

During normal daylight hours nothing further happened in the way of fresh incidents and our energies were concentrated on improving the bag situation, which by this time had become pretty acute, and in organising further transport and filling gangs at various points. With the exception of the fact that the cradging work on Deeping High Bank immediately above Crowland Bridge was laid off for a few hours owing to the fact that the access was considered unsafe for normal traffic, and the consequent failure of this cradging, nothing untoward happened until shortly after 7 o'clock at night when there was a serious subsidence at the Bell Tunnel Cowbit. This subsidence broke the Electric Supply Authority's H.T. line which for some time put the Podo Hole electrically operated pump out of action, but within a matter of rather less than half an hour this length of line had been isolated and made safe and Podo Hole was again in operation. Throughout the whole of the night the work of making the Bell Tunnel safe was constantly going on, and unfortunately on one occasion some new transports which had been brought in somehow managed to get in the reverse direction on the traffic circuit with the inevitable result that dis-organisation for about two hours was intense. It must be realised that on this particular length of bank some 800 loads were handled during the night in the dark and under flood conditions and I think probably the chaotic state that I have just mentioned can better be imagined than described.

The Glen breach by about 9 o'clock at night had a "string piece" across it and, although some very considerable amount of water was still coming through the breach, it was felt that now this was in position and a considerable amount of material had been got to the site it would not be long

before complete closure could be effected. By early on Thursday morning the 20th March the cradging along Deeping Bank immediately above Crowland Bridge was again in a more or less reasonable state and a more hopeful view was being taken of the situation at this particular point, although the flow of water over the bank had not been completely stopped it had to a very large degree been checked and it seemed probable that, provided the infiltration through the bank itself assumed no worse a character than it had done to date, this particular piece of bank would now hold. The portion of Deeping bank that was now creating the greatest concern was the length from Four Mile Bar to Locks Mill Bridge and shooting and cradging was absolutely continuous on this four or four and a half miles of protection work. At 9 o'clock in the morning of the 20th the gauge at Market Deeping Bridge had fallen to 23'4½" and the flow through the Maxey Meadows was also beginning to decrease, the input however into the Washes was still considerably greater than the capacity of the main River Welland through the town of Spalding with the net result that the water level in the Washes was still rising. As a result of this continued decrease of the river level in the Market Deeping district, the upper end of Deeping Fen was now beginning to get somewhat drier and, although many roads were still flooded, traffic was able to get through in most places by normal route which did something towards relieving one of the greatest bugbears of the situation, namely the difficulty of handling material on to the sites. In many cases however it was impossible to get to the banks with transport, materials being taken to the most convenient point and boated for some considerable distance to the place where they would be used, which of necessity meant the general slowing of

operations.

The South Holland system, during the early part of the week, had been discharging a great deal of water partly arising from its own local catchment and partly due to extraneous water from the Crowland and Cowbit Washes finding its way into the upper end of the South Holland Drain and a discharge in the main drain of 1,800 cu.secs. was recorded. When it is realised that the normal catchment area draining to the point at which this gauging was taken is something in the order of 38,000 acres, it will be seen that the quantity of water dealt with by the South Holland drainage system was phenomenal, being something in the order of 47 cu.secs. per thousand acres although this of course does not prevent a true picture of the local run-off due to the fact that so much water was being introduced from the Crowland and Cowbit Washes.

It is interesting to note that if one assumes a run-off previously mentioned of 30 cu.secs. per thousand acres in the upper reaches of the Welland as applying to the South Holland district, something in the order of 600 cu.secs. of the peak discharge in the South Holland Main Drain was attributable to inflow from the Crowland and Cowbit Washes which gives some very adequate idea of the precarious state of the Cowbit bank. When one further considers that this was in all probability the best section of bank under the control of this office which fronted the Crowland and Cowbit Washes the precarious situation as a whole can be well imagined.

Before 10 a.m. the breach on the River Glen had been sealed to such an extent that no water was now coming through and work continued for some time at this particular

point to strengthen the closure so made. The final closure was made with something in the order of 4'6" of water flowing across the line of the "string piece" which had a clear span of about 75'0" and the difference in water level of the River Glen and the Counter Drain Washes was something in the order of 7ft. It is quite obvious from this information that unless a closure had been made the Counter Drain Washes and the area that had already been segregated to hold the flood water would have been totally inadequate to act as a reservoir, with the result that Deeping Fen would have suffered from further extensive inundation. As an outcome of this breach and the water level that obtained in the Counter Drain and the Counter Drain Washes, it was impossible to operate the Bourne South Fen pumps as this pumping would have only aggravated the situation in general and have placed Deeping Fen area in greater danger, and in any case Bourne Fen itself was flooded to a very great degree by this time.

Soon after 10 o'clock in the morning the Bell Tunnel Cowbit was again made reasonably safe and a certain percent of the labour force that was being continuously employed on this job was released for other work, but not before sufficient reserve of material and men was made available at the site should the situation again worsen.

As a result of the closure of the breach in the Glen the water level in the Counter Drain had shown no increase in level for some hours, and by 2 o'clock in the afternoon of the 20th the position was such that the greater part of the labour which had been employed on cradging the Counter Drain bank and in the Baston Common district could be transferred to other sites.

At the height of the flood many structures of various descriptions such as sluices, weirs, flood banks, etc. were damaged to various degrees and in particular the bridge over the Welland at West Deeping completely failed with the resultant closure of traffic.

As I have previously said the sack situation was at one time very definitely precarious, but this was relieved as a result of the Ministry of Food Potato Division making sacks available at their stores which unfortunately were not right in the centre of activity, but did not involve transport of more than 40 or 50 miles, whereas we had previously been collecting sacks from as far afield as Essex which it can well be imagined put a tax on the already extended transport capacity available.

Now that we were beginning to hold our own in most districts, and in fact in some places to very definitely gain from a point of view of water levels, we were in a position to concentrate more of our efforts upon the high level banks impounding the Crowland and Cowbit Wash waters, always bearing in mind of course that sufficient labour and plant was available to maintain the present position in other areas and to cope with a sudden emergency should it arise. As a result of this improved position everything possible was concentrated on the Deeping High Banks and the South Holland Bank and by the evening a relatively strong organisation, by way of comparison by previous labour strength employed on the job, was in being; transport was very considerably augmented, and the traffic systems and road closures that had been made had been in operation for some considerable while with the result that the odd snags had been ironed out, flood lights were made available in many more cases, and considerable numbers of P.O.W's from

various sources were working and by this time had some experience of the job they were supposed to do. Throughout the night the water level at the upstream end of the Washes was beginning to steady and although there was some considerable inflow through Market Deeping and Maxey Meadows the quantity of water put into the Washes was by this time only 50% of the peak inflow. As an outcome the top end of the "Wash reservoir" hardly increased in level, but the lower end of the Wash and the Crowland Bridge district was increasing as the reservoir was "flattening out" owing to the fact that the Spalding channel was still incapable of dealing with the quantity being fed into the reservoir.

Through the town of Spalding itself during the day and evening of Thursday water levels were increased very slightly and by Thursday night the highest level to be recorded at Spalding High Bridge of 18.10 O.D.L. was obtained.

A discharge recording taken at this time showed 2,300 cu.secs. as the flow through the Welland at Spalding and a figure of 5,500 cu.secs. has been computed as the peak input into the Washes. The difference between the input and output from the "Wash reservoir" had to be made up in containing the water and by the loss into the surrounding districts, and in light of this the figure of 600 cu.secs. as the possible loss into the South Holland area, which I previously mentioned, does not seem to be as fantastic as one might at first imagine. It is interesting to note that the 1880 flood at Spalding reached a level of 17.38 Liverpool (0.72ft below 1947) and the 1939 level was 16.32.

It had been fortunate that the tides were relatively low, i.e. neaps, but we were now beginning to approach the

period when the tidal influence might be expected to be felt and this highest recorded figure was possibly influenced to the extent of about  $\frac{1}{2}$ " as a result of high tide as the water level rose and fell  $\frac{1}{2}$ " within about six hours. It was anticipated that for the next few days this tidal influence would become more pronounced and, with this in mind, work was continued in strengthening banks through the town of Spalding although there were by this time not many places where water was flowing in any serious quantities into the town.

Our feeling of comparative contentment with regard to the additional labour force we had been able to collect for the Deeping bank was somewhat shaken early on Friday morning when it was realized that a certain amount of friction was taking place between labour that had been obtained from various sources and numerous P.O.W.Camps but were working on the same sites, and the lesson was learnt from this that it was desirable to only operate P.O.W. labour on one site that came from one particular camp if friction was to be avoided. During the early hours of the morning before daylight a number of blows of various descriptions were beginning to work in the Deeping High Bank, but in most cases these were checked as a result of sheeting, bag breasting and similar work, and it is worth noting that by daylight there was very little water going over the bank as cradges had been built up to a sufficient height and of sufficient strength in most places, but there was of course no factor of "safety" worth mentioning in this connection.

It was quite evident by this time that, provided all the banks could be maintained, the precarious position would continue, so far as the Crowland and Cowbit Washes area was concerned, for several days to come and in the event

of a failure of a bank an equally difficult situation would arise in the area flooded as a result of any breach. Although water levels were not rising with the same rapidity, increases were still being experienced at Crowland Bridge and at Locks Mill and our own organisation was getting to a state that it was suffering very badly from fatigue and during the morning of Friday the 21st. it was decided to contact the Military Authorities with a view to having arrangements completed to the last detail in the event of it being necessary to invoke their assistance. In this connection I would here like to say how helpful Col. Ingle was, who is in charge of the Fulney P.O.W.Camp. He went to a lot of trouble in preparing schedules of requirements and in getting them to agree with the various items that he knew would possibly be available from the Military Authorities, and I feel that the time that he spent short-circuited many delays that would have arisen if the situation had become such that, as a last resource, service personnel had been called in.

After the prolonged use of transport many local operators, farmers, etc. were beginning to run seriously short of petrol and emergency arrangements were made whereby petrol could be drawn for all hired transport from whatever source it was obtained.

Trouble was being experienced all through Friday morning with a number of culverts through both the Deeping Bank and the South Holland bank, but in all cases they were sealed, some of them not perfectly but sufficiently to cut down the flow of water and minimise the danger of a "blow" at a low level.

Shortly after mid-day the information came into the office that the North Level bank had failed at a point near Crowland and steps were taken immediately to get this

confirmed, but before this visual confirmation, which incidently at a crisis of this nature is the only form of confirmation to trust, it was fairly evident that something had happened to some section of the Wash protection works as the water level at Crowland Bridge and in the vicinity fell an inch or so in considerably less than an hour.

#### THE EFFECT OF THE BREACH IN THE NORTH LEVEL BANK AT CROWLAND

Confirmation was immediately forthcoming that this breach had very definitely occurred and it was a failure in the bank of major proportions, this fact was also evident from the effect that it was having on the water levels of the River Welland and the Crowland and Cowbit Washes, for in a matter of two hours the water level at Spalding had fallen by approximately a foot and later on during the afternoon the Cradge Bank at Crowland Bridge was above water indicating a fall in water level of about 4ft.

The effect of this very rapidly falling water level was that nearly all work on the remaining high level protection banks could be laid off, there were of course a few points at which work had to go on but approximately 80% of the work that had been in hand could now be considered redundant and consideration had to be given to the effect of the breach on the surrounding countryside.

It must be understood that the breach at Crowland was in a bank under the control of the North Level Commissioners and so came outside the area with which the organisation from Deeping House had been dealing. As an outcome of this it was difficult to know exactly what had happened as the nearest point upon which I had any definite information as to the behaviour of the banks was Brotherhouse Bar, some

2½ miles distant from the site of the breach, it was however abundantly clear that the breach was of major proportions and would in all probability virtually drain the Cowbit Wash and take a considerable proportion of the water on the upper Crowland Wash before it could be sealed, an assumption that was more than borne out by the actual happenings. The water being discharged through this gap would first of all enter the Postland area of the North Level immediately adjacent to the South Holland Board's area which comes under my jurisdiction and steps were immediately taken to segregate the two areas completely from a point of view of preventing further extraneous water entering the South Holland District.

Arrangements were put in hand during the afternoon to build protection works along Queens Bank and the line of the railway so that the flood could be limited to extend in a south easterly direction, leaving the South Holland area unaffected. In fact it was necessary to make protection good from Brotherhouse Bar to the old South Eau bank, a distance of some five miles. With this aim in view the first things to be done were to close the culverts under the railway line, organise one way traffic and to put as much transport as was available on to the job and it is interesting to note that by midnight we felt reasonably sure that the rising flood level could be contained, but as a second line of defence another wall was built behind the railway line along Martins Drove and, as materials brought into the site had the unrestricted use of a hard road, this was easier to deal with than the railway line. It must be realised that in this office we were not aware of the actual steps that were being taken by the North Level Commissioners

and the River Nene Catchment Board to limit the extent of this flood, but it was anticipated that it could possibly be confined to some 8 or 10 thousand acres in the vicinity to the east of Crowland and with this possibility in mind it was necessary of course to bring our protection works to a sufficient height to hold the impounded water, and by about 4 o'clock in the morning all these protection works were of sufficient height to hold the total volume of water which could be expected to drain into the area from the breach, but work still proceeded on strengthening and making good one or two weak spots.

It will be remembered that arrangements had previously been made whereby Military Personnel and equipment could be immediately available to us should they be required and this organisation was immediately switched, in so far as our Boards were concerned, to the River Nene Catchment Board and the North Level Commissioners, who were of course responsible for the work at the breach and controlling the flood waters arising there from.

It is interesting to note that during the Friday morning the River Welland through Spalding had reached its peak discharge before the breach occurred and a quantity of about 2,400 cu.secs. was being evacuated from the Crowland and Cowbit Washes through the restricted channel which of course compares unfavourably with the input at the upstream end of the Washes. It is safe to assume from the behaviour of the River Welland over the next few days that the water level in the Crowland and Cowbit Washes might have risen by as much as another 6" in the event of the Crowland breach not having occurred.

Soon after 5 o'clock on Friday afternoon the Culvert

at Tongue End under the Counter Drain again gave cause for alarm but by means of working steadily throughout the night the position was made relatively safe by early on Saturday morning.

By 7 o'clock in the evening of Friday the stops were put on at the overfall adjacent to Crowland Bridge as the water level had dropped sufficiently following the breach in the North Level bank to allow water to flow from the River Welland into the Washes thus feeding the breach. A calculation to give some indication as to the rate of discharge through the breach, based on the fallen water levels of the Wash, indicated that if the flood was contained in the 8 or 10 thousand acres already mentioned in the Crowland district it was probable that the water level would be some 2ft above the road level along Queens Bank for the greater part of its distance, and it was on this assumption that levels of this protection work were determined. The North Level Commissioners however did not contain the flood in the way that had been anticipated, with the result that in the worst case the level was only approximately 1'3" to 1'6" above the road level on the Queens Bank, and this level fairly rapidly dropped as the flood extended into the Borough Fen and other parts of the North Level area.

Now that the situation as far as the Welland banks was concerned was somewhat relieved and there were only minute quantities of water coming into Deeping Fen it was decided to pump a certain amount of water in the Deeping Fen area back into the Counter Drain with the object of preventing a further slow spread of the flood area. This could only be done of course as the Counter Drain water

levels dropped, but by this time they had fallen by a matter of an inch or so in the Tongue End district and shortly after 6 o'clock on Saturday morning one of the Boards portable units together with two N.F.S. pumps were being installed at the lower end of Baston Fen for this purpose. These pumps were only operated for a short period as they were detrimental to Bourne South Fen.

#### EVACUATING RESIDUAL FLOOD WATER FROM THE LOWLAND AREAS.

Following the breach in the North Level Barrier Bank the problem now remaining, so far as the Boards under the administration of the Deeping House were concerned, was to evacuate the residual flood water now in the area. The subject was not quite so clear cut as this statement would leave one to believe, but the discharges from the uplands were very definitely falling off and the River Glen in its embanked channel was within fairly safe limits. By this time the River Welland was substantially below the Cradge Bank level at Locks Mill, and although water was going over the Cradge Bank above Crowland Bridge, the effect was not serious in so far as our areas were concerned; the most deleterious effect that this could have was on the breach affecting the North Level area. With a view of restricting the amount of water flowing through the breach, however, work was put in hand on the upstream end of the Cradge Bank to raise cradge work so that the River Welland would, as much as possible, be retained within its normal channel thus excluding water from the Washes which would in turn feed the breach.

During the day arrangements were made for people on the site at Crowland to close all the openings in the

Crowland Causeway, and to build up a certain amount of cradging work with the object of retaining as much water as possible in the high wash, thus preventing it flowing into the Crowland Fodder Lotts and ultimately to the breach.

On Saturday afternoon the first sizeable unit brought in from an outside source, as a commencement to the use of additional pumping capacity, was a centrifugal pump driven by a 75 h.p. diesel engine mounted on a bogey. This was directed through to the 4th District, as their problem, so far as pumping was concerned, was the most urgent, because this District had a large area of land under water and the lowering of this water level had to be undertaken before relief could be given to the Counter Drain and Counter Drain Washes, and upon that level the Baston Common district and Bourne South Fen and Thurlby area depended for the evacuation of their water.

A review of the situation at this time showed, that of all the districts to the east of the River Welland, the South Holland Board was probably in the worst state at its upstream end, because it had received a considerable amount of River Welland water over and through the Cowbit Bank. However, water levels were steadily falling at the upstream end of the South Holland Main Drain by a matter of an inch or so a day, and it was felt that under the conditions that now existed and that could be foreseen, this district, together with the remainder of the Marsh area could, to the best advantage, be evacuated by means of its normal system of drainage. For this reason pumping units were not installed in any of these areas, work being done in a number of cases to assist a gravitational discharge which might have been blocked as a result of flood debris.

The Deeping Fen district was now showing some signs that the worst of the flood had been passed. By Sunday morning the water level at Podo Hole was lowered by more than an inch as a result of the continued pumping, and the cessation of the input of large quantities of upland water through and over the high level banks. It was here anticipated that additional pumping plant would take so long to erect, and would require a considerable amount of work to be done in the way of constructing discharge bays, that the normal pumping operations would, in all probability not be greatly improved in time cycle, and here again it was decided to dispense with additional pumping capacity. The 4th. District area had already one pump installed from an outside source, and by Sunday a  $\frac{1}{2}$ " drop had been recorded in the water levels in the district, it being anticipated that the capacity now on the site would be sufficient to relieve all the flooded land within the course of a few days. The Spalding and Pinchbeck area had, as has been mentioned previously, a somewhat easier time during the flood; water levels were by this time becoming somewhat lowered and a certain amount of water could be diverted satisfactorily to other areas, and in this district it was not deemed necessary to provide any further capacity.

The two most seriously affected areas, i.e. Bourne South Fen and Thurlby, and the Counter Drain District, were then considered from a point of view of increased output, but it must be remembered that the only capacity at Bourne Fen was one of the Board's portable units and this had its normal outfall through Heathcotes Tunnel under the River Glen into the Counter Drain. It was quite obvious that if a considerable number of pumps were assembled to augment this

discharge, the Counter Drain Washes would be put under some strain, as they were already seriously flooded, and, as an outcome, Deeping Fen would be under the threat of receiving more flood water, a situation that would have been far from desirable. In view of these observations it was decided to drain the Counter Drain by its normal outfall into the Vernatts Drain at Podo Hole, and as soon as water levels in the Deeping Fen area and the 4th District permitted, to augment this discharge by means of the culverts which were completed last summer. As soon as the water levels in the Counter Drain were somewhat lowered, the next step was to open the culvert under the Counter Drain and take a certain amount of the Washes water into the Deeping Fen system in that way, but this, of course, was entirely dependent on the ruling water levels of Deeping Fen from time to time, and the safety of the culvert, in view of the trouble which had been experienced with it during the flood, had to be considered. Water was also discharged from the Washes into the Counter Drain by means of the old sluice near Counter Drain Station, this, however, only acted at a relatively high level, but it did discharge water in gradually lessening quantities until such time as the Wash was virtually dry. Pumping as a major operation was considered for this area, but in view of all the local circumstances and the interdependence of the other surrounding districts with this problem precluded the use of a great deal of pumping equipment, but in the course of the next few days, the pump, that had already been installed at the 4th District, was stripped and taken to Tongue End Bridge and run for 432 hours continuously pumping the Counter Drain Washes water into the River Glen, which materially assisted the situation.