H.N.B.

POLICY RECOMMENDATIONS ON THE ACQUISITION STORAGE AND DISPOSAL OF CORE

by H.N. Bowman, M.J. Christensen and N.L. Markham

July 1982

1. INTRODUCTION

At the request of the Secretary a committee comprising H.N. Bowman, M.J. Christensen, and N.L. Markham, was nominated to develop a policy on the acquisition, storage and disposal of core at the Londonderry Core Library. The findings of the committee are summarised in this report.

1.1 OBJECTIVES OF THE CORE LIBRARY

The Core Library forms part of the department's overall information services programme. The Core Library is an important element of the first objective of this programme as set out in Appendix 1 (Statement of Information Services Programme Objectives). As such the objectives of the Core Library are to store a representative collection of core resulting from departmental and non-departmental drilling carried out in New South Wales and to provide access to that core for reference and sampling purposes in order to minimise costs to the State and exploration/mining industry users who desire recourse to the results of previous drilling.

2. DESIRABILITY OF RETAINING CORE

Appendix 2 outlines a number of non-quantitative arguments as to why core should be retained; however the desirability of retaining core is ultimately determined by the costs and benefits of retention. The costs are easily determined but the benefits depend on usage of the core which is probabilistic in its occurrence. Because of the probabilistic nature of benefits from storage of core (not to be confused with the definite benefits from usage of core) it is necessary to apply expected value analysis to the decision to store or not. The application and results of expected value analysis to this problem are given in Appendix 3 where it is shown that the highest expected monetary value is attached to the decision to store (which is, therefore, the most desirable decision given current costs and probability of usage).

Even with the unlikely assumptions of "low" usage probability and the "worth" of core being only half of current drilling cost, the storage policy is still the most desirable.

Besides assisting in policy selection, expected value analysis serves to highlight the options available to the Department to increase the desirability of making core available to potential users, viz.,

i increase the probability of usage by:-

* reducing the stock of core without reducing the usage, i.e. increasing the relative usage of core;

* increasing the absolute usage of core; and

ii decrease the cost of core by:-

* reducing the storage element of cost

* reducing the access element of cost

Sections 3 and 4 of this report respectively deal with the issues of usage and cost, given that the desirability of retaining core has been established.

3.0 IDENTIFYING MOST DESIRABLE CORE: CULLING AND RETAINING POLICIES

3.1 INTRODUCTION

The Committee believes that the probability of usage of core can be correlated with:-

(i) the borehole's location;

(ii) the borehole's "representativeness" (its ability to represent a surrounding area where that area's boundaries are defined by the geological nature of the area);

(iii) the title situation of land in the borehole's representative area and the stage of development of the deposit being tested;

(iv) the style of mineralisation in the borehole's representative area.

Characteristics (i) and (ii) relate to a core's ability to replace other core from a similar area because any one core from that area is likely to sufficiently represent that area. Characteristics (iii) and (iv) relate to the need to represent that area; for example, a core from a currently operating mine may no longer be of use whereas a core from an interesting or controversial style of mineralisation not yet developed may be of significant use.

In addition to an analysis of the characteristics of core (see below) it is worth noting that usage of core is also greatly influenced by knowledge of the existence of that core. Accordingly, the Committee is of the opinion that periodically the Department should inform interested parties as to new core received at the library and a brief precis of the nature of the core.

Appendix 4 records the number of visitors to the Core Library at Londonderry over the period 1968-1982 for the purpose of examining core.

3.2 NATURE OF CORE HELD AT THE CORE LIBRARY

Currently some 90,000 boxes of core are stored at the Londonderry Core Library (refer Appendix 5). Of these, 78,000 boxes are housed in core libraries Nos. 1, 2, 3 and 4 with a further 12,000 boxes in outdoor storage. In addition some 5,000 boxes of core obtained as a result of this department's more recent coal drilling programmes are stored in five regional storage centres, viz. Gunnedah, Wyee, Bargo, Rylstone, Dunedoo.

Core available at the Core Library can be grouped as follows:

Metalliferous core

Coal core

Petroleum-stratigraphic-others

3.2.1 Metalliferous

The department does not carry out its own programme of exploration for metalliferous ore deposits. Hence all metalliferous core stored at the Core Library has been generated by mining and exploration companies. It should also be emphasised that there is no statutory requirement for industry to make available core to the Core Library for storage. Hence, the metalliferous core available at the Core Library may be regarded as a somewhat random sampling of holes drilled within New South Wales, reflecting in part the willingness of individual companies to donate material to the department. Those localities for which metalliferous diamond drill core is held at the Core Library are shown on the attached 1:1,000,000 scale geological map of New South Wales (Plan 1). It is clear from this map that only a small proportion of deposits and prospects that have undergone exploration to the drilling stage are represented in the Library. Moreover, the distribution of these deposits is uneven.

A further indication of the range of metalliferous core available at Londonderry is given in Appendix 6 which lists the number of drill holes represented on a 1:250,000 sheet basis. This clearly shows, for example, that a relatively large number of holes are available from prospects on the Bathurst

sheet. By contrast representation from sheets such as Cobar, Bourke, Broken Hill, Cargelligo and most sheets in the New England region is small.

It is clear therefore that metalliferous core held at the Londonderry Centre represents a small, somewhat random, albeit important collection of holes drilled within New South Wales. Significant collections of metalliferous diamond drill core are of course stored by individual mining/exploration companies at places such as Broken Hill, Cobar and other centres of mining or exploration interest. A significant quantity of diamond drill core would have been disposed of by companies at the conclusion of their exploration programmes.

3.2.2 Coal

Drill core derived fromcoal exploration programmes makes up about 50% of total core stored at Londonderry. A large number of holes arising from exploration drilling in the Sydney, Gunnedah, Clarence Moreton and Oaklands Basins are represented. These holes comprise not only core from the coal measures themselves but also, as in the case of the Sydney and Gunnedah Basins, from overlying rock units.

Coal core stored at Londonderry includes a large quantity of core generated as a result of this department's own coal exploration programmes as well as core generated by coal mining and exploration companies.

All core generated by the Department of Mineral Resources as a result of its coal exploration programmes is permanently stored. However, the extent of private industry representation is similar to that of metalliferous core, i.e. there is no statutory requirement for industry to make core available to the Core Library nor is there a systematic policy or programme to acquire core from this source.

Table 1, overleaf, gives an indication of the distribution of retained coal by coal field as a percentage of holes drilled. The location of the holes in the coalfields is shown on plans 2 - 7.

The committee notes from Table 1, that the coal core held represents 6% of the coal holes drilled in N.S.W. The core held is not representative of New South Wales coalfields. Core from approximately a quarter of the holes drilled in the Clarence Moreton, Southern and Western coalfields has been retained. Examination of the hole distribution maps however indicates that the holes retained in these fields give only a patchy coverage of the fields. Insufficient core from the Newcastle, Hunter Valley and Gunnedah Coalfields is stored at Londonderry to give an adequate coverage of these coalfields. Although only 12% of the core from holes drilled in the Oaklands Basin is stored at Londonderry the geographic spread of the holes does cover the whole basin. The distance between the holes is several times 4 km and many more holes would be needed to give adequate coverage of the Basin. No core from the Gloucester or Great Australian Basins is held at the Core Library.

Some 44% of the coal core held is from colliery holdings and this could be expected to be mainly closely spaced:

3.2.3 Petroleum-Stratigraphic-Others

About 10% of total core held at the Core Library falls under this category. A small quantity of core and cuttings derived from earlier petroleum exploration drilling operations in New South Wales is stored at the Core Library. However, the collection is unsystematic and does not provide a full coverage of rock types intersected in petroleum drilling within the prospective sedimentary basins.

In addition to this material miscellaneous core derived as a result of stratigraphic drilling, drilling for engineering purposes or as a result of water supply drilling programmes is available at the Core Library. This includes

core obtained by the Snowy Mountains Hydroelectric Authority as a result of its investigations carried out in the 1950s and 1960s, a number of holes completed by the Water Resources Commission in the Murray Basin, the department's own stratigraphic drilling programme in the Great Australian Basin, the Department of Public Works' core derived from site investigations at localities such as Pejar Dam, and other miscellaneous core.

Again, no systematic policy of acquisition of core under these various headings currently exists and the collection at the Core Library therefore is a random one.

3.2.4 Confidential Core

A small quantity of core currently held at the Core Library is confidential. This is estimated to be:

Metalliferous	1.5%	of total metalliferous core
Coal	5%	of total coal core
Petroleum	1%	
Other	0%	

The committee recognises a fundamental conflict between the storage of this core and the objectives of the Core Library (viz. to provide access to stored core); however the worth of this core should be a determinant factor in its storage since, with time, it will lose its confidential status.

The committee feels that this confidential core should be retained at the Core Library provided that it satisfies the department's core retention policy and that it is likely to become non-confidential within a maximum period of 5 years. Core that is likely to remain confidential for a longer period of time, e.g. from operating mines or leases, should not be stored.

3.3 CULLING POLICY

Based on the characteristics of core currently held at Londonderry as described in Section 3.2 of the report, it is apparent that culling of such core could be carried out along the lines of:

Coal Core

1. All closely spaced drill core should be culled. As a guide closely spaced holes can be considered to be holes closer than 4 km apart.

2. Core from the cover rocks in departmental drilling programmes in which the holes are closer than 4 km will be disposed of.

3. Coal measure core from departmental programmes in which the holes are closer than 4 km apart not required by the recipients of the areas will be discarded apart from roof and floor rocks of important seams.

4. All closely spaced company drilling will be discarded after selection of suitable holes at more than 4 km spacing.

5. All confidential core will be discarded unless agreement can be reached to make such core non-confidential in a maximum period of five years.

6. All core presently stored at Londonderry which cannot be readily identified and easily made accessible to the public will be discarded.

7. All core which is no longer representative (e.g. as a result of intense sampling) should be culled.

Metalliferous Core

1. All closely spaced drill core should be culled. As a guide closely spaced holes can be considered to be holes closer than 0.5 km apart. The criteria for culling however cannot be based wholly on minimum hole spacing but should be based also on the criteria of "representativeness" i.e. ability of the hole retained to represent the geological characteristics of a larger area.

2. Core from the cover rocks in closer spaced drilling programmes where these are of a younger age or show no close geological relationship to the rock sequence being tested will be disposed of.

3. All confidential core will be disposed of unless agreement can be reached with the title holders to make such core non-confidential in a maximum period of five years.

4. All core presently stored at Londonderry which cannot be readily identified, is in poor condition, or easily made accessible will be discarded.

5. All core which is no longer representative (e.g. as a result of intense sampling) should be culled.

Petroleum-Stratigraphic-Others

This includes core of variable nature and type.

1. All available petroleum core and cuttings should be retained unless they can no longer be identified or are in poor condition, since petroleum wells are widely spaced and provide deep stratigraphic penetration.

2. Core from closely spaced engineering site investigation programmes should be culled and a representative sample retained. This should take place only when construction work has been completed.

3. Core from Snowy Mountains Hydroelectric Authority early drilling programmes should be culled and representative samples retained.

4. All core presently stored at Londonderry which cannot be readily identified, is in poor condition, or easily made accessible will be discarded.

5. All core which is no longer representative (e.g. as a result of intense sampling) should be culled.

3.4 RETENTION POLICY

Based on factors identified in Section 3.1 of this report it is apparent that retention of core generated by future departmental or industry drilling programmes could be based on the following guidelines:

Coal

1. All broadly spaced reconnaissance drill core should be retained. Reconnaissance holes could be considered to be holes spaced more than 4 km from each other.

2. A selection of holes spaced more than4 km apart should be retained from more closely spaced drilling.

3. As a general rule core from the deepest hole should be selected as the one to be kept, if a decision has to be made between core from two holes.

4. Coal measure core from closer spaced drilling should be kept until the areas being tested are disposed of by way of tender or invitation. This core could then be offered to the recipient of the area. If the recipients do not want this core only roof and floor rocks of important seams should be retained.

5. Confidential core meeting the above requirements will be retained only if agreement can be reached with the title holders to make such core non-confidential within a maximum period of five years.

Metalliferous

1. All broadly based reconnaissance drill core should be retained. Reconnaissance holes could be considered to be holes spaced more than 0.5 km from each other.

2. A selection of holes spaced more than 0.5 km apart should be retained from more closely spaced drilling programmes. However each programme would need to be examined separately and a decision on the core to be retained based on the representativeness and/or unique scientific value, of the core. In highly variable geological terrains, a closer spaced selection of holes may be necessary.

3. Confidential core meeting the above requirements will be retained only if agreement can be reached to make such core non-confidential within a maximum period of five years.

Petroleum-Stratigraphic-Others

1. All petroleum exploration cores and cuttings should be retained unless the wells are closer than 4 km.

2. All stratigraphic holes at greater than 4 km spacing should be retained.

3. Core from engineering site investigation programmes should be retained on site until the necessary construction works have been completed. Thereafter representative cores based on a spacing appropriate to the detail of the investigation and variations in site geology should be retained.

4. Confidential core meeting the above requirements will be retained only if agreement can be reached to make such core non-confidential within a maximum period of five years.

The above actions serve to describe a policy on what core should be retained as it becomes available in the future. The department should maintain close liaison with all organisations that generate drill core samples and require such organisations to offer core to the department. A decision on whether to accept such core would then be made, based on the above policy.

3.5 DISPOSAL POLICY

Based on the culling and retention policies as outlined in sections 3.3 and 3.4 of this report, the following policy relating to disposal of core might be developed.

1. Core derived from departmental drilling programmes

Notification of intention to dispose of such core to be incorporated in the departmental circulars referred to in section 5.5 of this report, such circulars to be widely distributed to industry, educational and research organisations.

2. Core derived from non departmental drilling programmes

Notice of intention to dispose of such core to be first given to the company (organisation) responsible for donation of such core to the Core Library. If the company (organisation) has no interest in receiving this core, notice of intention to dispose of core will be incorporated in a departmental circular, such circular to be widely distributed to industry, educational and research organisations.

3. Surplus core (including core boxes) to be made available to interested organisations free of charge, but recipients will be responsible for cost of collection of core from Londonderry or from regional storage centres.

4. If more than one organisation expresses interest in a particular parcel of core, the department to allocate such core on the basis of the relevant merits of the requests.

5. Surplus core, for which no expressions of interest have been received from other organisations, will be discarded.

4.0 METHOD AND LOCATION OF STORAGE

A number of "trade-offs" are available in these decisions, viz. increased ease of access to core boxes reduces the labour expense of operating the library but increases the capital cost of constructing the library; decentralised storage of core reduces the cost of core transportation and the cost of land but increases the cost of use of the core by geologists who do not operate close to the decentralised storage site. Evaluation of these alternatives can only be made when consideration is given to the costs and the likelihood of usage.

4.1 METHOD OF STORAGE

Because only a small proportion of the retained core is likely to be used (somewhere between 9% and 20%) it is preferable to minimise the cost of storage for all core at the expense of increasing the cost of using some core. As a result, the more expensive individual core box racking system, giving relatively easy access to core, is less desirable than a cheaper pallet system. This cost-usage analysis is further supported when whole cores are required rather than individual boxes and so access on an individual box basis is of no great benefit to users(as is the case with most usage of core).

Within the higher density or pallet storage systems a number of alternatives are available. The committee's investigations show that part of the costing analysis in the "Report for the Proposed Bore Core Library Project" for alternative storage systems was deficient (pers. comm. Public Works Department) and so before any further construction is undertaken a full evaluation is needed of the:-

* storage system construction costs;
* storage system operating costs; and
* the costs of the most desirable building for each alternative storage system

It is apparent that this evaluation needs to be reasonably precise, taking into account once-only expenses and the stream of operating expenses (over say 10 years) discounted back to current values. The framework for this evaluation is briefly described in Appendix 7: Method of Costing Alternative Storage Systems.

Before such an evaluation can be meaningfully completed it is necessary for the Department to decide if it must vacate the existing core library buildings. Strong economic arguments (i.e. low operating costs) support the retention of those buildings with relatively expensive storage systems (Libraries 1, 2 and 3). The diversion of Government funds to construct a library building with capacity to evacuate existing libraries (1, 2, 3 and 4) is based on an alternative desired use of those library buildings by the Department of Industrial Relations. A more rational expenditure would be directly on new buildings designed for Industrial Relations' uses thereby avoiding the costly process of transferring core and the wasteful dismantling of an expensive and efficient storage system. It is worth noting that the report detailing design and cost of the proposed library did not include the transfer costs nor the dismantling (and partial re-assembling) of the storage racks. These costs have been estimated to be at least $100,000.

A Government decision to construct new buildings for Department of Industrial relations' purposes whilst retaining the existing library buildings to store core would not eliminate the need to construct further storage since there is a projected annual growth rate of 10,000 boxes. However, this growth rate contrasts with previous estimates used to justify the proposed library (20,000 boxes p.a.) and so calls for a re-evaluation of storage needs. This evaluation is further necessitated if the culling and retention policies outlined in section 3.3 of this report are adopted. Preliminary estimates suggest that such a culling policy could result in the disposal of some 15,000 boxes and the retention policy could reduce the projected annual growth rate to about 7,000 boxes per annum. A decision to retain all or some of the existing libraries will alter the desirability of incorporating low density storage systems in any new building. The significance of this is readily apparent when it is noted that the estimated building construction cost of high density storage in the proposed building is $6.74/box compared with $26/box for low density (relocated racking) storage.

In addition to these storage cost savings, made when high density storage systems are used, the committee has been informed by the Department of Public Works that significant building cost savings would be made if all pallet racking storage was used rather than the proposed mixing of storage systems.

4.2 LOCATION OF STORAGE

This section deals with regional vs central storage of core. Storage of core at regional locations is here only considered in respect of departmental coal drilling programmes as these are the only predictable sources of large volumes of core that the department is likely to acquire.

The issue of where core should be stored is related to:-

* cost of transporting core;
* cost of transporting core boxes;
* cost of providing access to the core;
* cost of transporting geologists to the core; and
* cost of storage construction.

In addition to these costs which may be estimated for both regional and central storage, other factors may be determinant, viz:-

- advantage of having core on site during the course of drilling and prospecting operations and in any subsequent geological investigations.

- ultimate likely use of core (e.g. coal core may become the property of the successful tenderer and thus required close to the drilling location);

- availability of uncommitted Crown Land; and

- rental prospects for storage facilities.

Costing of the regional and central storage options has been undertaken in respect of the five regional coal storage locations. This information is summarised in Appendix 8. With the exception of Picton it is concluded that central storage of core has slight cost advantages over regional storage on a long term basis. Such a conclusion is heavily dependent upon cost estimates for shed construction which are subject to considerable uncertainty. This uncertainty, together with the small margin of advantage favouring central storage, suggests that in certain cases there may be no significant difference in costs.

Notwithstanding the above assessment of long term storage costs, the committee is of the view that all core should be stored on site until the completion of the exploration programme. This could be achieved by the hire of suitable storage accommodation.

5.0 RECOMMENDATIONS

5.1 Based on expected value analysis the Department should retain core. The provision of access to retained representative core is an element of the department's information programme that should be continued.

5.2 The department should increase the relative usage of core by culling the existing collection of core in accordance with the culling policy outlined in Section 3.3 of this report. This policy should be implemented as soon as feasible.

5.3 Decisions to retain core should be based on the core's representativeness and/or unique scientific value, and accordingly the retention policy outlined in Section 3.4 should be adopted.

5.4 In order to be able to retain a more representative collection of core at the Core Library consideration should be given to insertion of an appropriate clause in the Conditions of Authority applicable to exploration title that core must be offered to the Department for retention in its core library before a decision is made to dispose of such core.

5.5 The Department should advise the exploration industry as new core is received. This advice should take the form of a circular, issued every six months, including a brief outline of the nature of the core.

5.6 Where confidential core is to be stored by the department, such confidentiality should be maintained for a period not exceeding five years.

5.7 The Department should recommend to the Government that the existing core libraries be retained for their original use.

5.8 Construction of further storage facilities (to cater for expected growth rather than relocation - see recommendation 5.7) should be undertaken. This should be the subject of a full evaluation of needed capacity, alternative building designs and storage systems, estimating operating costs as well as building costs.

5.9 As the Department enters into major new drilling programmes, it should fully evaluate the costs and benefits of long term regional vs. central storage of core from those drilling programmes. Core from departmental drilling programmes should be stored on site at least until the completion of exploration.

5.10 Core to be disposed of in accordance with the disposal policy outlined in section 3.5 of this report.

Table 1 Coal Bores at Library

COALFIELD	BORES DRILLED TO END 1981 (SOURCE J.C.B)	BORES STORED AT LIBRARY	% OF BORES DRILLED STORED AT LIBRARY
Newcastle Coalfield	1533	91	6%
Hunter Valley and Gunnedah Coalfields	11016	486	4%
Southern Coalfield	968	249	26%
Western Coalfield	219	56	26%
Oaklands Coalfield	184	22	12%
Gloucester Coalfield	772	0	0%
Great Australian Basin	4	0	0%
Clarence-Moreton Basin	16	4	25%
TOTAL	14712	908	6%

APPENDIX 1

STATEMENT OF INFORMATION SERVICES PROGRAMME OBJECTIVES

1. To facilitate an efficient geological information process involving the phases of -

   . collecting;

   . sorting, preserving and storing;

   . making available, distributing and retrieving;

   . advertising the existence of geological information

   so as to satisfy the information needs of:

   i) the Minister for Mineral Resources;

   ii) officers of the Department of Mineral Resources;

   iii) other Government Departments;

   iv) the mining and mineral exploration industry;

   v) potential land users seeking geoscience information generated as a result of the mining-related information process;

   vi) members of the general public seeking knowledge of N.S.W.'s mineral resources and its mining industry.

2. To provide information about existing exploration/mining titles and the availability of land for exploration/mining title applications.

3. To provide explanations of legislation relevant to exploration and mining of N.S.W.'s mineral resources.

4. To provide statistical information pertaining to the activities of the N.S.W. mining industry.

5. To provide Departmental publications to the users listed in No. 1 above so as to:

   . inform the mining and exploration industry of latest developments in N.S.W.; and

   . develop a public awareness of the importance of mining to N.S.W.

6. To provide the services listed above in the most efficient and effective way so as to minimise costs to the Department whilst providing appropriate service levels to users of the information.

ARGUMENTS FOR STORAGE OF CORE

1. The storage of core achieves a permanent physical three dimensional record of the rocks and minerals which constitute the State of New South Wales. This record has cost the State and private industry many millions of dollars and can be preserved so that future workers who do not have access to the considerable funds required for drilling operations will be able to examine this record and thereby contribute further to the geological knowledge of the State.

2. Departmental coal drilling programmes are producing a comprehensive record of the coal resources of the State. It is vital that this core be retained for geological research, and investigation of the shaft, roof and floor conditions likely to be encountered in colliery development.

3. It is important to realise that approximately half of the "geological surface" of New South Wales is hidden by Quaternary cover and that a record of drill core and cuttings is the only permanent available record of the underlying rocks other than hand specimens taken from costeans and shafts.

4. The preservation of core enables the most important analytical tool of all to be applied, namely the human eye. Visual inspection whether carried out macroscopically or microscopically reveals more to the geologist than all other methods except in those cases where the material is extremely fine grained and even in these cases the availability of raw material for the application of new techniques is of paramount importance. One cannot carry out x-ray diffraction, chemical analysis, or extract microfossils from a photograph or geological log.

5. The core available in store may not be duplicated in some cases.

6. For engineering geology studies, the preserved core may enable the most efficient planning of future testing, based on information that was not recorded when the core was logged.

7. In the case of abandoned or exhausted mines, drill core usually provides the only orderly record of the geological setting.

8. Technologies change, as do metal prices - both initiating a technical re-examination of preserved drill core.

9. In the past an inability to examine old core has on occasions meant significant expenditure for new drilling programmes.

10. There are no viable alternatives to core storage - photography, geophysical logging, geological logs, analysis etc., are useful techniques, but they represent either a part only of the information available from a drill hole or an interpretation of the raw data.

11. Most State Mines Departments provide permanent core storage facilities.

EXPECTED VALUE ANALYSIS OF THE DECISION TO STORE OR NOT TO STORE CORE

In the following analysis a number of assumptions have been made:-

* there are 2 policies: store and don't store;

* there are 2 "states of nature": need core and don't need core;

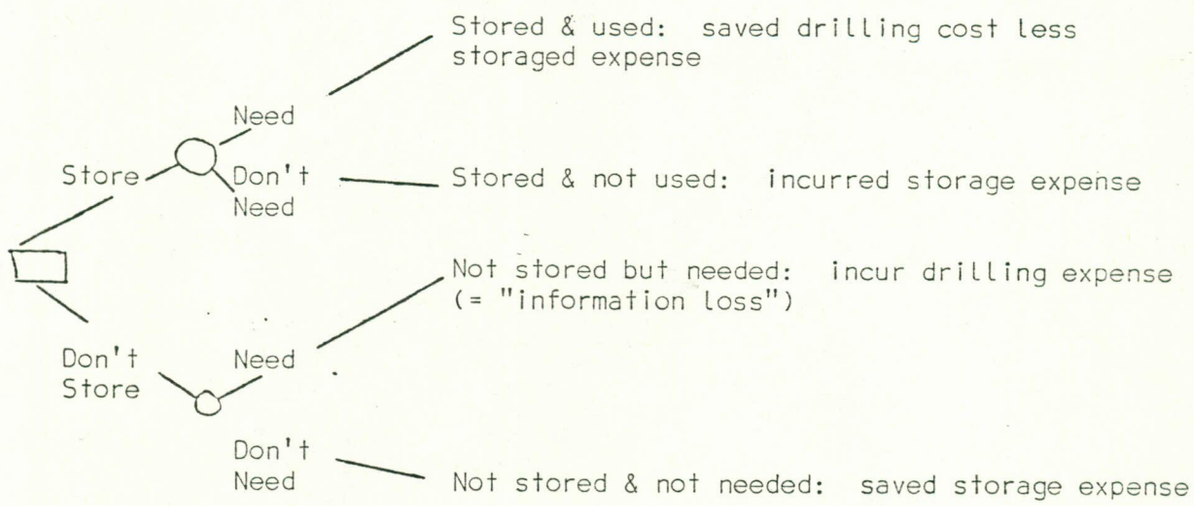
* when the need of core arises and it has not been retained the cost of "information loss" is equal to the cost of drilling the hole again;

* the benefit gained when core is used again is equal to the cost of drilling the hole less the cost of storing the core;

* the probability of core being used again can be measured by the incidence of previous usage relative to the volume of core held. Some contention exists as to the validity of records of usage and so "high" and "low" probabilities have been used separately; and

* on average, it is estimated that each user of core examines core from one hole in a day (this assumption is necessary since usage records have only noted the number of visitors daily).

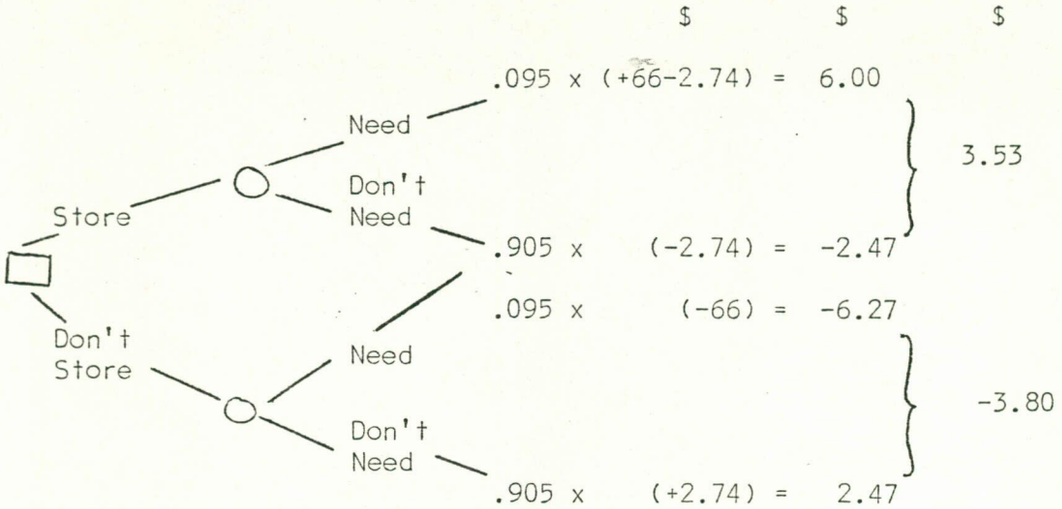
The schematic below represents the outcome expected from the combinations of policy decisions with alternative states of nature.



When probabilities are assigned to both states of nature and costs are assigned to each outcome, it is possible to compute expected monetary values for both policy decisions. This is done below where the "low" probability of usage is assumed (i.e. probability of usage is based on actual usage over a 14 year period, assuming each visitor uses core from one hole daily and taken as a proportion of the current stock of core). The cost assumptions made in the following workings are that:

- drilling the State's "average" metre of core costs $66; and

- storage costs are made up of the library's annual operating costs and the full capital cost of proposed storage buildings and core boxes (brought to account in the first year of operation) - when expressed per metre of core these costs are estimated at $2.74.



(1) Decision	(2) State of Nature	(3) Probability of Outcome	(4) Value of Outcome	(5) Expected Value of Outcome (3)x(4)	(6) Expected Value of Decision

The desirability of the policy decision to store core is apparent when its positive expected monetary value (EMV) of $3.53 is compared to the negative EMV of not storing core (-$3.80). When the "high" estimation of usage probability (20%, based on 1981/82) is used the EMVs of "store" and "don't store" respectively are $10.49 and $-11.22. This naturally reflects the desirability of increasing usage of the library's core.

Sensitivity analysis of the assumptions behind the above EMVs shows that because of the very large cost differences between storage and drilling, the usage probability at which storage of core becomes undesirable is around 4-5%. Even if the "information loss" of not storing when required is assumed to be only 75% of the drilling cost the EMV of storage is positive and the EMV of no storage is negative ($2.47 and -$2.22 respectively); if this assumption is changed to 50% the EMVs change to 40 cents and -66 cents respectively, again showing the desirability of the storage policy.

APPENDIX 4

NUMBER OF VISITORS TO THE CORE LIBRARY TO EXAMINE CORE

DATE	DEPT. OF MINES				OTHER GOVT. DEPARTMENTS			UNIVERSITIES			COMPANIES		
	Total	Coal	Strat.	Met.	Coal	Strat.	Met.	Coal	Strat	Met.	Coal	Strat	M
1968	10	-	-	-	-	-	-	-	-	-	-	7	
1968/69	50	4	13	-	-	1	-	4	-	2	4	8	1
1969/70	57	15	9	1	6	3	-	-	3	1	-	4	1
1970/71	117	19	28	8	7	-	1	4	-	1	14	3	3
1971/72	126	38	21	12	9	4	-	6	2	2	21	3	
1972/73	137	51	22	18	-	-	-	10	4	8	5	5	1
1973/74	264	18	25	6	7	60	-	21	48	17	24	11	2
1974/75	130	31	13	10	-	3	3	16	4	7	13	5	2
1975/76	167	31	20	15	3	-	-	25	5	8	34	4	2
1976/77	166	13	19	30	11	-	22	6	2	14	21	6	2
1977/78	169	22	18	28	20	-	-	11	-	10	24	1	3
1978/79	106	25	2	12	3	3	-	7	4	8	11	2	2
1979/80	61	4	3	-	2	2	-	-	4	2	3	1	4
1980/81	125	29	3	3	-	6	-	4	1	5	7	8	5
1981/82 2nd of Feb.	223	99	3	-	15	3	-	16	3	8	31	14	3

Some uncertainty exists in respect of figures from August 1978 until commencement of 1981/82 year.

APPENDIX 5

ACQUISITION OF CORE AT THE LONDONDERRY CORE LIBRARY

DATE	CORE BOXES RECEIVED
Prior 1968	13228
1968	1701
1968-69	2049
1969-70	2790
1970-71	10602
1971-72	7159
1972-73	6489
1973-74	6201
1974-75	5813
1975-76	8200
1976-77	4694
1977-78	6059
1978-79	2349
1979-80	5395
1980-81	4448
1981-Feb. 1982	3385
Total:	90,562 boxes

DISTRIBUTION OF METALLIFEROUS CORE BY 1:250,000 SHEET

1:250,000 Sheet	No. of Holes Represented
Bathurst	311
Bega	33
Bourke	40
Broken Hill	23
Canberra	153
Cargelligo	1
Cobar	33
Cobham Lake	4
Coffs Harbour	11
Cootamundra	48
Dorrigo	68
Dubbo	96
Engonia	5
Forbes	20
Gilgandra	38
Goulburn	153
Grafton	34
Hastings	46
Inverell	4
Louth	5
Mallacoota	2
Manilla	32
Menindee	51
Milparinka	1
Narrabri	1
Narrandera	95
Narromine	63
Nymagee	186
Sydney	4
Tamworth	6
Wagga Wagga	24
White Cliffs	5
Wilcannia	6
Wollongong	13

METHOD OF COSTING ALTERNATIVE STORAGE SYSTEMS

As the data becomes available it will be necessary to estimate:

i) storage system construction costs, including relocation and assembly (where relevant);

ii) storage system annual operating costs in terms of number of staff required to make access available for an average number of users (i.e. taking explicit account of the usage probability);

iii) building construction costs for the most efficient building required given the storage density of the storage system and the number of boxes to be stored.

An appropriate costing can be represented:

$$C = S + B + \left(O \times \frac{(1 - (1 + i)^{-n})}{(\quad 1 \quad)}\right)$$

where C = total cost
S = storage system construction cost (i above - once only)
B = building construction cost (iii above - once only)
O = operating cost (ii above - annually recurring charge)

$\frac{1 - (1 + i)^{-n}}{1}$ = the present value factor of an annuity over n years using 1% discount rate

n = say 20 years

REGIONAL vs. CENTRAL STORAGE

LOCATION	NO. OF METRES DRILLED ('000)	REGIONAL			CENTRAL IMPUTED BUILDING & TRANSPORT COST	COST DIFFERENCE (Central - Regional)
		COST OF STORAGE SHED (1)	ADDED COST OF ACCESS (2)	TOTAL COST (1)+(2) (3)	(4)	(4) - (3)
Newcastle	29	50000	215x.2x52 = 2236	52236	45240	-6996 ∴ Cent
Picton	51	60000	-	60000	79360	19,360∴ Reg.
Rylstone	41	50000	1097x.2x82 = 17990	67990	63960	-4030 ∴ Cent
Dunedoo	27	50000	1097x.2x45 = 9873	59873	42120	-17753∴ Cent
Gunnedah	139	150000	1097x.2x330 = 72402	222402	216840	-5562 ∴ Cent

CONCLUSION: Store centrally except from the Southern Coalfields

Notes

1. Regional storage sheds have been estimated at $50000 for a basic cement floored, aluminium roofed and walled shed housing approximately 40000 metres of core; no cost allowance has been made for land purchase.

2. Regional 'added cost of access' has been based on an estimated field trip expense to each location (less the estimated expense of visiting Londonderry - costed at $177):

Newcastle	-	$215
Picton	-	no added cost
Dunedoo	-	$1097
Gunnedah	-	$1097
Rylstone	-	$1097

These field trip expenses have been multiplied by the estimated number of holes to be examined: 20% of the cumulative number of holes drilled over 5 years.

3. Central 'imputed building & transport cost' is $1.36 times the number of metres to be drilled (where $1.36 represents building storage cost) plus $1 transport cost per box of core.