The Collections Survey in the Federal Archives and Manuscript Divisions of the Public Archives of Canada: A Progress Report on Conservation Programme Planning

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Introduction

In 1983 the senior administration of the Public Archives of Canada identified as a priority the development of a rational, department-wide conservation programme by 1987. A prerequisite for an integrated, long-term programme was accurate description of the physical condition of the archival collections in the PAC's custody. While evaluations of the conservation requirements of these collections had been made previously, archivists had never attempted to apply to this task a statistically sound methodology. Use of such a methodology would not only produce defensible data on the condition of the various media held in the PAC, but also permit, for the purpose of allocating resources, comparison of conservation requirements among the media divisions in the Archives Branch of the PAC.

The Archives Branch Conservation Committee was directed in the fall of 1983 to develop a methodology and apply it systematically in a survey of the branch's holdings. The committee quickly established the primary criteria: the survey was to judge both restoration and copying needs for all media (although the Machine Readable Archives Division later withdrew because it had an ongoing copying programme for magnetic tapes already in place); the survey was to be based on clearly observable physical characteristics such as those used presently by curators when requesting conservation assistance for their collections; the survey was to be in the form of a statistically valid sample; and the services of a professional statistician were to be employed in order to ensure the defensibility of the final product. A report on the survey's findings, converted as required into operational planning figures, was to be submitted for approval to the Archives Branch Management Committee, then sent on to the technical branches of the PAC so that the department's capacity to meet the identified restoration and copying requirements might be determined. It was presumed from the beginning that there would be a large gap between the conservation requirements pinpointed by the collections survey and the present resources of the PAC. A further report combining the findings of the collections survey and evaluating the restoration and copying capabilities of the PAC as well as justifying requests for additional resources will be prepared.

* The views expressed in this article are those of the authors and not necessarily those of the Public Archives of Canada.

Because of space limitations, this report focuses only on the collections survey in the Federal Archives and Manuscript Divisions. The Canadian government records in the former and private manuscripts in the latter, because of their similarity in age and paper type, may almost be treated as a unit. In fact, the survey methodology for the textual holdings of these two divisions was virtually identical. We shall outline briefly the methodology, analyze in some depth the findings of the survey, and describe the implications of these findings for the two divisions and for the Public Archives of Canada.

Methodology

To ensure precise findings, a systematic sampling of the holdings was made. A sample of appropriate size was chosen for each division: 1,133 samples of government records and 733 of manuscript material. Each sample was a one-inch cluster of documents which was selected on a lineal basis. Randomness was assured by choosing a random start point in the different stack areas surveyed. Samples of Federal Archives material were selected every twenty-six metres on the first pass. Since too few samples were obtained in this manner, the records were selected again at an interval of eighty-three metres. In addition, more intensive sampling at an interval of six metres was done in certain storage locations where it was suspected that a bad micro-environment might be causing a higher than normal rate of deterioration. The samples isolated as a result of the application of the above three survey intervals totalled 1133. For manuscript material the survey interval was one inch every fifteen metres.

Each sheet in each cluster was then examined by an archivist and the following information was recorded on a work sheet: the age of the material, general description (such as correspondence, spiked files, scrapbook, and letterpress letterbooks), environment (i.e. storage area), presence of other media (such as photographs, maps, and newspaper clippings), use rate during the previous five years, and condition. Within each one-inch cluster, three sheets were selected at random for further testing by conservators who recorded the paper type and pH level.

The most important element in the survey was the report on the physical condition of the material. Every effort was made to ensure the consistency of categorization by establishing simple yet precise criteria for categories and by having a small and experienced group of persons carry out the examination of documents.

Category I represented material in the immediate treatment category. Its condition was manifestly so poor that further use seriously risked damage or loss either to the document itself or to the text. The factors indicating that the physical integrity of the page was at risk were visible weakening from mould action, very brittle paper, as evidenced by fragmentation or breaking along folds, and major tears (i.e. more than two inches in length). Even if the entire page was not at risk, certain factors might endanger the text: mould, brittleness, or mutilation in the vicinity of the text; faded inks; or water damage to the text.

Category II included documents which had suffered damage which was visible but not sufficiently severe to risk loss of text or document. For example, there might be slight mould action or minor tears or mutilation which produced merely local damage. In these cases, neither the sheet nor the text was at immediate risk.

Category III documents showed no evidence of damage or deterioration. Category IV contained those documents which had been restored or copied or both. This was a non-exclusive category, in that its items were also counted in one of the other categories.

In addition to classifying documents according to their physical condition, the teams assessed the importance of those in categories I and II by designating them either for copying or restoration. Those picked for restoration had to be of sufficiently high intrinsic value that mere preservation of the information was not enough: the original had to survive. If the damaged items did not qualify for restoration, it was assumed that they should at least be copied in order to preserve their information. In making these choices about both condition and value, the survey attempted to deal with the documents in as realistic a fashion as possible. The goal was to evaluate them in the same manner as they would be judged by archivists in their daily work.

A secondary purpose of the survey, in addition to obtaining objective evidence about the condition of our holdings, was to test a number of curatorial hypotheses. Although we felt some doubt that there would be sufficient evidence to test fully all the hypotheses, it was decided to try them all, since the data existed and need only be manipulated. The following hypotheses were tested:

1. There is a difference in the condition of the sheets among locations.
2. There is a difference in the condition of the sheets among chronological periods.
3. There is a difference in the condition of the sheets among usage levels.
4. There is a difference in the acidity level of the sheets among locations.
5. There is a difference in the acidity level of the sheets among chronological periods.
6. There is a difference in the acidity level of the sheets among usage levels.
7. There is a difference in the condition of the sheets among acidity levels.
8. There is a difference in acidity level among paper types.
9. There is a difference in the condition of the sheets among record groups.
10. There is a difference in the acidity level of the sheets among record groups.
11. There is a difference in the usage level of the sheets among record groups.
12. There is a difference in usage levels among chronological periods.

Findings — Hypotheses

Certain of the hypotheses were not established by the survey evidence. One of the most surprising results was that no difference was detected in the condition of sheets, despite their location (hypothesis 1). Expressed another way, it appeared that the quality of the storage environment did not matter. However, it was discovered during the survey that extensive relocation of collections had recently taken place in the stack area in question; thus reliable evidence could not be obtained. A second point worth noting was that the documents in this most unsuitable storage area had been there for only a few years, a period almost certainly too brief for higher rates of deterioration to have produced easily *visible* results. We remain convinced that good environmental conditions will add significantly to the life-span of collections. Because environment is one of the conservation

factors which is relatively easy to control, archivists should always give it their close attention.

The fact that there was no detectable difference in condition between documents in the high and low use categories (hypothesis 3) was an anomaly due to category definition. The rates of use were so low and the differences between the low (0-1) and high (4 or more) use categories so small, that no difference in condition should have been expected.

The failure to detect any difference in condition among acidity levels (hypothesis 7) is another apparent paradox. This survey finding seems to say that there appears to be no correlation between the level of acidity in documents and their condition. In fact, the differences in pH levels were generally too small to affect significantly the rate at which damage occurs. All the papers were found to be very acidic, so that other factors would have to account for most of the variation in condition.

Two minor findings of the survey were that there was no difference in the acidity level of the sheets between usage levels (hypothesis 6) and that there was no difference in usage levels among chronological periods (hypothesis 12).

Seven hypotheses were established by the survey evidence. That there is a difference in the condition of documents in different chronological periods (hypothesis 2) was a fairly obvious finding, one fully in accord with daily experience. (These results are discussed in greater detail in the section below on the data in figure 1.)

The detection of differences in acidity levels in government records according to location (hypothesis 4) was unexpected. This difference is not likely due to environment, but to the nature of the collections stored in the different locations. In the first place, the differences in acidity levels among storage areas were too small to be significant. The overall variation in mean pH was from 3.93 to 4.43; within the same building/floor it varied from 3.93 to 4.21. We also know, for example, that there is not a random distribution in the storage areas of paper by chronological period or type, because series or entire record groups tend to be stored together. In fact, the Federal Archives Division keeps some of its most fragile records in the main building, where the environment is best.

The differences in the acidity levels of documents from different periods (hypothesis 5) and from different record groups (hypothesis 10) were findings of minor importance. Because acidity was present at a serious level (mean pH ranged only from 4.0 to 4.6) and was widespread, the survey merely identified different degrees of badness.

Not surprisingly, the survey uncovered differences in the acidity levels of different paper types (hypothesis 8). The lowest pH readings were found in newsprint (3.36), while the highest readings (5.04) were on coated photocopy paper. It is likely that these unusually high readings were due to the presence of alkaline compounds which had been added to enhance the photocopying processes, as well as to the difficulty in getting accurate readings through the thick coating in the time allowed for this type of pH test.

Some difference was found in the condition among record groups (hypothesis 9). Higher rates of damage were detected in Record Group 10 (Indian Affairs), RG 24 (National Defence), and RG 76 (Immigration Branch). The two most likely explanations of these findings are the handling of the documents in the departments prior to transfer and the high rate of use which they have been subjected to in the past two decades by researchers in the Public Archives.

The survey also found small differences in usage levels among record groups (hypothesis 11). Given the low rates of use for all usage categories, this result was considered unimportant.

Findings

The tables in this report, which are discussed in the following section, are taken from the statistical information provided for this study by Bureau of Management Consulting. It should be noted, though, that they have been simplified for presentation here. For example, we have omitted such features as the expression of the confidence factor (i.e. the plus and minus range).

General Condition (Table 1)

Slightly less than 5 per cent (6,283,333 sheets) of the holdings of Federal Archives Division and 2 per cent (1,059,180 sheets) of those in Manuscript Division were estimated to be severely damaged (category I). The proportion of those to be restored rather than copied, for each collection as a whole, was only 1:26 for federal records, but 1:3 for manuscripts. For specific chronological periods the ratio varied widely, and ranged from 6:1 (1760-1800) to 1:43 (1961 and later) for manuscript material.

More than 13 per cent (17,714,176 sheets) of government records are estimated to be in the moderately damaged category. The ratio of restore to copy was 1:680. For manuscripts only 1.67 per cent (about one million sheets) are estimated to be in this category. The ratio of restore to copy of these was about 1:2. The preponderance of damaged government records marked for copying reflects the decision to deal pragmatically with this large bulk of material by saving information and not the actual documents, as well as the conviction that such material generally has a low percentage of high intrinsic value.

Combining these two categories, one can see that 18.51 per cent of government records exhibit some damage, whereas only 3.44 per cent of manuscripts show visible damage. What accounts for a damage rate more than five times as high in government records? Our hypothesis, discussed in greater detail in relation to damage in chronological periods, is that the difference must be due to the treatment the documents received prior to their arrival in the archives.

More than 81 per cent of government records and 96 per cent of manuscripts were found to be undamaged.

Only 0.001 per cent (1,297 sheets) of government records were estimated to have been restored and 7.13 per cent (9,240,882 sheets) were estimated to have been copied. In the case of manuscripts, the estimate of the proportion restored was 0.31 per cent (184,699 sheets) and that copied was 4.59 per cent (2,744,184 sheets).

The figures for material restored are far too low in the case of both types of material. A more reliable estimate would be a total of about 500,000 sheets treated for both divisions: 25,000 sheets of government records and 475,000 sheets of manuscripts. The undercounting was due both to the clustering inherent in restoration since one tends, especially in the case of manuscripts, to restore associated documents, rather than single sheets, and to the failure to recognize material which had merely been deacidified.

The total for the number of manuscript pages copied is also far too low. Based on the division's microfilm holdings, a more accurate figure would be about eight million sheets.

The major reason for the error in the estimate was likely the severe clustering inherent in copying activity. It is collections or major series which are copied, not boxes of documents, let alone individual sheets.

Using the corrected figures, one can say that 0.01 per cent (15,000 sheets) of government records have been restored and 7.13 per cent (9,240,000 sheets) have been copied. In the case of manuscripts, the proportion treated was 0.8 per cent (485,000 sheets) and that copied was 13.7 per cent (eight million sheets).

Damage by Period (Figure 1)

Figure 1 details the differences in the incidence of damage in different periods. Not surprisingly, one can see a steady increase in the rate of damage over time. This finding merely confirms what archivists see every day: the effect of declining strength in the face of accumulating use.

One very striking feature is the much higher percentage in the damaged category in nearly every chronological period when one compares government records to manuscripts. Since paper types, acidity, and rates of circulation in both divisions are very similar, the most probable explanation for this difference lies in the way that the documents were kept and used prior to their arrival in the archives.

More than 70 per cent of government records and about 80 per cent of all of the Federal Archives Division's unbound material are on spiked files, which tend to be much larger than the files in manuscript collections. This method of keeping records subjects documents to a much higher rate of use than analogous material in manuscript collections receives. For example, in a one-inch file of government records there might be 150 sheets. Each time a new item was added or any use was made of the file, all previous documents were handled. This repeated, unavoidable use over decades, when combined with the kind of mechanical damage characteristic of spiked files (mutilation of page edges due to disarrangement on the spike and to stress on the pierced area from the weight of the many sheets of varying size on a thick file), results in a substantial proportion of the documents being damaged before their transfer to the Public Archives.

The second point to note from figure 1 is that the rate of damage to manuscript material is unexpectedly low for the period 1881-1900 and unexpectedly high for the periods 1801-1840 and 1841-1880. In the first case, the low reading is probably an instance of the one case in twenty which does not fit the pattern. With only twenty-five samples for the period, it is possible to have skewed results. The evidence for the same period for government records, wherein the results fit the general trend, tends to strengthen the interpretation that the manuscript result is an aberration.

The high proportion for the other two periods may be due, in part, to the same kind of error possible in small samples. Another reason may be the heavy restoration work done on manuscripts from these two periods. The Manuscript Division has concentrated its conservation work on such large projects as the "C" series, seigneurial and colonial government records, hence the very high proportion in the major damage plus restored column. Since all sheets in a volume are being treated, there is a tendency to push up the percentage. The third reason for such elevated figures is the likelihood that the collections from those periods have undergone heavier than average use. The great attention paid over the last half century to mid-nineteenth-century historical questions implies a high

rate of use, one which could not have been detected in circulation data from the past five years.

Paper Types (Table 2)

More than 69 per cent of government records and 61 per cent of manuscripts consist of machine-made paper, most of which is a relatively poor grade of paper. The identifiably good quality papers are hand-made, mould-made (twentieth-century paper), ledger, linen-ledger, linen-bond, and rag content. If one adds a proportion of the machine-made paper (some of that produced during the past half century) to this category, we can say that about 35 per cent to 50 per cent of the paper in our holdings was a good quality paper when produced. Conversely, from one-half to two-thirds of our holdings consist of paper whose original quality ranged only from fair to poor.

When one combines the fact of the high levels of acidity found in all papers with the high proportion of paper which is not of a good quality (i.e. lacking a high initial strength), our conclusion must be that deterioration in the physical condition of very large parts of our collections will be rapid in the future.

Proportions of Holdings in Chronological Periods (Table 3)

The most striking feature is the extremely high proportion of manuscript material — 71.5 per cent — which is from the post-World War II period. In fact, the post-1960 material constitutes nearly half of the Manuscript Division's holdings. By contrast, in the case of government records, only 57 per cent of the documents originate from the post-1940 period and only 19.78 per cent are from the post-1960 period.

This difference is more apparent than real and was caused by a difference in methodologies. The Manuscript Division survey included unprocessed and semi-processed collections, which were in overwhelming proportion from the past two decades. In the Federal Archives Division survey, several thousand linear feet of documents (37 per cent of total divisional holdings) were excluded since, because they were unprocessed, it was expected that only a small percentage would be selected for permanent retention. Had the latter been included, it is likely that the chronological profiles of the two collections would have been even closer.

This chronological distribution has two implications for conservation. First, because so much of the material is less than twenty years old, the problem of deterioration is still minor. In the post-1960 documents, only 4.15 per cent of federal records and 0.47 per cent of manuscripts were in the first two categories. But, as soon as one moves back one generation and includes the post-1940 documents, the seriousness of the future situation becomes readily apparent. Fully 17 per cent of government records (category I, 2.29 per cent; category II, 14.79 per cent) and 2.41 per cent of manuscripts (category I, 0.63 per cent; category II, 1.78 per cent) already show some damage.

Description (Table 4)

Nearly three-quarters (71.85 per cent) of government records are on spiked files. We believe that this characteristic and the generally higher use of such documents in active records systems in government departments prior to transfer to the PAC are the major reasons for the difference in the damage rates between government records and manuscripts (see the above discussion on figure 1).

An important difference between the two surveys was the identification of mechanically reproduced material and scrapbooks in the case of manuscripts. These two groups, which total 16.51 per cent of the material, will have an important effect on preservation efforts. In effect, about one-sixth of the Manuscript Division's holdings consist mainly or exclusively of print or near-print material. Since most of these documents are of a paper whose original quality usually ranged from fair to poor, they are likely to become a major conservation problem in the near future.

Usage Rates (Table 5)

The patterns of use found were close to those expected. The overwhelming proportion of the material surveyed (government records, 86 per cent; manuscripts, 84 per cent) received little or no use in the previous five years. The most telling fact was that more than 50 per cent of the volumes sampled had not circulated even once during that interval. A small part of the holdings (government records, 4 per cent; manuscripts, 7 per cent) was subjected to what was defined as a high level of use.

It must be recalled about these figures that the actual rate of use in the categories is very low; low (0-1), medium (2-3), high (4 or more). Thus, one researcher can have a very large effect on the statistics, even though the effect on the documents might not be major. To be able to measure the effects of use, we must have usage data from periods much longer than five years. In addition, the low usage figures prove the success of the divisions' protective microfilming programme wherein some of the most heavily consulted series have been copied and the original documents withdrawn from reference by researchers and staff.

Presence of Other Media (Table 6)

Roughly half of the samples contained no other media: government records, 58.2 per cent; manuscripts, 45.2 per cent. But in 31 per cent of the manuscripts and 15 per cent of the government records examined, printed material was found. Furthermore, newspaper clippings were found in 17 per cent of manuscript samples and 8.3 per cent of those of government records. Such high percentages mean that both printed material and newspaper clippings are very widely scattered through the holdings and that the proportion of print and near-print material is even higher than the 16.5 per cent identified in the discussion under "Description." A conservative estimate would be that 20 per cent of the total manuscript holdings and 10 per cent of government records are either print/near-print or newspaper clippings. Since this paper had the highest levels of acidity found (mean pH 3.3-3.6) and was of poor quality when manufactured, this significant part of our collections is undergoing rapid deterioration. The fact that so much of it is scattered throughout collections makes it difficult to identify and deal with.

Acidity (Tables 7 and 8)

The evidence here is all bad and little optimism is possible. Whether one looks at different periods or different types of paper, the levels of pH vary little: they are all low. The samples from all periods of the past two centuries show a range of mean pH from 3.95 to 4.60. Paper only twenty years old averaged 4.24, while that two hundred years old averaged 4.01. The extremely low readings for newsprint (3.36) could be expected; those for handmade papers (4.37-4.42) and for paper with rag content (4.47-4.53) were dismayingly low.

What do such widely distributed low levels mean? They must be the effects of general factors such as absorption of air pollutants, sizing, paper degradation, and migration of acidity. These seem to ensure that no paper will long remain immune from the appearance of high levels of acidity.

How serious are these levels? Although no precise correlation between the level of pH and deterioration rate has been established, we can say with confidence that, if not deacidified, our entire collection will be destroyed by acidity, the paper's strength eventually declining to that of charred paper. The only thing we do not know yet is whether that period is a few decades or a few centuries.

Implications of the Survey's Findings

The findings of this collections survey have implications for the Public Archives of Canada on several levels ranging from departmental policy making, programme planning, and re-evaluation of traditional archival practices to investigation of new technologies and the improvement of the old. Considerations raised by the survey touch every archivist from the most junior to the most senior. While it is obviously premature to make definitive statements about new directions the Public Archives might decide to take as a result of this survey, we can present here some obvious areas to consider and some options to ponder.

To begin with, the collections survey, if it has done anything, has exposed the time-bomb remorselessly ticking away in our stacks. The levels of damage are more widespread and far more serious than predicted. It is clear from the profile of our holdings achieved by the survey that the conservation problem for government records and manuscripts will only grow as more and more paper of poor quality and high acidity is accessioned. Damage rates will accelerate. The bulk of material requiring attention and the seriousness of the damage exhibited will increase markedly.

What are the implications of these unsettling facts for collections management? Initially, some enhancement of the survey itself is required, a study which would include tests of the physical qualities of our papers on the microscopic level. One specific and highly important need which was not and could not be part of the survey is to correlate condition and time much more closely. For example, we know pH levels, but we do not know what kind of life expectancy documents with a particular pH level might have. Indeed, what life expectancy do any documents have? Are there any objective criteria for saying that a particular document or a particular type of document or paper has reached a stage where visible damage will be caused by any kind of use?

If we had a threshold or series of thresholds to approximate different stages in the usable life of a document — expressed in terms of folding endurance and tear resistance, for example — and we had general readings on the condition of documents in different chronological periods, we could then estimate the relative dangers faced by our collections. From these estimates we could then prepare long-term projects to protect either the documents or their information.

The problem of the dimension of the conservation need may be approached on two fronts — the existing backlog and future acquisitions. It may be appropriate to consider seriously the matter of de-accessioning. Specific collections could be identified wherein distinct long-term benefits might be achieved if resources were found to weed out material of marginal informational value — and of no intrinsic value — as well as documents of

particularly poor quality papers which would become sources of deterioration. In order to lessen the very bulk of archival holdings, which in itself adds to the complexity of a conservation programme because it complicates the identification of material requiring attention, it might even be worthwhile to re-evaluate the long-term value of whole accessions. Brought into the PAC in the expansive "good old days," when resources and space seemed unlimited, the decision to retain permanently some of this material might not stand up to sober second thought.

Considerable time has been devoted at the PAC to re-evaluation of acquisitions policy. With the results of the collection survey still fresh in mind, selection should be based on even more rigorous criteria to limit, as much as is sound from an archival point of view, the rapid growth of collections. It is unfortunately a truism that the larger the holdings, the larger the conservation problem. Archivists might decide not to acquire collections of poor quality paper — large proportions of newsprint, print, and near-print documents and 1950s "wet process" copy papers. These are the paper types that will soon produce particularly serious conservation problems. When records and manuscripts are acquired, a form of condition reporting should be built into the accessioning procedure. Substantial pockets of particularly poor quality papers should be identified either for copying as soon as possible onto a more stable medium or, at the very least, to permit careful ongoing monitoring of their physical state. This procedure will, of course, be more onerous for archivists acquiring large accessions, as in the case of government records, but the long-term benefits of such resource diversion might prove worth the initial effort.

In the case of the government records archivist, it may be time to do more proselytizing about the inherent fragility of modern files. The survey showed that damage rates for spiked files were far higher than for similar manuscripts. We have deduced that these higher damage rates are most likely due to mechanical damage incurred during the records' active life-span before their transfer to the PAC. Is it not time for the PAC to emphasize its concern about storage and handling techniques used in government departments? Should not the PAC become involved in the pre-transfer life of records through the provision of information sessions for records managers and greater participation in the development of standards for the physical maintenance of files in the creating departments?

An issue similar in sensitivity to de-accessioning is whether the PAC should continue to pay the high premium to house and service large collections of originals which have been microfilmed. Should serious consideration be given to the destruction of bulky and deteriorating originals, once they have been copied? If master negative microfilms can be afforded the proper level of protection in order to provide a storage lifetime of hundreds of years, then is it reasonable to attempt to maintain in perpetuity both originals and copies on the off-chance that the odd document may have been missed during filming?

A major purpose of any integrated conservation programme must be slowing the rate of deterioration. Time must be bought so that collections can be restored or copied as part of a long-term programme — or at the very least, if such treatments are impossible, so that their usable life may be extended to the utmost. A traditional response to this need has been the provision of low-acid or buffered file folders and boxes. However, the horror of the collections survey findings with regard to pH throws this approach into question. Acidity levels were found to be so high throughout our holdings that it is valid to ask if we are wasting resources by trying to provide such high quality storage material across the board. Should the PAC not concentrate on the provision of properly designed containers

which will serve to limit mechanical damage resulting from storage modes and handling for the overwhelming bulk of non-deacidified collections? Should not the limited resources available for storage stock be directed towards the provision of truly acid-free (i.e. buffered) file folders and boxes to protect those documents which have been deacidified?

If the collections survey has underlined anything, it is the very real danger to our holdings from uncontrolled, excessively high acidity levels. In the past few years, considerable progress has been made by the PAC and the Library of Congress in the development of mass deacidification systems for books. To date, however, no similar mass treatment exists for non-printed, textual material. Such research and development is an absolute necessity. Mass deacidification of those non-printed textual records and manuscripts which are still sufficiently strong, so that their life-spans might be extended significantly by such a treatment, is one obvious way to slow the deterioration of large proportions of our collections. Resources should not only be directed to developing such a system at the PAC, but also to monitoring other mass deacidification strategies being tried elsewhere.

Along the same lines, surely the deterioration of archival records and manuscripts can be slowed by the provision of storage facilities which are environmentally controlled. While the collections survey, for reasons already detailed above in the analysis of the findings, could not draw conclusions based on the impact of substandard storage environments, the available literature makes clear that the uncontrolled temperature and relative humidity in most of our stacks can only be harmful to our holdings. Continual monitoring of storage environments, with the communication of results to senior administrators and property managers, should become a regular part of our collections management programme. As a corollary, the survey highlighted the degree to which our holdings are becoming centralized in large stack areas in a few buildings. The potential for catastrophic loss should disaster strike these facilities is very real. Consequently, even more attention should be paid to the development and continual updating of contingency plans, as well as the provision of the best fire detection and suppressant systems and security measures to protect these unique and irreplaceable collections.

There are other implications raised by the survey, not only for future conservation developments with regard to technological change but also to future enhancements of the survey. The sheer mass of records and manuscripts requiring treatment brings us to the obvious conclusion that greater emphasis must be placed on retention of information as opposed to the long-term maintenance of original documents. Thus greater attention must be paid to copying technology. It is apparent that if the basis of our conservation strategy is to be the conversion of the most endangered information onto media other than paper, then traditional micrographics technology is inadequate. Efforts should be made to develop customized, high resolution lens systems for planetary cameras, to identify better film stock for the copying of particularly poor quality originals, and to investigate image enhancement techniques for archival microforms. At the same time, a rigorous preservation programme should be instituted to ensure the long-term maintenance of master microforms produced in these microfilming projects. For the next few years at least, microfilming will remain the copying technique of choice for government records and manuscripts. For the future, though, we should continue our search for new technologies such as the optical data disk. Those disk applications presently being tested for machine-readable and motion picture collections at the PAC and patent records at the

National Archives and Records Administration in the United States should be assiduously monitored. The testing of this technology as a long-term copying medium for textual government records and manuscripts — whether on paper or microfilm — should be carried out. This new technology may prove to be a reasonable alternative to microfilming for archival textual collections in the not too distant future.

Conclusion

The collections survey completed in the Federal Archives and Manuscript Divisions of the PAC has provided the extensive data required for the development of an integrated conservation programme. We now have a more accurate picture than ever before of the state of our holdings, of the conservation requirements of our collections, and, by extension, of the resources needed to carry out the necessary treatments. In addition, the survey's results have raised a number of fundamental issues about archival practices. These issues must be faced if we are to provide custody for our documents for longer than two or three generations. Although difficult and perhaps even painful to arrive at, basic decisions will have to be made if the PAC is to direct its limited resources in an effective way.

TABLE 1

GENERAL PHYSICAL CONDITION OF GOVERNMENT RECORDS AND PRIVATE MANUSCRIPTS SURVEYED

Condition Categories	Federal Archives Division		Manuscript Division	
	Percentage	Number of Pages	Percentage	Number of Pages
Category I — Restore	0.18	233,388	0.42	249,852
Category I — Copy	4.67	6,049,945	1.35	809,328
Category I — Total	4.85	6,283,333	1.77	1,059,180
Category II — Restore	0.02	27,229	0.53	314,407
Category II — Copy	13.64	17,686,947	1.14	683,805
Category II — Total	13.66	17,714,176	1.67	998,211
Category III — No Damage	81.49	105,662,684	96.56	57,715,737
Category IV — Restore	0.00	1,297	0.31	184,699
Category IV — Copy	7.13	9,240,882	4.59	2,744,184
Category IV — Total	7.13	9,242,179	4.90	2,928,883

FIGURE 1

COMPARISON OF FEDERAL ARCHIVES AND MANUSCRIPT DIVISIONS' DAMAGE RATES

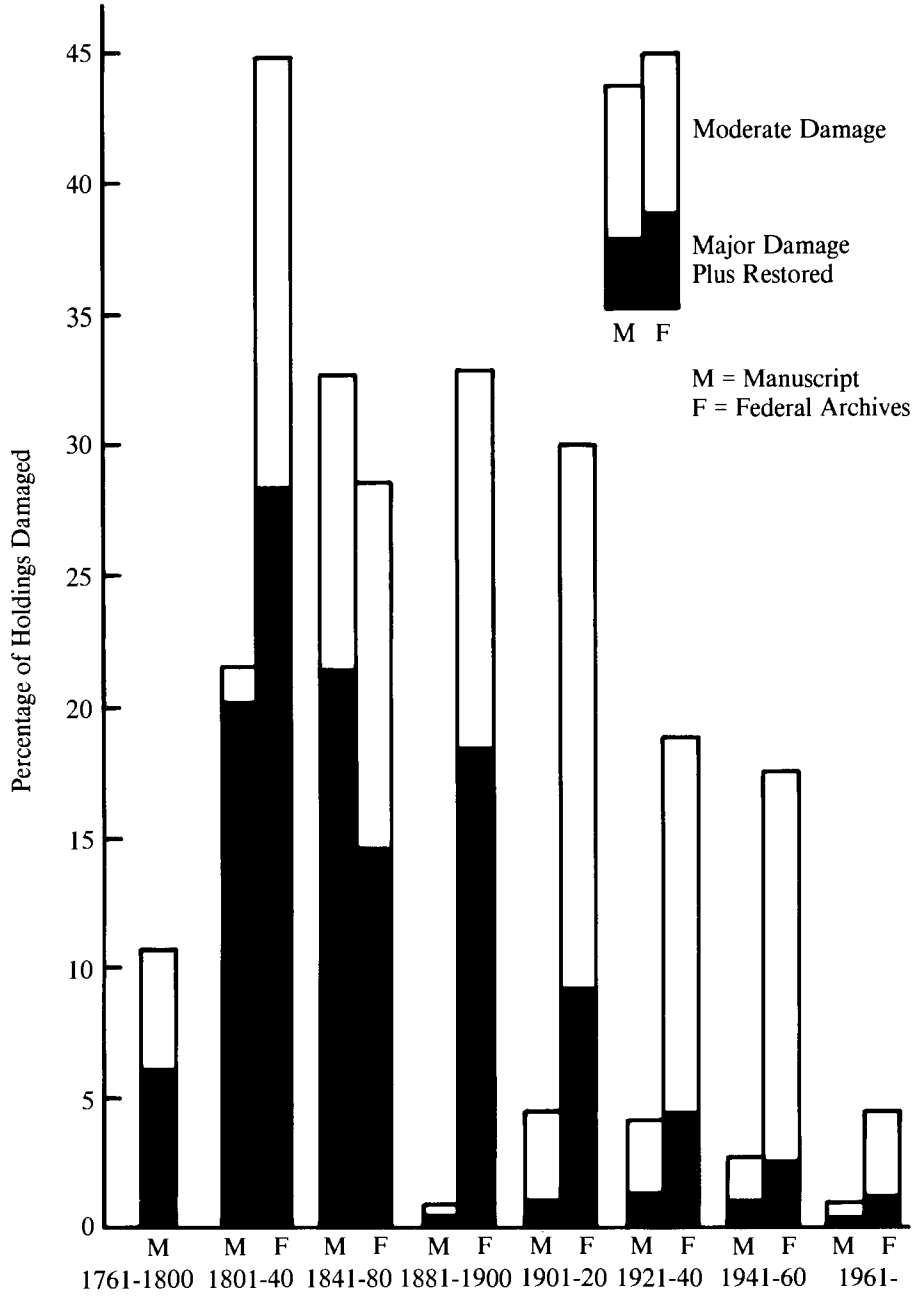

TABLE 2

PAPER TYPES REPRESENTED IN COLLECTIONS SURVEY

Paper Type	Federal Archives Division		Manuscript Division	
	Percentage	Number of Pages	Percentage	Number of Pages
Hand-made	0.83	1,072,290	3.19	1,904,970
Machine-made	69.59	90,234,418	61.18	36,569,200
Onionskin	5.95	7,712,188	4.00	2,388,534
Vellum/Parchment	0.03	41,491	—	—
Mould-made	8.44	10,940,727	4.90	2,928,883
Ledger	0.19	247,651	0.10	56,784
Linen-Ledger	1.77	2,294,985	0.86	511,658
Linen-Bond	3.45	4,469,387	7.66	4,578,024
Newsprint	0.35	453,811	5.14	3,071,143
Rag Content	0.41	536,793	1.00	597,134
Photocopy — Coated	1.86	2,406,493	0.57	341,305
Photocopy — Uncoated	0.96	1,238,255	8.04	4,805,759
Other	6.18	8,011,703	3.38	2,019,136

TABLE 3

TIME PERIODS REPRESENTED IN COLLECTIONS SURVEY

Period	Federal Archives Division		Manuscript Division	
	Percentage	Number of Pages	Percentage	Number of Pages
Pre-1760	—	—	0.09	53,796
1761-1800	—	—	0.69	412,435
1801-1840	0.31	407,133	2.45	1,462,051
1841-1880	1.63	2,113,461	4.63	2,766,300
1881-1900	5.67	7,399,140	2.91	1,736,409
1901-1920	19.61	25,426,364	8.63	5,157,225
1921-1940	15.69	20,347,574	9.13	5,458,482
1941-1960	37.33	48,396,964	24.83	14,840,472
Post-1960	19.76	25,619,558	46.65	27,886,555

TABLE 4

DESCRIPTION OF GOVERNMENT RECORDS AND PRIVATE MANUSCRIPTS SURVEYED

Description	Percentage	Number of Pages
Federal Archives Division		
Spiked File	71.85	93,154,366
Loose File	14.14	18,328,765
Letterpress Letterbook	2.70	3,502,122
Non-letterpress Letterbook	0.33	433,065
Ledger/Oversize Bound Volume	5.70	7,385,445
Oversize Single Sheet	0.38	486,226
Other	4.91	6,370,205
Manuscript Division		
Correspondence	37.81	22,597,829
Subject File	35.54	21,245,761
Letterpress Letterbook	3.13	1,868,508
Oversize Bound Volume	3.73	2,231,331
Scrapbook	1.85	1,105,205
Mechanically Reproduced	14.66	8,760,350
Other	3.29	1,964,145

TABLE 5

USAGE RATES OF GOVERNMENT RECORDS AND PRIVATE MANUSCRIPTS SURVEYED

Use	Federal Archives Division		Manuscript Division	
	Percentage	Number of Pages	Percentage	Number of Pages
High (4 or more)	4.24	5,498,889	7.12	4,252,858
Medium (2-3)	9.74	12,625,013	8.81	5,267,806
Low (0-1)	86.02	111,536,291	84.07	50,252,464

TABLE 6

OTHER MEDIA REPRESENTED IN COLLECTIONS SURVEY

Other Media	Federal Archives Division		Manuscript Division	
	Percentage	Number of Instances	Percentage	Number of Instances
Photographs	2.7	33	2.3	19
Maps	4.2	48	1.4	12
Plans	4.6	57	1.5	13
Blueprints	3.0	37	NS*	NS*
Printed Material	15.3	192	31.0	252
Posters	0.1	2	0.4	3
Newspaper Clippings	8.3	104	17.1	144
Parchments	NS	NS	0.1	1
Other	4.0	50	1.1	10
No Other Media Included	58.2	728	45.2	381
		1,252		844

NOTE: NS = The category was not surveyed under this heading.

TABLE 7

CORRELATION OF pH AND AGE OF GOVERNMENT RECORDS AND PRIVATE MANUSCRIPTS SURVEYED

Period	Federal Archives Division Mean pH	Manuscript Division Mean pH
Pre-1760	—	4.10
1761-1800	—	4.01
1801-1840	4.51	4.60
1841-1880	4.46	4.53
1881-1900	4.25	3.95
1901-1920	4.15	4.00
1921-1940	4.04	4.00
1941-1960	4.12	4.05
Post-1960	4.36	4.24

TABLE 8

CORRELATION OF pH AND PAPER TYPE FOR GOVERNMENT RECORDS AND PRIVATE MANUSCRIPTS SURVEYED

Paper Type	Federal Archives Division Mean pH	Manuscript Division Mean pH
Hand-made	4.42	4.37
Machine-made	4.13	4.10
Onionskin	4.20	4.19
Mould-made	4.25	4.49
Ledger	4.03	—
Linen — Ledger	3.85	4.08
Linen — Bond	4.06	4.16
Newsprint	3.36	3.59
Rag Content	4.53	4.47
Photocopy — Coated	4.91	5.04
Photocopy — Uncoated	4.77	4.44
Other	4.34	4.32