TERROR FROM THE SKY
North Viet-Nam's Dikes and the U.S. Bombing

by John Gliedman

Vietnam Resource Center
Cambridge, Mass.
The Vietnamese Resource Center is staffed and operated by Vietnamese students in the United States. It is now in its fifth year of contributing to the anti-war movement. The Center's main purpose is to provide the all-important social and political context of current information about the war. One of the main vehicles of this effort is the Center's newsletter, *Thoi Bao Ga* (subscription $5.00 a year). Each month it draws upon Vietnamese-language sources to present short analytical articles on current aspects of the struggle in Vietnam. Much of what appears in its pages is translated nowhere else. We have been financed solely by contributions from Vietnamese students and by subscriptions to the newsletter. To help us carry on our work, subscriptions and contributions are urgently needed. Please send them to the above address.
Many people have given generously of their time in the course of preparing this study. The Science for Vietnam, Chicago collective supplied me with much useful material on weather modification, including a preliminary copy of their excellent "The Big Gun is the Rain." Gary Porter always seemed to know where to track down a reference when I needed it most. And without the patient support of my good friend Ngo Vinh Long I would have never written a line. It was his idea in the first place, and he has seen it through to the end. Finally, I would like to thank Jim Morrell. Besides doing the layout, Jim had the thorny task of typing and editing the manuscript.

J.G.

Because metric units are used pretty generally throughout, the reader may find the following list of equivalents of use.

1 meter = 39.37 inches (about 1 yard plus 10 per cent)
1 kilometer = .62 mile
10,000 square meters = 1 hectare
1,000,000 square meters = 1 square kilometer
100 hectares = 1 square kilometer
1 hectare = 2.46 acres (about the area of a football field as wide as it is long)
1 square kilometer = .37 square miles
1 square mile = 2.59 square kilometers
1 acre-foot = 1,230 cubic meters
1 kilogram = 2.2 pounds
Table of Contents

I. Strategic Targets .................................................. 1
II. The Prospects for Mass Drownings ............................... 3
III. The Prospects for Widespread Famine .......................... 42
IV. The Vulnerability of the Dikes to Attack ....................... 60
V. Weather Modification in North Vietnam ......................... 69
VI. Will the Dikes Be Destroyed? ................................. 83
VII. Main Conclusions of the Study .................................. 95

Appendices

I. Report on the Destruction of the Dikes; Holland 1944-1945 and Korea (Gabriel Kolko) .............................................. 97
   The Attack on the Irrigation Dams in North Korea (Quarterly Review Staff) .................................................. 100

II. Dikes and Other Hydraulic Works Which North Vietnam Claims Were Attacked By U. S. Planes From March 1965 to August 1967 (Foreign Languages Publishing House) .................. 109

III. Static and Dynamic Seeding Explained ......................... 112
   The Effectiveness of Static Seeding Methods ..................... 116
   Is the U. S. Steering Typhoons Towards North Vietnam and Southern Yunnan Province? ................................. 121
   Is China Being Affected By U. S. Seeding of North Vietnam and Laos? .................................................. 130
TERROR FROM THE SKY

NORTH VIET-NAM'S DIKES
AND
THE U. S. BOMBING

BY JOHN GLIEDMAN

August, 1972

©1972 By John Gliedman
Reproduction in whole or part by the movement welcomed. Unauthorized commercial publication prohibited.
I. STRATEGIC TARGETS

IN THE CLOSING stages of the Korean War the United States Air Force was given the task of destroying the dams of North Korea. The first to be hit was the Toksan dam to the north of the capital. On May 13, 1953 some 20 F-84s attacked and destroyed the dam, triggering a flash flood which inundated 27 miles of farmland downstream. In the succeeding weeks the Chasan, Kuwonga and Toksang dams were also bombed. Only the signing of the armistice later that year spared the bulk of North Korea's remaining dams from a similar fate.

The significance of the raids was not lost on the Pentagon planners. (1) "These strikes," states an official U.S. account of the war, "largely passed over by the press, the military observers and news commentators in favor of attention-arresting but less meaningful events, constituted one of the most significant air operations of the Korean war. . . . To the Communists the smashing of the dams meant primarily the destruction of their chief sustenance—rice . . . [and with that] starvation and slow death." (2)

Nineteen years later history may be set to repeat itself on a larger and more deadly scale. There are persistent indications from Washington that the next step in the Indochina War will be an all-out attack on the dikes and dams of North Vietnam. According to Neil Sheehan in the June 10, 1972 New York Times, "senior" officers
are saying that if Nixon

... wants to escalate the war significantly ... he may
have to begin attacking civilian targets—the cities and the
flood control dikes in the northern edges of the Tonkin
delta. Moreover, if the present campaign fails to achieve
results, some officers would not be surprised if Mr. Nixon,
having “made his commitment,” changed his mind on such
targets, perhaps after adequate warning to the North Viet-
namese.

And only a month before, the President himself lent substance to
these speculations. The destruction of the dikes and dams, he said
in Texas on April 30, could cause “an enormous number of civilian
casualties,” something which “we needed to avoid,” and also “some-
thing we believe is not needed.” But he refused to rule out attacks
on them in the future. Most ominously of all, he called them “stra-
tegic targets,” thereby implying that he now accepted the Joint Chiefs
of Staff long-standing definition of them as legitimate military targets. (3)

In these hints of an even more destructive escalation of the war
lies an ugly irony. A generation ago, only months after Ho Chi Minh
had proclaimed Vietnam’s independence from France, the Nuremberg
War Crimes Tribunal sentenced to death a man who also believed
that dikes were “strategic targets.” This was the German High Com-
missoner for Holland, Seyss-Inquart, who in 1944 ordered the destruc-
tion of the Dutch dikes in order to slow the Allied advance into
Holland. But times change. And what was once a war crime punishable
by hanging is now called something “we need to avoid” but cannot
rule out by an American president. Of course, Seyss-Inquart’s victims
were white Europeans, while the prospective victims of a Nixon
decision to destroy North Vietnam’s dams and dikes are, in the words
of former Undersecretary of the Air Force Townsend Hoopes, “Asian
hordes” with an “oriental indifference to death.” (4)
II. THE PROSPECTS FOR MASS DROWNINGS

Most of North Vietnam’s 160,000 square kilometers (61,000 square miles) is mountainous, fully three-quarters of it. Only about 2 million hectares, 13 per cent of the total, is farmland. Of this, 80 per cent lies in the river deltas and coastal plains. It is here, in an area half the size of Vermont and barely larger than the state of Connecticut, that 15 million of North Vietnam’s 21 million inhabitants live. The great deltas of the Red River, the rivers Chu and Ma, and the Ba River dominate the lowlands. Of these, the Red River delta is by far the largest. Its 1.5 million hectares (of which 1.1 million hectares are cultivated) contain 52 per cent of North Vietnam’s arable land and produce at least two-thirds of its annual foodcrops. The deltas of the Chu and Ma in Thanh Hoa province to the south are North Vietnam’s second largest crop region. Their 150,000 hectares represent 7.5 per cent of the total farmland. Still further to the south lies the important delta of the River Ba in Nghe An province.

Water Problem

Throughout this region—vast in human resources, tiny in physical size—the great problem is water: too much during the wet season, too little in the dry season. Toward the north and west of the Red River delta the greatest problem is the constant threat of a rupture of the dikes during the rainy season. In the southern part of the delta a second
problem is added to this—extensive waterlogging of the fields due to poor drainage. Only the easternmost parts of the delta where drainage is better and the river crests are lower are relatively less vulnerable to these problems. Perhaps the greatest danger here is from sea water flooding during the typhoons which strike North Vietnam’s coast once or twice a year from May to November. During these storms sea is high enough to flood considerable sections of the coast if the levees are breached. Fortunately, really high seas such as occur near the center of a typhoon are quite rare and, unlike the storms in the Bay of Bengal, those off North Vietnam generally deal the coast a glancing blow. (5) In the deltas and plains to the south, drought is the main enemy—not just during the dry season but sometimes even during the wet season. (6) As for dikes only the Chu-Ma and Ba deltas possess networks even roughly comparable to the great embankments of the Red River delta. And even here, the threat of serious river flooding—when nature is not aided by the U.S. Air Force—is much less than in the north. The danger from typhoons in the coastal regions is, however, just as great. (7)

Thus, one can roughly divide the lowlands into four main regions with respect to their water problems. These regions are 1) the eastern parts of the Red River delta; 2) the rest of the Red River delta; 3) the Chu-Ma and Ba deltas in the panhandle (Thanh Hoa and Nghe An provinces respectively); and 4) the coastal plains of the two southernmost provinces in the panhandle, Ha Tinh and Quang Binh. Of these, mass death by drowning is most likely to result from an all-out attack on the dikes and the flood control system in region 2. Elsewhere, with the possible exception of parts of region 3, the main result of such an attack would be the loss of the rice harvest. As for the sea levees, their destruction before a typhoon would lead to widespread crop losses but probably little loss of life. But these are only crude first approximations. Let us take a closer look at each of the main regions.

South of the Red River

There are only two river systems of consequence south of the Red River delta. The first of these is the Song Ma-Song Chu system in Thanh Hoa (song means “river” in Vietnamese). (See Figure 1a and 1b.) In normal times its delta escapes serious flooding. Still,
floods occasionally occur, some as disastrous as those to the north. The worst of these in recent times took place in October of 1927, when about a quarter of the region's rice land was covered by a sheet of water. Rice yields on these lands were cut in half as a result. But "it is necessary to repeat that [this] was quite extraordinary: the peasants considered it to be the most disastrous they had experienced since 1866." (8) Still, in Vietnam even relatively minor tragedies are large in absolute terms. And during French times a fair amount of the land in the lower delta experienced frequent flooding during the wet season. The triangular wedge between the Song Chu and the Song Ma was especially hard hit. (9)

**Serious Flooding**

All told, about one-eighth of Thanh Hoa's pre-World War II population—or some 87,000 people—lived in delta districts in which serious flooding occurred every three or four years during July and August, and even occasionally in April and May. (10) If the area has grown as fast as the rest of Thanh Hoa, something like 200,000 people may live in it now (11). The land here is low, no more than three or four meters above sea level. And the dikes are high, towering six to seven meters above the surrounding plain. (12) Were they to rupture without warning during a period of exceptionally high water levels, mass drowning might well occur.

But perhaps the most vulnerable part of the delta lies to the south of the Chu River. For fifty years some 70,000 hectares of it have been irrigated by gravity flow in the dry season by a reservoir across the Chu upstream at Bai Thuong. Enough water is stored in the reservoir during the rainy season to cover about 100,000 hectares with a meter of water. (13) Should all this water be released at once, flash floods would ensue, imperiling the half million people in the area. (14) Should the attack on the dam be coordinated with attacks on the dike system of the Chu and Ma delta, the results could be catastrophic.

Our information about the deltas and plains to the south of Thanh Hoa is much less complete. There is a large dam on the Ba River in the northern part of Nghe An province (the Do Luong dam) which irrigates 80,000 hectares. Together with other lesser irrigation projects it serves an area inhabited by hundreds of thousands of people. (15) The Song Ba, the only river of consequence south of the Song Chu and Song Ma, possesses a network of dikes as extensive as those of
Thanh Hoa. (16) Still further to the south a reservoir on the Be River in Quang Binh behind the Da Mai dam irrigates 2000 hectares. (17) In general, except for Thanh Hoa and Nghe An, the lowlands of the panhandle have very few irrigation projects. (18) The main watersheds of all the rivers in the panhandle lie in Laos—a fact which will assume some importance later when we discuss rainmaking efforts in Indochina. (19)

North Vietnam's Heartland

The Red River delta is North Vietnam’s heartland. Here most of its people live—some 12.5 million. Here is where most of its farmland is located and most of its food produced (see Figure 2a and 2b). Here too is where the danger of floods during the rainy season is greatest, and where the dike system has been painfully constructed over a period of a thousand years. The region’s dependence on its flood control system—the drainage ditches, pumping stations, dams, but most especially the dikes—is absolute. Without these great earthwork fortifications nearly two-thirds of the plain’s farmland, some 750,000 hectares, would be inundated every summer (see Figure 3). Without the dikes all cultivation in the wet and the dry season would be frustrated:

The Red River must be surrounded by embankments in order for the delta to be fit for cultivation. Indeed... [without them it] would block all attempts at agriculture. Every other year, on the average, the fifth month rice [harvested in June] would be lost. Two years out of three, the transplanted seedlings for the tenth month rice [harvested in November] would be destroyed... so late in the growing season that they could not be replaced in time to get an acceptable crop. Rice culture is only possible if the Red River is contained by dikes. It is impossible to obtain a harvest from October to May. The most important crop, that of the tenth month, is reaped in November: the rice thrives on the heavy summer rainfall; it ripens during the dry and sunny weather from October to December. The fifth month crop feeds on the high humidity and periods of fine rain (during the dry season) and ripens in the heat of early summer. There is no way to schedule a crop so that it could be entirely protected from the seasonal floods. A crop replanted in late October would suffer
from dry and cracked soil because November and December are the driest months of the year. Should it survive it would stagnate during the cold and sunless periods of mists and fine rains. Then, its stay in the soil uselessly lengthened to six months, it would ripen in early May. The present agricultural rhythm is demanded by the climate. One could not imagine it any other way. (20)

The Delta’s Vulnerability

The source of the delta’s great vulnerability lies in a combination of the given of geography and climate. As in the lowlands to the south, the region’s rainfall is not evenly distributed throughout the year. At Hanoi something like two-thirds of it falls during the wet season months of June through September and only about one-seventh during the December to April dry season. (21) As Figure 4 shows, the further south one goes in North Vietnam, the later and shorter is the rainy season. Most of the precipitation during the wet season is accounted for by thunderstorms and by the one or two typhoons which graze the coast every year. (22) As for the typhoons, the quantity of rain they can bring in their wake is enormous. In 1927 one such storm dumped 42 inches of water on the Red River delta during a four-day period. (23) Oddly enough, the delta is not part of the Red River’s watershed. The river’s drainage basin lies to the north and northwest, in the mountains of North Vietnam (39 per cent) and in the plateau of southern Yunnan (61 per cent). (24) Slopes and drainage channels here are unusually steep and great tracts of land are treeless. As a result, a very large proportion of the region’s rainfall—something like 50 per cent—eventually finds its way to the sea. (25)

The river that is fed by this watershed is extraordinary. During the winter it is a mere stream scarcely 2.5 meters deep at Hanoi, with a flow rate of 700 cubic meters per second. (26) Barely five months later it is a raging torrent which upon occasion has stood more than 12 meters high at Hanoi and discharged more than 23,000 cubic meters a second. Upstream, where the Red River enters the delta at Viet Tri, the flow rate can reach 30,000 cubic meters a second. (27)

As indicated in Figure 4, the flood season begins in June and extends through October (June because the rainy season begins earlier
in southern Yunnan than in the delta). (28) About half the time the river crests above 7 meters at Hanoi at least once before June 30; in two years out of three it crests above this level at least three times after September 1. (29) Figure 5 shows the typical pattern. In most years the high water mark will exceed 9.5 meters at Hanoi at least once (indeed it failed to do so only twice between 1901 and 1962). (30) Still higher crests are fairly common. From 1885 to 1930 there were 10 stages at or above 11 meters. And had the dikes not given way it is estimated that seven of these crests would have been above 12 meters. (31)

More recently, the Red River has crested at above 12 meters at Hanoi in 1945, 1969 and 1971. (32) Above 9 meters the discharge rate increases rapidly with each new increment of height (see Figure 6) and a difference of only a meter can spell the difference between a moderate but no longer dangerous stage of 11 meters and a serious threat to the safety of the entire delta. Thus in August of 1913 the Red River crested at 11.65 meters at Hanoi, rupturing its dikes in numerous places and inundating nearly 470,000 hectares of farmland. It is estimated that if the dikes had held, the flood crest would have been 1.27 meters higher. (33)

Might of the Red River

Such is the might of this great river whose peak discharge rate during the rainy season is twice that of the Nile and the Indus put together and equal to the maximum discharge rate of the Danube. The flooding of nearly two-fifths of the delta’s farmland lowered its water level less than 10 per cent. (34)

The plain over which these enormous masses of water roll every summer is flat, low (never more than 15 meters above sea level, generally much less) and among the most densely populated rural areas in the world with an average density of 621 people per square kilometer (1580 people per square mile). (35) (See Figure 7). In the northwest, including all of the delta above the Red River and west of a line drawn parallel to the western side of Hai Duong province, the main rivers ride on a kind of “alluvial cushion” which spills out over their banks for some way. (36) These natural dikes are broken in many places and they stand two or three meters above the surrounding plain. Because of their modest elevation, the ridges have long been favored as village sites. When they intersect they form enormous basins within
which water tends to collect. It is upon this network of alluvium that the dike system in the northwest is superimposed. Dikes are less frequent here than in other parts of the delta. In the main they are confined to the banks of the major rivers. But they are higher and more massive than to the east, where the river's maximum stages become progressively lower. (Figure 8). Though less densely peopled than other parts of the delta, densities are still very high. As Figure 7 shows, great tracts have more than 500 people per square kilometer (1300 per square mile).

The land abruptly changes character as one moves eastward along the northern bank of the Red River. In contrast to the northwest, where the rivers meander across the plain on top of alluvial ridges, stream beds are now usually slightly lower than the surrounding plain. (38) "The main exception to this are the four fingers of land between the alluvial ridges of the "Canal des Rapides," the Cau River, the Thuong River, the Luc Nam River and the hills of the "Sept Pagodes." This is an area manaced by serious flooding. (39) For if the S. Luc Nam, the S. Thuong, and the S. Cau rise simultaneously, the lowlying basins are invaded and can only drain themselves slowly. "South of the 'detroit' of the 'Sept Pagodes,' the land is also very low (indeed the main part of the eastern delta is less than one meter above sea level). But no obstacle opposes the free flow of the water which drains off through the large and numerous arroyos so easily that this region dreads the floods less." (41) Throughout the area, which is more densely populated than the northwest, there were few dikes during French times.

The Lower Delta

To the south of the Red River and extending all the way from Viet Tri to the sea is the lower delta. It is the most densely populated part of the plain and probably the part which is most vulnerable to serious flooding should the dikes be destroyed. The land is low, but no lower on the average than in the eastern delta north of the Red River. But the area is criss crossed by alluvial ridges and drainage is poor. As a result, when there is flooding here, the water pools because it has no place to go. The most important of the region's basins lies in the province of Ha Dong; (42) Some 880,000 people live within its bounds, cultivating 107,000 hectares. (43) The ridges of the Red River, the Phu Ly canal, and the Day River completely seal it off. The natural embankments of the Day are the highest in
the delta. They stand six meters above sea level while the surrounding basin is only two meters above sea level. (44) Natural drainage is also quite poor in Son Tay province, which lies between the right bank of the Day and the mountains which mark the western border of the delta, and in Ha Nam province, to the east of Ha Dong. All told, perhaps two-thirds of the cultivated land south of the Red River is contained in low-lying basins in which water naturally tends to collect. (Figure 9). In 1960 some 1,740,000 people lived in these provinces. The figure is probably well above 2 million today. (45)

Dikes at Hanoi

The capital city of Hanoi and the provinces of Hung Yen and Bac Ninh on the north bank of the Red River occupy intermediary positions. Both Hung Yen and Bac Ninh are quite low. Elevations range from 1 to 4 meters above sea level and from 2 to 4 meters above sea level respectively. The southern part of Hung Yen is especially vulnerable to destruction of its dikes. Here the land is only 1 to 2 meters above sea level and the Red River can rise above 7 meters in the rainy season. Still, natural drainage in this area is much better than in the great basins to the south. Some 1,171,400 people lived in the two provinces in 1960. The number is closer to one and one-half million today.

Hanoi itself stands on an alluvial ridge 6 meters above sea level. But parts of it are only 4 meters above sea level. And as noted above the Red River often crests here during the rainy season at 10 or 11 meters. Were the dikes to give way at their base during one of these periods, a wall of water 15 feet high could roar through the streets of Hanoi. Its population in 1960 was 643,000. According to recent reports, 80 per cent of its people have been evacuated. One or two hundred thousand have remained behind. (46)

All of this should be made much clearer by the set of five cross-sectional maps of the delta (Figures 11 to 15). Each of them is keyed into Figure 10 and the large fold-out map of the delta. Taken together they provide a detailed look at the relative heights of the dikes and the surrounding land throughout the delta. Figure 16 and 17 distinguish between large dikes (between 4 and 8 meters high) and small (between 2.5 and 4 meters high) and should provide convenient overviews. Table 1 supplies some of this information for a number of cities and towns in the delta. It gives their heights above sea level,
### TABLE 1.

Heights above sea level of dikes, high water marks during rainy season, and selected towns and cities in the Red River delta. Unless otherwise noted the towns are right next to the dikes and rivers indicated. (From Figures 11-15).

<table>
<thead>
<tr>
<th>Town</th>
<th>Height of dikes</th>
<th>Highest recorded water level during wet season (a)</th>
<th>Elevation of town</th>
<th>Maximum height of water above adjacent town</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northwest delta</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ha Dong</td>
<td>10.64 (b)</td>
<td>9.50 (Day River)</td>
<td>6.20</td>
<td>3.3</td>
</tr>
<tr>
<td>Hanoi (c)</td>
<td>13.50</td>
<td>11.93 (Red River)</td>
<td>8.00</td>
<td>3.93</td>
</tr>
<tr>
<td>Bac Ninh</td>
<td>7.00</td>
<td>6.26 (Cau River)</td>
<td>3.00</td>
<td>3.26</td>
</tr>
<tr>
<td><strong>Central delta</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phu Ly</td>
<td>5.04</td>
<td>4.04 (Day River)</td>
<td>2.10</td>
<td>1.94</td>
</tr>
<tr>
<td>Hung Yen</td>
<td>8.48</td>
<td>7.18 (Red River)</td>
<td>2.50</td>
<td>4.98</td>
</tr>
<tr>
<td>Hai Duong</td>
<td>none (d)</td>
<td>2.90 (Thai Binh R.)</td>
<td>2.60</td>
<td>.40</td>
</tr>
<tr>
<td><strong>Eastern delta</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ninh Binh</td>
<td>2.70</td>
<td>2.20 (Day River)</td>
<td>1.00</td>
<td>1.20</td>
</tr>
<tr>
<td>Nam Dinh</td>
<td>5.90</td>
<td>4.60 (Red River)</td>
<td>1.80</td>
<td>2.80</td>
</tr>
<tr>
<td>Haiphong</td>
<td>2.90</td>
<td>1.90 (Mouth of the Nam Trieu R.)</td>
<td>1.50</td>
<td>.40</td>
</tr>
<tr>
<td><strong>West to East traverse of delta</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viet Tri</td>
<td>16.45</td>
<td>15.45 (Red River)</td>
<td>13.00</td>
<td>2.45</td>
</tr>
<tr>
<td>Hanoi</td>
<td>13.50</td>
<td>11.93 (Red River)</td>
<td>8.00</td>
<td>3.93</td>
</tr>
<tr>
<td>Ninh Giang</td>
<td>3.22</td>
<td>2.22 (“Canal des Bambous”)</td>
<td>1.50</td>
<td>.72</td>
</tr>
<tr>
<td><strong>North to south traverse of delta</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phuc Yen</td>
<td>14.21 (9.33) (e)</td>
<td>12.91 (Red River)</td>
<td>8.00</td>
<td>4.91</td>
</tr>
<tr>
<td>Ha Dong</td>
<td>14.21 (f)</td>
<td>12.91 (Red River)</td>
<td>6.20</td>
<td>6.71</td>
</tr>
<tr>
<td>Phu Ly</td>
<td>5.04</td>
<td>4.04 (Day River)</td>
<td>2.10</td>
<td>1.94</td>
</tr>
<tr>
<td>Ninh Binh</td>
<td>3.20 (g)</td>
<td>2.20 (Day River)</td>
<td>1.00</td>
<td>1.20</td>
</tr>
</tbody>
</table>

a. As the dike system has been improved, the highest water marks recorded in the delta have crept upward. This is, of course, due to the fact that water which would have spilled out onto the surrounding plains when the dikes were weaker is now being contained—all other things being equal, a given flood crest must.
be higher than in the past to rupture a given number of dikes. For this reason
the high water marks in this table and in figures 11-15 are undoubtedly too low.
To cite only one example: the table says the highest water level ever reached
at Hanoi was 11.93 meters. Actually, the Red River crested well above 12 meters

b. Ha Dong is about 8.5 kilometers northwest of this dike on the Day River.
c. Actually most of Hanoi is 6 meters above sea level and parts are only 4 meters
above sea level. (See note 47).
d. i.e., in 1930 when the transverse maps of the delta were made.
e. Phuc Yen is about 15 kilometers due north of this Red River dike. It is guarded
by a dike just to its south which stands 9.33 meters high.
f. Ha Dong is about 16 kilometers southeast of this section of the Red River dike.
g. Ninh Binh is about 4.5 kilometers north of this part of the Day River dike.
Between it and the dike runs a railroad line. The embankment upon which the
line runs is slightly higher than the dike.

Note also that the maps show Ha Dong to be about 19 kilometers southwest
of where the Red River has stood at 11.93 meters, Bac Ninh to be some 22
kilometers northeast of the Canal des Rapides (10.50 meters), and Phy Ly to
be around 15 kilometers southwest of the Red River at a point where the water
has reached 7.18 meters.

the heights of their dikes and the highest water levels as of 1930
reached by their rivers in the rainy season.

Red River Dams

Now let us turn to the dams and reservoirs and locks which regulate
the water flow of the Red River and its tributaries. As with the water
control systems of the panhandle, our most precise information dates
from French colonial sources. Figure 18 shows where the principal
irrigation and flood control works were in 1938. The four largest of
these are the Cau Son dam on the S. Thuong (irrigating 7,000 hectares
by gravity flow), the Tac Cun dam on the S. Cau (irrigating 25,000
hectares by gravity flow), the Lien San dam on the S. Day north of
the Red River (irrigating 17,000 hectares by gravity flow), and the
Son Tay dam on the Red River (irrigating 10,000 hectares of land
by gravity flow and electric pump). (47) Their storage capacities
are, respectively, something on the order of 77 million, 109 million, 186 million, and 273 million cubic meters. (48)

As for newer dams, we know they exist, but we have not been able to find out very much about them. The Thac Ba dam in the Red River in Yen Bai province was the largest dam under construction in North Vietnam in the middle 1960's. The Suoi Hai reservoir in Ha Tay province is one of the largest dams in the country. (49) As for the rest, the names of some of them are given in Appendix II. We do know that most new dams hold only 5 to 7 million cubic meters of water. (50) There are, however, "a number" with storage capacities of from 10 to 300 million cubic meters. (51) This is enough to irrigate about 770 to 19,000 hectares of land and spread a sheet of water a meter thick over 1000 to 30,000 hectares. (52) Presumably, the Thac Ba and Suoi Hai reservoirs fall at the upper end of this range.

Despite the paucity of data about new dams, we do not think that we have overlooked too many of them. Indeed, if the Pentagon Papers are any guide, there are only seven or eight "worth" targeting for possible destruction in all of North Vietnam. (53)

Electric Pumping Stations

Finally, we must mention the network of 600 electric pumping stations, large and small, which are the armatures of all the irrigation and drainage systems in the lowlands and midlands. (54) "The pride and joy of the new regime," they are extraordinarily vulnerable to air attack because of their dependence upon the electrical grid. (55) Indeed, even in 1969, more than a year and a half after the end of the unconditional air war, difficulties were being encountered in supplying electricity to the network. (56) We shall go into the matter of irrigation and drainage more closely when we take up the matter of weather control. For the present, suffice it to note that without the pumping stations, the task of minimizing the effects of flooding is made vastly more difficult.

What conclusions can we draw from this brief survey? First, while no part of the delta would be immune from flooding should its dike system be seriously damaged, mass drownings are far more likely in certain areas than in others. The most vulnerable regions of all are the great basins south of the Red River and the spits of land which
parallel the banks of the "Canal des Rapides," the S. Cau, the S. Thuong, and the S. Luc Nam. Figures 11 and 12 make clear why this is so. On the one hand--as is the case throughout much of the delta--the high water mark of the nearby rivers is some 4 to 5 meters above the surrounding land. On the other, there are no natural drainage routes for water trapped in these basins. As a result, deep flooding in a relatively short time is possible. Moreover, both areas stand downstream from important dams. Rupture of the dams on the S. Thuong and S. Cau during the rainy season would imperil the basins north of the "Canal des Rapides." Breaching the dams on the S. Day and the Red River at Son Tay would imperil Hanoi and the great basins to the south. In these areas live well over two million people.

Flood Records

Yet another clue of what is in store for the Red River delta, if its most vulnerable areas are bombed comes from the records of actual floods. The five worst in this century occurred in 1913, flooding 477,000 hectares; 1915, flooding 365,000 hectares; 1926, 145,000 hectares; 1945, 250,000 hectares; and 1971, 450,000 hectares. (57) Of these, both the area south of the Red River and north of the "Canal des Rapides" were badly hit in two floods, those of 1913 and 1915, while the region between the north bank of the Red River and the "Canal des Rapides" suffered greatly in a third flood in 1926. The flood of 1915 was especially severe. It is estimated that half of the Red River's waters were diverted onto the surrounding plain by breaches in the dikes. (58) In all, something like 40 billion cubic meters of water rolled across the plain, of which about 26 billion cubic meters were concentrated in the region south of the Red River (59). During the height of the flooding—which was at its peak between July 11 and July 27 but persisted well into October—the average level of the flood waters above the land south of the Red River was 2 meters in the northern part of the Ha Dong basin, 4 meters in the southern part, 2.5 meters and 2.0 meters in the basins of Binh Luc and Nam Dinh, and 2.0 and 1.5 meters in the Ninh Binh basin. (60)

Here is how the official report of the flood described the situation in the southern part of Ha Dong province:
The condition of the inhabitants was especially critical in the south of the Ha Dong basin, where the fields are only 2 meters above sea-level while the flood waters were 6 meters above sea level. ... [Here] the inhabitants had no other recourse than to seek refuge on roofs and rafts when there was no dike nearby, and they had lived in this precarious way for 4 months. In spite of this, there were few deaths. But much of the livestock and all of the barnyard animals were destroyed, as were all of the fruit trees. Most of the grain reserves were also submerged. As a result of these losses, many inhabitants emigrated to neighboring provinces which had not been flooded, there to seek work and to try to live until the end of the flood. (61)

Yet another writer describes the situation this way:

The flood was disastrous in the Ha Dong basin. There, the breaching of the [dikes at] Lien Mac resulted in the discharge of an enormous volume of water estimated at 6,400 cubic meters per second ... 103,000 hectares out of 107,000 hectares were flooded. The waters reached 6 meters above sea level in the southern part of the basin ... [every part of which] is less than 2 meters above sea level, completely submerging all the villages ...

When the waters retreated, the entire countryside between Lien Mac and the Son Tay road "presented the aspect ... of desert dunes where, except for the half ruined villages, nothing indicated the hand of man: roads, streams, hollows, everything had been made plain; and, on these waste, desolate expanses, not a single blade of grass, not a single tree or tombstone, not a single sign of life." The relief of the area had been so gravely modified that the [official] map ... of the region had to be remade ...

The flood left behind the breaches at Lien Mac a band more than 2 kilometers wide of infertile sand, a one kilometer wide band of poor sandy soil, then a layer of rich alluvial silt which grew thinner and thinner the further one went from the site of the ruptures. (62)

Figures 19 and 20 show the extent of the floods in 1913 and 1915. Unfortunately, we have not been able to find any detailed
Pentagon Papers

But perhaps the best clue of all about the effects of an all-out attack on the dikes and dams comes from the Pentagon Papers. Buried in a discussion of North Vietnam’s probable import capacity after the mining of its ports is an estimate of the amount of rice which it would have to import were its dikes and irrigation dams specifically targeted for destruction. (63) Using this figure—220,000 to 920,000 metric tons of rice—we can derive 160,000 to 685,000 hectares as the amount of riceland which the war planners envisaged flooding. (64) Now, bearing in mind that the farmers who till this land live nearby—sometimes in villages built on low alluvial ridges, sometimes in villages at the same level as their fields—we can make a rough estimate of the number of people who would stand in danger of drowning if the dikes were destroyed without warning. For all we need to do is to multiply the average population density of the delta—621 per square kilometer—by the area of the land affected by flooding. To be sure, when we do this, the high end of our estimate must include areas in which the river level is not great enough to threaten human life (for the high estimate involved about half the arable land of the delta.) Still, it is a sobering exercise. For when we do it, we see that the war planners had in mind flooding an area containing from 1 million to 4.25 million souls. And this is over and beyond the hundreds of thousands of people who would be affected if the Red River dikes protecting Hanoi were destroyed.

But, of course, as the President said on April 30, 1972, the system of dikes and dams is “a strategic target and indirectly a military target.”
Figure 1a.

The North Vietnamese Panhandle

Scale 1:5,000,000

Légende

- Limites de province
- Capitale
- chef-lieu de province

THANH-HOA Nom de province
Figure 1b.

Main Rivers of the North Vietnamese Panhandle

Scale 1/3,000,000
Figure 2a. The Red River and Surrounding Regions

Boundary of rice-growing area (1932)
Figure 2b. The Red River Delta and Surrounding Regions—Relief (in meters)

from Bouault and Lataste
Figure 3. Area of Red River delta flooded each year if there were no dikes

- a. Regions not protected by dikes flooded during each period of high water
- b. Regions protected by dikes which would be flooded in case of a rupture
- c. Railroad

From Normandin 1924
Figure 4. Political Divisions, Relief, and Rainfall in North Vietnam

INDEX TO PROVINCES

1. HA GIANG  15. QUANG NINH
2. CAO BANG  16. HAI DUONG
3. TUYEN QUANG  17. HUONG YEN
4. BAC CAN  18. HA DONG
5. THAI NGUYEN  19. SON TAY
6. LANG SON  20. HOA BINH
7. LAI CHAU  21. HA NAM
8. SON LA  22. THAI BINH
9. NGOIA LO  23. NAM Dinh
10. LAO CAI  24. BINH BINH
11. YEN BAI  25. THANH HOA
12. PHU THO  26. NGHE AN
13. YEN BAI  27. HA TINH
14. HA BAC  28. QUANG BINH

LAOS

NORTH VIETNAM

--- International boundary
--- Province boundary
© National capital

ELEVATION

METERS
3000 and over
1000
900
800
600
400
328
0

FEET
9842 and over
3281
1640
1000
0

KEY

AV. MONTHLY TEMPERATURE
AV. MONTHLY PRECIPITATION

Figures below charts show average annual precipitation in inches

from U.S. Dept. of Agriculture, 1965
Figure 6. Discharge of Red River, "Canal des Rapides," and River Day as Function of Height of Red River at Hanoi (cubic meters per second)
Figure 7. Population Densities of the Red River Delta

- Average (400-599/km²)
- Below average (less than 400/km²)
- Above average (600/km²+)

The average density of the delta in 1960 was 621/km². See Appendix Four for densities of North Vietnam provinces.
Figure 8. Level of Red River Throughout Delta
When It Is 11.5 meters High at Hanoi

from Gourou, (1936)
Figure 9. Areas in Red River Delta With Naturally Poor Drainage

from Gourou (1936)

- June harvest only during French period
- November harvest only during French period (good drainage)
- June and November harvest during French period (adequate drainage)
Figure 10. Key Map for Horizontal Traverses of Delta (Figures 11-15)

Legend:
(a) Limites des zones du Delta
(b) Limites de l'influence des marées sur le niveau des fleuves en saison sèche et en saison de crue.
(c) Limites des eaux aquatiques en saison sèche.
(d) Tracés des différents profils en travers du Delta (Planches III et IV et V)
(e) Superficies des zones du Delta

| Zone Nord                 | 180,000 km² |
| Zone de moyen Delta       | 340,000 km² |
| Zone Sud-Ouest            | 90,000 km²  |
| Zone maritime             | 144,000 km² |
| Total                     | 1,154,000 km² |

Echelle 1:400,000

- a. Outlines of different regions of delta
- b. Furthest extent of influence of sea on river level during the dry and wet seasons
- c. Limit of salt water penetration—dry season
- d. Tracks of traverses of delta followed by Figures 11-15
- e. Area of different zones of delta
- f. Figure 11 from Pouvayin (1931)
- g. Figure 12
- h. Figure 13
- i. Figure 14
- j. Figure 15
Figure 11. Cross-Section of Delta From Ha Dong to Bac Ninh By Way of Hanoi

P.H.E. = Highest recorded water level
Etage = Low water mark during dry season
Mamelons = Hills
All heights in meters above sea level

from Pouvain (1931)
Figure 12. Cross-Section of Delta From Phu Ly to Hai Duong By Way of Hung Yen

from Pouvayin (1931)
Figure 13. Cross-Section of Delta From Ninh Binh to Haiphong By Way of Nam Dinh

from Pouvevin (1931)
Figure 14. Cross-Section of Delta From Vietri to Ninh Giang By Way of Hanoi

PROFIL EN TRAVERS DU DELTA DE VIETRI A NINH-GIANG PAR HANOI

Echelle: 1 cm = 1 km
Figure 15. Cross-Section of Delta From Phuc Yen to Phat Diem By Means of Phu Ly

PROFIL EN TRAVERS DU DELTA DE PHUC-YEN A PHAT-DIEM PAR PHU-LY

Echelle: 1 cm = 1 kilomètre from Poueyin (1931)
Figure 16. Bird’s-Eye View of Dikes of the Red River Delta

1 = Important dikes 2 = Minor dikes

from Gourau (1936)
Figure 17. Primary, Secondary, and Tertiary Dike Systems in the Red River Delta

(a) Primary network
(b) Secondary network
(c) Flood containment dikes
(d) Tertiary network
(e) Sea levees
(f) Roads in the neighborhood of the dike networks

from Gauthier (1930)
Legend:

(a) Ouvrages d'art principaux construits
(b) Ouvrages d'art principaux à construire
(c) Noms des provinces
(d) Noms des localités

Echelle 1:500,000

a. Hydraulic works already constructed
b. Hydraulic works to be constructed
c. Names of provincial capitals
d. Names of other towns

Barrage or barge = dam
Usine de pompage = pumping station

from Bigorgne (1938)
a. Dikes
b. Roads
c. Flooded areas which were replanted with rice
d. Flooded which could not be replanted with rice
Figure 20. Regions Flooded in 1915 Which Had No November Harvest.
III. THE PROSPECTS FOR WIDESPREAD FAMINE

SO FAR we have implicitly assumed that the only consequence of bombing the dikes would be mass drowning. But there is also the danger of mass starvation.

In order to see why, we must first examine the effects on North Vietnam’s agriculture of U.S. bombing raids during the Johnson phase of the war. From independent news sources we know that the dike system was a fairly frequent object of attack during this period. Thus on September 8, 1967 the following AP dispatch by Amando Doronila of the *Manila Times* appeared in the New England edition of the *Christian Science Monitor*:

NINH BINH, North Vietnam—Dikes in the fertile Red River delta—North Vietnam’s rice basket—have come under increasing air attack lately.

The American bombing appears intended not only to demoralize and harass the population in the most densely populated region of the country, but also to destroy the rice crops in the vast alluvial plains with their vulnerable open spaces.

But the great dike system near Hanoi and Haiphong, built over a hundred years ago to shield these cities from floods and divert the flood-waters to irrigate fields, has been reported to have been attacked only lightly. And the bombing of dikes in Hanoi was connected with the strikes at the Paul Doumier Bridge Aug. 11-12.

Any destruction of these major dikes is regarded here as liable to have serious international political complications, and Americans have so far withheld their heavy air blows from these targets.
But here in the delta region, whose paddy fields provide the bulk of the rice supply of 17 million North Vietnamese, there have been almost daily attacks on dikes along the numerous small confluences of the Red River which empties into the Tonkin Gulf.

One particular dike we visited recently in Gia Ninh village, district of Gia Vien, was bombed Aug. 27. Eight 500-pound bombs were dropped and three left a 20-foot breach in the dike.

The breaching of the dike flooded a small village and the rice crop 9.8 feet below the water level at a time when rains were heavy.

When we arrived at the bombed spots, accessible by a 30-minute ride by flatboat, repair crews from the village population, mostly women, were filling the breaches with mud and rocks from the river. At the same time they were digging trenches to protect themselves from possible raids.

The pattern of bombing in the delta seems evident—to interdict agricultural production. No military targets are visible in the dikes. The heaviest artillery pieces we saw were antiquated rifles of the peasant militia. (1)

And about a month and a half earlier an Agence France Press dispatch by Bernard-Joseph Cubanes in Le Monde described an attack on a dike 100 miles northwest of Hanoi in Lam Thao district, Phu Thi province:

... Newsmen were taken to see the effects of the July 13 attack against the dike on the left bank of the Red River. Reporters were able to determine that four bombs had gouged out four craters five meters deep and twelve meters across in the dike. Other bombs had fallen on nearby rice fields. During the course of the attack, a church in the area was destroyed. Fifteen houses were also destroyed, but they had been abandoned since the preceding year. Eye witnesses said that the bombardment had been carried out by twelve F-105s.
At present, the Red River is not high enough to reach the damaged part of the dike. Nonetheless, according to the vice-minister [of waterworks] the attacks on the dikes are intended to weaken them so that they will give way during periods of high water...\(2\)

And still earlier, in January of 1967 Harrison Salisbury reported that he saw bombed dikes in the province of Nam Dinh.

Although American authorities insisted that dikes and water control works had never been listed as targets, the evidence in the Phatdiem region (as in the Namdinh region) was that bombs repeatedly fell on such works. What was the explanation for that? Was it nothing but one accident piled on top of another all over North Vietnam? I would not expect anyone in North Vietnam to believe that. The Pentagon claimed that we had perfected an incredibly accurate bombing technique. But we could not have it both ways. Either we could not control the placement of our bombs or we were bombing civilian targets, possibly on the faulty assumption that they were military. \(3\)

Then too, there are the numerous depositions made before the Russell War Crimes Tribunal by Tribunal investigating teams:

\[\ldots\] The bombs used for the destruction of dikes were of about 1,500 kg, and combined with the use of ball bombs. If the destruction of dikes alone was intended, then demolition bombs would have sufficed; but ball bombs, the exclusive purpose of which is to kill and wound men and beasts, were used in combination. Further, after destroying dikes by bombing, additional bombing was conducted against people engaged in repair work. The dike at Traly, Thai Binh province, was bombed twice in 1967 while it was under repair; 52 bombs were dropped and 32 people were wounded. In Quang Binh province, the tide water control dike was bombed several times, destroying paddy fields of 1,500 hectares. Of late, bombings were carried out against the Vinh Linh area. These are major examples of U.S. bombing. The purpose is to bring about economic difficulties by the destruction of rice crops through flood, and at the same time to kill and wound men and beasts.
The results of the investigation made by the Second Japanese Investigation Team are given below:

(1) On August 13, 1966, the Red River dike in the vicinity of Hanoi was bombed with a 1,350 kg. bomb, producing a bomb crater 12 meters in diameter and 9 meters in depth. Although the water level of the Red River was at its highest at this time, it was quickly repaired and almost no damage was done.

(2) From October 2, 1965 to June 30, 1967, the vicinity of Bac Giang city, Ha Bac province, was bombed 77 times; Bac Giang city was devastated. In the meantime, the dike in the Thuond river was attacked and destroyed by 100 bombs. Although the destroyed parts were quickly repaired, large scale bombing were done even while repairs were going on. At about 1 p.m. on September 7, 1966, four “mother” ball bombs were dropped.

(3) Although the Red River dike that runs through the suburbs of Hai Duong city was destroyed for 15 meters, it had already been repaired. The dike is located in the suburbs far away from Hai Duong city, with no military target at all in the vicinity, only a church. This fact leads to the conclusion that the bombing was for the sole purpose of destroying the dike.

(4) On July 13, 1967, the dike of the Lai Vu river that runs by Ha Thach city, Lami Thau prefecture, Phu Tho province, was bombed by 12 planes. Four bombs hit the dike, and as a result 100 meters were destroyed. A bomb crater 12 meters in diameter and 5 meters in depth resulted. On July 18 the same year Ha Mao was bombed. The investigations of the Japanese team on July 21, showed that there were bomb craters about 15 meters in diameter and 5 meters in depth in 22 places. No bombs had directly hit the dike. It was explained that the height of the dike is about 5 meters and that the water level used to be up to the 4 meter mark at high water. From this, it can easily be seen that the destruction of the dike at high water would bring about serious flood damage. It is also evident that even if the dike itself is not destroyed, destruction in the vicinity of the dike would result in the destruction of the dike because of the nature of the soil in this area which is light and weak in cohesion.

(5) The case of Da Mai dam, Quang Binh province, as told by Mr. Nguyen Hoan, Minister for Water Conservation, is as follows: The Second Japanese Investigation Team visited the ruins of this dam; The dam is situated in the upstream portion of the Zinh river, about a few score kilometers from the sea. Construction was begun in 1965 and was completed on July 5. It supplies water to 2,000 hectares in Bo Truch prefecture. As soon as the water began to run in the channel, it was bombed. The bombing is being carried on sometimes even now.
Commenting on the denunciation of the Foreign Ministry and the Water Conservancy Ministry of the Democratic Republic of Vietnam that “the U.S. forces are carrying on the planned destruction of dikes, killing and wounding the inhabitants, and are trying to destroy food production and transportation,” a U.S. Defense Department spokesman said that “this was done by accident by American pilots and should not in any way be interpreted as intentional” (AP dispatch, July 22). But according to our investigation, the bombing by the U.S. is so accurate that it is inconceivable for places which have no target other than dikes to be bombed by chance. It should therefore be judged that the U.S. forces have carried on bombing purposely to destroy dikes and kill and wound the people repairing them. (4)

And finally, there are the extremely detailed dossiers prepared by the North Vietnamese themselves (see Appendix II).

Mass Drowning Minimal

Now, what is striking about all these reports, the North Vietnamese ones included, is that the great majority of attacks seemed to take place when or where the danger of mass drowning was minimal. Thus, in the Red River delta the damage was concentrated in the east and southeast, where the main effect of flooding would be crop destruction. To the south, in the panhandle, a great many irrigation dams seem to have been bombed. But most of these attacks occurred during the dry season which extends into early August in these areas. All this is made clearer by Figure 21, an earlier version of which was introduced into evidence at the Russell War Crimes Tribunal by the first Japanese Commission of Inquiry. (5) As the map shows, almost all the attacks in 1965-1967 occurred in coastal areas.

Thus, we suspect that the American strategy was deliberately low-key. It sought maximum disruption of the agricultural effort consistent with low publicity. This would be easy to carry off because of the secondary uses to which dikes are put. Often the highest ground for miles around, they are natural places to store goods which might be damaged by flooding. Moreover, as we have seen, in the central and western parts of the delta, the dikes stand on the alluvial deposits which parallel the great rivers, natural places for storage facilities (and villages). And, of course, many roads and railroads cross, run
Figure 21. Dikes and Irrigation Works Hit by U.S. Planes, March, 1965—August, 1967

FROM FOREIGN LANGUAGES PUBLISHING HOUSE, 1968
alongside or even on top of the dikes. In the southern part of the Red River delta, the last kilometer or so of rail line going north into Nam Dinh runs on or next to the main dike on the left bank of the Day River, as does a one and one half kilometer length of track around Phu Ly. Further north, a 40 kilometer stretch heading due south from Hanoi to Nhu Kha stays within one to three kilometers of the right bank of the Red River. In addition, railroad tracks cross major dikes at or near Viet Tri, Bac Ninh, Hai Duong, Hanoi, Ninh Binh, and Phu Lang Thuong. (See Figures 11 and 18).

As for roads, the main highway between Phu Ly and Ninh Binh (a distance of some 20 kilometers) runs next to and crosses the Day River. Other thoroughfares cross important dikes at Viet Tri, Hanoi, Ha Dong, “Sept Pagodes,” and Hai Duong. (Figures 11 and 18). Moreover, smaller roads frequently run along the spines of dikes for considerable distances. (6)

Subterfuge

In fine, merely by ordering the destruction of storage areas and the disruption of the road and rail network, the war planners could insure that many dikes would be hit—a subterfuge which probably explains the numerous attacks against the dike system in the spring of 1972. But in this case, as Harrison Salisbury suggests, it seems reasonable to believe that the bombing of the dikes and the irrigation works during the Johnson years were only part of a much more systematic effort against North Vietnam’s rural economy.

The intensity of the United States attack on the area surprised me, although I could see one explanation for it. Ninhbinh was an important junction point. Ninhbinh and Namdinh were the two principal cities of the mid-south region of North Vietnam. One cause for the repeated attacks in the Phatdiem area might be that Seventh Fleet planes flying to and from missions to Ninhbinh and Namdinh must traverse this farming community. It was possible that the United States planes jettisoned leftover bombs on the way back from missions or exhausted their rocket stocks over this area. Or possibly planes which had difficulty in returning to base might lighten their loads in the Phatdiem area. There were antiaircraft installations in this region to protect the approaches to Ninhbinh and Namdinh and no doubt the Americans attacked them on occasion.

Yet when all this had been taken into account, the fact remained that an astonishing amount of high explosives was
falling on a simple, quiet, rice-growing area. And when this was taken into consideration, it was no wonder that North Vietnam’s agricultural output had declined, with all the dangerous consequences for the prosecution of the war which that implied. Peasants could not be expected to turn out as much rice if their villages were being attacked and if they were constantly being called out by the local authorities to assist in repairing bombed-out roads and railroads.

The United States, I understood, estimated that the equivalent of 300,000 people had been diverted to maintenance work. I wondered whether the figure might not be higher. Not in the form of permanent stand-by crews but in terms of occasionally-diverted labor.

I rode back through the night to Hanoi—deeply troubled. The New Year’s truce had ended. Already the bombing and the fighting had begun again. I had seen towns and cities savagely damaged by the American air offensive. But, perhaps in a way, the punishment to the rural community was even more serious. It had a deeper effect than anything else on the war potential of North Vietnam, although I had never heard this mentioned by the Pentagon strategists. By forcing a diversion of manpower from agriculture to other tasks, our bombing had severely affected North Vietnam’s capacity for feeding itself—a serious handicap to a nation at war.

But, by what means had this been accomplished? In part, of course, by bombardment of means of transport and the diversion of labor to maintenance work. But this was not the whole story. There were the thousands of tons of bombs that fell on the countryside, on the fields, on the villages, on the peasant huts; on the peasants in the fields and on the roads.

Accidents, all accidents. This was our version. This might well be the literal truth. But how to make it credible to the peasants of North Vietnam? (7)

And indeed, whatever the war planners’ original hopes, they concluded that the “main effects of the bombing of N.V. had been indirect,” including “a reduction in agricultural output and the catch...” (8)

How effective was this strategy against North Vietnam’s agriculture? If the Pentagon Papers and the Kissinger Memo (NSSM-1) are any guide, it was very effective. In 1966 North Vietnam imported 77,000 metric tons of food. (9) A year later it imported 450,000 metric tons and the rice harvest was estimated to be 500,000 metric
tons less than normal. The harvest was as bad or worse in 1968, and North Vietnam imported 700,000 metric tons of rice. (10) Wheat flour, which has the same caloric value weight for weight as milled rice, accounted for the great bulk of these imports. (11) These are very considerable quantities of food—just how considerable can be seen from *Table 2*, in which we have set out the amount of rice land necessary to produce the corresponding amounts of milled rice. (12)

**Table 2.**

**EFFECT OF US BOMBING 1966-1968 ON FOOD PRODUCTION**

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports (in metric tons)</th>
<th>Equivalent in unmilled rice (paddy) in metric tons</th>
<th>Land needed to grow this much rice (in hectares)</th>
<th>Imports as % of total food crops tonnage in normal year (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>77,000</td>
<td>118,000</td>
<td>63,000</td>
<td>2.1%</td>
</tr>
<tr>
<td>1967</td>
<td>450,000</td>
<td>695,000</td>
<td>370,000</td>
<td>12.5%</td>
</tr>
<tr>
<td>1968</td>
<td>700,000</td>
<td>1,080,000</td>
<td>575,000</td>
<td>18.9%</td>
</tr>
</tbody>
</table>

a. When tonnage for all non rice crops is converted into its equivalent in unmilled rice. (About 75 per cent of all North Vietnam’s food crop is still rice.)

With this background in mind, let us once more consider the Defense Department’s own estimate of how much more rice would be destroyed if the dikes were specifically targeted for destruction. That estimate was an additional 220,000 to 920,000 metric tons a year which would have to be imported. As we saw in Chapter 2, this is equivalent to 340,000 to 1,400,000 metric tons of paddy or from 11 per cent to 48 per cent of the November rice crop, and implies the flash flooding of from 160,000 to 685,000 hectares of rice land. (13)

Now let us make one of those worst case analyses so beloved by Mr. Laird and the Pentagon: Suppose that sometime this summer or fall the dikes, the locks and the sea levels are attacked en mass. And also suppose that 1) the general level of bombing is as deadly as it was in 1967 and 1968; 2) North Vietnam cannot make good its losses from stored stocks; and 3) the U.S. is able to prevent any food shipments from reaching North Vietnam. Then, assuming that
the ensuing rice deficit could be spread out evenly through the year, would the North Vietnamese still have enough to eat? Table 3 summarizes this hypothetical situation.

**TABLE 3.**

<table>
<thead>
<tr>
<th></th>
<th>minimum</th>
<th>maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>From general bombing</td>
<td>450,000</td>
<td>700,000</td>
</tr>
<tr>
<td>From destroying</td>
<td>220,000</td>
<td>920,000</td>
</tr>
<tr>
<td>the dikes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>670,000</td>
<td>1,620,000</td>
</tr>
<tr>
<td><strong>Total deficit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>expressed as paddy</td>
<td>1,030,000</td>
<td>2,500,000</td>
</tr>
<tr>
<td><strong>Total deficit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>expressed as % of foodcrop in a good year (1962)</td>
<td>18%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Clearly, this is an enormous amount of rice. But how can we go from these figures to an idea, however crude, of the impact of such a deficit on the North Vietnamese diet? Fortunately, once more the Pentagon Papers come to our aid. Buried deep within its fourth volume is the following passage:

... the estimated North Vietnamese daily intake of calories has fallen from 1,910 in 1963 to 1,880 in 1967. The North Vietnamese are not badly off by past North Vietnamese standards or by the standards of other Asian countries. (14)

Using the second of these figures (that for 1967), along with a figure for North Vietnam's 1968 population, and knowing the caloric weight of rice, we can arrive at a rough estimate of what would happen if North Vietnam could not import what she needed in our worst case situation. Table 4 sets all this out. (15)
TABLE 4.
AVERAGE DAILY CALORIC INTAKE IN NORTH VIETNAM
IF IT CANNOT MAKE GOOD ITS LOSSES FROM GENERAL
BOMBING AND FROM THE DESTRUCTION OF THE DIKES

<table>
<thead>
<tr>
<th>Condition</th>
<th>Calories per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficit from general bombing not made good</td>
<td>1515 to 1645</td>
</tr>
<tr>
<td>Deficit from destruction of dikes not made good</td>
<td>1400 to 1765</td>
</tr>
<tr>
<td>Deficit from both general bombing and destruction of dikes not made good</td>
<td>1035 to 1530</td>
</tr>
</tbody>
</table>

Thus, we see that according to the war planners' own estimates, the destruction of the dikes—when superimposed upon a bombing campaign as ferocious as that of 1967-1968—could result in a lowering of the daily per capita ration to 1035 to 1530 calories. The lower end of our scale represents barely more than half (57 per cent) of North Vietnam's minimum daily caloric intake. (16) The upper end is scarcely more than three-fourths of this value (85 per cent). Table 5, taken from the standard work on starvation, provides a very rough idea (plus or minus 50 per cent) of the loss of body weight which usually ensues from such restricted diets. (17)

TABLE 5.
BODY WEIGHT LOSS (IN PER CENT OF ORIGINAL WEIGHT)
AS FUNCTION OF REDUCTION IN DIET (EXPRESSED AS PER CENT OF MINIMUM CALORIC INTAKE NECESSARY TO MAINTAIN NORMAL BODY WEIGHT)

<table>
<thead>
<tr>
<th>Duration</th>
<th>90%</th>
<th>80%</th>
<th>70%</th>
<th>60%</th>
<th>50%</th>
<th>40%</th>
<th>30%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>6 months</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>12 months or more</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>...</td>
</tr>
</tbody>
</table>

Thus, one might expect body weight losses after a year on the order of 6 to 18 per cent for our high estimate of caloric intake and 13 to 37 per cent for our low estimate of caloric intake.