further pair of ventilation through the lower rear wall leading to air shafts which emerged in the adjoining demi-casemates: and two air shafts straight through the retaining wall on opposite sides of the door. For this last, it would appear that the exterior openings of Calder's ventilators were used.

There is no record of any alteration in the ventilation system after 1862.

Waterproofing: The original dos d'ane was formed of rubble masonry covered with ironstone flagging probably laid in mortar.[43] As there are presently gargoyles in the retaining wall in the right positions, it seems likely that some kind of drain was provided along the dos d'ane eaves for leading off the water.

An 1848 inspection of the casemates reported that the shifting room was "flagged and hipped."[44] No plans of the dos d'ane as it looked in this period have survived. The author suspects that the masonry hips rested partly on the shifting room dos d'ane and partly on the dos d'anes of the adjoining demi-casemates and that a gutter lead under the hip to the gargoyle.

It is unlikely that any changes were made to the waterproofing between 1848 and 1861, when a proposal was put forward and accepted for the complete renewing of the waterproofing:

> It is therefore proposed to uncover the arches and the backs of the walls and to remove the ironstore flagging which at present covers the dos d'ane. Substituting a coat of Portland Cement Concrete, and to

> render the back of the walls and the dos d'anes so formed with Portland Cement Concrete one inch thick: also to form a Gutter at the base, round the sides of the walls with Portland Cement Concrete, the surface of which to be rendered and graded so as to discharge the Soakage through the weep-holes to be cut through and formed in the front walls.... Loose stones and coarse gravel to be filled in over the gutters to facilitate in carrying off the Soakage from Superincumbent Soil.[45]

In all probability the casemate was waterproofed in this manner in the summer of 1862.

The waterproofing proposed in 1861 does not seem to have worked. In 1866 another proposal was made for uncovering the shifting room and rendering it in cement.[46] It is not clear whether anything was done at the time, but it is clear that major alterations were carried out sometime between 1862 and 1882, for a plan drawn in the latter year shows a dos d'ane covering which cannot be accounted for in any surviving documentation.[47] In the 1882 plan, there is no trace of the masonry dos d'ane at all. Instead the arch is shown covered with a wedge shaped slab of either concrete or cement.

Extant Remains: At the time of writing, the shifting room held material in storage for the gallery, as well as odds and ends accumulated over the years. The interior was damp and the floor quite badly decayed in places. The writer did not therefore get the opportunity to conduct as thorough an examination as he would have liked.

The problems of identifying extant features in the interior of the shifting room is further complicated by the fact that we have only the vaguest of ideas as to what the military actually used it for. Technically a shifting room was used to facilitate the rotation of powder barrels to ensure that the oldest powder was used first and generally to make the task of altering the arrangement of the barrels in the magazine easier. It is not clear from either the primary or secondary literature just exactly what in the way of physical equipment was felt to be necessary for the operation of a shifting room. Even if the room

had been cleared for physical examination, therefore, the author would have had trouble identifying the original purposes of any extant features.

From what little information is available, it appears likely that, unlike some of the other casemates, the shifting room was not altered or adapted to other uses after the magazine ceased to be used as ammunition storage. The fact that the present floor appears to date from 1862 (and is in such wretched shape) suggests years of neglect. In all probability, the room was only used for occassional storage in the period ca. 1900-1934.

On the second world war plans of the magazine, the shifting room is marked as a furnace room.[48] No further information is available, but it would appear that some kind of stove was placed there for heating the magazine. It appears from a photograph that smoke exhausted through a pipe which probably passed through the window and up through the area.[49] It is not known whether the installation of the furnace and pipe necessitated any changes in the shifting room.

The obvious extant remains can be characterized as follows:

1. On the arch, there are openings at the crown at either end. These are part of the 1862 ventilation system. They originally led to an air passage running along the ridge of the dos d'ane. The air passage may have been altered or removed in renovations to the dos - d'ane carried out after 1862.
2. On the south wall, there are two granite-framed air grates on the upper wall, and two air holes near the floor. The former are part of the original ventilation system: the latter are part of the 1862 ventilation system.
3. On the north wall, there are two air holes near the floor. These are part of the 1862 ventilation system, but they lead to an outside opening which was part of the original system.

Recommendations: The most important thing is that the room be cleaned out. Once this is done:

1. The floor should be examined carefully, its composition determined,

and, if possible, part of it removed to examine for features hidden below it and for traces of the original floor.

2. If part of the floor is removed, it should be done around at least one of the original ventilation locations to see whether the under floor ventilators which the author believes are present, actually are.
3. It is desirable that the waterproofing system presently extant be examined, and this can only be done by exposing the dos d'ane.

Boundary Wall

Fabric: The wall, as designed, was to be a coped wall, 110 feet long X 10 feet high X 3 feet thick on a foundation 3½ feet wide X 3 feet deep. The two doors were to be of 3 in. oak, each 6 feet X 3 feet wide 8 inch X 6 inch oak frames.[50]

Extant Remains: The electrical conduit running along the west side of the wall under the coping dates from the 1950's. It is not clear what the two pipes in the coping over the north door were used for. Possibly they once held a sign. The bricks embedded in the outer face of the wall above the drain pit held the (unidentified) pole shown in the 1852 plan.

Area

Paving: Until 1849, no attempt was made to cover the area. In 1849 asphalt was laid on part of the area and on the remainder in 1850.[51] It was patched yearly thereafter until at least 1854.[52] The area was still asphalted in 1882.[53] Traces of the asphalt still remain.

As far as can be determined now, a cross section through the area in ca. 1853 would have revealed the following:

drains (at least 2) 18 in. below the surface
a 11 inch layer of shale
a 6 inch layer of concrete
a 2 inch layer of asphalt[54]
a surface gutter in the asphalt around the circumference of the magazine.[55]

It is not clear what the purpose of the subterranean gutters was, nor what they looked like, nor how long they were, nor where they led. An 1852 plan shows a subterranean gutter leading from the foundation of the magazine under the boundary wall and into a drainage pit just outside the area.[56] This may well have been one of the drains referred to.

It appears that the surface gutter drained the water into a catch basin located in the middle of the stretch of surface gutter which passed along the west side of the boundary wall. This basin emptied into another catch basin on the other side of the wall, which in turn emptied into the main Citadel drainage system.[57]

There is no record of any major alteration to the area paving. The author thinks that it was neglected for years before finally being removed, probably in the 1940's.

Structures in the Area: There were three structures of any significance: two lavatories and a covered passage to the shifting room. All have now been removed.

The 1882 plan shows a wood floor in the space between the south porch door and the shifting room door and a single wood roof between the porch and the shifting room.[58] There is no indication how long these existed. The author feels that they were probably present most of the time the shifting room was in regular use (ie. from about 1860 to about 1890) but there is no proof.

Two lavatories were constructed on either side of the south porch around 1943[59] and demolished around 1965.[60] No traces of either is now visible.

Drains and Services: Besides the drain referred to in the section on Paving (See

above), there have been and are both water and electrical service lines in the magazine area. Only the electrical lines currently in use are properly documented.

Although, as far at the author knows, there never has been running water or a sewer line in the magazine proper, there obviously were water and sewer lines for the lavatories off the south porch and in demi-casemate 21. No visible pipes remain, but some of the subterranean pipe may remain. No plans are available showing where the water lines for the lavatories were placed, but it seems logical that only the extreme south end of the area would be likely to have remains.

The present electrical conduit enters at the north end of the magazine. The conduit from the magazine to the shifting room runs from the west door of the porch underground to the west ventilator hole of the shifting room. We do not know if the electrical lines placed before 1950 followed the same route, but the author feels it probable that they did. As we have no proper plan of the pre-1950 services, however, it is possible that an unidentified electrical conduit may be buried in the area, most likely in the north and/or south ends.

Extant Remains: Visible extant remains are confined to the traces of the asphalt paving in demi-casemates 22-28 (the concrete floor in demi-casemates 21 and 22 is another matter and will be treated in the next section).

Recommendations: The most important thing here is an excavation of the area, preferably in several places to look for:

1. traces of the subterranean drains, shale and concrete and asphalt known to have been employed in the early paving attempts.
2. the catch pit known to have existed near the middle of the boundary wall on the east side.
3. modern water and electrical pipes not now recorded.
4. traces of the floor between the magazine and the shifting room.

Retaining Wall and Demi-Casemates

Fabric: The section of the 1836 estimate which provided for most of the Citadel retaining wall is sufficiently general as to be nearly worthless. In general, Jones seems to have contemplated a masonry wall, 20 feet high and 3 feet thick and a 3½ foot wide foundation with a mean depth of 5 feet. The demi-casemate piers were to have been 7 ft. long X 2½ ft. wide X 9½ ft. high on a foundation 3 ft. wide X 5 ft. mean depth and arched over with a 1½ ft. thick brick arch. The dos d'anes were to have been masonry gable roofs similar, on a smaller scale to the casemate dos d'anes. Jones proposed to tile the dos d'anes.[61] Although there are a few variations, and although the dos d'anes apparently do not in any way resemble those described above, this description fits the demi-casemates themselves and retaining wall in the magazine area.

Demi-Casemate Waterproofing: There are only two sources of information on the waterproofing of the demi-casemates. The first of these is the 1836 estimate which was referred to in the previous section. There is no good reason to doubt that the demi-casemates were constructed as Jones intended. By 1882 however, the original dos d'anes had been removed and a cement (or concrete) wedge substituted.[62] There is no record of any subsequent alterations.

Demi-Casemate Flooring: All demi-casemates were asphalted at the same time as the area. There is no record of any other type of flooring in the majority of them. Demi-casemate 21 was converted to a lavatory around 1943, and its concrete floor was probably added at that time. There is no record of the origin of the concrete floor in demi-casemate 20.

Demi-Casemate Use: It ought to be remembered that the demi-casemates were intended primarily as structural support for the retaining wall and only secondarily as usable storage space. It is not surprising then, that with the single exception of demi-casemate 21 (the lavatory), no assigned use is known for any of the magazine area demi-casemates. The author thinks that the demi-casemates probably never were assigned specific uses. Items like solid shot may have been stored in them on occasion as circumstances warranted.

Extant Remains: Demi-casemate 20 has a concrete floor similar to demi-casemate 21, a door knocked through the pier wall to demi-casemate 21, traces of having been enclosed with a wood partition and small holes in all three walls. None of this can be dated or explained. The door did not exist in 1943,[63] so the temptation is to speculate that the alteration had something to do with the lavatory next door. However the toilet in demi-casemate 21 would have interfered with the working of the door.

Demi-casemate 21 has a concrete floor, the door mentioned in the previous paragraph, small holes in the walls, a drain hole in the floor, two holes in the rear wall and traces of having been enclosed with a wood partition. The partition, drain and floor were probably built when it was converted into a lavatory. The small holes may relate to the installation of plumbing. The holes in the rear wall are part of the 1862 waterproofing and ventilation system for the adjoining shifting room.

The three small ventilator holes in the retaining wall outside the shifting room are the openings of ventilator shafts. The two lower holes (one under the window and the other to the east of the door) were placed when the wall was built. The one above the door was added in 1862.

The two gorgoyles on either side of the shifting room are for draining the casemate dos d'ane. These were installed when the wall was built and were probably rendered superfluous by changes in the dos d'ane sometime between 1862 and 1882.

The small hole in the rear wall of demi-casemate 22 is part of the 1862 waterproofing and ventilation for the shifting room.

Demi-casemates 22-28 all have traces of the asphalt paving used in the area. In addition, a part of what appears to be a granite manhole frame is presently to be found in demi-casemate 28. This does not belong here, but it may originally have framed the catch pit the surface gutter emptied into on the west side of the area.

Endnotes

A Brief History

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4 Great Britain, Public Record Office (hereafter cited as PRO). WO78/1649 [MPH464 (6)] "Plan and Section of a Stone Bomb Proof Magazine to Contain 1344 Barrels of powder, proposed to be built on Citadel Hill." 18 April 1811. The problems with this plan stem, in all probability from draughtsman's ommisions.

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10 Ibid, pp. 30-4, Boteler to Bryce, 14 Feb. 1832.

11 Ibid, pp. 37-8, Bryce to Couper, 28 March 1832.

12 Ibid, pp. 35-6, No. 242, Fanshawe to Boteler, 30 March 1832.

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16 Ibid., fols. 339-49, Peake's estimates for completing the Citadel.

17 Ibid., fols. 248-72, Jones' first estimate, 15 March 1834.

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19 Ibid., pp. 134-8, Pilkington to Couper, 4 June 1834.

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21 Great Britain Army. Corps of Royal Engineers, Aide-Memoire to the Military Science, Framed from Contributions of Officers of the Different Services, (London: J. Weale, 1846-52), Vol. 3, p. 317.

22 PANS, MG12, RE54, pp. 119-30, No. 399, Fanshawe to Jones, 19 July 1826.

23 PAC, MG13 WO55, Vol. 873, fols. 703-26, Revised Estimate.

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27 Ibid. Two sketches attached to Item 14, one showing the magazine with buttresses and the other without.

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30 Ibid., fol. 248-72. Jones' first estimate dated 15 Match 1834.

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33 Ibid. Drawings accompanying Item 14.

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35 Ibid., pp. 162-4, Jones to Mulcaster, 1 March 1843.

36 Ibid., pp. 160-2, No. 605, Matson to Calder, 3 March 1843.

37 Ibid., pp. 165-8, No. 13, Calder to Mulcaster, 22 May 1843.

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41 Ibid.,Byham to Mulcaster, 12 July 1843, E/889.

42 Ibid., No. 628, Matson to Calder, 18 July 1843.

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44 Ibid.

45 Ibid.

46 PAC, MG13, WO55, Vol. 873, fols. 703-26, revised estimate, 1 Feb. 1836, Item 14.

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48 PANS, MG12, RE56, "Report & Estimate of Works & Repairs...", 20 Oct. 1843.

49 Canada. Department of Indian and Northern Affairs, Parks Canada, Atlantic Region, Halifax Defence Complex. "Plan Sections and Elevations Shewing the work done during the half year ending 31st Dec. 1844." signed by Calder, 31 March 1845.

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55 PAC, RG8, C Series, Vol. 1825, pp. 108-19, report by Lt. Burmester, 30 Nov. 1848.

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Structural Analysis

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24 PANS, Map drawer 4, "Halifax Citadel, Main Magazine," 8 Aug. 1882.

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44. PAC, RG8, C. Series, Vol. 1825, pp. 108-19, report of Lt. Burmester 30 Nov. 1848.

45 Ibid., Vol. 1653A, civil buildings estimate 1862-3, 18 Nov. 1861.

46 Ibid., pp. 452-80, fortification and military stores estimate, 5 Dec. 1866.

47 PANS, map drawer 4, "Halifax Citadel Main Magazines," 8 Aug. 1882.

48 PAC, National Map Collection, H4/250, Halfiax, 1943, "Lavatories G.O.R. Citadel Hill," 12 July 1943 and "G.O.R. in 'B' Magazine Citadel...", 17 July 1943.

49 HDC. photograph 108-01-2-950-0020. This is one of a set taken in 1950 for the Massey Commission,

50 PAC, MG13, WO55, Vol. 873, fols. 703-26, revised estimate, 1 Feb. 1836, Item 14.

51 PANS, MG12, RE12, pp. 162-3, No. 394, Savage to Burgoyne, 16 May 1850, and pp. 498-502, Report of Lt. Parsons, 13 Feb. 1854.

52 Ibid., pp. 498-502, Report of Lt. Parsons, 13 Feb. 1854.

53 PANS, map drawer 4, "Halifax ... Citadel. Main Magazine...", 8 Aug. 1882.

54 PANS, MG12, pp, 162-3, No. 394, Savage to Burgoyne, 16 May 1850.

55 Ibid., pp. 498-502, Report of Lt. Parsons, 13 Feb. 1854.

56 PAC, MG13, WO44, Vol. 235, fol. 158, "Plan and Sections of the Gunpowder Magazine...". 21 Jan. 1852.

57 PANS, map drawer 4, "Halifax... Citadel. Main Magazine...", 8 Aug. 1882, and HDC plan 108-01-1-908-0001,Block Plan, April, 1908.

58 PANS, map drawer 4, "Halifax... Citadel. Main Magazines...", 8 Aug. 1882.

59 PAC, National Map Collection, H4/250-Halifax, 1943, "Lavatories. G.O.R. Citadel Hill", 12 July 1943.

60 Recollections, Patterson.

61 PAC, MG13, WO55, Vol. 873, fols. 703-26, revised estimate, 1 Feb. 1836, Item 4.

62 PANS, map drawer 4, "Halifax... Citadel. Main Magazine...", 8 Aug. 1882.

63 PAC, National Map Collection, H4/250-Halifax, 1943, "Lavatories, G.O,R, Citadel Hill", 12 July 1943.

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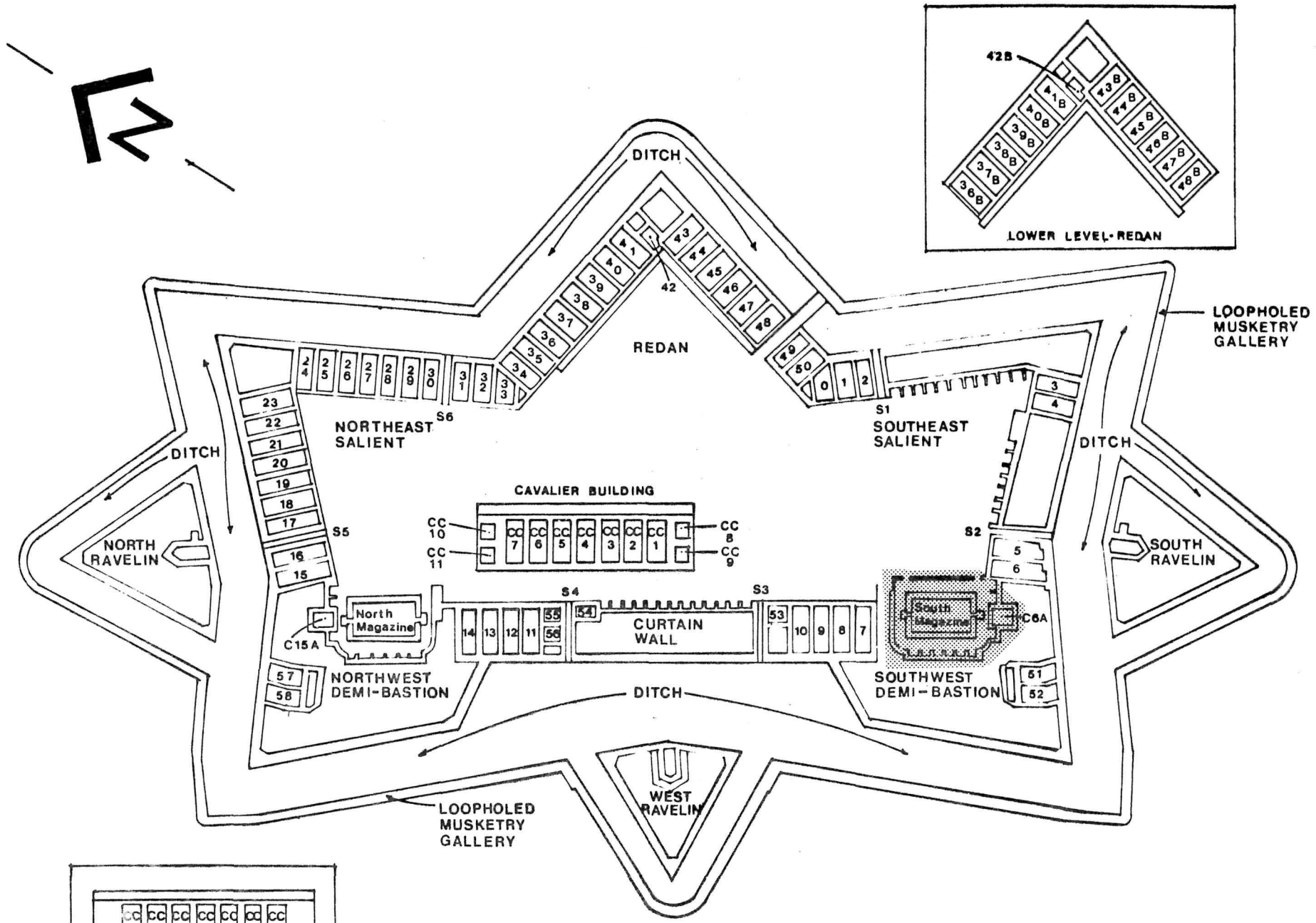
1 Site plan showing the location of the South Magazine.



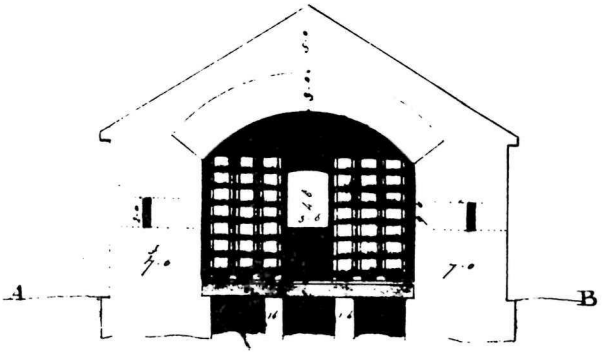
HALIFAX CITADEL
HALIFAX N. S. SCALE 1" 120' (APPROX.)

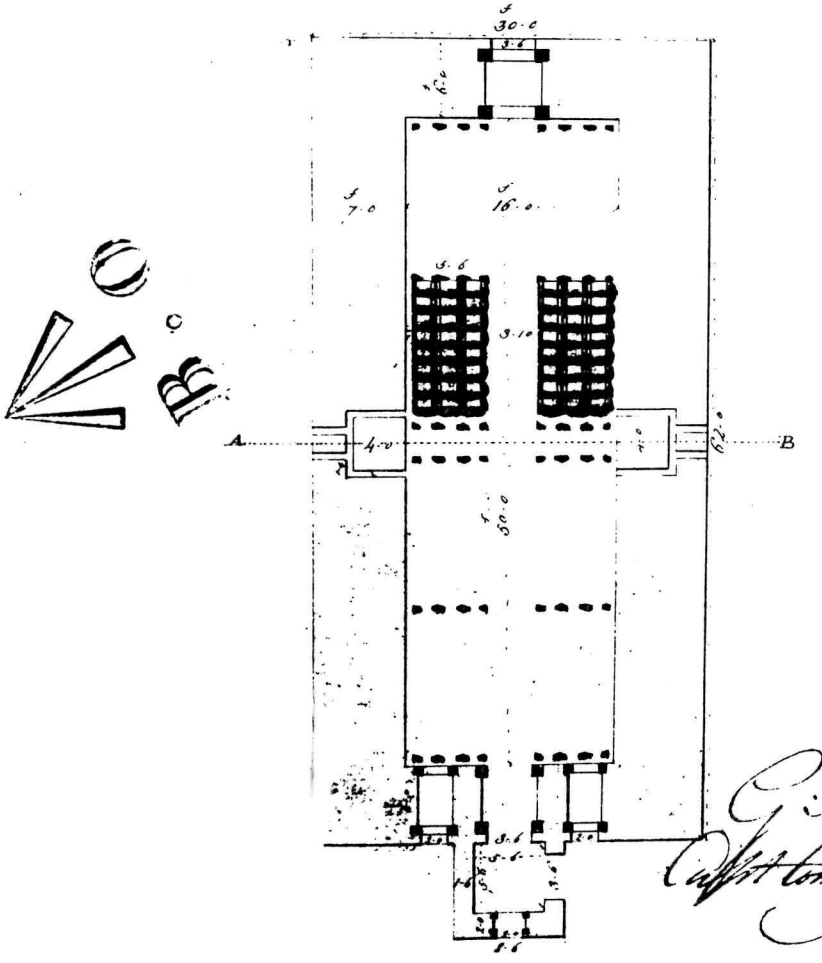
2 "Plan and Section of a Stone Bomb Proof Magazine..." (1811). Col. Nicolls' magazine as designed. It is not clear from this plan how the powder racks worked. The draughtsman probably omitted the sleepers from the plan and the uprights from the section. (Public Record Office.)

PLAN and SECTION of a Stone Bomb Proof Magazine to Contain 1344 Barrels of powder, proposed to be built on Citadel Hill

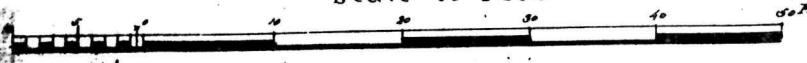
PLAN No. 7
Halifax Nova Scotia
18 April 1811

Section thro AB





Scale of Feet



John G. Taylor Draughtsman Roy. Eng. Dep.

3 "Section through one of the Magazines" (1834). The Boteler design as presented by Jones in his 1834 estimate. Given the history of the casemates, it is difficult to believe that this magazine would have been a particularly successful structure. (Public Archives of Canada.)

This Estimate provides for the Construction of two Bomb proof Magazines, in the Positions shown on Plan No. 1, and according to the annexed Section; to contain 1500 barrels each —

The Dwarf Walls should have ranging Plates to take the Joists

Section through one of the Magazines —
10 feet to an Inch. —
Calculated to contain 1500 Barrels — A.W

The extent of thickness &c. as shown on the Plan and Sections. — The arches are to be 3 feet thick

The Magazines to have brick or stone floors

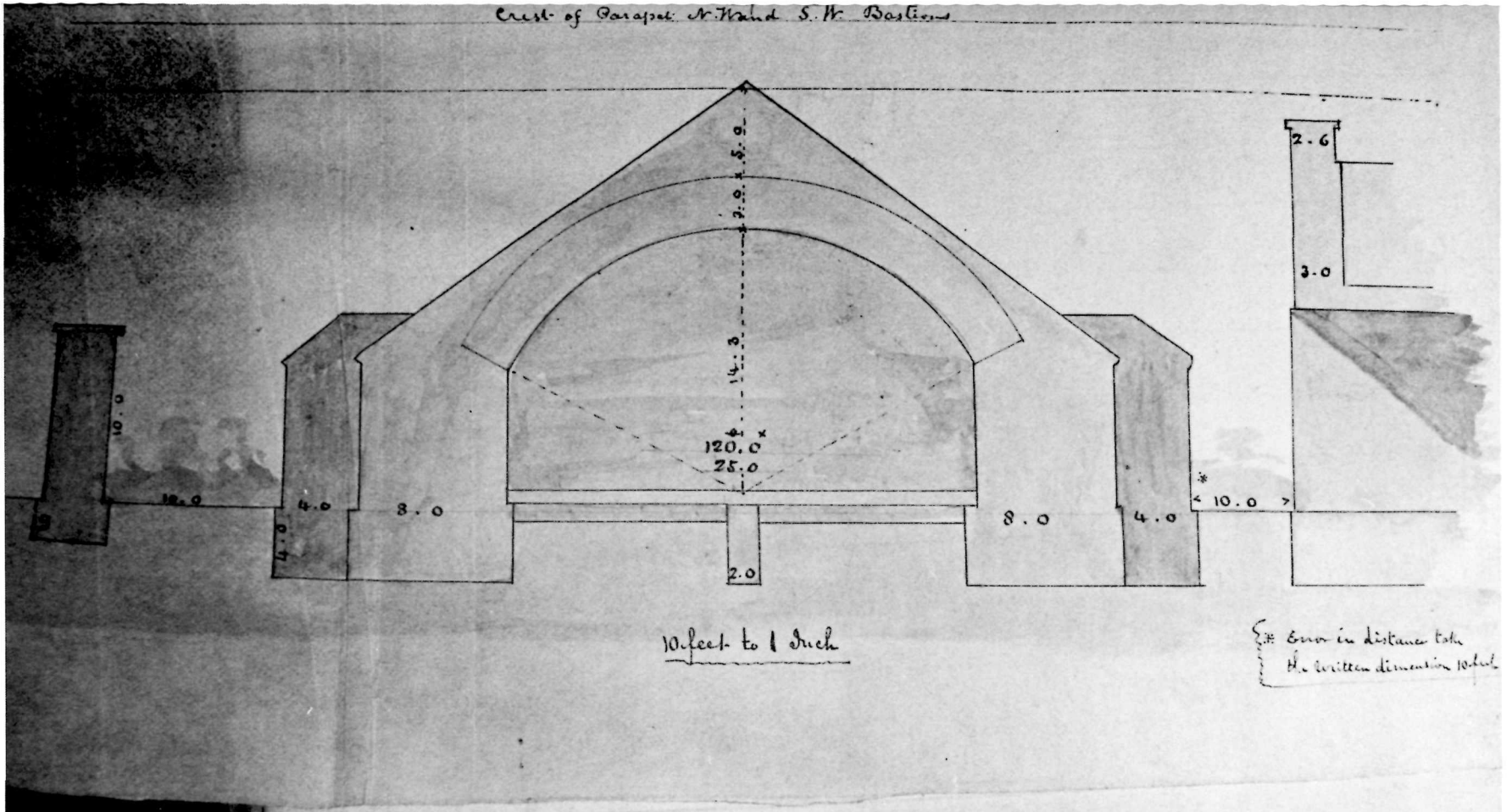
The floors of the Magazine Deal plank on joists 3 x 4 inch which rest on dwarf walls. The joists should be on Plates.

Four oak doors with frames

Two Gutters 50 feet long 2 feet wide of lead 10 lbs. p. foot.

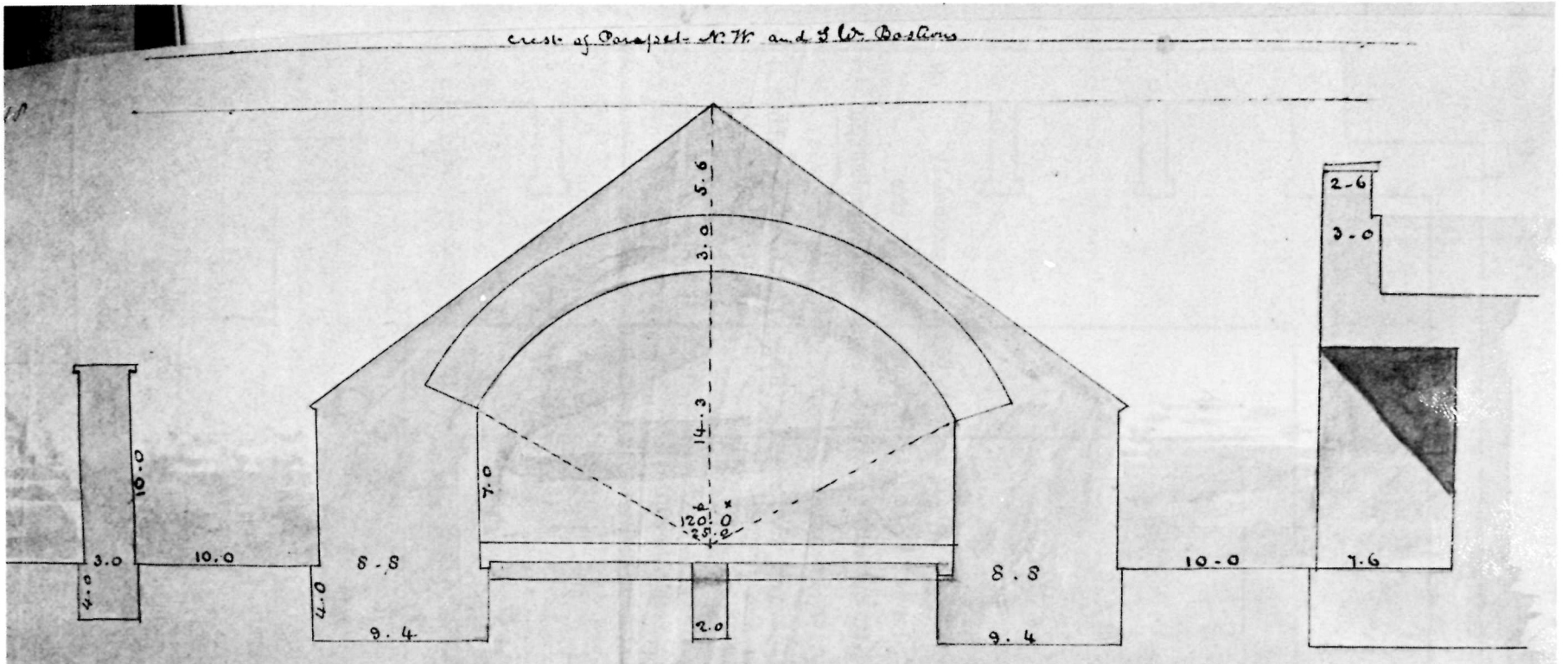
Copper work to be detailed when demanded

4 Section of Colonel Jones' proposed magazine (1836). Note the offending buttress (dark colour). (Public Archives of Nova Scotia.)



Length of Magazine 60 feet by 25 feet wide; Arch 3 fe
thick; flooring 2 inch pine plank on joists of 11
supported by dwarf walls; to be slated with battens &
the ridge be secured with sheet lead. — The Ma
magazine to be enclosed by a boundary wall 10 feet

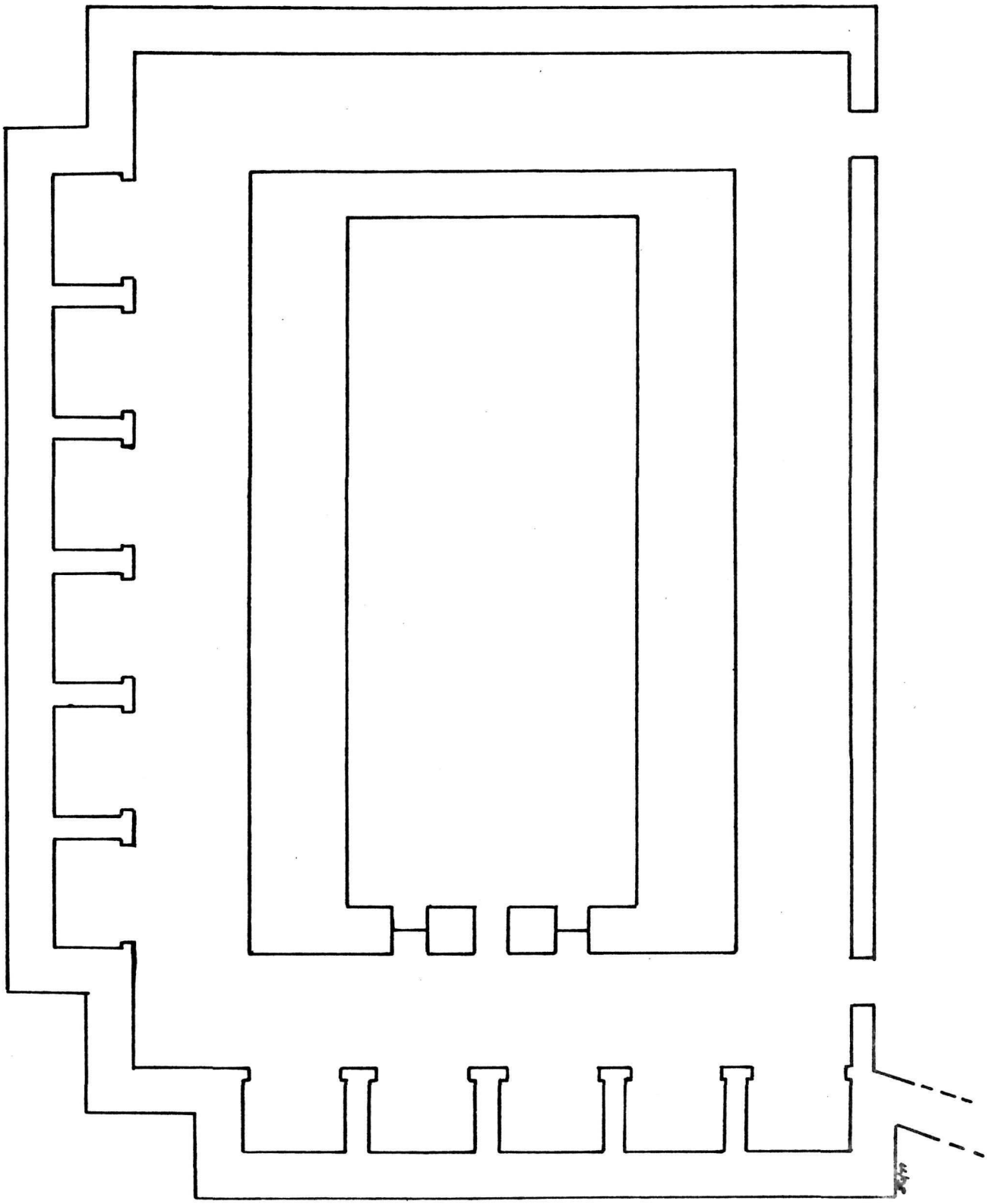
5 Section of Colonel Jones' magazine as revised (1836). The magazines were constructed to this section. The section of the retaining wall (right) is not accurate. (Public Archives of Nova Scotia.)



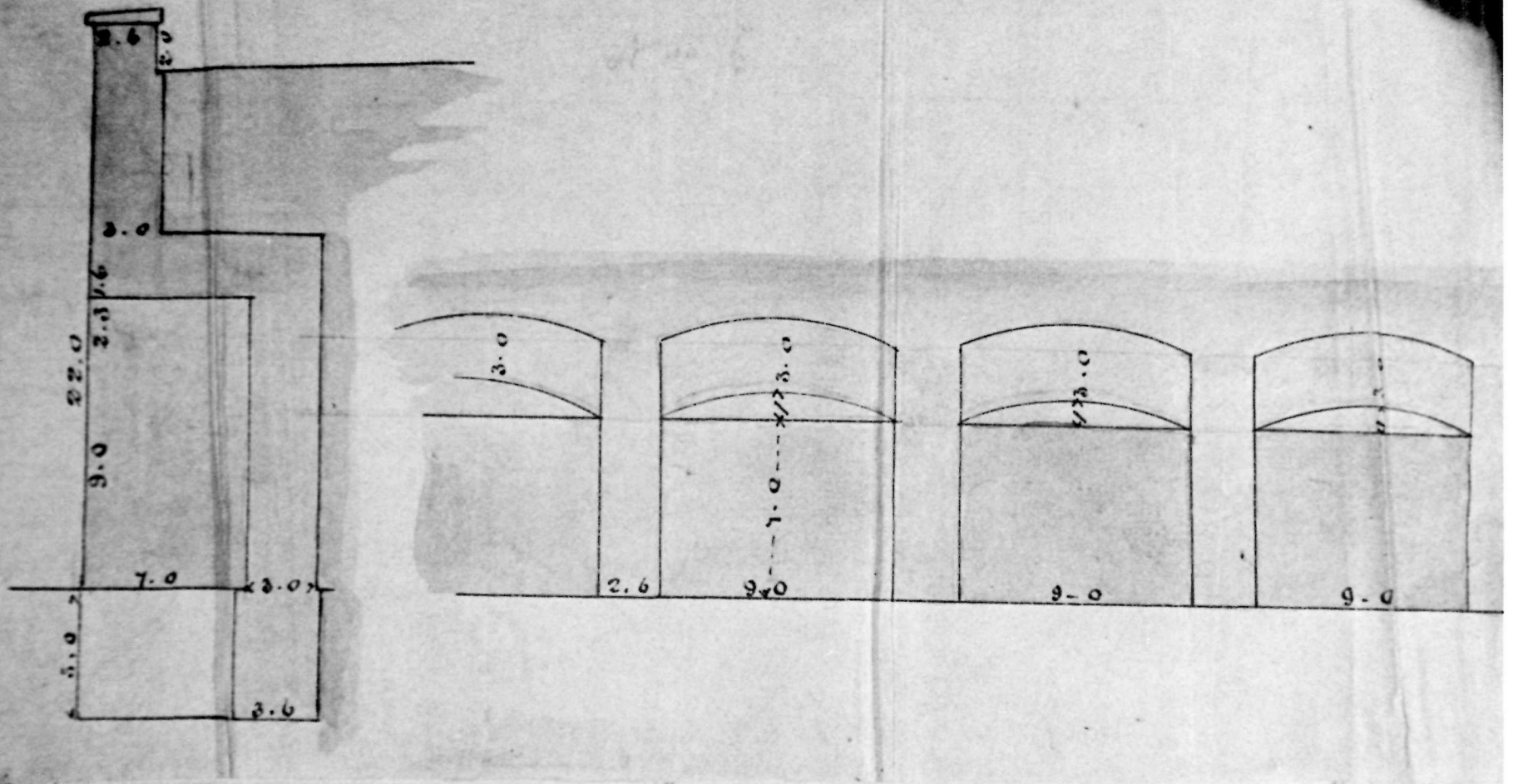
Section of the Proposed Magazine with Buttresses

10 feet to 1 Inch

6 Plan of Colonel Jones' magazine. This modern plan is probably an accurate reflection of Jones' intentions, but some of the details are conjectural. It is not known how many demi-casemates Jones intended to place in the retaining wall. This design was much altered before the magazine was built. (Drawing by the author.)



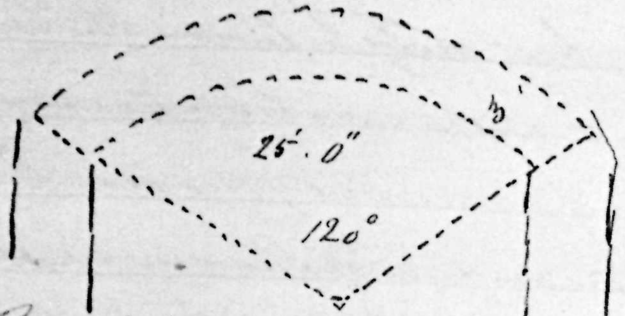
7 Plan and section of the retaining wall (1836). The retaining wall of the magazine area was built to this specification. (Public Archives of Nova Scotia.)



The walls and piers of these casemates are of the same
as quoted in Item 2.— The Piers to the Retaining wall
2ft 6ins thick;— the Retaining wall 3 feet thick. a
— The Casemates of defence are only 15 feet wide

8 Rough drawings made by the Surveyor of the Ordnance (1843). The Surveyor was curious about the discrepancies between a plan on a progress report and the approved plan. The middle drawing shows how the magazine appeared on the progress report; the upper drawing the approved plan. The magazine was actually constructed as shown in the latter. The bottom drawing is the only one we possess of the magazine as designed by Jones. (Public Archives of Nova Scotia.)

figured thus.



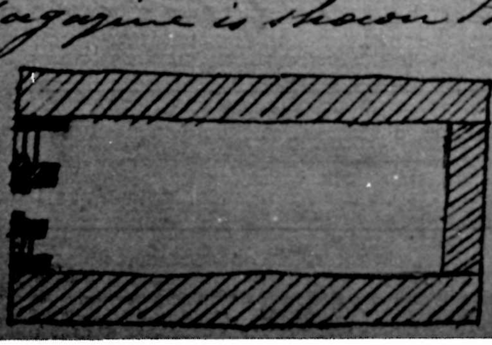
But it appears to be executed as follows taking the dimen=sions from Scale.

It may be an error in the Drawings, but as shown the Magazine is 1' 6" wider, and its arch a segment 112° instead of 120°.

This is an error, & may arise
from taking off the dimensions f
the drawing on bank post paper o
from the tracing in either case the
Magazine is constructed accordin
to the Section in the Estimate da
1st Feby. 1836 namely 25 feet wide
the segment of its arch 120°. and the
Brick arch what is called 3 ft. thick
being composed of 4 bricks.

The ~~arch~~ arch measures 3' 6" in thickness. -

In a plan dated 1st Feby. 1836 the Magazine is shown thus



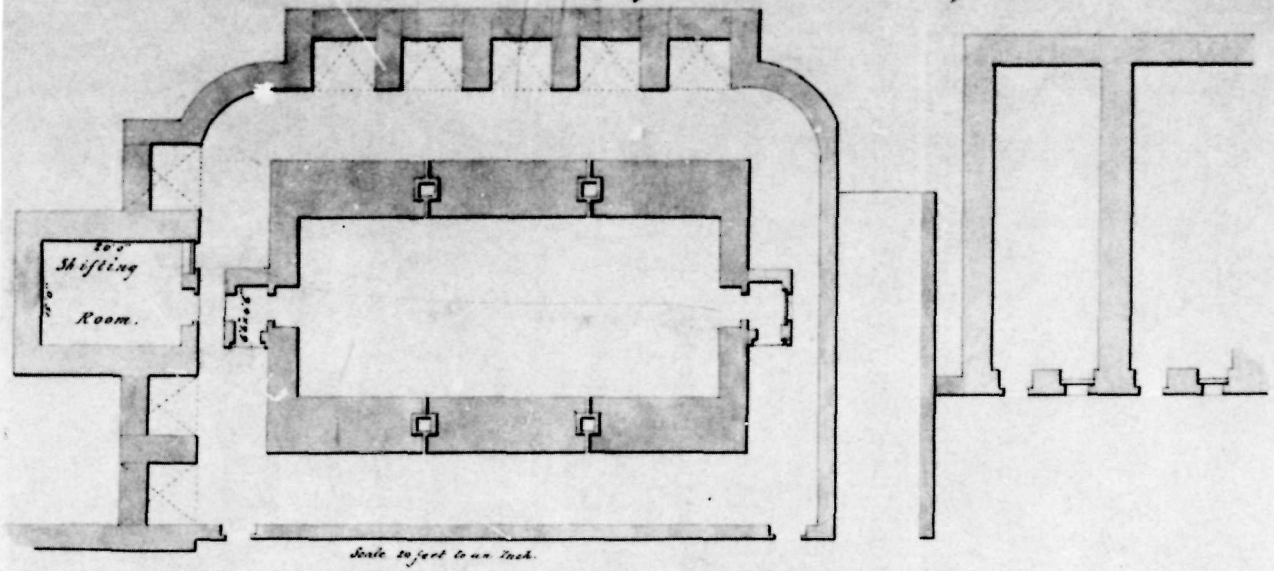
In the plan referred to the Magaz
is shown thus, but whether by mist
or intention I know not. known fr
the Report on Item 14 of the revised
Estimate dated 1st Feby. 1836. it is
evident that the construction was
intended to be as executed. -

9 "Plan of one of the Magazines..." (1843). This plan shows Calder's additions including the porches, shifting room, rounded corners to the area wall and the ramp. This is the first scaled plan we possess of either of the magazines. (Public Archives of Canada.)

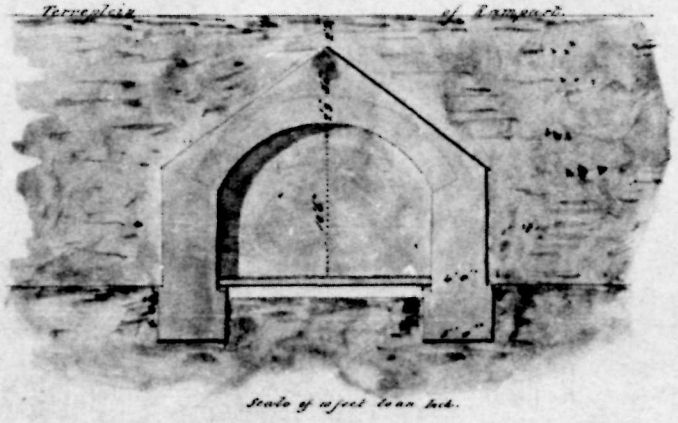
Plan of one of the Magazines shewing the proposed Porches Ventilators and Shifting Room.

The parts coloured red are provided for in the Revised Estimate.

Items 2. 3. To accompany Estimate dated 22. May 1843



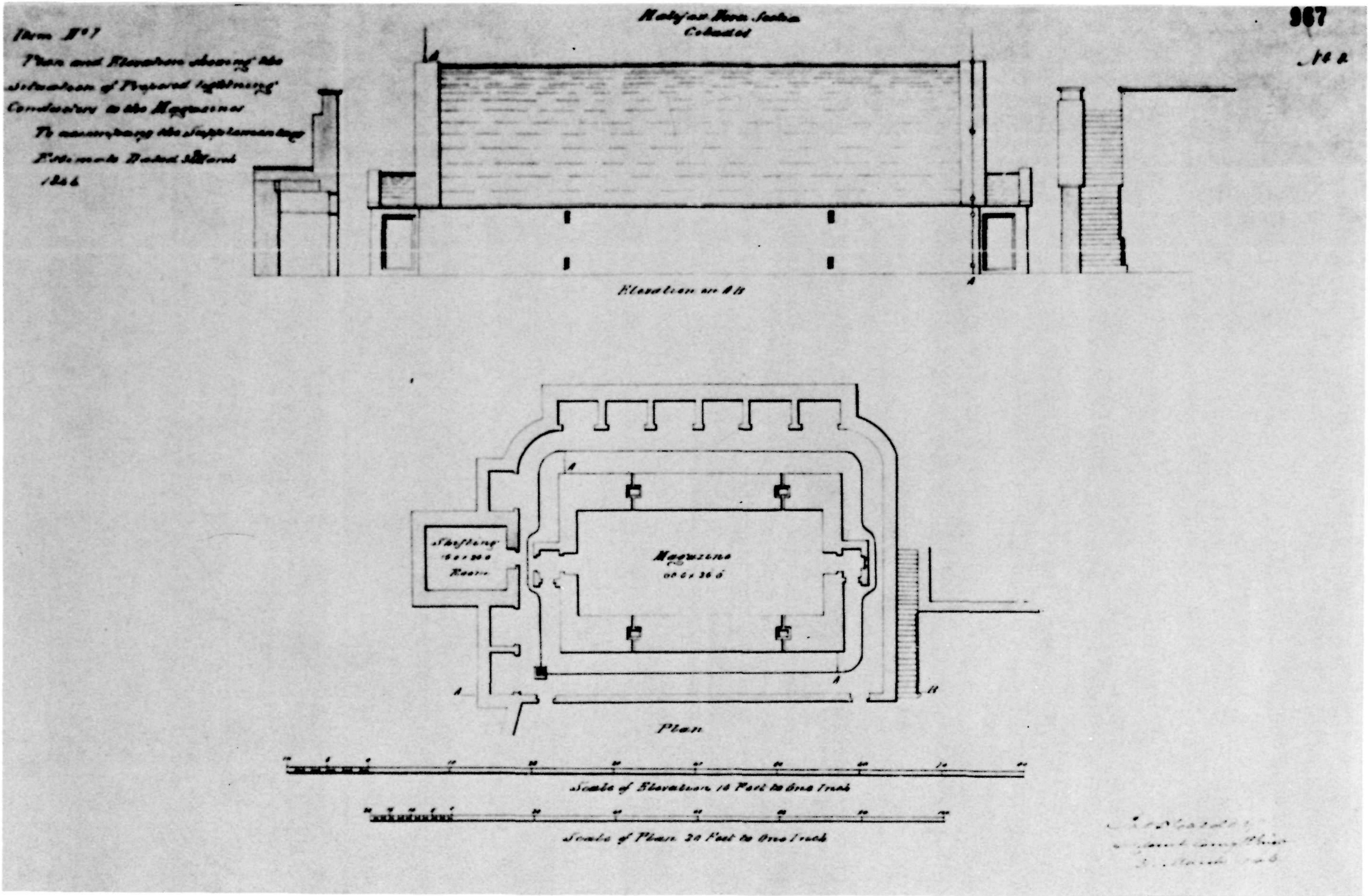
Section of Shifting Room.



Bern.d R. Gillingham L.R.E.

Sat.d Colonel
Comd.g Royal Engineer
22. May 1843.

10 "Plan and Elevation shewing the situation of the proposed lightning Conductors..." (1846). The lightning conductors shown here failed quite soon after installation. The drains shown in the area were never constructed as shown. The section of the demi-casemate is more accurate than similar sections in the 1836 estimate (see Figs. 4 and 5). Stairs were only built adjoining the north magazine area. (Public Archives of Canada.)


967
Halifax Nova Scotia
Citadel
Item No 7
Plan and Elevation showing the
situation of Proposed lightning
Conductors to the Magazines
To accompany the Supplementary
Estimate Dated 31 March
1846
Elevation on A B
Magazine
Plan
Scale of Elevation 10 Feet to One Inch
Scale of Plan 20 Feet to One Inch

11 "Section through the Magazines as at present fitted..." (1852). The powder racks shown in this section are almost certainly the first built in the magazines. It is not clear why such a comparatively inefficient system had been adopted. See Fig. 12. (Public Archives of Canada.)

108

Halifax N.S.

Plan and Section of the Gunpowder Magazine
in the
Citadel

Magazine No. 1 Situated in the South West Bastion of the Citadel is bombproof, is constructed with masonry and is in an excellent state of repair. Its interior dimensions are [illegible] feet long by 16 feet wide and the height to the centre of the Arch is [illegible] ft [illegible] in.

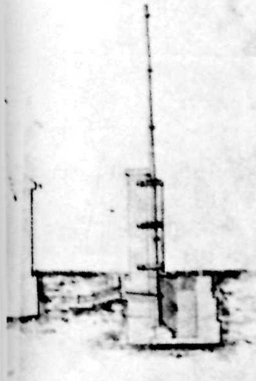
The Magazine at present filled up contains 1168 barrels of powder and if it were filled in the manner proposed in the Inspector General of Fortifications Circular Mem. dated 1st March 1850 it would contain 1470, thus giving an increased accommodation of 302 barrels.

Magazine No. 2 situated in the North West Bastion is similar in all respects to Magazine No. 1.

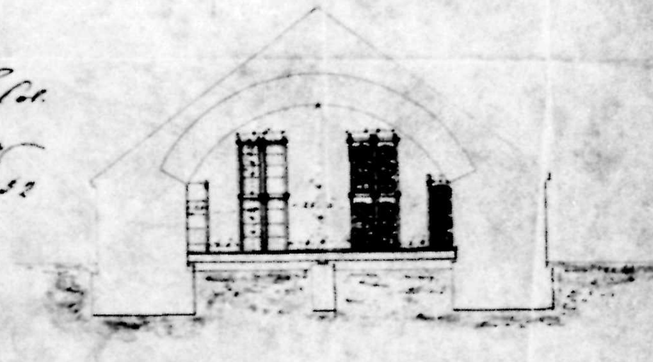
The total number of barrels contained in the Magazines at the Citadel is 2336
The total number that would be contained by the proposed Arrangement would be 2940
thus giving an increased accommodation of 604 barrels

[illegible]
Lieut. Rl. Engrs.
20th Jany 1852

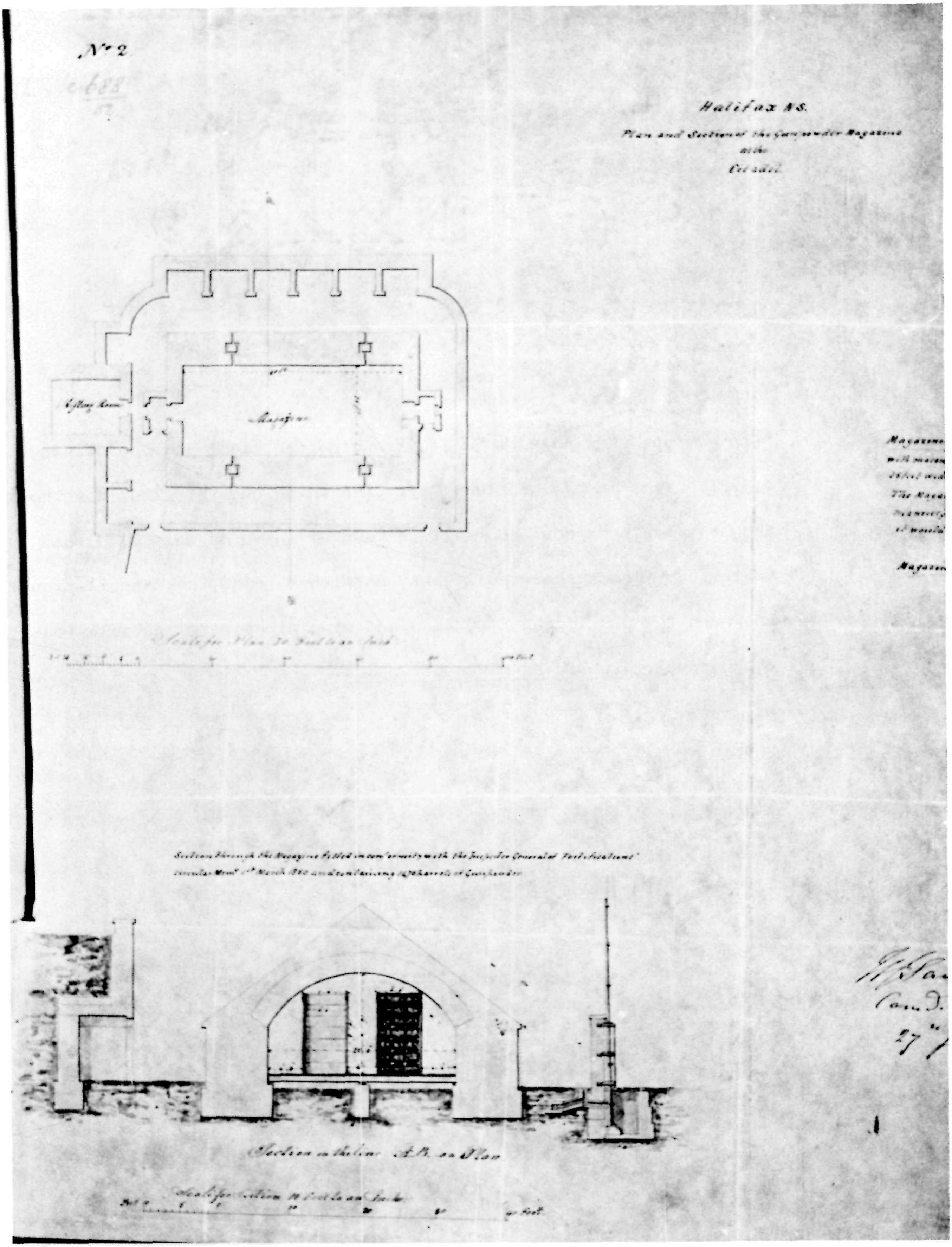
Section through the Magazine as at present filled and containing 1168 barrels of powder



W. Savage Lt Col.
Comd. R. Engs.
27th Jany 1852



12 "Section through the magazine..." (1852). The new powder racks shown here were installed sometime after 1852. Note that in neither this system of racking nor in the one which preceeded it (Fig. 11) were the rack uprights attached to the arch. The present slots were therefore added later for a subsequent rack arrangement (See Fig. 17). The rod attached to the boundary wall may well have been an interim lightning conductor, assuming that the 1846 system had already failed. The subterranean drain between the magazine and the boundary wall may have been installed as part of the asphalting scheme. The drain pit outside the boundary wall is still extant. (Public Archives of Canada.)


No 2
Halifax N.S.
Plan and Sections of the Gunpowder Magazine
at the
Citadel.
Magazine
Section on the line A.B. on Plan

13 "Projections shewing the mode of arranging the lightning conductors..." (1858). This is the problematical plan which ought to (but does not) show the gable window. Not all the system shown on this plan was installed. The author feels that, notwithstanding the cancellations shown on the plan, copper gutters and down pipes were installed on the porches. (Public Archives of Canada.)

627

— HALIFAX. —

Projections shewing the mode of arranging the lightning conductors to the existing Powder Magazines in accordance with Circular № 260 To accompany the Ordnance Annual Estimate 1859-60. Sheet 4.

References

Fig. 1. — North Magazine Citadel
Fig. 2. — Ammunition Store
Fig. 3 — Naval Magazine
——— — Flat Copper Conductor
- - - - - — Tubular Copper Conductor
——— — Copper Eaves Gutters & Down Pipes

A. Scott Lt. Dawson. R.E. Engr.
2nd August 1859

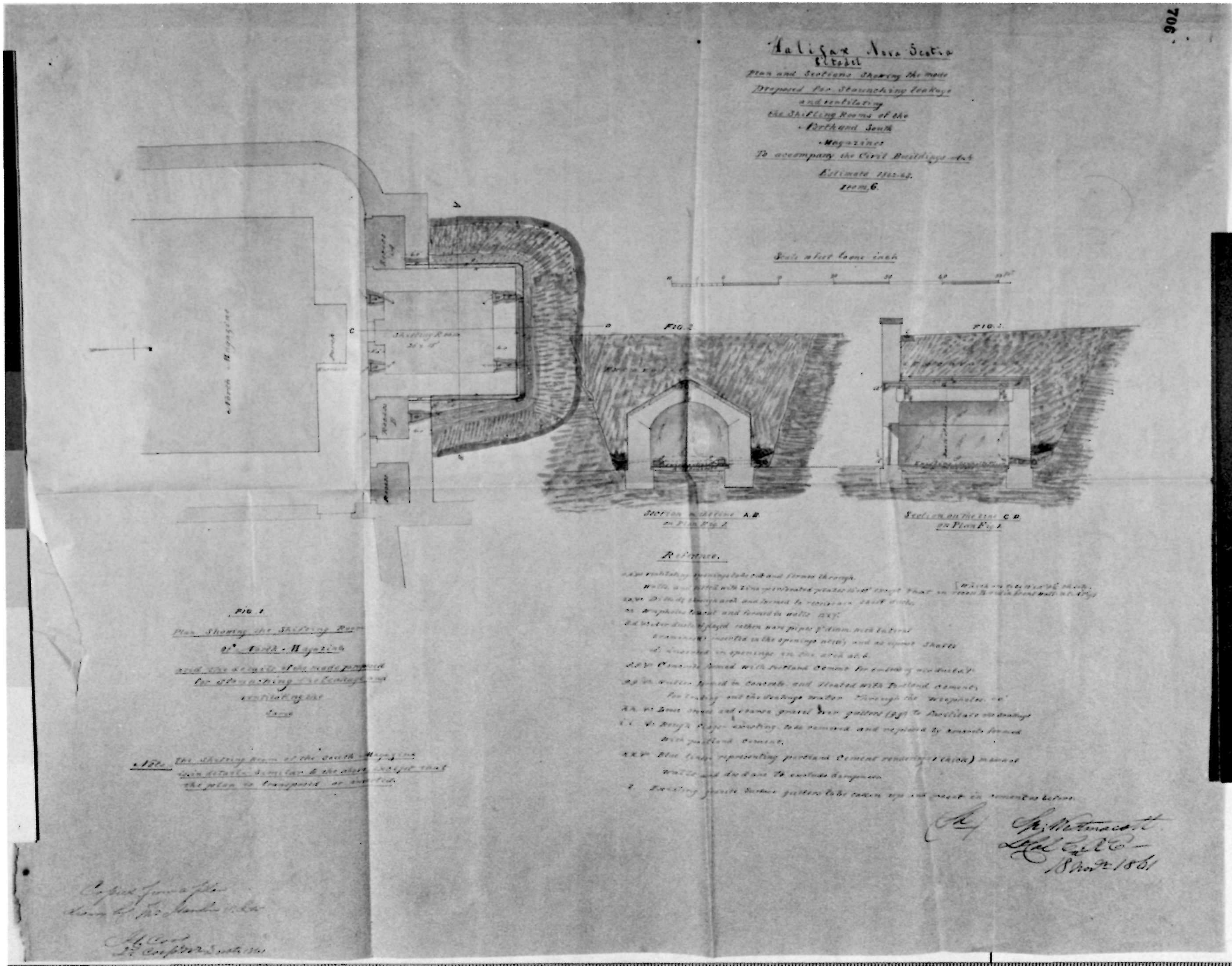
Fig. 1.

Fig. 2.

Fig. 3.

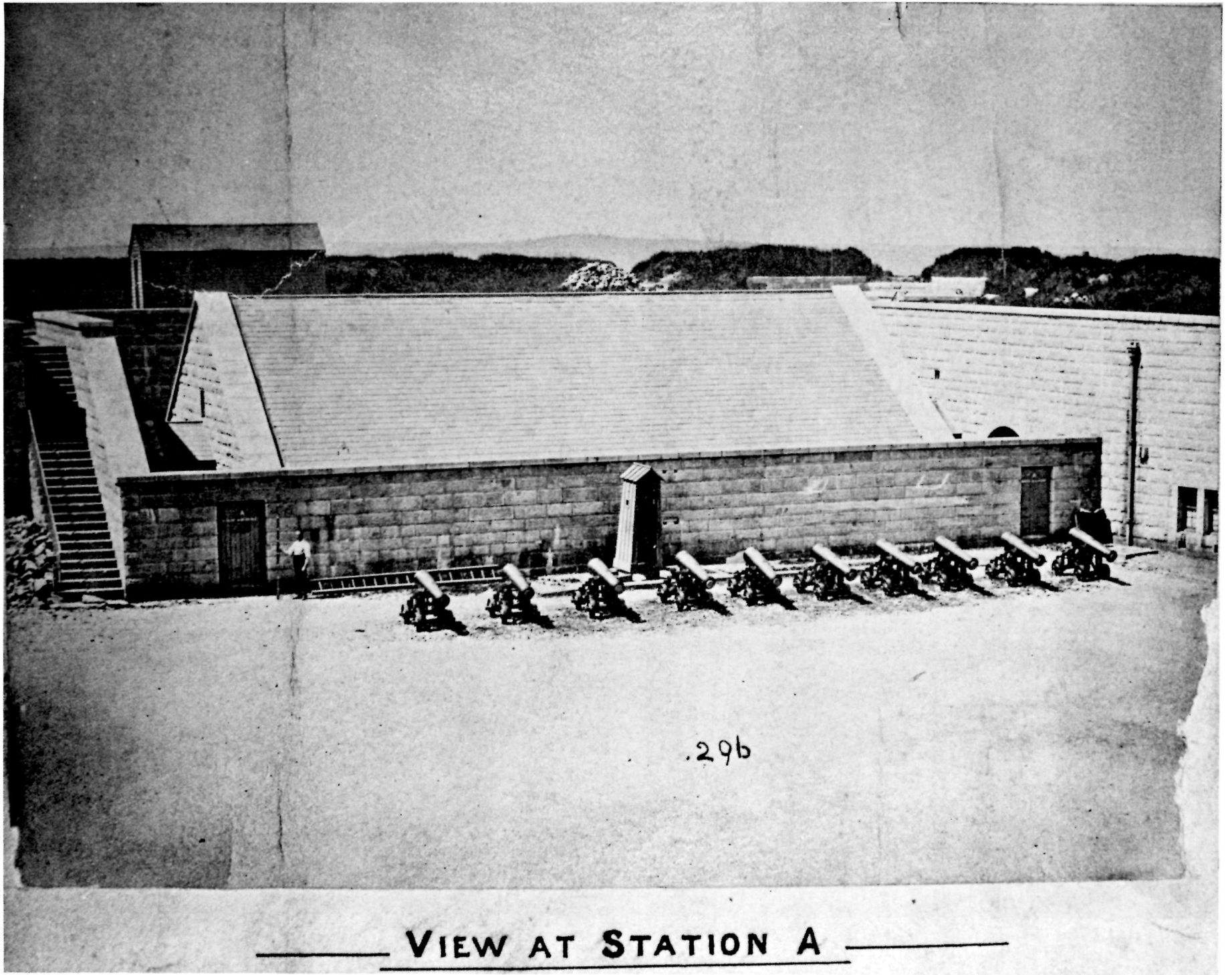
Ord. Mus. Lt. R.E.

14 Staunching the Shifting Room (1861). The drains and ventilators were probably installed as shown here, but the waterproofing measures did not work and were subsequently superceded. The north shifting room is shown in this plan. The south shifting room was slightly different, having a brick lining and Calder ventilators, but the existance of these did not alter the nature of the work done. (Public Archives of Canada.)



Halifax Nova Scotia
Citadel
Plan and Sections Showing the mode
Proposed for Staunching Leakage
and ventilating
the Shifting Rooms of the
North and South
Magazines
To accompany the Civil Buildings
Estimate 1862-63.
Item 6.
FIG. 2
FIG. 3
North Magazine
Shifting Room
Section on the line A.B
on Plan Fig. 1
Section on the line C.D
on Plan Fig. 1
Reference.
FIG. 1
Plan Showing the Shifting Room
of North Magazine
Note
18 Nov. 1861

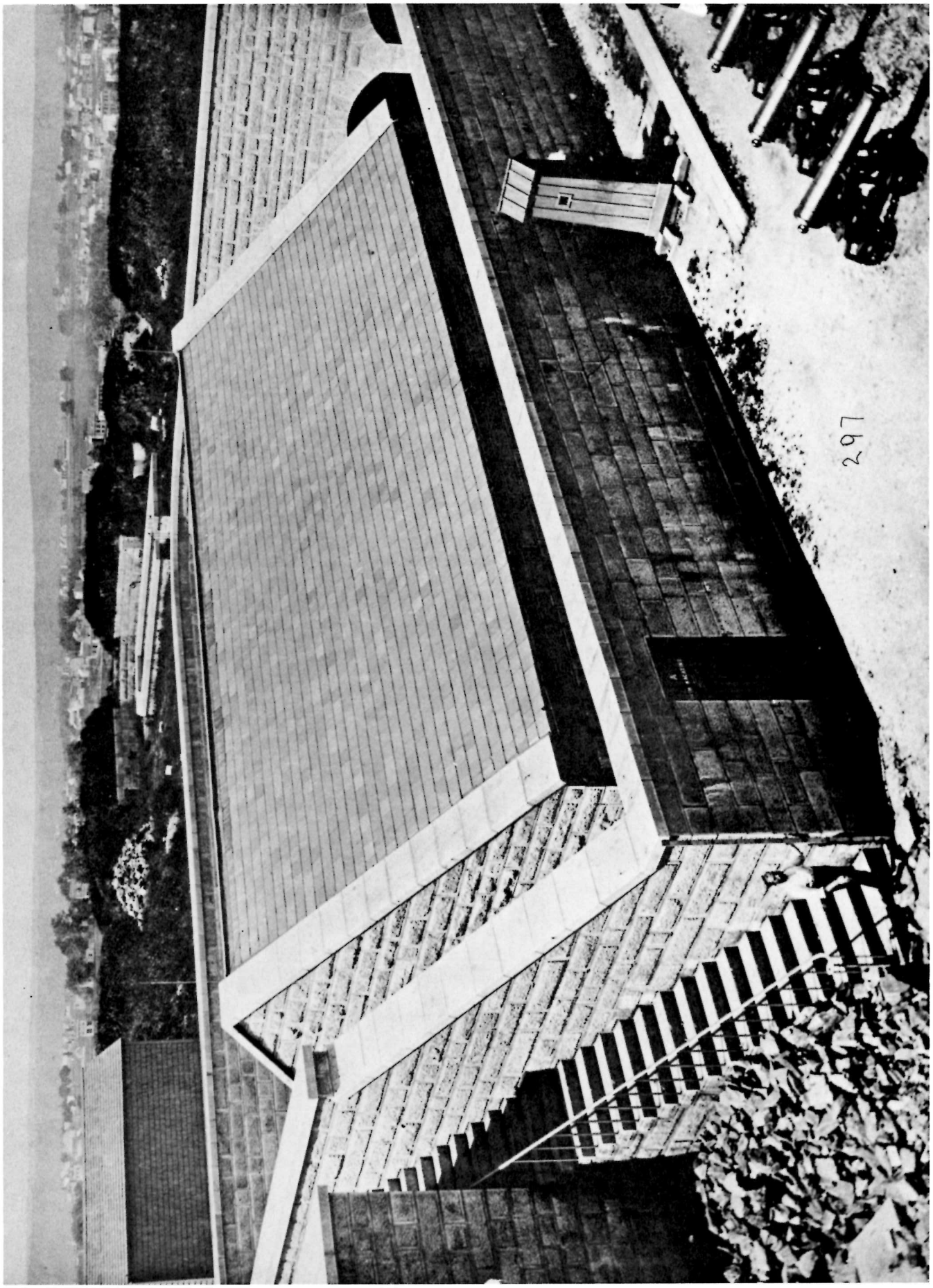
15 Photograph of the north magazine (1882). This and the following are the only nineteenth century photographs of either of the magazines which have been discovered. Both are of the north magazine. Fortunately, the south magazine was virtually identical. Note the lettering on the area door and the lightning rods, at each end of the roof ridge just behind the coping. (Public Archives of Nova Scotia.)



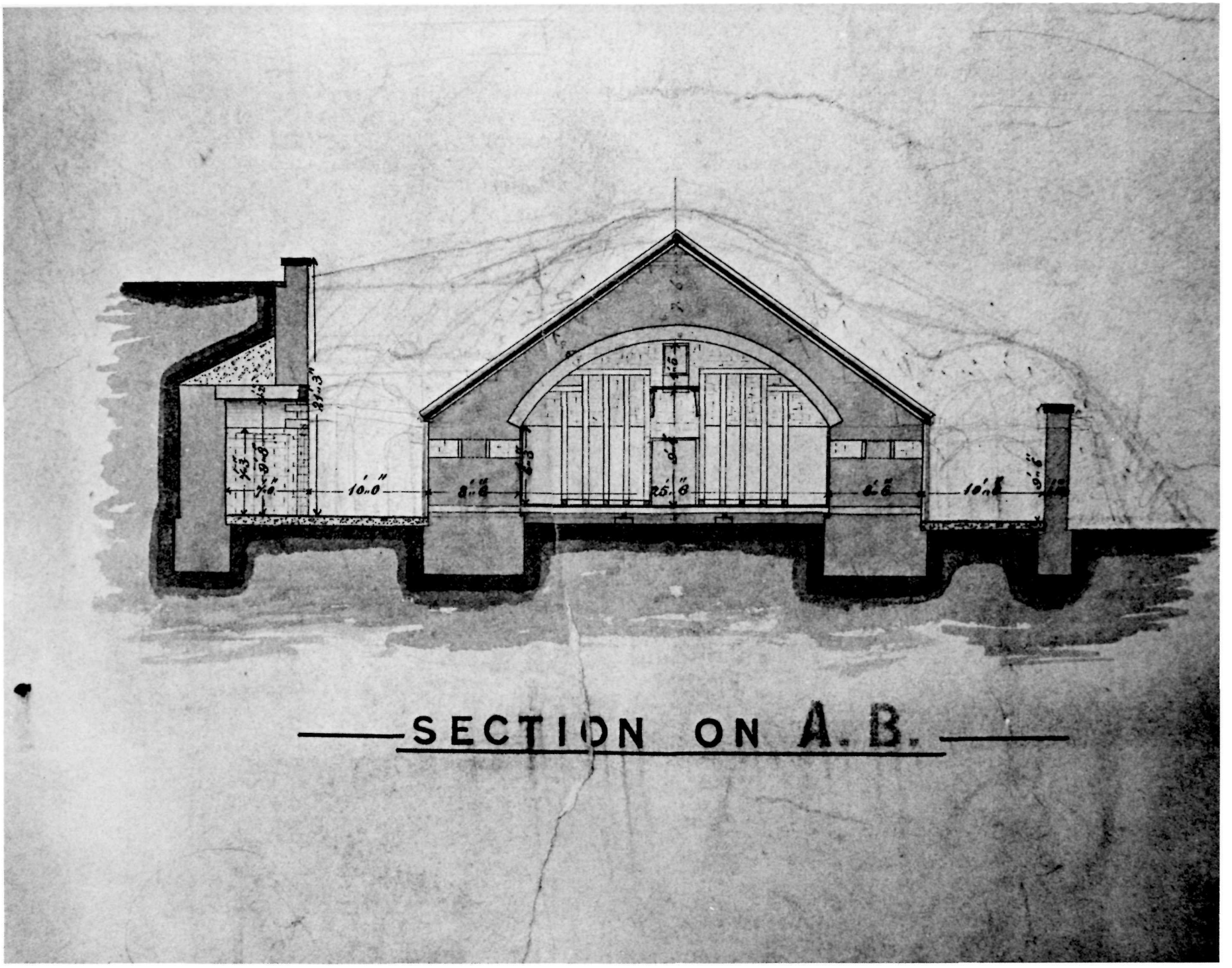
.29b

VIEW AT STATION A

16 Photograph of the north magazine (1882). This is our only photograph showing the copper gutter and down pipe. Note how the gutter was attached to the building. (Public Archives of Nova Scotia.)


297

17 Section of the south magazine (1882). This and the two following illustrations are all from the 1882 plan which is so exhaustively discussed in the text as to make elaborate commentary here superfluous. Note that the rack uprights are attached to the arch. Note also the demi-casemate dos d'ane. (Public Archives of Nova Scotia.)



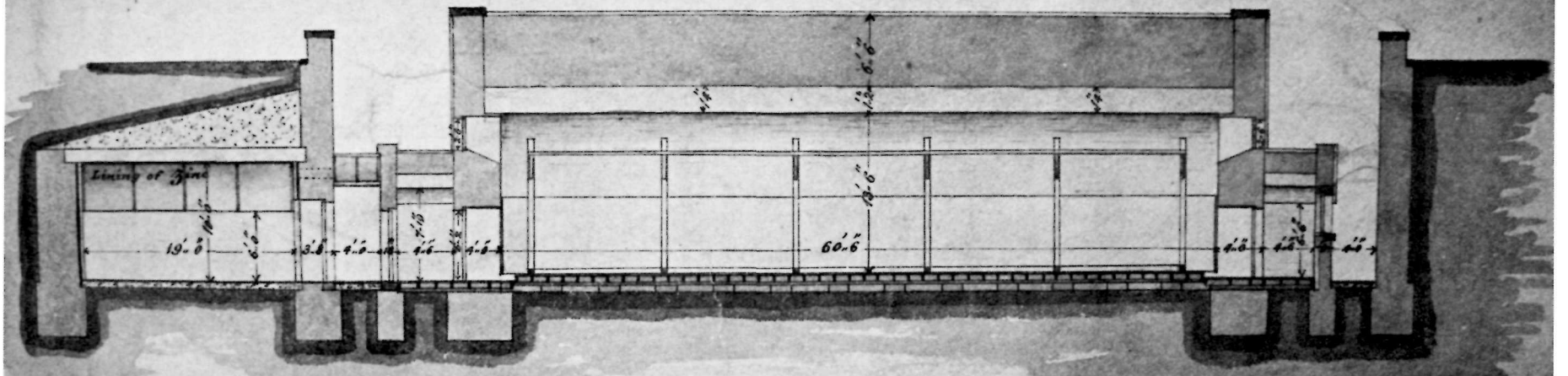
SECTION ON A. B.

18 Section of the South Magazine (1882). Note the dos d'ane, zinc lining and wainscot in the shifting room, and the wood floor and roof in the space between the south porch door and the shifting room door. The information on this plan concerning the magazine dos d'ane and arch is probably inaccurate. (Public Archives of Nova Scotia.)

ESTIMATED COST

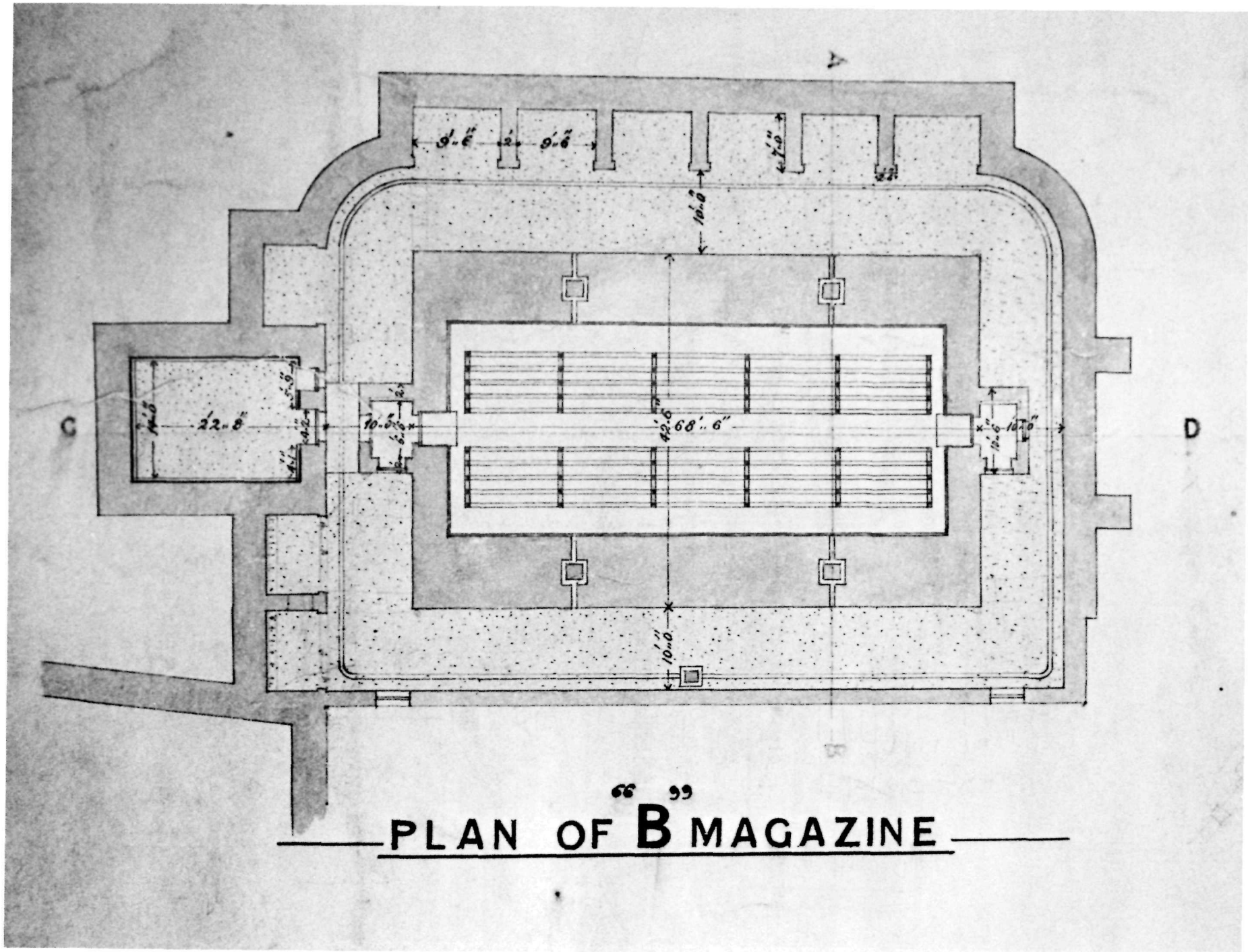
ACTUAL —Do—

DRAWINGS MADE FROM ACTUAL MEASUREMENT WHERE POSSIBLE, OTHERWISE FROM EXISTING DRAWINGS & INFORMATION RECEIVED FROM MEN EMPLOYED ON THEM AT THEIR CONSTRUCTION.



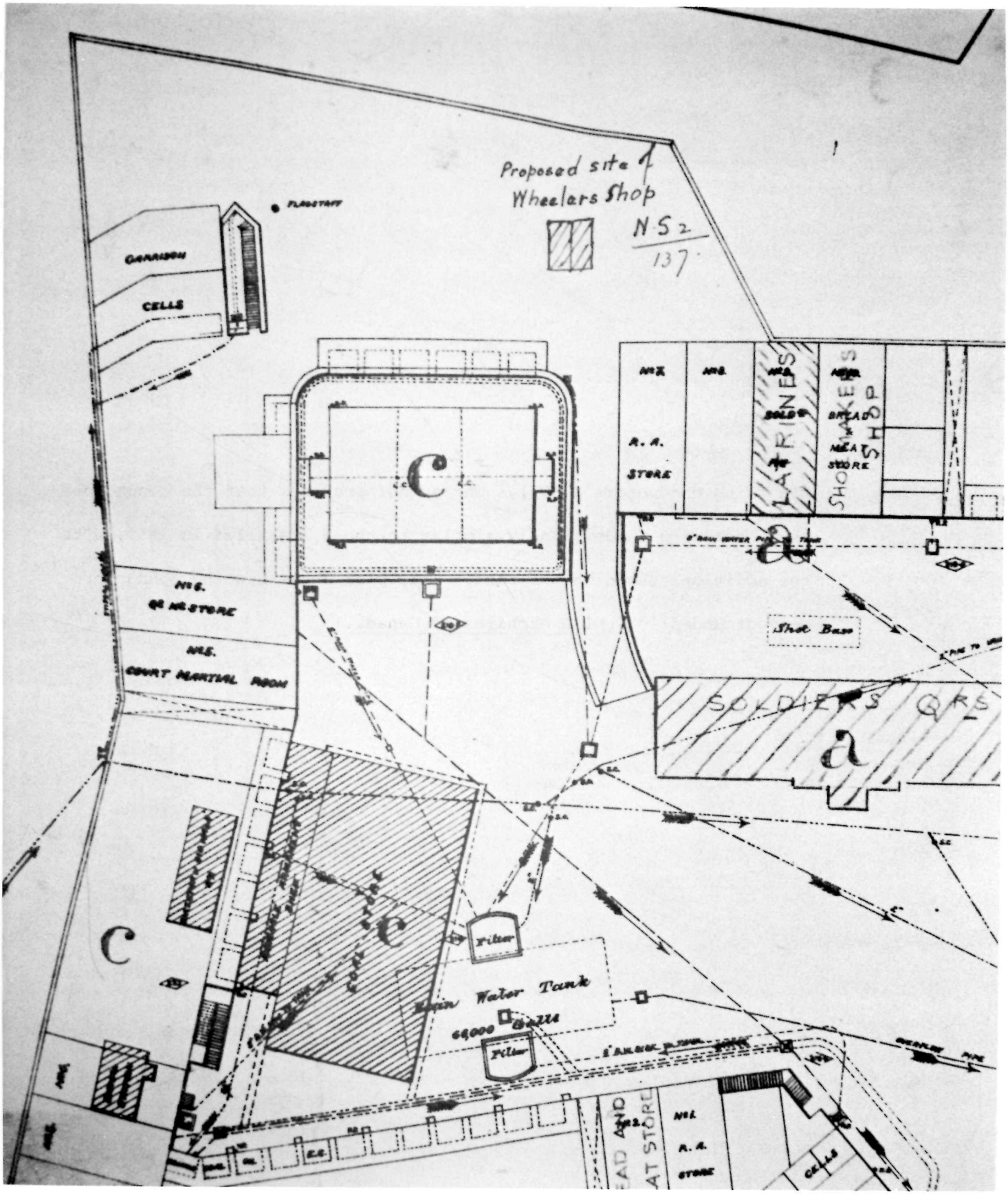
SECTION ON C D E F

19 Plan of the south magazine (1882). Note the surface gutter and catch pit in the area. (Public Archives of Nova Scotia.)

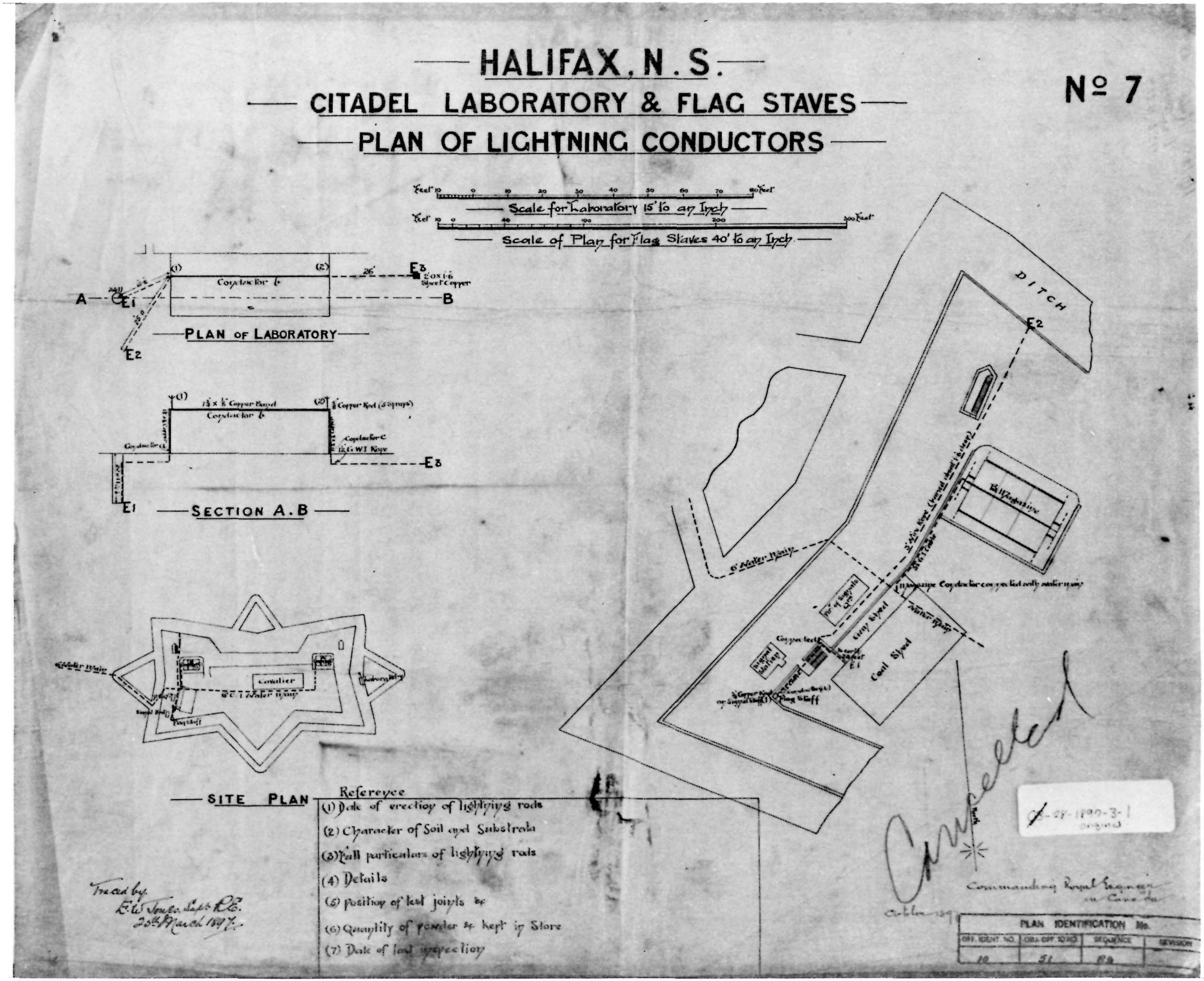


"B" MAGAZINE

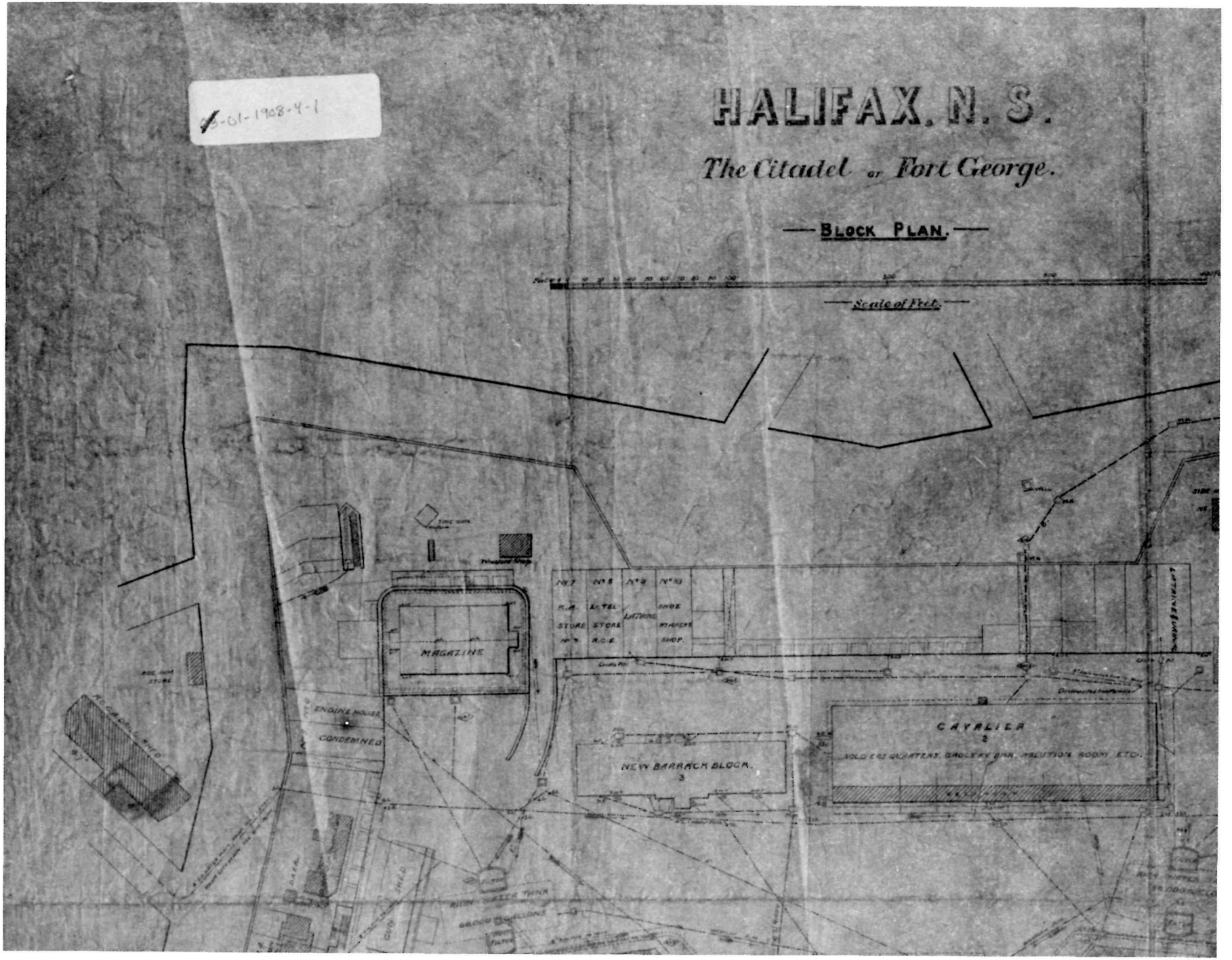
20 Citadel Block Plan (1891). This is the earliest plan which shows the drain catch pit just outside the middle of the magazine boundary wall. The surface drain in the area apparently drained into this. (Public Record Office.)


Proposed site of Wheelers Shop
N.S.2
137
FLAGSTAFF
GARRISON
CELLS
R. A. STORE
LATRINES
SHOEMAKERS SHOP
Shot Base
SOLDIERS QRS
Filter
Main Water Tank
64,000 Gallons
Filter
CELLS

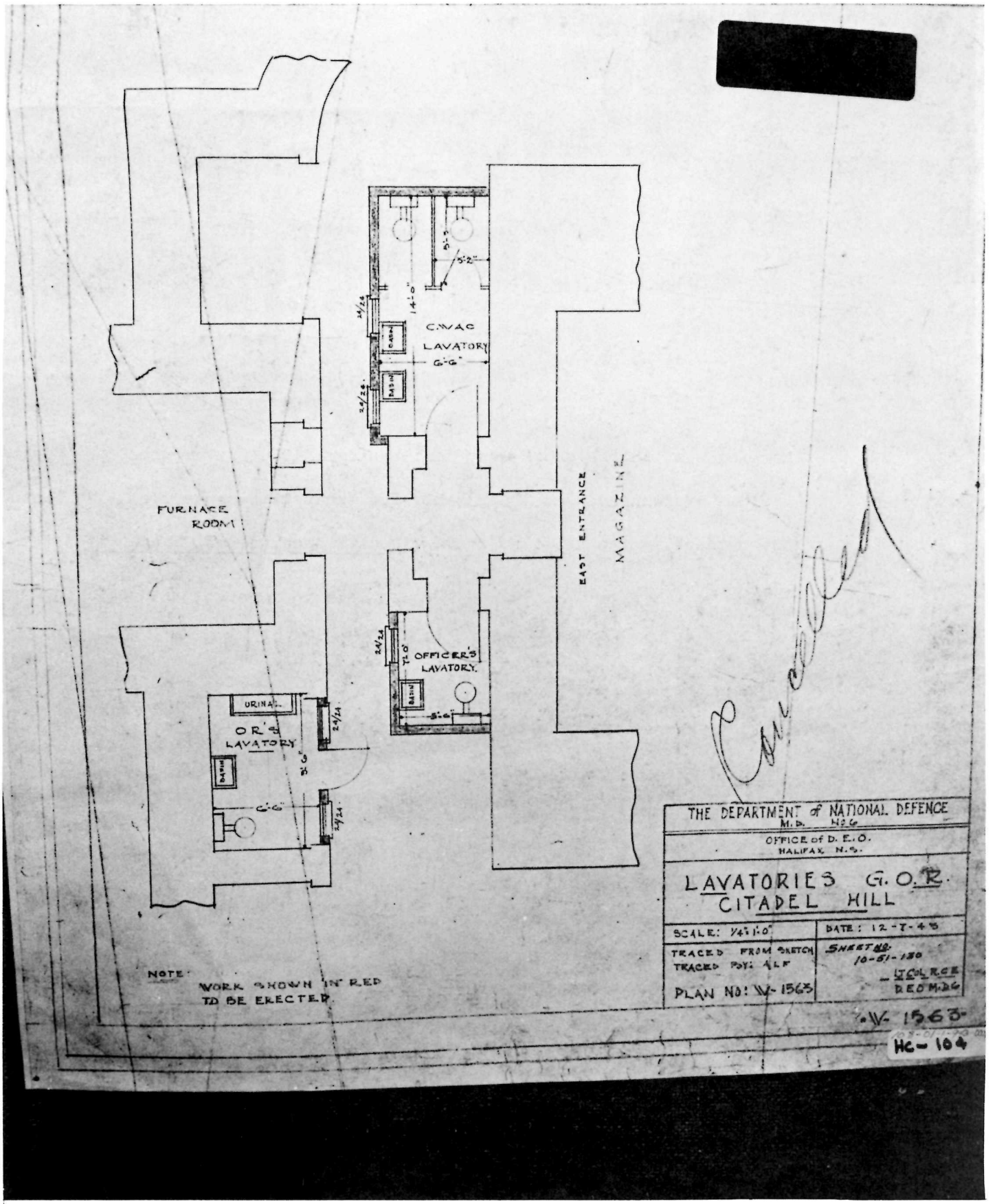
21 Lightning conductors (1897). The author presumes that the conductors shown here are fundementally similar to those installed in 1859, with the additions shown on the roof. This plan shows how the conductors were grounded. (Public Archives of Canada.)


HALIFAX, N. S.
CITADEL LABORATORY & FLAG STAVES
PLAN OF LIGHTNING CONDUCTORS
No 7
Scale for Laboratory 15' to an Inch
Scale of Plan for Flag Staves 40' to an Inch
PLAN OF LABORATORY
SECTION A.B
SITE PLAN
DITCH
Cavalier
Gun Shed
Coal Shed
Flag Staff
Reference
(1) Date of erection of lightning rods
(2) Character of Soil and Substrata
(3) Full particulars of lightning rods
(4) Details
(5) position of test joints &c
(6) Quantity of powder &c kept in Store
(7) Date of last inspection
Traced by
E.W. Toule, Sapr R.E.
20th March 1897.
Commanding Royal Engineer in Canada
PLAN IDENTIFICATION No.
10
51
84

22 Detail of a block plan (1908). This plan shows the lightning conductors and the drains in the vicinity of the magazine. (Public Archives of Canada.)


HALIFAX, N. S.
The Citadel or Fort George.
— BLOCK PLAN. —
Scale of Feet.
MAGAZINE
ENGINE HOUSE
CONDEMNED
NEW BARRACK BLOCK.
3
CAVALIER
2
SOLDIERS QUARTERS, GROCERY, BAR, ABLUTION ROOM, ETC.
LATRINES
LATRINES

23 Lavatories (1943). Only the west porch door and the concrete floor now remain of these lavatories. (Public Archives of Canada.)


FURNACE ROOM
C.N.A.C. LAVATORY
EAST ENTRANCE
MAGAZINE
OFFICER'S LAVATORY
URINAL
O.R.'s LAVATORY
NOTE
WORK SHOWN IN RED TO BE ERECTED
THE DEPARTMENT of NATIONAL DEFENCE
M.D. No 6
OFFICE of D.E.O.
HALIFAX N.S.
LAVATORIES G.O.R.
CITADEL HILL
SCALE: 1/4"=1'-0"
DATE: 12-7-43
TRACED FROM SKETCH
TRACED BY: A.L.F.
SHEET NO. 10-51-130
PLAN NO: W-1563
W-1563
HC-104

24 Looking west in the south-west demi-bastion (1950). The pipe visible over the coping is probably for exhausting smoke from the furnace in the shifting room. (Public Archives of Canada.)