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FINAL REPORT ON THE
MASTER PLAN OF MITIGATION WHICH STIPULATES THE RESPONSIBILITIES
OF THE PARTIES INVOLVED AND THE STEPS TO BE TAKEN FOR CONSERVATION
OF PALEONTOLOGICAL/ARCHAEOLOGICAL RESOURCES IN THE VICINITY OF
THE METRO RAIL WILSHIRE/FAIRFAX STATION

Prepared on behalf of the LOS ANGELES COUNTY NATURAL HISTORY MUSEUM FOUNDATION

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TABLE OF CONTENTS

Summary	1
1.0 Introduction and background	1-1
1.1 Historical summary	1-1
1.2 Importance of Rancho La Brea fossils	1-2
1.2.1 Scientific importance	1-2
1.2.2 Public recognition	1-2
1.2.3 Nature of continuing research	1-3
1.3 Characteristics of Rancho La Brea fossil deposits	1-5
1.3.1 Variety of fossils and archaeologic/anthropologic remains preserved	1-5
1.3.2 Size, shape, and stratigraphic context of deposits	1-5
1.3.3 Quality of preservation	1-6
1.3.4 Density of fossils	1-7
1.3.5 Geographic distribution of deposits	1-8
2.0 Potential impact of Metro Rail construction	2-1
2.1.1 Probability of encountering fossil deposits	2-3
2.1.2 Sampling procedures and priorities	2-4
2.1.3 Importance of additional specimens and data	2-5
2.2 Potential negative impacts	2-8
2.2.1 Tunneling	2-8
2.2.2 Cut and cover	2-8
2.3 Potential positive impacts	2-9
3.0 Mitigation goals and recommended procedures	3-1
3.1 Mitigation goals	3-3
3.1.1 Salvage and preservation of paleontologic remains	3-4

3.1.2 Salvage and preservation of archaeologic/anthropologic remains	3-4
3.1.3 Documentation of occurrence	3-5
3.2 <u>Site testing</u> (Survey)	3-7
3.2.1 Information needed	3-7
3.2.1.1 Wilshire/Fairfax station	3-7
3.2.1.2 Other stations in area	3-8
3.2.1.3 Depth of tunneling	3-8
3.2.2 Site testing plans	3-9
3.2.2.1 Integrated testing/excavation/salvage program, Wilshire/Fairfax station	3-10
3.2.2.2 Testing at other station locations	3-13
3.2.2.3 Testing for depth of tunneling	3-14
3.3 <u>Excavation monitoring and geologic/stratigraphic mapping</u>	3-16
3.3.1 Wilshire/Fairfax station	3-16
3.3.2 Other area stations	3-17
3.3.3 Tunneling	3-17
* 3.4 <u>Salvage procedures</u>	3-18
3.4.1 General	3-19
3.4.1.1 Personnel selection	3-19
3.4.1.2 Personnel training	3-20
3.4.2 Salvage of larger fossils	3-20
3.4.2.1 <u>In situ</u> excavation	3-20
3.4.2.1.1 Good preservation	3-20
3.4.2.1.2 Poor preservation	3-23
3.4.2.2 <u>En bloc</u> excavation	3-23
3.4.2.2.1 Soft matrix	3-23
3.4.2.2.2 Hard matrix	3-24
3.4.2.2.2.1 Typical deposits	3-24

3.4.2.2.2 Stratified deposits	3-25
3.4.3 Salvage of smaller fossils	3-26
3.4.3.1 General	3-26
3.4.3.2 Sampling Plan	3-26
3.4.4 Special study samples	3-27
3.4.4.1 Pollen	3-27
3.4.4.2 Lithologic	3-27
3.4.4.3 Microfossils	3-27
3.4.5 Archeological/anthropological salvage	3-28
3.4.6 Salvage of marine fossils	3-28
X 3.5 <u>Preparation and processing</u>	3-29
3.5.1 General	3-29
3.5.1.1 Personnel selection	3-29
3.5.1.2 Personnel training	3-30
3.5.2 Large fossils	3-30
3.5.2.1 From <u>in situ</u> collections	3-30
3.5.2.1.1 Well preserved	3-30
3.5.2.1.2 Poorly preserved	3-31
3.5.2.2 From <u>en bloc</u> collections	3-31
3.5.2.2.1 Soft matrix	3-31
3.5.2.2.2 Hard matrix	3-31
3.5.3 Smaller fossils	3-32
3.5.4 Special study samples	3-33
3.5.4.1 Pollen	3-33
3.5.4.2 Lithologic	3-33
3.5.4.3 Microfossils	3-33
X 3.6 <u>Curation procedures</u>	3-34
3.6.1 Identification	3-34

3.6.2 Cataloging	3-34
3.7 Temporary and permanent storage	3-36
3.8 Collection management	3-38
3.9 Other	3-39
3.9.1 Radiometric dates	3-39
3.9.2 Hazardous waste disposal	3-39
3.10 Summary of computerization	3-40
3.11 Summary of personnel and duties	3-41
3.11.1 Salvage personnel	3-41
3.11.2 Laboratory	3-42
3.12 Summary of estimated salvage times	3-44
4.0 Site specific considerations	4-1
4.1 Site security	4-2
4.2 Logistical considerations	4-3
4.2.1 Interface of excavation and salvage activities	4-3
4.2.1.1 Integrated excavation/salvage plan	4-3
4.2.1.2 Priorities	4-3
4.2.1.3 Equipment use	4-3
4.3 Other	4-4
4.3.1 Lead times for special equipment	4-4
4.3.2 Lead times for personnel selection and training	4-4
4.4 Digitizer evaluation and personnel training program	4-6
5.0 Responsibilities of parties to the agreement	5-1
6.0 Cost estimates and scenarios	6-1
6.1 Assumptions and sources of variation	6-3
6.2 Conical deposits	6-6
6.2.1 Small deposit	6-6

6.2.1.1 Good preservation	6-6
6.2.1.1.1 <u>In situ</u> excavation	6-6
6.2.1.1.2 <u>En bloc</u> excavation	6-7
6.2.1.2 Poor preservation	6-8
6.2.1.2.1 <u>In situ</u> excavation	6-8
6.2.2 Large deposit	6-9
6.2.2.1 Good preservation	6-9
6.2.2.1.1 <u>In situ</u> excavation	6-9
6.2.2.1.2 <u>En bloc</u> excavation	6-10
6.2.2.2 Poor preservation	6-12
6.2.2.2.1 <u>In situ</u> excavation	6-12
6.3 Stratified deposits	6-13
6.4 Deposits with only small fossils	6-14
6.5 Archeological sites	6-15
6.5.1 Small site	6-15
6.5.2 Large site	6-16
6.6 Marine fossils	6-17
7.0 Recommended funding structure	7-1
8.0 Report on project	8-1
References	8-2
9.0 Appendices	9-1
9.1 Glossary	9-1
9.2 Legal aspects	9-7
9.3 Detailed budget estimates	9-9

SUMMARY

The world-famous fossil deposits of Rancho La Brea constitute a unique and extremely important paleontologic resource which would be impacted by construction of the Metro Rail Project. Destruction of Rancho La Brea fossil deposits would result in a major negative impact but mitigation by means of proper salvage and care of those fossils and artifacts which cannot be avoided would result in a major positive impact. SCRTD has recently lessened the potential for impact by moving the proposed Wilshire/Fairfax station location to a less sensitive area, in the present May Co. parking lot (see Figures A and B for site plan and profile), and by assuring that tunneling depths will be designed so as to avoid, to the extent possible, the fossil resource.

However, the new location is still within a moderately sensitive area and will require appropriate mitigation efforts. This report addresses the need for mitigation, makes recommendation regarding mitigation methodology, and provides estimates of mitigation costs for a variety of individual deposits having different characteristics of size, quality of fossil preservation, and type of matrix. Archaeologic sites and marine invertebrate fossil deposits are included.

With this recent change of location, the extensive testing program recommended in the first draft of this document becomes less critical. Accordingly, and at the suggestion of SCRTD, we now recommend that building of the station proceed in two separate phases (an excavation/salvage phase followed by a construction phase) and that a scaled down testing program be integrated with the excavation/salvage phase. This will reduce total cost and allow more time for excavation/salvage but introduces additional elements of uncertainty. The more extensive testing program would have produced data regarding the size,

distribution, and characteristics of fossil deposits at the station location prior to onset of excavation. These data are necessary for predicting the total time required for the excavation/salvage phase, the number of workers which would be needed, the amount of specialized equipment to be obtained and the size of laboratory and storage facilities. Without such information, we will not be able to make any estimates of these parameters and they should not be inferred from our report.

Based on available information for sites within Hancock Park, and for sites documented in the adjoining area, the probability of encountering large quantities of fossils at the new (May Company) site is much less than at the originally proposed (junction of Wilshire Blvd. and Curson St.) station location. Even so, extrapolation from very sparse existing data indicate that there is still a 50+% probability of encountering at least one small vertebrate fossil deposit (10,000 bones distributed in 15 cubic meters of sediment) and a much larger probability (80-100%) of encountering one or more smaller concentrations of fossils at the new location. The possibility of encountering a large fossil bone concentration (100,000 bones), or more than one medium sized fossil deposit, cannot be ruled out. We emphasize again that no data exist upon which an estimate can be based of the total quantity of paleontologic and archaeological resources present.

All identifiable larger fossil bones and all archaeological materials encountered during the construction of the station must be salvaged with appropriate documentation of the context. Samples must be obtained of the invertebrate marine fossils and of microfossils (plant, invertebrate, vertebrate), again with proper contextual documentation. In order to expedite the integrated testing/excavation/salvage phase, mitigation efforts must take priority over the excavation work except where safety and logistical needs may require modifications as jointly determined between the prime contractor for

salvage and the prime contractor for excavation. Close coordination between these parties will be needed. To avoid undue disruption of the construction schedule, S.C.R.T.D. should schedule the maximum possible time for the excavation/salvage phase.

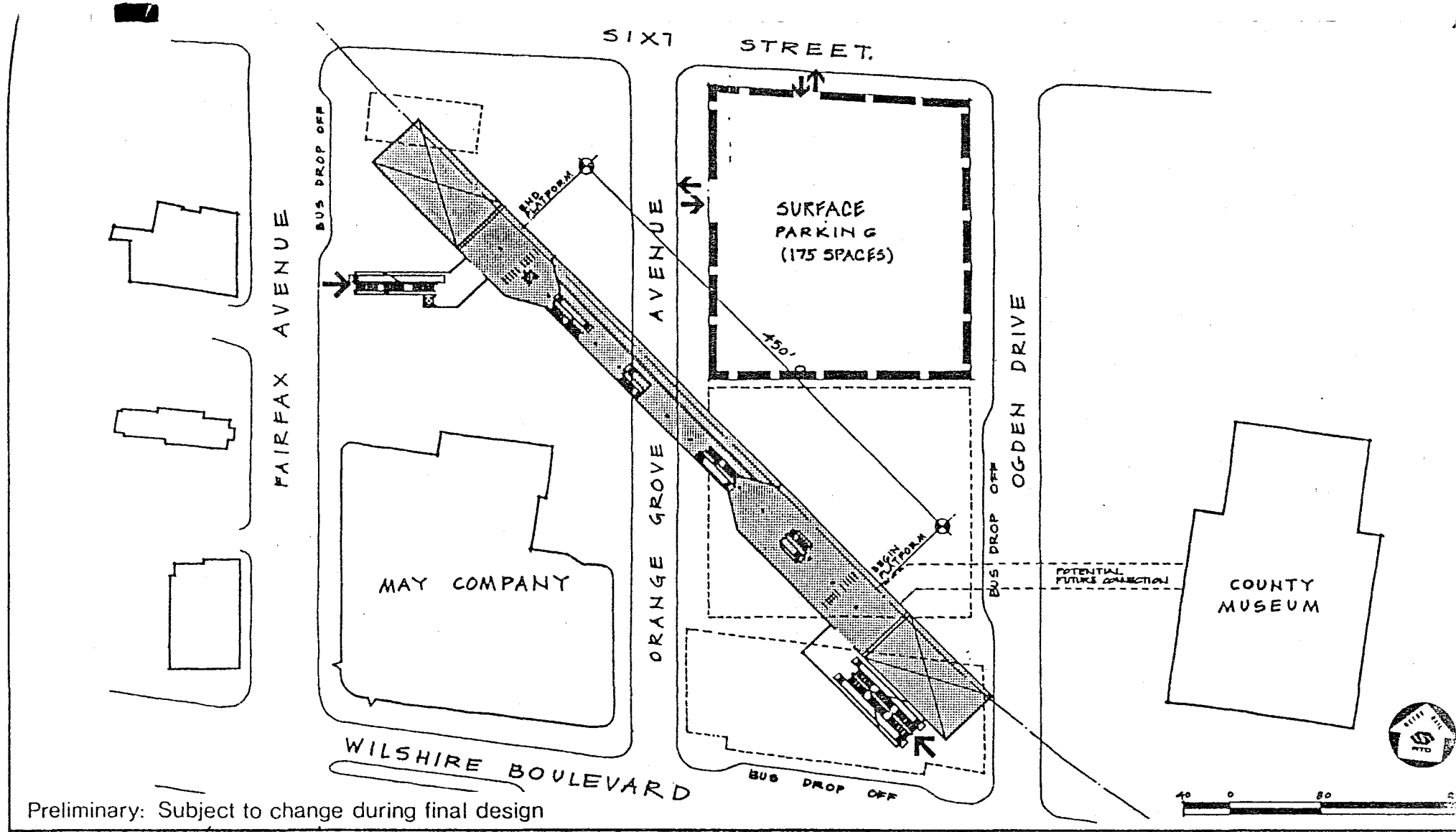
Past experience indicates that block excavation of asphalt deposits is feasible for thin deposits where the asphalt has been heavily oxidised. Block excavation of deposits with soft matrix does not appear to be feasible with present methods and would result in damage to or destruction of a significant portion of the resource. However, block excavation could save considerable time during salvage and SCRTD plans to pursue new techniques for implementing this method of collection. The recommended excavation procedures for vertebrate fossils presented in this document are standard methods that have been modified to meet the unique conditions of an asphaltic matrix with additional modifications for speedy recovery of contextual data.

The estimated spans of time required to salvage an individual bone concentration range from 60 team days (for a small deposit with well preserved bones) to 1600 team days (for a large concentration of poorly preserved bones), a team comprising seven people with specific allocated duties. Salvage time can be decreased by employing more than one shift per deposit per day (the added costs for night shift work or for lighting facilities required thereby have not been calculated). In most instances it should be possible to employ more than one team per concentration per shift but obviously the number of people engaged at one concentration will be limited by physical access to the exposed surface area of the concentration.

Preliminary and provisional budget estimates have been compiled for a number of different scenarios (with size of deposit, number of bones or artifacts, and degree of preservation of fossils being variable factors). These estimates range from \$460,437.32 (for small but well preserved concentrations of bones) to

\$4,645,041.37 (for major but poorly preserved concentrations of bones).

A recognized public scientific institution should be selected as the repository for salvaged paleontological and archaeological material and should be responsible for all aspects of monitoring, excavation, salvage, preparation and curation of such materials. In consequence, this institution should be responsible for the hiring, training and supervision of the staff needed for these activities. S.C.R.T.D. should be responsible for funding all aspects of the salvage activities (to include surface and subsurface survey and exploration of the construction site prior to and during excavation/salvage activity, costs of salvage staff and materials, and provision for permanent storage and care of excavated materials under the supervision of the scientific institution). S.C.R.T.D. should also be responsible for access to, and the safety and security of, the construction site, for providing temporary office and convenience facilities on site, and for the provision of any heavy machinery required during the salvage operation.



Preliminary: Subject to change during final design

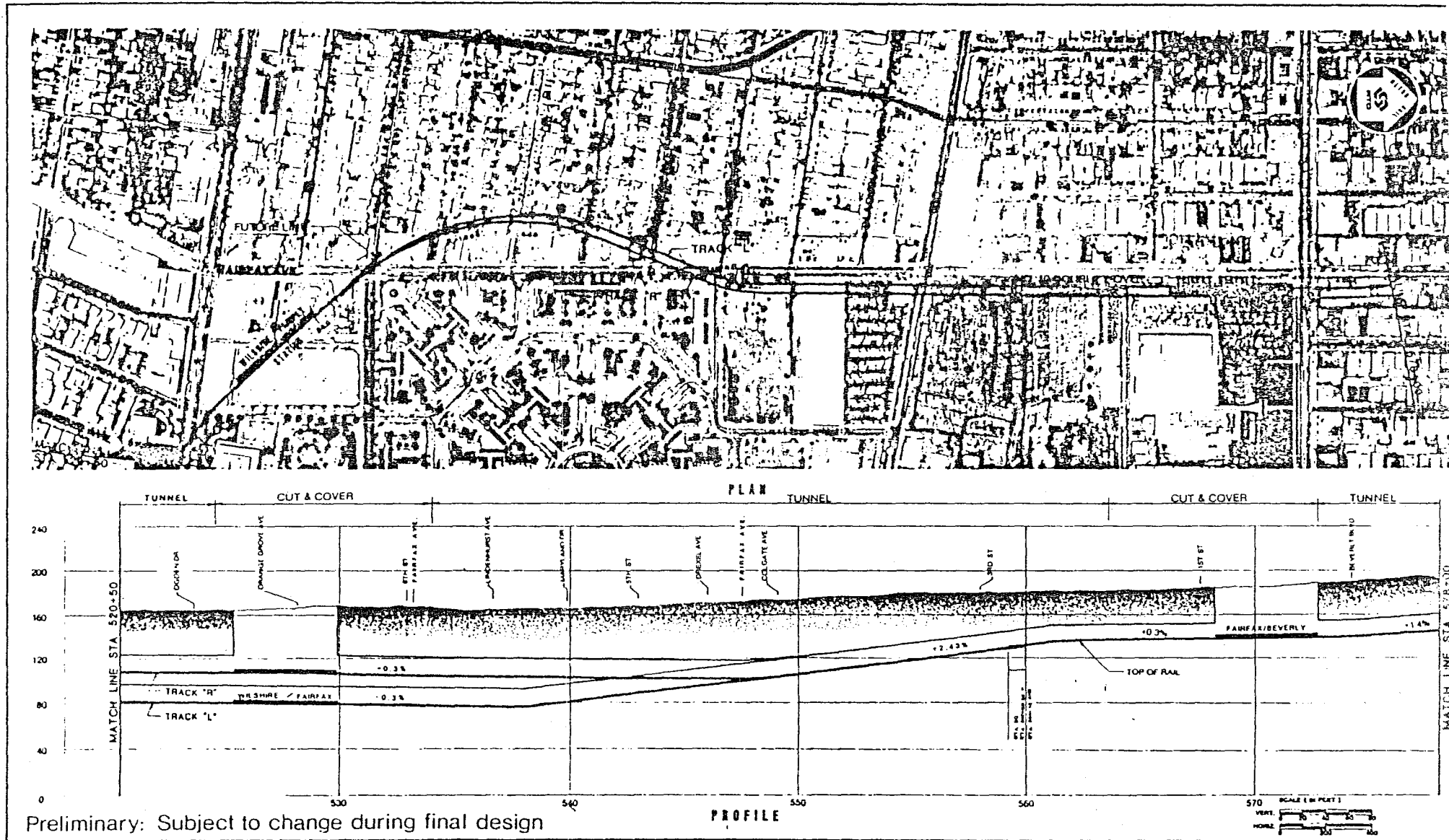
Southern California Rapid Transit District
Metro Rail Project
 PRELIMINARY ENGINEERING PROGRAM

Figure 2-17

**Wilshire/Fairfax Station Location for
 Locally Preferred Alternative**
 Harry Weese & Associates

Figure A: Site Plan for May Company Location, Wilshire/Fairfax Station

Figure B: Profile for May Company Location, Wilshire/Fairfax Station.



1.0. Introduction and background

1.1. Historical summary

Hancock Park, bounded by Wilshire Blvd., Curson Ave., Sixth St., and Ogden Dr., comprises about 23 acres including the core of the internationally known Rancho La Brea fossil deposits. These deposits have yielded over a million fossils of Pleistocene vertebrate, invertebrate and plant life between 10,000 and 40,000 years old including many extinct species. While the asphalt was extensively utilized by early Indians and European settlers, the importance of the bones found within it was not recognized until a brief mention of extinct mammals was made by Denton (1875). However, his description went unnoticed, and intensive collecting did not begin until 1907. The University of California, Berkeley, the Southern California Academy of Sciences, and the Los Angeles High School made significant collections between 1907 and 1913. Those collections made by the Southern California Academy of Sciences were instrumental in the decision to found a county museum for their curation. Between 1913 and 1915, the largest and best documented collection of extinct Pleistocene mammals was recovered by the Los Angeles County Museum (LACM). These excavations also disclosed the remains of prehistoric Indian cultures.

As a result of these discoveries, the 23 acres comprising Hancock Park were set aside as a scientific park and donated to the LACM. Additional excavations were begun in 1929 but were soon discontinued due to economic conditions. The Rancho La Brea Project, a long term systematic program of excavation, started in 1969. This project and the opening of the George C. Page Museum have provided new insights into the Ice Age of Southern California while exposing the public to the rich pre-history of Los Angeles.

1.2. Importance of Rancho La Brea fossils

1.2.1. Scientific importance

The scientific importance of Rancho La Brea stems from a combination of three factors, any one of which would be sufficient to establish it as a unique place to study ancient life. First is the extremely good quality of preservation of many of the fossils. The finest details, the most fragile structures, and even proteins within the bones are preserved. Second is the great abundance of fossil remains of some species, especially carnivorous mammals and birds. Third is the great variety of terrestrial life preserved here. No other locality contains so complete a representation of an extinct terrestrial ecosystem.

Many scientific studies, impossible at any other site, have been conducted here, with many more in progress. The contribution that Rancho La Brea has made to the field of paleontology is immeasurable but its full potential has scarcely begun to be realized. Rancho La Brea is of such importance to vertebrate paleontology that the Late Pleistocene portion of the geologic record in North America has been formally designated as the "Rancholabrean Land Mammal Age" (Savage, 1951). The published fauna from Rancho La Brea serves as the standard of reference for all terrestrial vertebrate faunas of similar age.

1.2.2. Public recognition

From the early part of this century, Rancho La Brea has captured the public's imagination. It is by far the most famous fossil deposit in North America if not in the entire world. Hordes of visitors, from ordinary people to heads of state, have visited the site from all over the world, even during those decades when there was little or nothing in the way of facilities and exhibits in the park.

Official recognition includes designation of Hancock Park as a California

Historical Landmark (No. 170) in 1940, and a National Natural Landmark in 1964. Due to the international recognition of the fossil deposit, the Sabertoothed Cat (Smilodon californicus), so abundant at Rancho La Brea, was named the official California State Fossil by the legislature in 1973.

1.2.3. Nature of continuing research

Paleontologic investigation is a continuing, open ended process. This is the reason museums and other research institutions carefully preserve paleontologic research collections. It can never be assumed that a collection of fossils has been completely studied; rather, it can be safely assumed that such a collection will always contain additional knowledge that can be extracted by future researchers.

Like any active field of study, the overall state of knowledge in paleontology is constantly advancing. As this happens, existing collections are constantly re-examined in the light of new discoveries to test new hypotheses or to answer new questions. Thus, one specimen, or a series of specimens, may be studied repeatedly by different researchers working on different research problems. For example, a single Smilodon skull may be studied by one scientist working on predation habits, by another for ontogenetic growth, or muscle reconstruction, or sexual dimorphism, or pathology, or brain and nerve interpretation, or as an example of Pleistocene micro-evolution, etc. In spite of the fact that the Rancho La Brea collections have been extensively studied over a 60 year period, new discoveries are constantly being made. If one were to compare what we now know about the Sabertoothed Cat with what was known about it 10 years ago, it would seem as though two different animals were being discussed. Our knowledge of how the fossil deposits formed has changed even more drastically, and, of the more than 500 species of plants and animals known from Rancho La Brea, more than a fifth have been identified in the past ten years.

Thus, we can not anticipate any "final report" on specimens recovered from salvage operations associated with the Metro Rail project. We can foresee a series of technical and popular articles addressing different aspects of the collection over a period of years, perhaps decades. Of course, each will acknowledge the source of funding which permitted collection of the data and specimens used in the study.

1.3. Characteristics of Rancho La Brea fossil deposits

1.3.1 Variety of fossils and archaeological/anthropologic remains preserved

While Rancho La Brea is justly famed for the great numbers of exceedingly well preserved remains of large extinct mammals and birds, much of its scientific importance lies in the preservation of many other forms of life. No other site provides such a complete picture of an extinct terrestrial ecosystem, allowing reconstruction of the environment at the time that the extinct animals lived. The variety of fossils preserved here include plant pollen, diatoms, leaves, seeds, flowering parts, wood, snails, clams, ostracods, spiders, scorpions, a great variety of insects, fish, salamanders, frogs, toads, lizards, snakes, 138 different species of birds, and 58 species of mammals from mice to mammoths.

One human skeleton has been found, dating from 9,000 years BP (Berger et al., 1971). Artifacts were also recovered, including rarely preserved types made of wood and bone, which date from 4,000 to 5,000 years BP (Hubbs et al., 1960; Salls, 1980).

1.3.2. Size, shape, and stratigraphic context of deposits

Many fossil deposits tend to form fairly continuous, thin layers which may be quite laterally extensive (a number of acres to miles). However, the Rancho La Brea fossils tend to occur in scattered and isolated masses of limited horizontal extent but considerable vertical depth. They come in a variety of shapes and sizes. The most common shape is subcylindrical to conical with the narrow end of the cone at the bottom. Several of these may coalesce to form a larger mass (Woodard and Marcus, 1973). This type of deposit may be from two to over 20 feet in diameter and up to 30 feet from top to bottom. Lenticular, stratified

deposits are relatively uncommon; the few that have been found seem to be about the same diameter as the conical deposits but several feet thick and flat-bottomed. In addition, there are elongate, thin deposits which follow ancient stream beds and areas which have yielded scattered fossils.

The stratigraphic context of the fossil deposits is best described using the terminology employed by Woodard and Marcus (1973) and illustrated in their Text-figure 3 (our Figure 1). All Rancho La Brea deposits occur in terrestrial sediments. Member A and the very base of Member B of the "Palos Verdes Sand" are clearly marine; Member C and the top of Member B are terrestrial. However, the exact position of the dividing line or interface between marine and terrestrial deposits within Member B is not known. At present, we can say that Rancho La Brea fossil deposits occur within Member C and extend to some extent into Member B. It is exceedingly unlikely that they will be found within the marine deposits of Member A or the marine portion of Member B. If the level of the interface between marine and terrestrial deposits within Member B can be determined, then one may safely assume the geologic section below that interface is free of Rancho La Brea fossil deposits, though marine invertebrates will occur.

The base of Member C occurs about 145 feet above mean sea level (MSL) in the immediate vicinity of Hancock Park and known marine deposits start at an elevation of about 120 feet above MSL. Thus, it is the interval between the elevations of 120 and 145 feet above MSL which cannot be interpreted at present. SCRTD is in the process of funding a study to more accurately determine elevation of the marine/terrestrial interface.

1.3.3. Quality of preservation

Asphalt typically preserves the hard parts of living things (bone, shell, wood, insect carapaces, etc.), but not the softer tissues (muscle, skin, hair, etc.). The fossils are not altered or replaced by minerals, but remain

essentially intact, though soaked with the asphalt. Even the microstructure of collagen (a protein within bone) is often preserved (Ho, 1967).

While many fossils at Rancho La Brea are exceptionally well preserved in most deposits, other deposits contain poorly preserved materials. Several deposits have been found with bones which appear to have become water-soaked before entombment in the asphalt. These are fragile, making collection of these specimens difficult. Unfortunately, most of the rare mastodon, mammoth and short-faced bear fossils found to date have come from such deposits. Thus, these deposits cannot simply be ignored in favor of better preserved materials. The distribution of these deposits forms no distinct pattern except that they appear to be more common near the southeast corner of Hancock Park, well away from the current Wilshire/Fairfax station location. However, the largest such deposit was found in the northwestern part of the Park, relatively close to the proposed station.

One known stratified deposit and parts of others contain oxidized asphalt. In these, exposure to the air has resulted in the asphalt altering to a hard, brittle substance much like bituminous coal. As this happens, the bones become brittle and friable. The extraction of specimens from oxidized deposits is difficult and time consuming, but the deposits may be relatively easy to collect in blocks because of their structural strength. The only known occurrence of articulated skeletons at Rancho La Brea was in such a deposit and was recovered in a number of large blocks. No pattern can be detected the distribution of the few known fossil bearing oxidized deposits, but an oxidized asphalt "cap" is reported to have existed near the southeast corner of the May Company station site. It is not known whether or not this "cap" contained fossils.

1.3.4. Density of fossils

At most other fossil localities, single bones or articulated skeletons are

encountered. However, at Rancho La Brea, most deposits consist of masses of tightly packed, disarticulated bones. Many individuals of different species may be jammed into a single cubic meter. The actual bone frequency varies widely from one deposit to another. Pit 16 contained 10,000 specimens in 96 cubic meters, mostly of smaller animals; in Pit 4 had 100,000 specimens, mostly of large animals, in only 87 cubic meters.

1.3.5. Geographic distribution of deposits

The Rancho La Brea fossiliferous asphalt deposits extend well beyond the actual boundaries of Hancock Park (Figure 2). For example, deposits and fossils have been discovered at Sycamore Ave. and La Brea Ave. (LACM fossil vertebrate locality #7247), the Museum Square Building parking lot; the California Federal Savings Building, the intersection of Olympic Blvd. and Curson Ave, and 8th St. and Spaulding Ave. (LACM fossil vertebrate locality #4590). Fossils were also discovered during the construction of the Mutual Benefit Building, the Los Angeles County Museum of Art and the George C. Page Museum. Two fossil localities are under Wilshire Blvd., south of the park (U. S. Dept. of Transportation, 1983).

The known distribution of fossil deposits within Hancock Park, as well as those found during development of the surrounding area, indicate that the major concentration falls along or near a line trending northwest from just north of the intersection of Hauser Blvd. and 8th St. to just east of the intersection of Ogden Dr. and 6th St. However, scattered deposits do occur at some distance from this linear group, and, short of implementing a testing program, there is no reliable way to predict the presence or absence of Rancho La Brea fossils in any portion of the area.

SOUTH OF HANCOCK PARK

HANCOCK PARK CORES

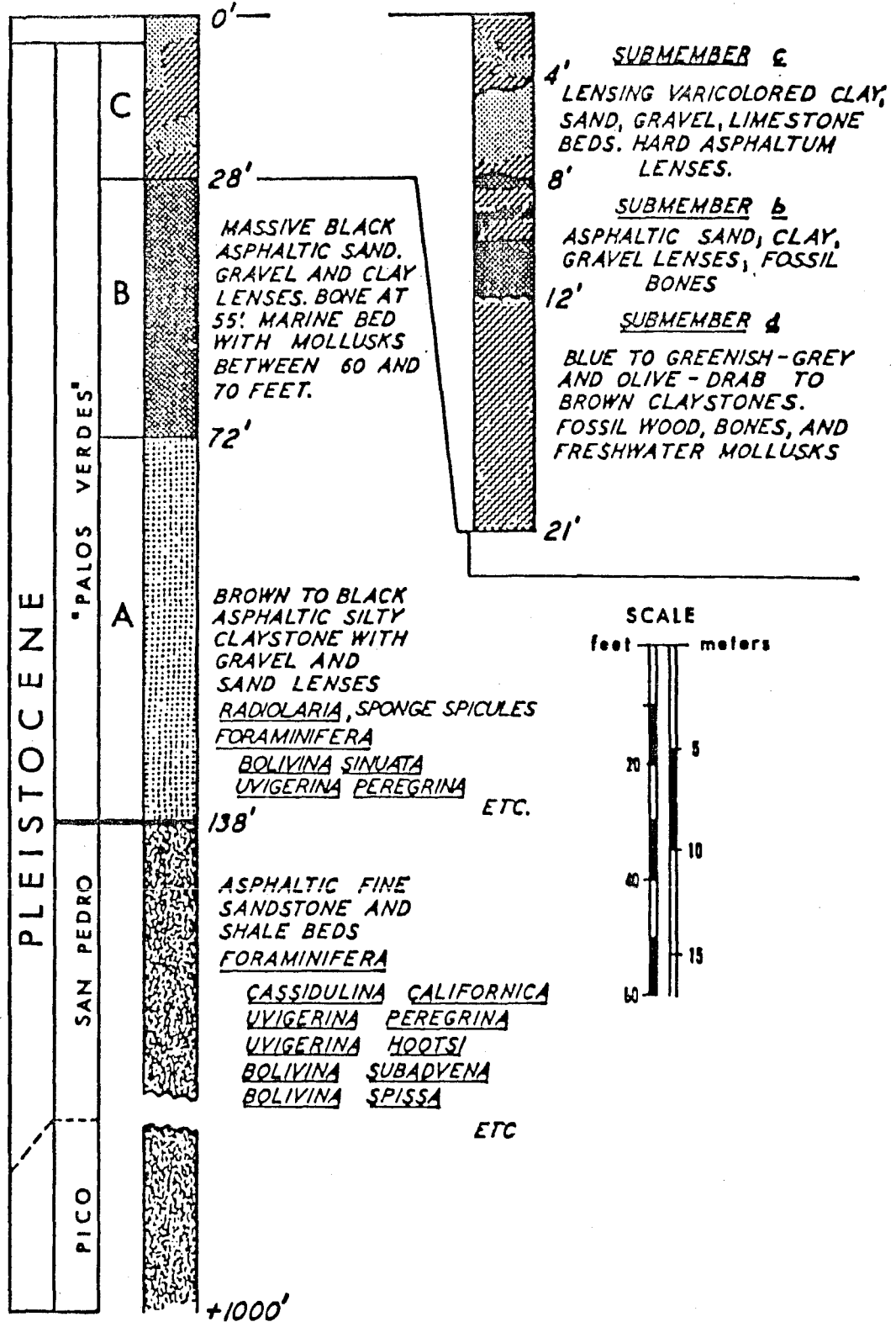


Figure 1. Stratigraphic Column at Rancho La Brea. From Woodard and Marcus (1973, Text-fig. 3).

Figure 2. Map of Hancock Park and vicinity showing known distribution of fossil deposits from scientific excavations, test borings, and structural excavations. Only those sites evaluated by vertebrate paleontologists are shown, others are considered to be unknown. Many excavations indicated as containing "No Large Fossils" were actually too shallow to adequately test the presence or absence of large fossils (This includes the Wilshire Galleria excavation on the north side of Eighth Street between Spaulding and Stanley).

EXPLANATION OF FIGURE 2

Scientific Excavations

Completed Excavations

Incomplete Excavations
(Unknown number of specimens
remaining)

- | | | |
|-------------------------------------|---------------------------------|-------------------------------------|
| <input type="checkbox"/> | No Large Fossils | |
| <input checked="" type="checkbox"/> | Less than 100 Large Fossils | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | 100 to 10,000 Large Fossils | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 10,000 to 100,000 Large Fossils | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | More than 100,000 Large Fossils | |

Test Borings Logged by Vertebrate Paleontologists

- No Large Fossils
- Few Large Fossils
- Many Large Fossils

Monitored Large Structure Excavations

..... Outline of Excavation

Fossil deposits within structure excavations indicated by same symbols as in Scientific Excavations. Number of large fossils in remainder of structure excavations indicated by "None" or "Few."

2.0. Potential impact of Metro Rail construction

SCRTD has recently provided partial mitigation of impact upon paleontologic resources by relocation of the Wilshire/Fairfax station from a more sensitive site under Wilshire Boulevard in front of the George C. Page Museum to a less sensitive site in the May Company Parking lot to the west of Hancock Park. The new site very probably contains significant paleontologic resources but the total resource should be much less than at the previous station location.

Rancholabrean fossil deposits are abundant in the C member of the Palos Verdes Sand which extends from ground level (170 foot elevation) to approximately 25 feet (145 foot elevation) below the surface. Below the 145 foot elevation is the B member of the Palos Verdes Sand, the upper part of which also contains terrestrial Rancholabrean fossils. Further below, at about 120 foot elevation, are Pleistocene marine invertebrate fossils which may also be impacted by the construction. Archaeological resources have been recovered in Hancock Park and there is a strong possibility that a prehistoric Indian site may exist in the Wilshire/Fairfax station area. While all known artifacts from Rancho La Brea were recovered from the western portion of Hancock Park, existing data are insufficient to estimate the probability that such a site will be encountered and present development at the station location precludes conducting an archaeological survey.

Assessment of the paleontological and archaeological resources in this proposed construction area is difficult without subsurface testing data. Existing records do not provide sufficient data for management purposes outside the immediate environs of Hancock Park. There is, however, enough knowledge to establish three resource sensitivity areas around the major Rancho La Brea fossil concentration. The Wilshire/Fairfax station is in a high sensitivity area, while those at Wilshire/La Brea and Fairfax/Beverly are considered to be in moderately

sensitive areas.

2.1.1 Probability of encountering fossil deposits

At this time, we can only provide very general estimates of the probability of encountering fossil deposits at the Wilshire/Fairfax station site on May Co. property. There is no solid information on this area (see Figure 2); however, verbal reports and fragmentary records indicate that a few asphalt seeps were present on the property and one oxidized tar cap (similar to those known to cover fossil deposits) existed at the southeast corner prior to existing development. Recent borings indicate the presence of asphaltic sediments below the surface. These few data indicate that a reasonable probability of encountering fossil resources exists at this site. The following probabilities are given as ranges and are based strictly upon extrapolations from adjacent areas.

Type of Deposit	Range of Probability
Few scattered large bones	80% to 100%
About 10,000 specimens	30% to 70%
100,000 specimens plus	10% to 40%
Small fossils only	80% to 100%
Marine fossils (below 120' MSL)	100%
Archaeologic deposit	No data

More exact estimation of these probabilities cannot be made without new information.

2.1.2. Sampling procedures and priorities

As discussed elsewhere, standard sampling procedures are recommended for the collection of small vertebrates (section 3.4.3.1), pollen (3.4.4.1) and microfossils (3.4.4.3), pending consultation with the peer review board. Only samples of the marine invertebrates from the lower portion of the section need be collected.

Normal archaeological practice is to excavate only part of any archaeological site, leaving a portion untouched for posterity (to answer unresolved questions with the aid of future collecting techniques). As in this instance any uncollected materials will be destroyed, it will be necessary to salvage all exposed archaeological materials.

Similarly it will be important to collect all the medium and large sized vertebrate fossils encountered, in part to properly document the faunal composition of new local faunas and in part to obtain the rarer bones of common species plus a larger total sample of the less common species. Limitations of time available for salvage activities may affect the degree of documentation that can be provided for any individual fossil concentration. Any decision concerning the priority to be afforded any individual fossil concentration must necessarily be deferred until a clearer picture is obtained of the total volume of materials requiring salvage.

2.1.3. Importance of additional specimens and data

The need for additional specimens and data in the fields of paleontology and archaeology is a constant source of concern to investigators. With the rapid advances in these sciences, data that are considered sufficient at the time of collection will be inadequate in the future, when new research questions are formulated. Most of the fossils and all of the artifacts in the Los Angeles County Museum's Rancho La Brea collections were recovered between 1913 and 1915. Some 750,000 specimens were retrieved using techniques that were among the most advanced and thorough of that time. However, because of scientific progress during the ensuing 70 years, the information that these collections provide today is far less than if they had been collected within the past decade.

While Rancho La Brea is justly famed for the richness of its fossil deposits, most of the fossils come from only a handful of the more than 500 species known from these accumulations. Among the large mammals, the sabertoothed cat, dire wolf, and coyote make up more than 85% of the specimens. Similarly, of 138 species of birds, more than a quarter of the specimens come from two species. The great majority of species from Rancho La Brea are known from relatively few specimens. For example, we have only three foot bones of an extinct tapir, one of an extinct llama, one of a second type of sabertoothed cat, one of an extinct musk-ox, one limb bone of a raccoon, one each of two different bats, etc. Additional material of these and many other species would contribute greatly to our knowledge.

Even among the better known forms, additional specimens could yield new information and insights. In spite of the fact that we have a number of specimens of the giant bird, Teratornis, the front portion of the lower jaw has never been found. A complete lower jaw would be invaluable for interpretation of its mode of feeding.

Very little is known about the diets of extinct herbivores because plant material is very rarely preserved in deposits which contain fossil bones. However, at Rancho La Brea, botanical materials are exceptionally well preserved. Plant fragments, samples of diet, have been found in the teeth of several herbivores and can be identified. Unfortunately, these have long since been cleaned out of most of the teeth in the existing collections and a complete study of the diet in these extinct animals will require new, uncleaned specimens.

The sabertoothed cat, Smilodon, is the second most abundant large mammal known from Rancho La Brea with more than 600 good skulls in the LACM collections. Of this huge number, only one possesses the critical information needed to unlock the secret of how the large upper canine teeth were used. Had this specimen never been collected, the knowledge might never have emerged. Thus, we can never assume that new specimens will not yield new information, even among the most abundant and well known fossils from Rancho La Brea.

The small fossils of plants and animals, while not spectacular and mostly from species still living today, are very important to our understanding of past ecology. Many of those which survive to the present time have very specific requirements of temperature, rainfall, etc., for survival. Thus, their presence in the fossil record at Rancho La Brea helps to define many ecological parameters which influenced the lives of extinct forms. Their importance was not realized until after the main collections were made at Rancho La Brea. As a result, this area of potential knowledge is incomplete and would greatly benefit from new collections. It would be especially important to sample ecologic changes which may have occurred at the time of extinction of the Pleistocene megafauna. This interval of time is almost unknown in Southern California but old records indicate that the potential for finding deposits of this age is quite good at Rancho La Brea. If found, such a deposit would constitute a "treasure trove" of scientific knowledge.

In addition to the potential for advancement of science inherent in new fossil specimens, new data regarding their distributional relationships, orientations, and relationships to geologic units will be critical to answer questions about the origin and development of the deposits.

The exquisite preservation typical of fossils from Rancho La Brea also occurs in the archaeological specimens. Though relatively few in total number, the great majority are of bone and wood, materials which do not readily preserve in most archaeological sites. In addition, marks produced by manufacture and use are well preserved. Study of use marks is of special interest in current archaeological research. New materials from Rancho La Brea could shed much light on the manufacture and use of non-lithic artifacts by prehistoric cultures. Other questions of major importance which could be addressed by new cultural finds include the current issue of man's coexistence with, and effect upon, the late Pleistocene megafauna; the connection between the 9,000 year old human skeleton and the possibly contemporaneous Millingstone Culture; and the technology, methods, and trade networks in the prehistoric and historic utilization of asphalt. A major find of well preserved archaeological materials could have as profound an effect on the fields of archaeology and anthropology as the Rancho La Brea fossils have had on the field of paleontology.

2.2. Potential negative impacts

The potential negative impacts of this construction project consist of the irretrievable loss of potential knowledge through the destruction of non-renewable paleontologic and cultural remains and data. Some of this is inevitable in that it is physically impossible to collect every tiny fossil and scrap of information from any paleontologic and archaeological site.

2.2.1. Tunneling

The underground tunneling devices will totally destroy any scientific resource in their paths with no hope of mitigation beyond noting that a resource was present. The only feasible mitigation of impact is to attempt to avoid areas which are likely to contain significant resources (see section 3.2.1.3). SCRTD assures us that, to the extent possible, tunneling will be done at depths that will avoid fossil deposits.

2.2.2. Cut and cover

With the assurance of the SCRTD that the tunneling will be designed, as much as possible, to avoid areas with potential major resources, the greatest impact on paleontologic/archaeologic resources will occur during cut and cover excavations of rail stations, crossovers, pocket tracks, and vents, especially those associated with the Wilshire/Fairfax station. Since these excavations must go through the uppermost geologic units (those most likely to contain Rancho La Brea fossil deposits and archaeological sites), there is a high probability of creating a negative impact on such resources unless adequate mitigation measures are undertaken.

2.3. Potential positive impacts

The major potential positive scientific impact of the Metro Rail Project will be the collection of additional specimens and data under the strict supervision of the responsible federal agencies. A similar private development might have less stringent requirements for mitigation. Proper mitigation will have the potential of greatly augmenting our knowledge of the past (see Section 2.1 above). There is also a potential, but difficult to quantify, positive impact in educating and involving the public beyond that inherent in having a station so close to several museums in the area.

As recent experience has shown, any activity or new finds at Rancho La Brea very quickly become a hot news item with much public interest. Thus, we have a considerable potential to get the public involved in a positive manner. Careful consideration should be given to the possibility of setting up educational displays, lectures, or other activities because any salvage work at the Wilshire/Fairfax station site will attract intense public interest. We will have an interested audience eager to learn about what we are doing and why. The Museum and the SCRTD could gain favorable public relations exposure from such educational activities. This could be augmented in the longer term by educational exhibits within the station after completion. There are precedents in other subway systems of the world.

3.0. Mitigation goals and recommended procedures

The mitigation goals take into account the fact that it is impossible to collect all data and specimens. They are designed to maximize, as far as practical, the amount and quality of specimens and data recovered while recognizing the need for meeting construction deadlines (see sections 3.4 through 3.4.6 for more detailed information).

Paleontological and archaeological resources that are likely to be impacted by construction activities include plant and animal fossils (including fossil human remains) and organic and lithic artifacts. As outlined in section 2.1.2, we propose that all larger identifiable plant and vertebrate fossils and archeological artifacts be salvaged but only samples of microfossils (plant, invertebrate and vertebrate) and of marine invertebrate fossils need be recovered.

The recommended procedures take the above into account in addition to the different constraints which affect different portions of the project. In salvage (the physical removal of the specimens from the excavation area) of specimens and data, time is the most crucial element. Thus, specialized equipment and multiple shifts are more readily justified because they significantly reduce the total elapsed time of salvage. Similarly, extensive use of volunteers is not justified because, while it ultimately reduces total personnel costs, the time required to train and supervise volunteers would add appreciably to the total time required to complete the task.

Preparation of specimens after salvage, on the other hand, does not face such severe time limitations. Here the costs of equipment need to be balanced only with potential cost savings and the use of volunteers for certain tasks is much more economical.

All of the goals, procedures, recommendations, sampling strategies, etc.

presented herein are subject to the review and concurrence of the Peer Review Board as described in a Memorandum of Agreement signed by representatives of ACHP, SHPO, UMTA, and SCRTD (reproduced on pages 4-27 through 4-30 of the final Metro Rail EIS).

3.1. Mitigation goals

Cultural resource management must, if it is to obtain more than one kind of information, define the various problem-specific research designs and erect a general plan of investigation (Corbyn, 1980:11). Archaeology and paleontology are faced with an ever-growing pattern of resource destruction due to development. To curb this destruction, Federal and local governments have enacted Environmental Protection Acts to guard these resources (see Section 9.2.).

Because of this legislation, cultural resource managers met and established the Management of Cultural Resources (the Airlie House Report) as a source defining the minimal categories of information in a mitigation proposal (Vivian et al., 1977). These suggestions are now standard in all Federal and California mitigation reports, and have been followed in this report. Although there are many problem-specific research questions regarding the Rancho La Brea deposits, the specific data sought from the mitigated assemblage include: Pleistocene faunal populations, environment and environmental changes during the late Pleistocene, processes of extinction and replacement, and stratigraphic and depositional context of the fossil deposits. There are also specific research questions including the coexistence of man and Pleistocene megafauna in Southern California, and cultural utilization and transport of asphalt in prehistory.

The fossil resources at Rancho La Brea are a known resource which must be preserved for future generations. Archaeological remains, though scarce, are also known from Rancho La Brea. Possible cultural remains include prehistoric (Indian groups) and historic (Spanish, Mexican, and early United States). Historic records indicate much activity in the Rancho La Brea area (Sibley, 1977; Torrence, 1977). The goal of the Metro Rail mitigation is to insure that, as much as possible, both paleontological and archaeological resources are

identified, protected, and preserved for maximum longevity so that the potential knowledge they contain may be elucidated and disseminated while allowing schedule adherence and cost effective construction of the Metro Rail Project.

3.1.1. Salvage and preservation of paleontologic remains

The salvage of paleontologic resources involves more than simply rescuing large bones. The fossils must be correctly documented at the time of collection (see Section 3.1.3) and, once taken from the ground, must be properly cleaned and repaired. The preparation methods used must take into account such easily damaged surface features as occlusal wear facets on teeth, or fragments of a herbivore's last meal still embedded in its dentition. The specimens must be protected from the deterioration caused by exposure to oxygen and humidity. They must be cataloged and stored in such a way that they are readily available for research.

3.1.2. Salvage and preservation of archaeologic/anthropologic remains

Archaeological remains, especially those dating from before 10,000 years BP, are rare in Southern California. Human skeletons older than 7,000 years BP are rare everywhere on this continent. The Rancho La Brea asphalt deposits have already produced one of the oldest human remains in North America, the 9,000 year-old "La Brea Woman." Numerous artifacts were also found, many of perishable materials such as wood and bone. In most archaeological sites, stone tools are all that remain, though prehistoric people are known to have used a variety of materials in tool manufacture. The excellent preservation at Rancho La Brea makes it a likely source for additional prehistoric artifacts and perhaps more human skeletal material. Historic asphalt mining may also have left remains pertinent to the history of the City of Los Angeles.

Although the specimens recovered in archaeological and paleontological salvage are different, the methods and goals are the same. Unless artifacts are properly collected, ^{curated} prepared, and stored, their contained information will be destroyed. For example, the edge-wear marks on stone tools could be obliterated by careless cleaning.

3.1.3. Documentation of occurrence

Thorough documentation at the time of collection is a basic requirement in any paleontological or archaeological salvage project. Without exact data (locality, precise location, stratigraphy, micro-environment, and associations) a fossil or artifact is nearly useless. Recording this data must be done in situ, as, once the specimen is removed from its original context, the information cannot be reconstructed.

A fossil is useful because of the information that it contains; the actual bone is only a small part of the complete data package. To properly interpret a fossil one must have data on the following: large fossils that may be near the specimen of interest, the small vertebrates, invertebrates, and plants associated with it, the nature of the sediment surrounding it, the extent of the fossiliferous stratum in which it was found, and the relationship of that particular layer to the surrounding stratigraphy.

Taphonomy is the study of the processes that affect a potential fossil between the time of death of the animal and the time that its fossilized remains are recovered. Data on the precise location and orientation of each major bone in a fossil deposit can yield valuable clues to how the bones accumulated. Specimens that have been transported by water show preferred orientations, the details of which depend on the hydrologic characteristics of each fossil. The amount of abrasion and polishing on the bone indicates the distance it traveled. The relative proportions of age classes within a single species, or ratios of

carnivores to herbivores in the total biomass, indicate whether the fossil assemblage represents a normal living community or a biased death assemblage. If the latter is the case, the same information may be useful in determination of the nature of the bias.

From many such pieces of information, a complete picture of the paleoenvironment may be reconstructed. Without this data, only incomplete or inaccurate reconstructions are possible. For example, Gilbert (1910) described Rancho La Brea as having a semi-tropical climate during the late Pleistocene. This was based upon the megafaunal assemblage, which he compared to the present-day fauna of Africa and India. In a later paper he advanced the theory that the bones were washed into the asphalt seeps by the action of seasonal floods, which he based on the disarticulated nature of the individual skeletons (Gilbert, 1927). From newly collected data unavailable to Gilbert we now interpret the paleoclimate at Rancho La Brea to have been cooler and wetter than today, more comparable to that of the Monterey Peninsula in northern California. The bone orientation and faunal composition data recently collected at Rancho La Brea do not indicate that much water transport took place. Rather, a biased, predominantly carnivore, death assemblage was entrapped in situ.

Data recovery is just as important in an archaeological context. The association between two objects may be more informative than either object in itself. The taphonomic data that allows paleontologists to reconstruct a paleoenvironment can help archaeologists comprehend how a human culture dealt with the same environment. Faunal and floral elements give information on subsistence patterns; reconstruction of paleoclimate has implications for shelter and clothing practices. The perishable materials preserved at Rancho La Brea may yield useful information on prehistoric use of bone and wood implements not available elsewhere.

3.2 Site testing (surveys)

3.2.1 Information needed

In order to proceed with mitigation in an orderly and efficient manner, certain information, not presently available, will be required. Sections 3.2.1.1 through 3.2.1.3 present these needs and Sections 3.2.2 through 3.2.2.3 describe procedures to attain the needed information.

3.2.1.1 Wilshire/Fairfax station

This includes all the cut and cover excavation which will occur during construction of this station, including excavations for entrances, ventilation shafts, etc. Advance knowledge of the approximate total quantity of fossils present, the quality of their preservation, and the distribution of major fossil deposits within this site are important pieces of information for planning (see Section 1.3 for descriptions of these items). They will influence determination of the most efficient pattern of excavation - where to start and the order in which to proceed. For example, completion of the station could be considerably delayed if a major fossil deposit, or a poorly preserved one, were uncovered at the very end of station excavation. Knowing the distribution of the deposits would allow excavation and salvage to begin in areas of major or poorly preserved deposits and avoid potentially expensive delays.

This information will also play a major role in determining the size of the salvage crew to be hired and trained prior to the start of excavation. On one hand, too large a crew would be a waste of money. On the other, too small a crew would result in considerable delays until additional personnel were located, hired, and trained. The lead time between identification of the need for

additional excavation personnel and completion of their training is estimated to be between three and six weeks, depending on their previous experience.

Similar delays could result from having an inadequate amount of the specialized and custom-built equipment on hand that will be needed to perform the salvage efficiently. The required lead time on several of these items is as much as eight to ten weeks for a single unit. If four or five additional units suddenly became needed, the delay could be much greater.

3.2.1.2 Other stations in area

Two other station locations, Fairfax/Beverly and Wilshire/La Brea, may encounter Rancho La Brea type fossil deposits but the probability of their doing so appears to be low. Before proceeding with construction at these locations, it would be highly desirable to determine whether or not the actual probability of finding Rancho La Brea fossil deposits is as low as anticipated. An unanticipated discovery of major fossil resources during station construction could result in a major setback to construction schedules or destruction of the resources.

It should be possible to determine whether or not the probability of encountering fossil deposits is low enough to safely assume that it approaches zero. Asphalt seeps to the surface from deeper units and will saturate any permeable unit (such as sand) through which it passes. Demonstration of the presence of a continuous layer of sand which is free of liquid hydrocarbons below the maximum depth of cut and cover excavation will satisfactorily demonstrate that the probability of encountering asphaltic fossil deposits at these locations is minimal. This will require several logged core holes at each location. Existing logs and samples may suffice to make this determination.

3.2.1.3 Depth of tunneling

As described in Section 2.2.1, the underground tunnel boring machines will utterly destroy any fossils in their path. The only way to avoid a completely negative impact upon the fossil resources of Rancho La Brea with this equipment is avoidance of such deposits. Existing data indicate that those fossil deposits in the vicinity of Hancock Park extend from near the surface to an elevation of 145 feet above mean sea level (MSL), possibly deeper, and that it is extremely unlikely that they extend below an elevation of 120 feet above MSL (see Section 1.3.2) unless displaced by faulting. The sediments at, and above, 145 feet in elevation are known to be of terrestrial origin and are very likely to contain significant resources of terrestrial fossils. Those at or below 120 feet above MSL are known to be of marine origin and, hence, are very unlikely to contain significant deposits of terrestrial fossils. That portion of the geologic section between elevations of 120 feet and 145 feet is, at present, of unknown origin. At this time, the only way to be certain of avoiding the fossil deposits is to construct the subway tunnel so that the top of the tunnel will not be at an elevation higher than 120 feet between the intersections of Wilshire/Dunsmuir and Fairfax/3rd St. (Present surface elevations along this segment of the tunnel range from 165 to 195 feet.) However, if sedimentologic and micropaleontologic analyses of cores (currently being initiated by SCRTD) can determine that the interface between terrestrial and marine deposits lies at a shallower depth, as it probably does, then the tunnel could be constructed at a shallower depth. There is also the problem of whether or not faulting in the area may have changed the elevation at which these sediments occur.

3.2.2 Site testing plans

Since the types of information being sought in this program are quite different from those sought in typical engineering geology testing programs, personnel engaged in evaluation of the cores, auger bores and other types of

information, should be specialists in the evaluation of stratigraphy, sedimentology, and paleontology rather than engineering geologists. At least one stratigrapher/sedimentologist should have previous experience in working with the geology of Rancho La Brea. Only two individuals have extensive experience with the geology of Rancho La Brea: Dr. N. J. Maloney of the California State University, Fullerton and Dr. G. D. Woodard of Sonoma State University. If at all possible, one or both should be involved with the project. Final evaluation of testing results should be the responsibility of the prime salvage contractor in consultation with staff members from the Natural History Museum of Los Angeles County.

New cores and auger bores will not be necessary in places where adequate information is available from previous testing. In most cases, this will require the availability of useable cores but, in some instances, detailed logs will suffice. We strongly urge that this testing program be integrated with other planned testing programs as a cost saving measure.

3.2.2.1 Integrated testing/excavation/salvage program,
Wilshire/Fairfax station

Perhaps the most difficult task will be to locate major fossil deposits and estimate their size within the Wilshire/Fairfax excavation site. The location of smaller fossil deposits would be prohibitively expensive and not that critical for planning purposes. Also, determination of potential archaeological sites appears to be beyond the abilities of current technology. As noted in Section 1.3.2, major deposits are relatively small in diameter (usually under 20 feet) but may extend to considerable depth. They may also occur at any depth, with the top of the deposit from near the present ground surface to many feet below. Large deposits are typically conical or cylindrical masses of asphaltic sediment but the great majority of asphaltic sediments in this area do not contain

significant numbers of fossils.

The first part of the problem is to locate the asphaltic sediments, particularly those whose geometry indicates that they may potentially contain fossils. ^{From Brown studies current data base.} The second part is to establish whether or not these asphaltic sediments actually contain significant fossil resources. ^{is it?} Finally, the approximate magnitude of the resource and the quality of preservation of the fossils should be determined. Extreme detail is unnecessary; only the larger deposits need be located and evaluated.

Our first draft of this plan included extensive electronic surveying and test boring of the station location in order to evaluate, prior to the onset of excavation, the extent and distribution of fossil deposits. This would have been fairly costly and would have required several months for implementation and evaluation. At the time that portion of the draft was written, the station location was still supposed to be in front of the George C. Page Museum with an option to shift the location somewhat east or west to avoid any huge paleontologic resources which might be located. This site was also potentially very rich in fossil deposits and very detailed knowledge of their distribution was critical to development of a successful mitigation effort.

With the station location now fixed in an area which probably contains fewer paleontologic resources and which allows little, if any, adjustment in exact positioning of the station, the testing program need not be so extensive. SCRTD has suggested that both time and savings would be effected by implementing a scaled down version of the testing program simultaneously with site excavation and salvage. They have also suggested that station construction be conducted in two phases: the first to consist of a mitigation-oriented team effort between excavation and salvage contractors to provide a proper scientific excavation; the second to consist of actual station construction in the excavation resulting from the first phase. We accept these combined suggestions in light of the changes

described above and the fact that time is already short according to SCRTD projected construction schedules. In addition, there will be substantial cost savings and it would appear that the two phased approach will minimize the potential for conflict between salvage and construction needs.

Accordingly, we propose the following general approach:

1. Prior to beginning the excavation, all available data (bore-hole logs, cores, seismic maps, test excavations, etc.) should be analyzed to arrive at a tentative plan for excavation/salvage and a preliminary assessment of where additional bore-hole data are needed.
2. After demolition of existing structures and removal of all concrete, man-made asphalt, and fill, the site should be surveyed with a terrain conductivity meter and/or a sonic survey device currently under development at the Jet Propulsion Laboratory.
3. The survey results will then be integrated with the preliminary assessment of need for additional borehole data and any additional data which may result from site preparation, such as borings made to set up a shoring system, in order to arrive at a final plan for additional bore holes. The number of additional boreholes will be dependent upon the quantity and quality of data already collected as of this date. It will certainly amount to far fewer than were originally recommended. A very rough estimate would be on the order of 10 to 100 additional boreholes, more probably closer to the low end of this range.
4. The next step will include boring the additional holes and (if possible) begin earth moving activities in areas where such excavation will not interfere with borings.

5. Subsequent to completion of the borings, a final evaluation of all pertinent data will result in the final general excavation/salvage plan. This will be subject to further modifications as additional information is revealed during the excavation/salvage phase. In order to expedite salvage operations after the plan is completed, early stages of excavation should be concentrated in areas known to contain fossils or where the probability of encountering fossils is judged to be greatest. Areas where the probability of finding fossils is judged to be lowest will be excavated during later excavation stages or when it becomes necessary to shift the earth moving equipment from fossiliferous areas. The excavation/salvage plan or shifts of earth moving equipment will be subject to limitations imposed by safety needs, earth moving logistics, etc. as determined jointly by the prime excavation contractor and the prime salvage contractor.

6. Additional surveys and/or borings may be required as excavation/salvage work proceeds.

While the above approach will effect savings in time and expense, scaling down of the testing program introduces several elements of uncertainty. It will not be possible to determine in advance the extent and total cost of testing either prior to or during the excavation/salvage phase. Without advance data on the extent, nature, and distribution of fossil deposits, we cannot make any estimate of the total cost of salvage and the time which will be required to complete the excavation/salvage phase. The number of trained salvage personnel and the quantity of salvage equipment needed for an efficient salvage operation will be very difficult to estimate in advance.

3.2.2.2 Testing at other station locations

Evaluation of the sites for the Fairfax/Beverly and Wilshire/La Brea stations

will require the stratigraphic and sedimentologic analysis of three continuous cores at each location to a depth of at least 20 feet below the maximum depth of anticipated station excavation, or to such a depth that they penetrate several substantial thicknesses of sand. Should these demonstrate the presence of major sand units lacking in liquid hydrocarbons below the maximum depth of excavation and the lack of liquid hydrocarbons throughout the rest of the cores, no further testing will be required. Should liquid hydrocarbons be found, additional testing will be needed, the scope of which will depend on the results obtained from the initial data. Part or all of the required data may be available from existing borings and records.

3.2.2.3 Testing for depth of tunneling

We recommend the following procedures to minimize the probability of negative impact on paleontologic resources during the tunneling operation between the intersections of Wilshire/Dunsmuir and Fairfax/Third St. Where the top of the tunnel is at or below an elevation of 120 feet above mean sea level, no testing will be needed. In any area between the two above intersections where the top of the tunnel is proposed to be above this 120 foot elevation, elevation of the interface between terrestrial and marine environments of deposition shall be determined by a qualified geologist. Such determination shall be based on, but not limited to, sedimentologic, paleontologic, and stratigraphic analyses of a sufficient number of core samples taken within or immediately adjacent to the areas in question. The 120 foot elevation limitation will be subject to revision according to the performed studies. Should evidence be developed that faulting has elevated or depressed the terrestrial/marine interface, depth of tunneling will be adjusted accordingly. The reported occurrence of peat (which usually forms under terrestrial conditions) and rootlets at depths of 72 to 77 feet (elevations of about 93 to 88 feet) in borehole #19-3 near the intersection of

Wilshire and Ogden may indicate a depression of the terrestrial/marine interface and should be carefully evaluated.

3.3. Excavation monitoring and geologic/stratigraphic mapping

Experienced and/or trained monitors will be needed in order to assure avoidance of negative impacts, and proper recovery of any paleontological or cultural resources. These monitors should be qualified both in paleontologic and archaeological work and be able to interpret geologic features associated with both. One way in which costs may be minimized, especially during early stages of excavation/salvage, will be to train salvage personnel to also serve as monitors. They will then be used to cover at least part of the monitoring task until needed for salvage. This will, however, require having trained monitors available on a stand-by basis so that excessive time will not be lost while training monitors to replace personnel shifted from monitoring to salvage duties. A very important phase of the data salvage effort will be mapping, photographing, and videotaping of the geology and stratigraphy, particularly at the Wilshire/Fairfax station. All recommended staffing levels are on a per-shift basis.

3.3.1. Wilshire/Fairfax station

Because this station is located in a sensitive area, a thorough monitoring program will be required. Prior to start of the excavation/salvage phase, it will not be possible to definitely locate all potential paleontologic or archaeological sites which may be present. One monitor should be assigned to each piece of earth-moving equipment in order to closely inspect the working face or contents of any piece of equipment and to suspend earth-moving operations, pending evaluation, should evidence of paleontologic or archaeological resources be encountered. The salvage supervisor would then be responsible for evaluating the evidence and determining, in a timely manner, whether earth-moving may continue or the salvage phase should be implemented in that area. As part of their duties, monitors should sketch and sample geologic features under the direction

of the Geologic/Stratigraphic Mapper.

The Geologic/Stratigraphic Mapper shall map, sample, and photograph or videotape the geologic units exposed by the excavation process. These data are important for understanding the geologic context and mode of formation of the Rancho La Brea fossil deposits. He shall also be empowered to temporarily suspend earth-moving operations in order to perform his duties. He will advise and aid in the supervision of the site monitors.

3.3.2. Other area stations

Even if testing at the proposed station locations at Fairfax/Beverly and Wilshire/La Brea indicates little probability of encountering fossiliferous asphalt deposits, they are located in moderately sensitive areas and require at least one monitor to be present during earth-moving activities. The monitor's qualifications, duties and responsibilities shall be the same as those described for the Wilshire/Fairfax site except that he/she will also bear primary responsibility for geologic and stratigraphic mapping.

3.3.3. Tunneling

Once the tunneling operation is set in motion, there will be no opportunity to mitigate any negative impact which would be produced. Even though all available data indicate that tunneling at a sufficient depth will not impact major deposits of fossil vertebrates, it is important to gather additional information to confirm or negate this interpretation. Thus, we recommend that a monitor quickly check, and sample if needed, each truck load of material removed during the tunneling operation between the Wilshire/La Brea and Fairfax/Beverly stations. Even if a significant resource is encountered, the only mitigation which can be implemented is to gather a sample of the materials in the truck and determine the approximate vertical and horizontal coordinates of the resource.

3.4. Salvage procedures

An overall description of a recommended integrated testing/salvage/excavation plan may be found in Section 3.2.2.1.

It is apparent that, if a significant fossil deposit is discovered, present salvage methods will be much too time-consuming to use on this project. We cannot hold up Metro Rail construction for the years or decades which current procedures would require. Therefore, we have explored many new means of salvaging specimens and data with an emphasis on employing appropriate technology to speed up the process and, when possible, effect overall cost savings. Both are best accomplished by utilization of equipment which directly or indirectly reduces the amount of personnel time required to attain the objectives, and by determining the minimal amount of certain categories of specimens and data needed for research objectives.

The most proven cost and time reducing development in recent times has been the employment of computers and computer related technologies to gather, store, and manipulate data. The accurate gathering and storing of data are of greatest interest here. These steps have been highly labor intensive in paleontologic and archaeological salvage operations. The information to be gathered and stored includes three types: identificatory information (i.e., information observed at the time of excavation that will permit later identification of the specimen or event as a unique item or data point), contextual information (e.g., surrounding conditions, climatic, geographic, stratigraphic, environmental or associative), and collection management documentation (e.g., artifact or specimen number, precise location, date and time of collection, collector's name, etc.).

Loy (1982) tested a computerized data gathering system (the PARIS system) in an archaeological excavation. He estimated that, overall, this system reduced costs by 85% in comparison to standard techniques and that total man-hours were

cut by 67%. The system we envision would be more sophisticated and less labor intensive than the PARIS system and should result in even greater savings in the data gathering and recording portion of the salvage effort.

3.4.1. General

3.4.1.1. Personnel selection

Due to the unique nature of the Rancho La Brea deposits, it is vital that the Principal Investigator (Project Supervisor) be a person with an established interest in the field of vertebrate paleontology, preferably with some experience of asphaltic fossil deposits. In addition, this person should have administrative and salvage supervision experience. The principal investigator should be assisted by consultants (perhaps in the form of an advisory board) in the following areas: taphonomy, sedimentology, archaeology, physical anthropology, invertebrate paleontology, computer programming, and radiocarbon dating. Monitors should have previous monitoring experience in paleontology and archaeology. If individuals with combined experience are not available, those with paleontologic experience are preferred. The geologic/stratigraphic mapper should have at least a bachelor's degree in geology, with course work in mapping and considerable prior experience. Shift supervisors should have training in paleontology and considerable experience in the supervision of paleontologic excavations. Excavation crew foremen should have previous experience in supervision of paleontologic excavations and extensive excavation experience. Excavators should have at least three months of experience in paleontologic or archaeological excavation. Data entry specialists need to be experienced in computer or microcomputer work. Data entry assistants require a good background in mammalian and avian osteology.

Recruitment of these personnel should proceed as soon as possible, but not

less than six months prior to the start of construction. The demand for qualified personnel in this area is quite variable, but tends to be greatest during summer months.

3.4.1.2. Personnel training

Every project has special conditions which require personnel training to orient the employee to the task. Since individuals with experience in the collection of fossiliferous asphalt deposits are rare, special training will be required for the selected staff. The prime salvage contractor shall bear responsibility for developing and implementing an adequate training program. Six to eight weeks should suffice for supervisory level staff, and three to six weeks for crew foremen, excavators, data entry specialists and data entry assistants. Such training can be conducted at the Pit 91 excavation site in Hancock Park (see section 4.4 for more details).

3.4.2. Salvage of larger fossils

Great effort should be made to save all of the fossils large enough to be visible during salvage of the fossil deposits. The following sections are based on that premise.

3.4.2.1. In situ Excavation

In situ excavation of the larger fossils is scientifically much more preferable than en bloc removal because essentially all specimens can be collected without damage.

3.4.2.1.1. Good preservation

The excavation procedure for the in situ removal of fossils in good condition is based on the methods developed in the Rancho La Brea Project excavation of

LACM 6909 (Pit 91) in Hancock Park (Shaw, 1982; Winans and Winans, 1982).

However, the Pit 91 excavation is an ongoing program without time constraints, where mapping and bone measurement are done by hand and all matrix is retained and processed. It is critical for the principal investigator of the Metro Rail salvage project to recover the maximum amount of data while meeting construction deadlines. Therefore, numerous new procedures for increasing the data base while meeting construction demands have to be implemented.

Previous procedures:

The entire excavation area was laid out in horizontal squares, three feet on a side, termed grids. Excavation units consisted of one horizontal square being excavated to a depth of six inches. Specimens were thoroughly exposed and a series of positional measurements were taken relative to the edges of the grid and to an arbitrary horizontal datum. From one to three points on each specimen were manually measured, each point requiring three measurements (X, Y, and Z) to define its position in space. A reference manual was used, defining the points to be measured on each type of specimen and including an abbreviation for each point selected. A preliminary identification of the species and element, with the point abbreviations and measurements, and the date collected and collector were entered into a field notebook. This information was then recopied on a separate card which was kept with the specimen. Once this was completed, the specimen was removed from the ground and bagged with the card. These procedures were very time consuming, especially taking manual measurements and data recording. For the mapping of geologic units within the deposits, the sides of each grid were carefully kept vertical and a horizontal floor was established at each six inch depth level. Once completed, the grid floor and walls were then photographed and drawn illustrating all stratigraphic features of interest.

Recommended procedures:

The heart of the following, more efficient, procedure is a device termed a sonic digitizer. This device is capable of measuring the X, Y, and Z coordinates on any specimen at a rate of 10 to 30 points per second with an accuracy of 0.1 mm. It consists of a sonic signal generator, an array of microphones and a control unit. The signal generator is touched to a point and activated. The signal is picked up by the microphone array and the three dimensional coordinates of the point are automatically calculated by measuring the time required for the signal to reach each microphone. When connected to a microcomputer with data storage capabilities, this becomes a very useful and efficient method of capturing and recording positional information.

With use of this device, we have modified previous procedures as follows. It will still be necessary to construct a grid system, one meter on a side, for accurately locating all samples. Excavation crews will expose the fossils within one area of the deposit. The fossils will not be as completely exposed as before, but only uncovered enough to identify the specimen, measure the points and to remove the specimen after measurement. One to three points will be measured by a separate team utilizing the sonic digitizer and the specimen, or a group of specimens, will be photographed by a digitized camera interfaced with the computer. Each specimen will receive a unique number along with a preliminary taxonomic and osteologic field identification which will be entered into the system with the measurements. A member of the excavation crew will then remove the specimen, place it in a plastic bag labelled with the specimen number and include an aluminum tag also bearing the specimen number. The specimen will then be temporarily stored until it can be prepared, curated and permanently stored.

The sonic digitizer will also be used to draw geologic features, eliminating the need for the time consuming process of making and drawing flat grid floors and walls.

Another device which promises to be even better for this application is under development by the Canadian Heritage Information Network (CHIN) but may not be available in time for this project. The CHIN device, termed ADAS, will be custom designed for archaeological data gathering (essentially the same as we need for this mitigation effort). We have been informed by CHIN representatives that a prototype has been constructed and tested under laboratory conditions, that software development is essentially complete, and that field tests will be conducted this July and August at a site near Calgary, Alberta. Final development will take place as soon as possible after the field testing. We have provided input to CHIN regarding features that we would consider to be desirable. If ADAS includes the features needed for this mitigation effort and becomes available in time, the per unit cost savings are substantial, on the order of \$10,000 to \$20,000 per unit including software, and no time would be required for software development.

3.4.2.1.2. Poor preservation

Fossils that are poorly preserved must be protected with an externally applied preservative. Other than this, the same methods used in the in situ removal of well preserved specimens can be used.

3.4.2.2. En bloc excavation

En bloc removal is desirable for this project since it could greatly reduce the time required to remove the specimens from the excavation site. However, it is less scientifically desirable because a portion of the specimens and associated data will inevitably be damaged or destroyed by the cuts needed to isolate each block for removal.

3.4.2.2.1. Soft matrix

Block removal of soft fossiliferous matrix is only feasible if the matrix can be stabilized so that the block can be removed without damage to the stratigraphy or the contained fossils. There is a distinct possibility that no feasible method will be found, although cooling the deposit to the point that the asphalt becomes firm holds some promise of success. Preliminary indications are that this would be a rather expensive approach. SCRTD plans to persue this problem further and to explore other methods of block stabilization. Until a solution is found we cannot describe the techniques (if any) which can be used to facilitate en bloc removal of fossil deposits in a soft matrix but they should be very similar to those described in Sections 3.4.2.2.2.1 and 3.4.2.2.2.2.

3.4.2.2.2. Hard matrix

In deposits where the asphalt has become hardened (oxidized), en bloc excavation is the most desirable method of removal. Specimens from oxidized deposits are best prepared under controlled laboratory conditions rather than in the field. The techniques for en bloc removal of fossils in a solid matrix are standard and have been perfected through many years of experience. As described in the following two Sections, there would be minor differences in technique depending on whether the deposit were typical or stratified.

3.4.2.2.2.1. Typical deposits

As previously described (Section 1.3.2.), the typical fossil deposit at Rancho La Brea is conical in shape, tapering and pinching out 20 to 30 feet below ground level. As some of these individual deposits may be as large as 261 cubic yards (199.5 cubic meters) in volume, with a weight of 399 tons, they present a considerable excavation and salvage problem, both in the preservation of the resource and in meeting construction goals. With proper bracing and support, well consolidated material could, theoretically, be salvaged en bloc. However,

no typical Rancho La Brea deposit has been found in a completely oxidized matrix. Only small portions of these deposits are known to be oxidized. If found, this type of deposit would be removed in blocks no larger than one cubic meter. After each block is mapped, they would be freed either by hand or by cutting them apart with a diamond saw, wire saw, or other similar device. Each block is removed after it is stabilized with a coating of plaster-of-paris saturated burlap. The blocks can then be temporarily stored pending preparation in the laboratory.

Blocks of 39 inches on a side (1 cubic meter) would weigh about 4,000 lbs. (2 tons). This is the largest size and weight convenient for moving, storage, and processing in the laboratory. Based on the largest (to date) single deposit in Hancock Park (Pit 61/67), 177 blocks, each of 2 tons weight, are possible for a single deposit. The smallest known deposit would yield 2 or 3 blocks of this weight. Considering the fact that several deposits of various sizes may exist in the proposed station area, handling and temporary storage alone would constitute a major expense.

3.4.2.2.2. Stratified deposits

Stratified deposits are usually thin and of comparatively small horizontal extent. Oxidized stratified deposits are best suited for en bloc removal. Because these types of deposits are thin, their removal is easier and less destructive to fossil specimens. Standard techniques involve exposing the fossils in relief, manually cutting the deposit into manageable blocks, covering the exposed fossils with tissue, stabilizing the exposed surfaces of the block using burlap strips soaked with plaster-of-Paris, reinforcing the block with lumber, freeing the underside of the blocks, rolling them over, then stabilizing the remainder of the exposed surfaces with additional plaster and burlap. The size and shape of each block is dependent on the thickness of the deposit, where they can be most easily separated without damage to specimens, and logistics of

removal.

3.4.3. Salvage of smaller fossils

3.4.3.1. General

Rancho La Brea is famous for its large fossils, but the smaller micro-vertebrates and invertebrates are also present in great quantities and are an important part of the paleoecologic information. Unlike the large bones, the small fossils are difficult to distinguish in the asphaltic matrix. However, once the asphalt is removed (using a vapor degreaser), they are easily sorted out of the residue. When dealing with a small deposit, all the fossiliferous matrix should be collected and processed to recover the small fossils. This is not practical when salvaging a major deposit, since there could be over 30,000 5-gallon buckets of matrix produced.

3.4.3.2. Sampling plan

The recommended practice will be to sample (one five gallon bucket) each meter square grid at each 10 cm level, 10 samples per cubic meter. Research has shown that sufficient data on tiny fossils can be obtained by sampling the deposit at each level in each grid square (Story, 1968). This process is recommended for any major deposits uncovered by the Metro Rail salvage project, as it appears scientifically sound and reduces the amount of matrix to be processed. For example, a 96 cubic yard (73.4 cubic meters) deposit (based on Pit 16), would fill 6,912 buckets. Using this sampling technique, only 734 buckets of matrix would be collected, a reduction of 89.4%. If an unusual fossil deposit or stratigraphic feature is discovered, adjustments in this policy will be made to insure proper salvage of the resource.

3.4.4. Special study samples

3.4.4.1. Pollen

Extraction of fossil pollen from sediment must be done under completely sterile laboratory conditions because of the risk of modern pollen contamination. A sample for pollen analysis is a three inch unbroken cube of matrix which is trimmed to the inner uncontaminated one inch cube in the laboratory. Any cracks in the cube will admit modern pollen. The jumbled and closely packed nature of the Rancho La Brea fossil deposits makes it difficult, if not impossible, to isolate an unbroken three inch cube at each level. Pollen samples should be taken as often as feasible, which will probably be at an average of four per cubic meter.

3.4.4.2. Lithologic

In the past, a special sample was separately taken for sedimentologic study. If adequate mapping and photography are done in situ, a portion (one pound or less) of the one matrix sample per 10 cm level of each grid should be sufficient for sedimentological analysis. Any distinctive geologic features observed should also be sampled (contacts, stream channels, middens, hearths, etc.). The size of samples to be taken from such features will be determined on a case-by-case basis.

3.4.4.3. Microfossils

In previous excavations, another special sample was separately taken for the extraction of microfossils. As with lithologic samples, a portion (two pounds or less) of each five gallon matrix sample will suffice for study of microscopic specimens. This will be processed in an ultrasonic cleaner, using 100 mesh screen rather than the 24 mesh screen used on the rest of the matrix. In order

to retrieve truly microscopic fossils, the residue will be sorted under a microscope by an expert.

3.4.5. Archaeological/anthropological salvage

Two kinds of archaeological sites are possible at Rancho La Brea, asphaltic and non-asphaltic. Cultural remains found in an asphaltic matrix will be removed in the same manner as the bones. Non-asphaltic sites will probably be shallow in depth, but rather wide in horizontal extent. These will have to be excavated in situ, as it is unlikely that any of them will be suitable for en bloc removal. Any artifacts or human skeletal material found will be photographed, measured and recorded in situ using the sonic digitizer package. Artifacts or human skeletal material will be processed in the laboratory in the same way as the fossils (see Section 3.5.).

3.4.6 Salvage of marine fossils

Marine invertebrate fossils are abundant in the B member of the Palos Verdes Sand, underlying the terrestrial deposits of the C member, and may be impacted in deeper portions of the station excavations. As with terrestrial fossils, the surrounding stratigraphy and micro-environment form an important part of the data base for this resource. The use of the sonic digitizer package for exact location of individual fossils will not be necessary. However, if this fossil zone is exposed, a specialist with a molluscan paleontology/geology background will be required to supervise photography, stratigraphic mapping, and fossil collection. Sampling both the fossiliferous and non-fossiliferous strata in a measured section is essential. The actual collecting of marine fossils can be done by the same excavators used for the salvage of terrestrial fossils.

3.5. Preparation and processing

3.5.1. General

The severe time constraints imposed on excavation by construction deadlines are not applicable to preparation and other procedures which will take place after the specimens are removed from the excavation. Improvements in these procedures have been made primarily on the basis of overall cost reduction rather than the need to meet deadlines. Basic procedures for the the preparation and processing of the fossils recovered from Rancho La Brea have been worked out over many years (Shaw, 1982). We have not developed any new techniques for this area but more efficient usage of existing techniques will lead to considerable cost savings.

Over the past decade, the preparation and processing of Rancho La Brea material has been conducted by the use of salaried supervisors and volunteer workers. This rather inefficient arrangement was caused by budgetary limitations. While short-term savings were effected, the prolongation of the tasks resulted in long-term cost increases. A better balance between the use of salaried and volunteer labor will reduce the total overall cost of the total volume of work. For certain tasks, it is less expensive to use salaried staff than volunteers when the costs of supervision and training are considered. This process can be greatly speeded up by using salaried staff and ultrasonic machines that can clean several bones at once. Also, ultrasonic cleaning of bones will better preserve delicate surface marks which may be important for scientific studies. A properly equipped preparation laboratory with adequate ventilation will be required for this phase of the work.

3.5.1.1. Personnel selection

Preparation supervisors should be skilled in their field and be capable of directing both salaried and volunteer employees. They should have the ability to interview prospective employees and enough public relations knowledge to recruit volunteers. Previous experience is desirable for technicians; however, they can be easily trained.

3.5.1.2. Personnel training

The general preparation and processing of the fossils can be learned by the novice preparator during preliminary instruction and supervised on-the-job training. Although a person may be experienced in this field, a brief training program will be required to meet the special problems encountered with Rancho La Brea material.

3.5.2. Large fossils

3.5.2.1. From in situ collections

3.5.2.1.1. Well preserved

Most large fossils will be cleaned in an ultrasonic machine to remove the surrounding matrix. Each cleaner can handle several specimens at once, and one ultrasonic technician can handle several machines. Once the matrix is removed, the fossil will receive final touch-up and cavity cleaning from a volunteer worker. Care must be taken during these steps to keep the aluminum number tag with the specimen. At this point in the preparation process, the number on the tag is written directly on the bone with permanent ink and coated for protection. The fossil is then repaired, if necessary (bones are often found broken but held together with asphalt; they may come apart when cleaned). The specimen is finally hardened with a 1:5 Glyptal/Acetone solution, and is ready for scientific

identification and cataloguing (Shaw, 1982).

3.5.2.1.2. Poorly preserved

The same procedure will be followed when processing poorly preserved fossils, except for changes in the initial cleaning process. The specimens must first be soaked in a detergent solution to remove the temporary protective coating applied during excavation. Most will have to be hand prepared as they will disintegrate during ultrasonic procedures.

3.5.2.2. From en bloc collections

Preparation and processing of blocks will necessitate excavation of the blocks under laboratory conditions. The time saved at the site is therefore transferred to the preparation laboratory but the total time required will be somewhat increased because of the need to integrate information from separate blocks. The general procedures for in situ removal of fossils are outlined in Section 3.4.2.1., and will be used in laboratory excavation of specimens from blocks.

3.5.2.2.1. Soft matrix

If the fossils are well preserved in soft matrix they will be numbered, measured, and recorded (in reference to a datum established at the original site) using the sonic digitizer package. The specimens will then be removed and processed as outlined in Section 3.5.2.2.2. If the bones are poorly preserved, measures to stabilize the specimens will be taken and hand processing will be utilized to insure recovery of as much data as is technologically possible. The processes outlined in Section 3.5.2.1.2. will be used.

3.5.2.2.2. Hard matrix

After establishing the site datum correlation in the laboratory, specimen removal from the hard matrix will follow the process outlined in Section 3.5.2.2.1. Extremely hard oxidized matrix must be removed using hammer and chisel.

3.5.3. Smaller fossils

Small fossils (rabbit-sized or smaller) are difficult to distinguish in situ and must be recovered by sorting processed matrix. To remove the asphalt, matrix is processed within a vapor degreasing machine at 164 degrees F. (73.3 degrees C.) using 1-1-1-trichloroethane. This solvent is nonflammable, has low toxicity, and meets Federal, State, and local EPA smog standards (Miller, 1971). Once asphalt removal is complete, the clean matrix is dried and screened to remove the clay-to-silt fraction. The remaining concentrate is packed in plastic bags and stored in one gallon cans prior to sorting in the laboratory. Our experience shows that each 5 gallon matrix sample will reduce to about one gallon of sortable concentrate. Sorting of the fossils from the concentrate is done under illuminated magnifiers and the resulting fossils are segregated into general groups (insect, seed, shell, bird, mammal, etc.).

Techniques using heavy liquids to separate smaller fossils from non-fossiliferous components of processed matrix show promise in reducing storage requirements and the time needed for manual sorting (Shaw^h, 1982). Among the more promising compounds are ethanol and 1,1,2,2-tetrabromoethane, liquids which are completely miscible in all proportions. The procedure followed is to start with a low density mixture, primarily ethanol, and gradually raise the specific gravity by increasing the percentage of the heavier liquid. After each addition of the 1,1,2,2-tetrabromoethane, fossils which have floated to the surface can be quickly and easily "harvested," ultimately leaving non-fossil materials behind. Since an average of about five percent of the matrix is composed of fossil

material, space and time savings may approach 95 percent. Further experimentation and fine-tuning of this technique is needed but cannot be implemented at this time due to the lack of a suitable fumehood needed for working with these toxic chemicals.

A modest structure will be needed to house the degreasers and the fume hood and to store unprocessed and processed matrix.

3.5.4. Special study samples

3.5.4.1. Pollen

The three inch cube pollen samples (Section 3.4.4.1.) require specialized equipment and laboratory processing. Most palynologists prefer to process the samples themselves (some even refuse to study samples processed by other laboratories). For these reasons, we recommend that the raw samples be sent to an outside expert for processing and analysis.

3.5.4.2. Lithologic

Lithologic samples (Section 3.4.4.2) also require specialized processing, the exact nature of which depends on the research problem being addressed. These samples should be stored and, as needed, sent to outside researchers for study.

3.5.4.3. Microfossils

Portions of the microfossil samples (Section 3.4.4.3) may be ultrasonically cleaned and sorted for ostracods. Recovery of other microfossils will require special processing and expertise as with pollen and lithologic samples. Again, the samples should be stored for future study by outside researchers.

3.6. Curation procedures

After the specimens are properly cleaned and the smaller fossils are separated from the matrix, they go through a series of steps, collectively termed curation. These include identification, cataloging and permanent storage.

3.6.1. Identification

Identification requires experts in each of the taxonomic categories known from Rancho La Brea (i. e., plants, invertebrate and vertebrate animals) to determine the type of plant or animal, and which anatomic part is represented by each fossil. Experts in some of these areas reside in the Los Angeles area and may be available to make identifications. In a number of cases, such experts live elsewhere and special arrangements will be needed to send specimens to their place of work.

3.6.2. Cataloging

The catalog is the master record of the collection. It combines all the data accumulated on a given specimen (a unique specimen number, positional measurements, taxon identification, element identification, date collected, etc.) into one rigid format so that a permanent record of all known information about that specimen is available for research purposes. In the past, this has been laboriously compiled by hand and entered into voluminous ledgers. This is highly labor intensive, prone to error, difficult to correct, and generally unsatisfactory for efficient data retrieval. New computerized methods of cataloging are much preferable and, for all but very small collections, considerably more cost effective after the initial expense of software development. Fortunately, the Museum of Paleontology of the University of California, Berkeley, has developed the basic software for an excellent

computerized cataloging and data retrieval system for fossil remains. The Section of Vertebrate Paleontology, LACM, has the system up and running on an IBM computer at the University of Southern California. Only a modest amount of additional programming will be required to modify this software for use on fossils from Rancho La Brea, making it very attractive and cost-effective, providing that use of the system can be obtained. The specimen numbers, positional data, etc., recorded by the sonic digitizer, can be automatically entered into the system. After identification is complete, this information can be added to files by direct input from one or more terminals. Whether this will be done by technicians, or by identifiers, remains to be determined. In cases where the sonic digitizer was not used during collection of the specimen (such as smaller fossils sorted from matrix), all data including specimen number will be entered from the terminal.

Completion of this task will allow retrieval of information regarding any combination of specimens, and for such information to be sorted according to the needs of a particular researcher.

3.7. Temporary and permanent storage

The total volume of paleontological and archaeological materials that will be recovered through salvage activity cannot, at present, be estimated precisely. Parklabrea Associates have offered space of up to 20,000 square feet for temporary storage (up to 15 years) of unprepared materials and this should be adequate. Additional temporary storage may be needed should the preparation facility be located at a distance from the Parklabrea storage area(s).

After the salvaged materials have been prepared they will need to be placed in secure and permanent storage accessible to the scientific community for research purposes. The permanent storage area will require basic curatorial furniture (racks, cabinets with drawers, specimen trays, etc.) with layout and study areas (benches, tables) for scientific investigation of the materials. For a collection of 10,000 large specimens (with associated small specimens, samples and documents) provision must be made for a properly equipped storage area of 600 square feet with a minimum ceiling height of nine feet. A collection totaling 100,000 specimens would require a 3,000 square feet storage area.

It is patently desirable to permanently store the salvaged materials at the Page Museum, where their study may be undertaken in conjunction with pre-existing collections. Unfortunately the present storage capacity of that institution is almost totally occupied. Depending on the volume of the salvaged materials after curation, it may be possible to house these at the Page Museum by installing a new compactor storage system (this will increase the storage capacity of the main range by up to 25%). Otherwise it will be necessary to locate and purchase, or construct, an additional storage facility in the vicinity of Hancock Park. Should some other institution be designated as repository, the storage facility requirements will have to be determined by that institution according to its particular needs. Any of these alternatives must be construed as part of the

total salvage effort and should be budgeted in the costs of salvage.

3.8. Collection management

Collection Management is a collective term which, as used here, includes all procedures subsequent to curation, cataloging and storage. These are basically concerned with maintenance and use of the collections for research purposes. The maintenance aspect includes the prevention of physical damage to the specimens, repair of any damage which may occur through time, and insuring that the specimens and their associated data are retrievable in useable form.

We anticipate that much of the research done on these collections will be performed by specialists from other institutions. In order for them to readily study the collections, a Collections Manager will be needed to aid visiting researchers with location of the specimens and data they may require, and to process formal loans of materials to other institutions. In addition to the Collections Manager, major costs include secretarial assistance, packing materials, shipping fees, insurance fees, etc. See Section 7.0 for recommendations regarding funding of this continuing activity.

3.9. Other

3.9.1. Radiometric dates

Radiocarbon dating has proved to be the most efficient means of correlating various fossil deposits at Rancho La Brea with the chronology of the Pleistocene. This process should be used to date various collections recovered from sites during the Metro Rail salvage project. While the total number of radiometric dates depends on the stratigraphic complexity of a deposit (which cannot be determined beforehand), a minimum of four dates will be needed for each deposit collected. Due to the specialized nature of this dating method, samples must be sent to a radiocarbon laboratory for processing.

3.9.2. Hazardous waste disposal

Many of the procedures used in salvage and preparation operations produce material containing asphalt and/or solvents. These are considered hazardous wastes and require special, expensive disposal methods.

3.10. Summary of computerization

Several steps in the above procedures will involve the use of computers for maximum efficiency. These will be integrated, but their descriptions are scattered throughout the previous sections. Here, we have summarized them for ease of visualization.

Data gathered on specimens during excavation will be processed by the sonic digitizer and its interfaced microcomputer and digitized camera. This data will be temporarily stored (probably on floppy discs) for later transmission to the main catalog program. Additional data from the identification and curation process will be added from terminals and merged with the files generated by the sonic digitizer. Modification of existing catalog software will be required to assure proper integration of all data input. The services of a programmer experienced in the area of computerized museum collections will be required for this task.

3.11 Summary of personnel and duties

In order to ensure efficient and clear chains of command and to avoid conflicting responsibilities, all personnel employed in all aspects of the salvage effort should be selected and hired by the prime paleontologic contractor and should be responsible to only that prime contractor.

3.11.1 Salvage personnel

Principal Investigator (Project Supervisor): This person will be in charge of final planning, obtaining equipment and supplies prior to the start of the salvage program, and overall supervision of monitoring and salvage.

Executive Secretary: The Principal Investigator will need an assistant who can type, keep records (personnel, purchase, etc.), and perform other office duties.

Shift Supervisor: One Shift Supervisor is needed for each shift of operation to directly supervise salvage activities, and to substitute for absent personnel, if necessary.

Excavation Crews: The number of crews per shift depends upon the size of fossil deposits encountered. Each crew will consist of one foreman and three excavators. Excavation crews will perform all actual excavation work including uncovering specimens prior to measurements by a Data Gathering Team and removing specimens after measurement.

Data Gathering Teams: The number of teams per shift will depend upon what ratio of Data Gathering Teams to Excavation Crews is determined to be most efficient. The present estimate is one Data Gathering Team for every two Excavation Crews. We also tentatively estimate that each team will require two people, but it is quite likely that one person will be able to efficiently perform the entire operation. The ratio of teams required, and the size of each,

will be determined by field trial prior to the start of excavation, as described in Section 4.4. Data gathering teams will be responsible for assigning specimen numbers, using the sonic digitizers to take positional measurements, and grid photography.

Laborers: We estimate that probably one worker per shift will be needed to carry specimens and samples to a centrally located area for transport to temporary storage, haul away excavated matrix, and perform other unskilled tasks.

Monitors and Geologic/Stratigraphic Mapper: See Section 3.3

3.11.2 Laboratory

The levels of staffing suggested below represent a very intense effort in these areas. Since these tasks are not under the severe time constraints imposed on the removal of the specimens from the excavation, a less intensive approach can be used and may be desirable.

Processing Supervisor: One person is needed for overall supervision of preparation and curation, and to be responsible for ordering equipment, supplies, etc.

Secretary: One half-time position should be available for general office work.

Preparation Supervisors: Two people are required to supervise preparation procedures, train volunteers, etc.

Ultrasonic Technicians: Four people will be needed to process fossils through ultrasonic cleaners.

Hand Preparation Technicians: Four people will be required to harden and repair ultrasonically cleaned specimens and to hand prepare specimens too fragile to be cleaned ultrasonically. They will be assisted in this task by volunteers.

Flotation Technician: One technician will be required to remove fossils from matrix processed through degreasers using heavy liquid separation techniques.

This position is contingent on final development of the separation system.

Microsorters: Four Microsorters will be necessary to sort the smaller fossil specimens from concentrated matrix into general categories. They will also be assisted by volunteers.

Degreaser Operators: Two operators will be needed to process matrix samples through degreasers to remove asphalt and fine sediment.

Curatorial Assistants: Three people are required to do detailed scientific identification of vertebrate specimens, general identification by category for non-vertebrate specimens, to input data via computer terminals, to place specimens in permanent storage, and to perform as interim collections managers.

Collections Manager: One person is required, but may not be needed on a full time basis, depending on the total size of the collection. This position will not be occupied until curation is complete and will be permanent thereafter. Duties will include maintenance of the collection, retrieving specimens for visiting researchers, loaning specimens, etc.

3.12. Summary of estimated salvage times

We present here a summary of the times required to completely remove specimens from the station site under each of the scenarios detailed in the cost estimate sections. The estimated salvage times are based on data from previous fossil excavations and are not simply linear extrapolations. For example, a large deposit containing 10 times as many fossils as a smaller one will not typically be 10 times the volume, but will have a larger number of specimens per unit volume. Our estimates take this and other factors into account, as described in Sections 6.1. through 6.6., and Appendix 9.3.

1. Typical small conical deposit with 10,000 large specimens, good preservation, excavated in situ: utilizing one 40 hour shift of two excavation teams per week, 1.5 months will be required to salvage the deposit.
2. Typical small conical deposit with 10,000 large specimens, good preservation, excavated en bloc: no estimate can be provided for en bloc removal at this time.
3. Typical small conical deposit with 10,000 large specimens, poor preservation, excavated in situ: utilizing one 40 hour shift of two excavation teams per week, 3.0 months will be required to salvage the deposit.
4. Typical large conical deposit with 100,000 large specimens, good preservation, excavated in situ: utilizing two 40 hour shifts of four excavation teams each per week, 5.0 months will be required to salvage the deposit.

5. Typical large conical deposit with 100,000 large specimens, good preservation, excavated en bloc: no estimate can be provided at this time.

6. Typical large conical deposit with 100,000 large specimens, poor preservation, excavated in situ: utilizing three 40 hour shifts of four excavation teams each per week, 7.0 months will be required to salvage the deposit.

7. Stratified oxidized deposit with 10,000 large specimens, must be excavated en bloc: utilizing one 40 hour shift of four excavation teams per week, 3 weeks will be required to salvage the deposit.

8. Small deposit (10 cubic meters) containing only small fossils: utilizing one 40 hour shift of two excavators (one half of an excavation team) per week, one week will be required to salvage the deposit.

9. Typical small (25 cubic meters) archaeological site: utilizing one 40 hour shift of four excavation teams per week, one week will be required to salvage the site.

10. Typical larger (100 cubic meters) archaeological site: utilizing one 40 hour shift of four excavation teams per week, one month will be required to salvage the site.

11. Marine fossils: an adequate sample can be collected in one day.

4.0. Site specific considerations

Much of the detailed planning cannot be done until results of any testing program are known, the sonic digitizer package is properly interfaced and tested, and the nature of the planned construction methods have been determined. A minimum of two months should be allowed for fine-tuning of the salvage procedures by the Principal Investigator after these data are made available.

4.1. Site security

Normal site security (fencing and off-hour security guard provided by SCRTD or the excavation contractor) should be sufficient to insure the integrity of the site and the safety of the fossils under normal circumstances. However, a major discovery, with the inevitable media coverage, could generate unusual public interest. If this situation develops, additional security measures may be required.

4.2. Logistical considerations

4.2.1. Interface of excavation and salvage activities

4.2.1.1. Integrated excavation/salvage plan

Careful planning and coordination between the excavation contractor, the SCRTD, and the Principal Investigator will be necessary in order to meet construction goals while salvaging the scientific resource. General policies and procedures for coordination need to be agreed upon prior to the beginning of the excavation.

4.2.1.2. Priorities

In order to reduce potential conflict between the areas of responsibility, with concomitant waste of time, effort, and money, priorities should be firmly established before starting the project.

4.2.1.3. Equipment use

Heavy construction equipment may be needed for salvage purposes. If this equipment is not provided by the excavation contractor, it must be specifically rented. Renting this equipment exclusively for salvage purposes will impact on total salvage project costs. This will need to be resolved before the work begins.

4.3. Other

4.3.1. Lead times for special equipment

The following lead times will be required to obtain the necessary equipment for the salvage of any size deposit (see also Section 4.4):

90 days for each sonic digitizer, digitized camera, and microcomputer (plus interface time).

60 days to obtain other supplies and equipment.

4.3.2. Lead times for personnel selection and training

Only the lead times for salvage personnel are considered here. Timing is not as critical for the selection of preparation and curation personnel because these areas are not subject to time constraints imposed by construction schedules. In fact, it may be advantageous to defer preparation and curation work until the salvage is well under way (or completed) in order to focus all energies on a speedy salvage effort. The sole exception may be the processing of matrix through degreasers; this will greatly reduce the amount of storage space required and allow recycling of five-gallon buckets used to store unprocessed matrix.

A minimum of four months should be allowed for recruiting the Principal Investigator. This person should then be hired not less than six months prior to the start of the Wilshire/Fairfax Station and the Wilshire/La Brea to Fairfax/Beverly tunnels. This will allow enough time for the Principal Investigator to become oriented to the unique conditions at Rancho La Brea,
fine-tune salvage procedures, set up the overall salvage plan according to findings from the testing program, hire the remaining staff, and purchase equipment and supplies. An Executive Secretary should be hired soon after the Principal Investigator.

The remaining salvage workers should be recruited at least three months prior to the time they actually start on the project. Shift Supervisors and Excavation Crew Foremen should be hired eight weeks prior to the start of excavation for orientation and training. Other salvage personnel, Monitors, and the Geologic/Stratigraphic Mapper should be hired three to six weeks prior to the start of excavation for orientation and training.

4.4. Digitizer evaluation and personnel training program

In order for salvage to proceed in a timely fashion once excavation begins at the station site, it will be necessary to develop appropriate software to interface the sonic digitizer and camera equipment with a microcomputer, and to interface the microcomputer generated files with the hardware and software necessary to generate a computerized catalog. This, and fine-tuning the procedures to be used with the sonic digitizer, require operation under field conditions which closely approximate those which will be encountered during actual salvage. Fortunately, an open excavation site is available at Rancho La Brea, LACM 6909 (Pit 91), which can be utilized for this purpose and for orientation and training of the salvage personnel. We recommend that the following steps be taken under the direction of the Principal Investigator.

Components of one sonic digitizer system and one computer terminal should be ordered to arrive at least four months prior to start of salvage operations. Furthermore, a computer consultant should be employed to develop appropriate software for the system. Two people should be employed to field test the sonic digitizer in the LACM 6909 excavation. One or both should be experienced in excavation at Rancho La Brea and should be competent in mammalian and avian osteology. They will fine-tune procedures, determine the most efficient staffing levels and work with the computer consultant. By the end of eight weeks, all procedures and software should be finalized and the two excavators will be experienced enough to begin training Shift Supervisors and Excavation Crew Foremen who will, in turn, assist in orientation and training of the remaining salvage staff.

5.0. Responsibilities of Parties to the Agreement

A recognized public scientific institution and repository shall be selected as prime contractor and shall be responsible for all facets of mitigation including hiring of personnel, implementation of the digitizer evaluation and personnel training program, monitoring, geologic/stratigraphic mapping, salvage, preparation, curation, permanent storage, and collections management.

The SCRTD shall be responsible for implementation of any testing program and for identification and procurement of monies from whatever source(s) to fund all aspects of the mitigation effort. See Section 7.0 for a recommended overall funding structure.

To minimize the potential for construction delays due to the salvage effort, SCRTD should schedule the maximum possible lead time for the salvage of paleontologic and archaeological resources.

6.0. Cost estimates and scenarios

Herein are summarized the budgets for the various possible scenarios. Detailed cost estimates may be found in the Appendix, Section 9.3., under the same numbers and headings used in the text. The only exception is Section 6.6., Marine Fossils, which has only a textual summary, and is not in the detailed budget appendix.

The following items have not been included in any of the budgets:

- ✓ 1. Cost of sonic digitizer testing and personnel training (Section 4.4.). The equipment used for this will not require additional funding because it will later be used in actual salvage. Salary costs will depend largely on the total number of personnel to be trained and cannot be estimated at this time.
2. Cost of consultants. This cost will vary according to the individual expertise of selected supervisory personnel. There is also a possibility that members of the peer review board may be able to supply much of this need.
- ✓ 3. Cost of en bloc excavation. As noted previously, we have not yet been able to develop a viable method for block removal of fossils in soft matrix. Thus, this cost remains to be determined.
- ✓ 4. Cost of heavy excavation equipment used in salvage and/or in handling blocks of fossiliferous matrix. Temporary use of such equipment may occasionally be needed to expedite salvage activities. The most efficient approach here would be to utilize equipment already on the site. If a deposit is removed en bloc, the use of a fork-lift will be necessary during block reduction and processing.
- ✓ 5. Cost of night lighting for multiple shifts (if needed). Presumably SCRTD or the contractor will have such equipment available so that it will not have to

be rented.

6. Cost of temporary storage for salvaged materials prior to preparation and transportation to and from such temporary storage. Present indications are that temporary storage will be provided by the Parklabrea Associates at one or more unspecified locations. Transportation to and from temporary storage may be provided by SCRTD (per telephone conversation with Mr. James Crawley).
7. Cost of additional security, (if needed), to protect the deposit from vandalism, tourists, etc., during off hours and weekends.
8. Cost of on site liability insurance (if needed). This item may be included in SCRTD or contractor policies.
9. Cost of the specimen preparation (and/or block reduction) facility. A new preparation facility could be included with the permanent storage facility, or, perhaps, a portion of the temporary storage facility being supplied by Parklabrea Associates could be temporarily modified for this purpose. A facility for fossiliferous matrix processing has been included in the budgets.
10. Cost of a permanent storage facility for the specimens. The contents of this structure have been included in this cost estimate, however, we cannot estimate the cost of the actual building.
11. Cost of research on salvaged specimens and data. This cost is subject to extreme variation depending on the requirements of particular research projects, other potential sources of funding for same, and whether or not other Rancho La Brea collections will be included in the studies.

6.1. Assumptions and sources of variation

The following cost estimates are predicated on average conditions. Actually, each fossil deposit differs from every other and presents its own unique problems and advantages. Thus, it is very improbable that the cost estimates will exactly fit any one deposit. One assumption made for these estimates is that each deposit will be totally contained and exposed within the excavation. If any part of a deposit extends into areas not planned for excavation, it will complicate and slow procedures, because access to the entire deposit will be restricted. Also, some provision will be required to protect unexcavated parts of the deposit during subsequent construction activities.

For ease of calculation, estimates are based on the number of large bones encountered. However, depending on density of the bones within the deposit, the total volume of a deposit containing a particular number of bones may vary by a factor of five or more. If bone density is low, a greater volume of matrix will have to be excavated to remove a fixed number of bones, adding to the cost. This may be, at least partially, balanced by the greater ease and speed of removal, as fewer specimens will be tangled together. Also, if the same number of specimens is spread over a larger area, the total elapsed time of salvage will be substantially less because more personnel can work on the deposit at one time. Even with all other factors being equal, the ratio of vertical extent to horizontal area of any fossil deposit will play an important role in the total number of days required for salvage.

While the estimates have been broken into categories based upon the quality of preservation, this actually presents a continuum, grading from the best to the worst. We have assumed cases of average best and average worst but, again, any one deposit may fall above or below either average. To complicate matters, many deposits contain areas which are well preserved and others which are less well,

to very poorly, preserved. Other complicating factors include the proportion of very large (=difficult to remove) specimens, the ratio of microfossils to larger specimens, weather, and many others. Each will affect the cost and time estimates presented herein.

* Staff costs include all fringe benefits, indirect costs, and overhead. The cost figures for supervisory and secretarial personnel (Principal Investigator, Executive Secretary, and Shift Supervisors) are based on the assumption that only one deposit will be salvaged at a time. If, as is likely, more than one deposit must be salvaged simultaneously, these costs will not increase, and will be proportionately lower. If only one deposit is worked on at a time, the Shift Supervisor may also double as Foreman of an excavating team.

Salvage equipment and supplies are divided into several categories. The general site equipment (rented) is a single expenditure. The "per deposit" material is sufficient to handle a single deposit, but must be multiplied in case of additional deposits. Excavation team equipment must be multiplied by the number of individual teams, but computer team equipment may be reused in cases of multiple shifts.

No allowance is made in the estimates for delays due to inclement weather, construction worker strikes, construction problems or other factors beyond the salvage contractor's control. We strongly recommend that the salvage effort be scheduled during the dry season to minimize delays due to rain and cold weather.

While we have presented our most accurate estimates of time and cost, such estimates are subject to too many sources of variation to be absolutely applied to any particular deposit. They are intended to represent average values.

Costs of monitoring and geologic/stratigraphic mapping are dependent only on the duration of the station excavation and are not included in the detailed cost estimates.

* Monitors should be estimated at \$2139 per man month, one monitor per piece of

earthmoving equipment. The total cost of monitoring will thus depend on the duration of station excavation and the total number of pieces of earthmoving equipment used. Supplies should amount to under \$200 per monitor.

The Geologic/Stratigraphic Mapper should cost \$2551 per man month, the total depending on duration of station excavation. Equipment (primarily camera, high resolution videocamera with monitor and brunton compass) and supplies for the Mapper should amount to less than \$6000.

Please note that the salvage time estimates given in the following Summary Sections are in terms of total team days. The total elapsed time for complete salvage of any deposit will depend on the number of teams able to work simultaneously on that deposit and the number of shifts working per day. For example, in Section 6.2.2.2.1, the salvage time is given as 80 team months. With 3 shifts of four teams each, the total elapsed time for salvage would be one-twelfth of 80 or 6.7 months.

6.2. Conical deposits

6.2.1. Small deposit - 25 cubic meters, 5 meters depth, 5 square meters surface area (2.5 meters diameter), 10,000 major specimens,.

A ① 6.2.1.1. Good preservation

6.2.1.1.1. In situ excavation

1. Salvage

A. Staff	\$50644.50
B. Equipment and Supplies	\$33390.64
→ SUBTOTAL, ALL SALVAGE COSTS	\$84035.14
AVERAGE PER SPECIMEN SALVAGE COST	\$8.40

2. Preparation

A. Staff	\$209823.50
B. Facility	\$40000.00
C. Equipment and Supplies	\$78997.69
→ SUBTOTAL, ALL PREPARATION COSTS	\$328821.19
AVERAGE PER SPECIMEN COST OF PREPARATION	\$32.88

3. Curation

A. Staff	\$19132.50
B. Equipment and Supplies	\$28448.49
→ SUBTOTAL, ALL CURATION COSTS	\$47580.99
AVERAGE PER SPECIMEN COST OF CURATION	\$4.76
GRAND TOTAL OF ALL COSTS	\$460437.32
AVERAGE PER SPECIMEN TOTAL COST	\$46.04

4. Time

A. Salvage Time	60 team days (3 team months.)
B. Preparation Time	150 days (7.5 months)
C. Curation Time	50 days (2.5 months)

6.2.1.1.2. En bloc excavation1. Salvage

A. Block Removal - These costs cannot be estimated at this time.

B. Block Reduction

1. Staff	\$67526.00
2. Equipment and Supplies	\$31881.95

SUBTOTAL, ALL BLOCK REDUCTION COSTS	\$99407.95
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AVERAGE PER SPECIMEN BLOCK REDUCTION COST	\$9.94
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SUBTOTAL, ALL SALVAGE COSTS	\$
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AVERAGE PER SPECIMEN SALVAGE COST	\$
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2. Preparation

A. Staff	\$209823.50
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B. Facility	\$40000.00
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C. Equipment and Supplies	\$79002.96
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SUBTOTAL, ALL PREPARATION COSTS	\$328826.46
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AVERAGE PER SPECIMEN COST OF PREPARATION	\$32.88
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3. Curation

A. Staff	\$19132.50
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B. Equipment and Supplies	\$28448.49
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SUBTOTAL, ALL CURATION COSTS	\$47580.99
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AVERAGE PER SPECIMEN COST OF CURATION	\$4.76
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GRAND TOTAL OF ALL COSTS	\$
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AVERAGE PER SPECIMEN TOTAL COST	\$
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4. Time

A. Block Removal Time	Not Available
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B. Block Reduction Time	80 team days (4 team months.)
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B. Preparation Time	150 days (7.5 months)
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C. Curation Time	50 days (2.5 months)
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6.2.1.2. Poor preservation

6.2.1.2.1. In situ excavation

1. Salvage

A. Staff	\$447,808.00
B. Equipment and Supplies	\$33,709.87
SUBTOTAL, ALL SALVAGE COSTS	\$481,517.87
AVERAGE PER SPECIMEN SALVAGE COST	\$48.15

2. Preparation

A. Staff	\$264,237.25
B. Facility	\$40,000.00
C. Equipment and Supplies	\$79,230.08
SUBTOTAL, ALL PREPARATION COSTS	\$383,467.33
AVERAGE PER SPECIMEN COST OF PREPARATION	\$38.35

3. Curation

A. Staff	\$19,132.50
B. Equipment and Supplies	\$28,448.49
SUBTOTAL, ALL CURATION COSTS	\$47,580.99
AVERAGE PER SPECIMEN COST OF CURATION	\$4.76
GRAND TOTAL OF ALL COSTS	\$912,566.19
AVERAGE PER SPECIMEN TOTAL COST	\$91.26

4. Time

A. Salvage Time	120 team days (6 team months.)
B. Preparation Time	200 days (10 months)
C. Curation Time	50 days (2.5 months)

6.2.2. Large deposit - 100 cubic meters, 10 meters depth, 10 square meters surface area (3.57 meters diameter), 100,000 major specimens.

6.2.2.1. Good preservation

6.2.2.1.1. In situ excavation

1. Salvage

A. Staff	\$531540.00
B. Equipment and Supplies	\$84195.59
→ SUBTOTAL, ALL SALVAGE COSTS	\$615,735.59
AVERAGE PER SPECIMEN SALVAGE COST	\$6.16

2. Preparation

A. Staff	\$1570574.75
B. Facility	\$40000.00
C. Equipment and Supplies	\$97368.12
SUBTOTAL, ALL PREPARATION COSTS	\$1,707,942.87
AVERAGE PER SPECIMEN COST OF PREPARATION	\$17.08

3. Curation

A. Staff	\$191325.00
B. Equipment and Supplies	\$265959.67
SUBTOTAL, ALL CURATION COSTS	\$457,284.67
AVERAGE PER SPECIMEN COST OF CURATION	\$4.57
GRAND TOTAL OF ALL COSTS	\$2,780,963.13
AVERAGE PER SPECIMEN TOTAL COST	\$27.81

4. Time

A. Salvage Time	800 team days (40 team months.)
B. Preparation Time	800 days (40 months)
C. Curation Time	500 days (25 months)

5. Collections Management per year \$39547.00

6.2.2.1.2. En bloc excavation1. Salvage

A. Block Removal - These costs cannot be estimated at this time.

B. Block Reduction

1. Staff \$564210.00

2. Equipment and Supplies \$97111.22

SUBTOTAL, ALL BLOCK REDUCTION COSTS \$661,321.22

AVERAGE PER SPECIMEN BLOCK REDUCTION COST \$6.61

SUBTOTAL, ALL SALVAGE COSTS \$

AVERAGE PER SPECIMEN SALVAGE COST \$

2. Preparation

A. Staff \$1570574.75

B. Facility \$40000.00

C. Equipment and Supplies \$97338.83

SUBTOTAL, ALL PREPARATION COSTS \$1,707,913.58

AVERAGE PER SPECIMEN COST OF PREPARATION \$17.08

3. Curation

A. Staff \$191325.00

B. Equipment and Supplies \$265959.67

SUBTOTAL, ALL CURATION COSTS \$457,284.67

AVERAGE PER SPECIMEN COST OF CURATION \$4.57

GRAND TOTAL OF ALL COSTS \$

AVERAGE PER SPECIMEN TOTAL COST \$

4. Time

A. Block Removal Time Not Available

B. Block Reduction Time 800 team days (40 team months.)

C. Preparation Time 800 days (40 months)

D. Curation Time 500 days (25 months)

5. Collections Management per year

\$39547.00

6.2.2.2. Poor preservation

6.2.2.2.1. In situ excavation1. Salvage

A. Staff	\$1093295.00
B. Equipment and Supplies	\$89679.45
SUBTOTAL, ALL SALVAGE COSTS	\$1,182,974.45
AVERAGE PER SPECIMEN SALVAGE COST	\$11.83

2. Preparation

A. Staff	\$2867156.00
B. Facility	\$40000.00
C. Equipment and Supplies	\$97626.25
SUBTOTAL, ALL PREPARATION COSTS	\$3,004,782.25
AVERAGE PER SPECIMEN COST OF PREPARATION	\$30.05

3. Curation

A. Staff	\$191325.00
B. Equipment and Supplies	\$265959.67
SUBTOTAL, ALL CURATION COSTS	\$457,284.67
AVERAGE PER SPECIMEN COST OF CURATION	\$4.57
GRAND TOTAL OF ALL COSTS	\$464,5041.37
AVERAGE PER SPECIMEN TOTAL COST	\$46.45

4. Time

A. Salvage Time	1600 team days (80 team months.)
B. Preparation Time	1200 days (60 months)
C. Curation Time	500 days (25 months)

5. <u>Collections Management</u> per year	\$39547.00
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- 6.3. Stratified deposits - Example: Page Museum Salvage, 14 cubic yards (10.7 cubic meters), less than a meter in depth, at least 10,000 specimens (not yet prepared), in oxidized asphalt, must be removed en bloc.

1. Salvage

A. Staff	\$101045.00
B. Equipment and Supplies	\$34891.56
SUBTOTAL, ALL SALVAGE COSTS	\$135936.56
AVERAGE PER SPECIMEN SALVAGE COST	\$13.59

2. Preparation

A. Staff	\$85592.50
B. Facility	\$40000.00
C. Equipment and Supplies	\$75340.13
SUBTOTAL, ALL PREPARATION COSTS	\$200932.63
AVERAGE PER SPECIMEN COST OF PREPARATION	\$20.09

3. Curation

A. Staff	\$19132.50
B. Equipment and Supplies	\$28448.49
SUBTOTAL, ALL CURATION COSTS	\$47580.99
AVERAGE PER SPECIMEN COST OF CURATION	\$4.76
GRAND TOTAL OF ALL COSTS	\$384450.18
AVERAGE PER SPECIMEN TOTAL COST	\$38.44

4. Time

A. Block Removal Time	13 team days (2.5 team months.)
A. Block Reduction Time	100 team days (5 team months.)
B. Preparation Time	150 days (7.5 months)
C. Curation Time	50 days (2.5 months)

6.4. Deposits with only small fossils - These are usually small lenticular masses of asphaltic sand containing no animals larger than rabbits. Taphonomic data on each bone is not necessary, however detailed and accurate geologic mapping is essential.

1. Salvage

A. Staff	\$7165.25
B. Equipment and Supplies	\$6766.08
SUBTOTAL, ALL SALVAGE COSTS	\$13931.33

2. Preparation

A. Staff	\$142868.75
B. Facility	\$40000.00
C. Equipment and Supplies	\$50106.07
SUBTOTAL, ALL PREPARATION COSTS	\$232974.82

3. Curation

A. Staff	\$19132.50
B. Equipment and Supplies	\$27923.66
SUBTOTAL, ALL CURATION COSTS	\$47056.16

GRAND TOTAL OF ALL COSTS \$293962.31

4. Time

A. Salvage Time	10 team days (.5 team month.)
B. Preparation Time	90 days (4.5 months)
C. Curation Time	50 days (2.5 months)

↙

6.5. Archaeological sites

6.5.1. Small site - 25 cubic meters, 500 artifacts (mostly lithics), one meter depth, 25 square meters surface area, in normal midden without asphalt.

1. Salvage

A. Staff \$12834.00

B. Equipment and Supplies \$34845.08

SUBTOTAL, ALL SALVAGE COSTS \$44679.08

AVERAGE PER ARTIFACT SALVAGE COST \$89.36

2. Preparation

A. Staff \$2008.00

B. Equipment and Supplies \$3468.19

SUBTOTAL, ALL PREPARATION COSTS \$5476.19

AVERAGE PER ARTIFACT COST OF PREPARATION \$10.95

3. Curation

A. Staff \$638.00

B. Equipment and Supplies \$2893.98

SUBTOTAL, ALL CURATION COSTS \$3531.98

AVERAGE PER ARTIFACT COST OF CURATION \$7.06

GRAND TOTAL OF ALL COSTS \$53687.25

AVERAGE PER ARTIFACT TOTAL COST \$107.37

4. Time

A. Salvage Time 20 team days (1 team month.)

B. Preparation Time 7 days

C. Curation Time 7 days

6.5.2. Large site - 100 cubic meters, 2,000 artifacts (mostly lithics), one meter depth, 100 square meters surface area, in normal midden without asphalt.

1. Salvage

A. Staff	\$51329.00
B. Equipment and Supplies	\$32020.13
SUBTOTAL, ALL SALVAGE COSTS	\$83349.13
AVERAGE PER ARTIFACT SALVAGE COST	\$41.67

2. Preparation

A. Staff	\$7802.50
B. Equipment and Supplies	\$3493.15
SUBTOTAL, ALL PREPARATION COSTS	\$11295.65
AVERAGE PER ARTIFACT COST OF PREPARATION	\$5.65

3. Curation

A. Staff	\$2551.00
B. Equipment and Supplies	\$2893.98
SUBTOTAL, ALL CURATION COSTS	\$5444.98
AVERAGE PER ARTIFACT COST OF CURATION	\$2.77
GRAND TOTAL OF ALL COSTS	\$100089.76
AVERAGE PER ARTIFACT TOTAL COST	\$50.04

4. Time

A. Salvage Time	66 team days (3.3 team months.)
B. Preparation Time	30 days (1.5 months.)
C. Curation Time	30 days (1.5 months.)

6.6. Marine fossils

Salvaging marine fossils is extremely cost efficient, since they tend to be abundant and an adequate sample can be collected in forty-five minutes. The major expense will be in preparation, identification, and storage. A maximum budget of \$2,000.00 should be sufficient to cover all costs.

7.0. Recommended funding structure

As mentioned above (Section 6.1), there are far too many potential sources of variation which could effect the total cost of salvage to be able to make an accurate cost estimate for any particular site. Similarly, it is impossible to generate a bid which would safely cover the costs of salvage, unless it were enough to cover all worst-case contingencies. Such a bid would be so large as to be meaningless as an estimate of actual cost. Accordingly, the only practical approach would be to fund the salvage project on a cost plus overhead basis. If a thorough testing program were implemented, it might become possible to put a maximum cap on costs of salvage, but even this cannot be stated with certainty. Naturally, adequate safeguards for all parties would have to be included in any cost plus contract. However, this is beyond our area of expertise and will not be considered here.

Funding for the fossil materials after salvage presents a different problem, as it represents an essentially open-ended process. Preparation and curation will eventually end, but research and collection management will continue on a permanent basis. Rather than engage in years of submitting expenses and projected budgets (in itself an expensive and time-consuming process), we recommend that a lump sum be negotiated to cover these costs. This amount of money, and the interest it may earn, can then be managed in such a manner as to complete the work (from cleaning to storage), with enough remaining to fund a modest permanent endowment for collections management and continuing research.

8.0. Report on project

Because research on these collections will be an on-going process in the foreseeable future, it will not be possible to provide a final report covering this aspect. If desired, it will be possible to produce a report on the methods and results of the testing and salvage portions of the project. In fact, we anticipate publishing this information in a scholarly journal so that others can benefit from the new methods developed for this project.

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9.0. Appendices

9.1. Glossary

Archaeology

The study of human beings, both historic and prehistoric, through the analysis of the artifacts and skeletons they have left behind.

Artifact

An object that has been made or modified by humans.

Articulated

Used to describe a skeleton in which the bones still retain the relationships that they had when the animal was alive.

Asphalt

A bituminous substance, the residue from natural oil. Often called "tar."

Assemblage

A group of organisms or fossils sharing a common situation.

Biomass

The total mass of living organisms in an area.

Carnivore

An animal that eats other animals.

Collagen

The fibrous protein component of bone.

Cone Penetrometer

Device which forces an instrumented steel rod into the ground at a constant rate. The force required to maintain the constant rate, friction on the side of the tip, and electrical resistivity can be measured and, when calibrated to known geologic cores or sections, be used to closely approximate subsurface stratigraphy.

Curation

The processes of identification, cataloguing and storage of specimens, also any other processes designed to protect and maintain a collection of specimens.

Datum

A fixed arbitrary point or plane, derived from a known geographical position, which is used as a reference when removing specimens.

Disarticulated

Used to describe a skeleton, the bones of which are no longer in the same positions as in the living animal.

En Bloc

A method of fossil excavation in which blocks of fossiliferous matrix are removed to be dissected under laboratory conditions.

Fauna

The animal population present in a certain place or at a certain time.

Flora

The plant population present in a certain place or at a certain time.

Flotation

Method by which micro-fossils are separated from processed matrix using heavy liquids.

Fossil

The remains or traces of a formerly living thing preserved in the ground.

Fossil Deposit

An assemblage of fossils preserved together in a discrete geologic stratum.

Fossil Locality

A geographical spot at which fossils have been discovered.

Fossiliferous

Used to describe sediment that contains fossils.

Grid System

A network of numbered squares, laid out in reference to a datum, in order to control and facilitate specimen removal.

Ground Penetrating Radar

Surface device which uses radar type waves to map subsurface objects. It's depth of penetration is limited, especially in areas having shallow clay deposits.

Herbivore

An animal that eats plants.

Hydrologic

Relating to the study of water on the surface of the land, in the soil, and in the underlying rocks.

In Situ

Used to describe a fossil or geologic feature which has not been disturbed since its original deposition. In situ excavation involves the removal of individual specimens as they are uncovered.

Invertebrate

Collective term for animals that lack backbones (insects, molluscs, arachnids, etc.).

Marine

Refers to sediment and/or fossils deposited by the action of an ocean.

Matrix

The specific sediment enclosing a fossil.

Megafauna

The fauna composed of large animals that is characteristic of the late Pleistocene.

Microfossils

Fossil remains of microscopic organisms.

Occlusal

Refers to the surface of a tooth that comes in contact with the corresponding tooth in the other jaw.

Ontogeny

The study of an individual's growth and development.

Osteology

The study of bones.

Paleontology

The study of prehistoric life.

Pathology

The study of individual abnormalities and diseases.

Pleistocene

The most recent geologic epoch before the present one, covering from 1.8 million to 10,000 years BP. Often called "Ice Age."

Predation

The means by which a carnivore captures the animals that it eats.

Preparation

The cleaning and reconstruction of a specimen.

Provenance

The exact origin of a specimen.

Radiocarbon Dating

A dating process based on the half-life of Carbon-14, with an effective limit of 50,000 years BP.

Sedimentology

The study of sedimentary rocks, i. e., those formed by the transport of solid material from its site of origin by air, water or ice.

Sonic Digitizer

Device which utilizes a sound generating stylus and an array of microphones to rapidly and accurately measure the X, Y, and Z coordinates of a point.

Sterile

Used to describe sediment which contains no fossils.

Stratified

Characterized by horizontal beds of sediments.

Stratigraphy

The study of the formation, composition, sequence and correlation of sedimentary layers.

Stratum

A single sedimentary layer. (Plural: Strata)

Subsistence Patterns

The means by which an animal or group of animals obtain nourishment.

Taphonomy

The study of the processes that operate on a potential fossil between the death of the creature and the excavation of the fossil.

Taxon

A category of plant and animal classification (e. g., species, genus, family, etc.)

Taxonomy

The study of plant and animal classification and relationships.

Terrain Conductivity Instrument

Surface device which reads the electrical conductivity of subsurface sediments. Since asphaltic sediments have extremely low conductivity, they may be readily distinguished from most non-asphaltic sediments.

Terrestrial

Refers to sediment and/or fossils deposited by the action of wind and fresh water.

Ultrasonic Cleaner

A machine for cleaning delicate objects. Ultrasound waves clean the specimen

immersed in solvent.

Vapor Degreaser

A machine which is used to process matrix by removing the asphalt.

Vertebrate

A collective term for animals with backbones (fish, amphibians, reptiles, birds, and mammals).

9.2. Legal aspects

Paleontologic remains have been recognized as significant nonrenewable resources and, as such, are protected under the provisions of the Antiquities Act of 1906 and subsequent antiquity legislation, policies and executive orders. For example, California State Executive Order B-64-80 directs state agencies to identify and protect historic properties under their jurisdiction that are eligible to be listed on the National Register of Historic Places. The California State Water Resources Control Board's January 1979 "Clean Water Grant Program for the Protection and Preservation of Cultural Resources" defines cultural resources to include paleontological remains, as well as archaeological and historic materials.

Preservation and salvage of fossil material is lawfully mandated in part by the following: Antiquities Act of June 8, 1906 (34 Stat. 225, 16 USC 432, 433); Historical Sites Act of 1935 (49 Stat. 666, 16 USC 461 et seq); U.S. Congress, August 15, 1949 (63 Stat. 606, 20 USC 78 and 79a); Reservoir Salvage Act of 1960, as amended in 1974 (P.L. 86-523 and P.L. 93-921); The Montana Power Company Decision (Decisions of the Department of the Interior 721, D, A-30310 and 518-522, Dec 3, 1965); The National Historic Preservation Act of 1966 (80 Stat. 915, 16 USC 470 et seq, amended 1976); Executive Order 11593, Protection and Enhancement of the Cultural Environment, May 13, 1971 (36 CFR 8931, 16 USC 470); National Environmental Policy Act (NEPA) of 1969, (83 Stat. 852, 42 USC 4321-4327); Archaeological and Historical Preservation Act of 1974 (P.L. 93-921; Stat. 174, 16 USC 469); California Environmental Quality Act (CEQA) PR Code Sec. 40.97; The California Antiquities Laws RRC Sec. 5097.5 and memoranda of opinions U.S. Department of the Interior, Office of the Solicitor, to the Bureau of Land Management, indicating applicability of the Antiquity Act to fossils 1956-1974.

The United States Code 42 USC 1996, and Sec. 1 Chapter 1.75 Sec. 5097.9 et

seq of the California Public Resources Code, prohibit the removal of native American human remains and grave goods by any public agency operating under public funding, without showing, clearly and convincingly, that the public interest and necessity so require. As human remains are already known from Rancho La Brea, those that are likely to be found during the cut and cover excavation, would come within the scope of these laws. Sec. 3 section 7050.5 of the California Health and Safety Code requires that the Coroner be informed of the discovery of human remains. If the skeleton is of native American origin, the Coroner must notify the Native American Heritage Commission, which will then assist the descendants (if known) with the disposition of the remains.

9.3. Detailed budget estimates

6.2 Conical deposits

6.2.1. Small deposit. Example: 25 cubic meters, 10,000 major specimens, 5 meters depth, 5 square meters surface area.

6.2.1.1. Good preservation

6.2.1.1.1. In situ excavation

1. SalvageA. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of 6 weeks, using two excavation teams and one computer team for one 40-hour shift per week.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$6381.00

2. Executive Secretary @ \$2300.00 per month \$3450.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$3915.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

3 team-months @ \$8743.00 per team-month \$26229.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Bone Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

1.5 team-months @ \$5102.00 per team-month \$7653.00

LACMNTA LIBRARY

6. Laborer (one per shift) @ \$1931.00 per month	\$2896.50
SUBTOTAL OF SALVAGE STAFF	\$50644.50

<u>B. Equipment and Supplies</u>	Cost
1. <u>General Site Equipment</u> (rented)	
1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$852.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$14.60
2 24"x42" desks @ \$11.00 per month each	\$44.00
2 chairs @ \$11.50 per month each	\$46.00
1 filing cabinet @ \$17.50 per month	\$35.00
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$150.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$50.00
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$336.00
2 computer tables @ \$10.00 per month each	\$40.00
2 chairs @ \$11.50 per month each	\$46.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50

3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$2681.82
2. <u>Excavation Equipment</u> (per deposit)	
1 wheelbarrow	\$90.00
1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$1000.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
100 storage rack system tote boxes @ \$12.00	\$1200.00
4 line levels @ \$2.69	\$10.76
50 Melmat tote boxes 23"x19"x11" @ \$12.00	\$600.00
10000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$520.00
Plastic bags with opaque panel to write on	
6,000 7"x9"x1.5 mil @ \$17.80 per M	\$106.80
1,000 10"x16"x1.5 mil @ \$39.15 per M	\$39.15
1,000 6"x18"x1.5 mil @ \$30.15 per M	\$30.15
2,000 18"x24"x1.5 mil @ \$86.75 per M	\$173.50
10,000 4" paper-wire ties @ \$1.90 per M	\$19.00

1000 black lab marker pens, @ \$8.80 per pkg. of 10	\$88.00
1 case nylon line	\$36.00
SUBTOTAL	\$4117.26
3. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 round library-type stools @ \$30.00	\$90.00
2 doz. Edmont gloves @ \$32.95 doz.	\$65.90
3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL (Per Team)	\$734.19
4. <u>Computer Team Equipment</u> (per team)	

IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2850.25
TAX - 6.5%	\$2037.93
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES (2 EXCAVATION TEAMS, 1 COMPUTER TEAM)	\$33390.64
SUBTOTAL, ALL SALVAGE COSTS	\$84035.14
AVERAGE PER SPECIMEN SALVAGE COST	\$8.40

2. Preparation (based on Pit 91 operation in preliminary and final preparation)

A. Staff Cost

These costs are based on an estimated preparation time of 5 months for the major specimens, 7.5 months for microfossil sorting, and 6.5 months for the matrix processing.

1. Processing Supervisor @ \$2899.00 per month	\$14495.00
2. 1 half-time Secretary @ \$2081.00 per month	\$5202.50
3. 2 Preparation Supervisors @ \$2484.00 per month	\$24840.00
4. 2 Ultrasonic Technicians @ \$2139.00 per month	\$21390.00

5. 4 Hand Preparation Technicians	
@ \$2139.00 per month	\$42780.00
6. Flotation Technician @ \$2366.00 per month	\$15379.00
7. 4 Microsorters @ \$1931.00 per month	\$57930.00
8. 2 Degreaser Operators @ \$2139.00 per month	\$27807.00
SUBTOTAL PREPARATION STAFF	\$209823.50

B. Facility

1. 60'x30' storage and chemical process building with public viewing area and RTD-LACM Public Relations marquee	
	Cost-\$40000.00

C. Equipment and Supplies

Cost

1. Matrix processing

Tools

2 BH-220 Baron-Blakeslee degreasers @ \$2,250.00	\$4500.00
2 stainless steel lids @ \$180.00	\$360.00
Acidity test kit	\$30.00
4 stainless steel baskets @ \$165.00	\$660.00
1500 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$3584.00
1,512 tin cans, 1 gallon round, friction lid, no bail (42 bags of 36) @ \$29.58	\$1242.36
10 30"x72" work and drying benches @ \$246.00	\$2460.00
Fume hood	\$17500.00
1 roll window screen	\$62.00
300 feet garden hose	\$60.00
6 stack chairs @ \$22.00	\$132.00

2 rollaway chairs @ \$200.00	\$400.00
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
3 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$199.50

Safety Clothing

2 pr. rubber boots @ \$16.50	\$33.00
2 pr. rubber bib overalls @ \$26.10	\$52.20
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
2 pr. safety glasses @ \$5.25	\$10.50
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60
2 fire extinguishers @ \$24.00	\$48.00

Solvents

16 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$3008.00
30 5-Kg bottles of tetrabromoethane @ \$58.30	\$1749.00
2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00

2. Specimen Processing

Tools

10 2" paintbrushes @ \$2.00	\$20.00
2 counter brushes @ \$2.00	\$4.00
10 1/4" paintbrushes @ \$0.35	\$3.90
5 No. 1 fine brushes @ \$0.15	\$0.75
48 bottle brushes (various sizes) @ \$0.29	\$13.92
Metal funnel set	\$7.00
Lab screen set, stainless steel	\$300.00
Trays, stainless steel	
10 10"x6"x2" @ \$12.40	\$124.00
10 12"x7"x2" @ \$15.80	\$158.00
10 16"x9"x2" @ \$14.60	\$146.00
6 lamp magnifiers @ \$131.60	\$789.60
20 dental tools, double-ended explorers @ \$4.00	\$80.00
24 toothbrushes @ \$1.00	\$24.00
Wooden applicators	\$7.74
10 pkg. pipe-cleaners @ \$1.00	\$10.00
12 rolls masking tape @ \$1.40	\$16.80
20 cases cleaning towels @ \$2.60	\$52.00
Mixing bowl set (Rubber Maid Latex Molding)	\$6.00
2 pr. long-nosed pliers @ \$9.14	\$18.28
2 pkg. popsicle sticks @ \$1.99	\$3.98
2 pkg. forceps (curved) @ \$7.21	\$14.42
1 binocular microscope	\$925.00
4 ultrasonic cleaners (large) Branasonic B-72	
@ \$1155.00	\$4620.00
4 Branasonic 72-1 stainless steel covers @ \$30.00	\$120.00
4 Branasonic 72-2 solid insert trays @ \$72.00	\$288.00
4 ultrasonic cleaners (small) Branasonic #12	

@ \$255.00	\$1020.00
6 ear protectors @ \$12.00	\$72.00
6 C-clamps @ \$2.37	\$14.22
7,000 ft. roll twist wire	\$20.00
6 plastic sand-boxes VWR 62662-445 @ \$9.75	\$58.50
100 lbs fine sand	\$20.00
12 bottles of white ink @ \$1.00	\$12.00
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
13 lab coats @ \$21.26	\$276.38
7 lab aprons @ \$6.05	\$42.35
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60

Containers

12 500 ml (16 oz.) plastic squirt bottles	
@ 6 for \$7.00	\$14.00
12 500 ml (16 oz.) plastic (Red special treated) acetone squirt bottles @ 6 for \$10.69	\$21.38
4 solvent containers @ \$15.12	\$60.48
1 5 gallon nalgene tank w/lid	\$16.00
4 Carboy 5 gallon plastic jars @ \$140.65	\$562.60
6 5 gallon metal drum w/lid @ \$7.25	\$43.50
2 55 gallon drum cradles @ \$78.95	\$157.90
2 55 gallon drum gates @ \$12.05	\$24.10

Solvents

70 1-1-1 Trichloroethane 54 gallon drums	
@ \$188.00	\$13160.00
1 drum Acetone	\$80.00
2 gallons Degreaser soap (Marksen Catalog 5-17529)	
@ \$15.00	\$30.00
6 cases dishwashing liquid	\$60.00
36 units white glue @ \$1.13	\$40.68
10 gallons glyptal @ \$19.00 gallon	\$190.00

RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs. \$10157.72

TAX - 6.5% \$7262.77

SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES \$118997.69

SUBTOTAL, ALL PREPARATION COSTS \$328821.19

AVERAGE PER SPECIMEN COST OF PREPARATION \$32.88

3. Curation

A. Staff Cost

1. 3 Curatorial Assistants @ \$2551.00 per month \$19132.50

B. Equipment and Supplies Cost

Storage Equipment

3-person IBM work terminal @ \$650.00 per month \$1625.00

4 lab coats @ \$21.26 \$85.04

5 gallons glyptal @ \$19.00 \$95.00

Gelatin capsules

1 drum #000 (25,000) \$14.82

1 drum #00 (25,000)	\$14.82
1 drum #1 (25,000)	\$7.59
Vials	
70 1 dram pkg 72 @ \$6.04	\$422.80
70 1/2 dram pkg. 72 @ \$5.29	\$370.30
Corks	
10 pkg #4 Reg. (500)	\$244.80
10 pkg #2 Reg. (500)	\$212.70
Storage Racks	
Custom made racks, (Storage Rack Systems Inc.)	
22 19-drawer, 25"x28"x76", and	
13 17-drawer, 25"x28"x84", and	
9 24-drawer, 25"x28"x101"	\$12000.00
Custom made drawers, (Storage Rack Systems, Inc.)	
214 specimen drawers (Box 1) 25.81"x23.87"x1.5", and	
142 specimen drawers (Box 2) 25.81"x23.87"x3.5", all with	
snap-on label holders and labels	\$4000.00
1 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$250.00
8 vial and slide drawers (Bio Equip 8510)	
@ \$14.00	\$112.00
58 vial trays (85A) for 1/2 and 1 dram vials	
@ \$1.30	\$76.00
1 16-drawer specimen cabinet (Lane Model 301),	
including delivery	\$303.00
16 specimen drawers @ \$28.00	\$448.00
Specimen trays	
1000 1"x3"x5/8" @ \$105.00 per M	\$105.00
1000 2"x3"x5/8" @ \$82.50 per M	\$82.50

1000 2"x6"x5/8" @ \$107.50 per M	\$107.50
1000 3"x4"x5/8" @ \$100.00 per M	\$100.00
1000 4"x6"x5/8" @ \$115.00 per M	\$115.00
1000 6"x8"x5/8" @ \$130.00 per M	\$130.00
1000 8"x12"x5/8" @ \$160.00 per M	\$160.00
1000 10"x3"x5/8" @ \$120.00 per M	\$120.00
1000 15"x5"x5/8" @ \$140.00 per M	\$140.00
1000 2"x6"x1" @ \$130.00 per M	\$130.00
1000 3"x4"x1" @ \$120.00 per M	\$120.00

Office Equipment (Lab)

1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
2 boxes Dymo tape @ \$8.90	\$17.80
24 specimen boxes w/lid 12"x8"x6" @ \$18.00 per doz.	\$36.00
5 pkg. string cord @ \$5.57	\$27.85
1 photo file cabinet	\$171.75
10 5"x8" cardboard file boxes @ \$5.78	\$57.80
10 3"x5" cardboard file boxes @ \$4.35	\$43.50
2 staplers @ \$13.75	\$27.50
General office and laboratory supplies	\$2000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2428.38
TAX - 6.5%	\$1736.29
SUBTOTAL, ALL CURATION COSTS	\$47580.99
AVERAGE PER SPECIMEN COST OF CURATION	\$4.76

GRAND TOTAL OF ALL COSTS \$460437.32

AVERAGE PER SPECIMEN TOTAL COST \$46.04

4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that two teams could work simultaneously. Therefore, one five-day shift of two teams per week would halve the total salvage time, two five-day shifts of two teams per week would quarter the total time, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

- A. Estimated Salvage Time 60 team days (3 team months)
- B. Estimated Preparation Time 150 days (7.5 months)
- C. Estimated Curation Time 50 days (2.5 months)

5. Collections Management

The time and cost requirements for managing a single collection of this size are small enough to be absorbed by existing staff and budgets of most institutions.

6.2.1.1.2. En bloc excavation1. Salvage

As noted above, costs of en bloc cannot yet be determined. Costs given here include only the cost of block reduction after removal.

A. Staff

Cost

Costs for block reduction personnel are based on an estimated total time of 8 weeks, using two excavation teams and one computer team for one 40-hour shift per week.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$8508.00

2. Executive Secretary @ \$2300.00 per month \$4600.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$5220.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

4 team-months @ \$8743.00 per team-month \$34972.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Bone Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

2 team-months @ \$5102.00 per team-month \$10204.00

6. Laborer (one per shift) @ \$1931.00 per month \$3862.00

SUBTOTAL OF BLOK REDUCTION STAFF \$67526.00

B. Equipment and Supplies

Cost

1. <u>General Site Equipment</u> (rented)	
1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month	\$7.30
2 24"x42" desks @ \$11.00 per month each	\$
2 chairs @ \$11.50 per month each	\$
1 filing cabinet @ \$17.50 per month	\$
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$
2 computer tables @ \$10.00 per month each	\$
(Purchased)	
2 chairs @ \$11.50 per month each	\$
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$
2. <u>Excavation Equipment</u> (per deposit)	
1 wheelbarrow	\$90.00

1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$1000.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
100 storage rack system tote boxes @ \$12.00	\$1200.00
4 line levels @ \$2.69	\$10.76
50 Melmat tote boxes 23"x19"x11" @ \$12.00	\$600.00
10000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$520.00
Plastic bags with opaque panel to write on	
6,000 7"x9"x1.5 mil @ \$17.80 per M	\$106.80
1,000 10"x16"x1.5 mil @ \$39.15 per M	\$39.15
1,000 6"x18"x1.5 mil @ \$30.15 per M	\$30.15
2,000 18"x24"x1.5 mil @ \$86.75 per M	\$173.50
10,000 4" paper-wire ties @ \$1.90 per M	\$19.00
1000 black lab marker pens, @ \$8.80 per pkg. of 10	\$88.00
1 case nylon line	\$36.00
Burlap rolls (500 yds.) @ \$0.60	\$300.00

100 plaster 100 lb. bags @ \$9.00	\$900.00
10 cans spray paint @ \$1.50	\$15.00
100 ft. roll of chicken wire	\$50.00
2 pr. wire cutters @ \$6.00	\$12.00
1 10 lb. sledge hammer	\$10.00
3 wrecking bars @ \$29.00	\$87.00
2 crowbars @ \$10.00	\$20.00
SUBTOTAL	\$5511.26
3. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 round library-type stools @ \$30.00	\$90.00
2 doz. Edmont gloves @ \$32.95 doz.	\$65.90

3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL(Per Team)	\$734.19
4. <u>Computer Team Equipment</u> (per team)	
IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2721.46
TAX - 6.5%	\$1945.85
SUBTOTAL BLOCK REDUCTION EQUIPMENT AND SUPPLIES (2 EXCAVATION TEAMS, 1 COMPUTER TEAM)	\$31881.95
SUBTOTAL, ALL BLOCK REDUCTION COSTS	\$99407.95
AVERAGE PER SPECIMEN BLOCK REDUCTION COST	\$9.94
SUBTOTAL, ALL SALVAGE COSTS	\$
AVERAGE PER SPECIMEN SALVAGE COST	\$

2. Preparation (based on Pit 91 operation in preliminary and final

preparation)

A. Staff

Cost

These costs are based on an estimated preparation time of 5 months for the major specimens, 7.5 months for microfossil sorting, and 6.5 months for the matrix processing.

1. Processing Supervisor @ \$2899.00 per month	\$14495.00
2. 1 half-time Secretary @ \$2081.00 per month	\$5202.50
3. 2 Preparation Supervisors @ \$2484.00 per month	\$24840.00
4. 2 Ultrasonic Technicians @ \$2139.00 per month	\$21390.00
5. 4 Hand Preparation Technicians @ \$2139.00 per month	\$42780.00
6. Flotation Technician @ \$2366.00 per month	\$15379.00
7. 4 Microsorters @ \$1931.00 per month	\$57930.00
8. 2 Degreaser Operators @ \$2139.00 per month	\$27807.00
SUBTOTAL PREPARATION STAFF	\$209823.50

B. Facility

1. 60'x30' storage and chemical process building with public viewing area and RTD-LACM Public Relations marquee

Cost-\$40000.00

C. Equipment and Supplies

Cost

1. Matrix processing

2 BH-220 Baron-Blakeslee degreaser @ \$2,250 \$4500.00

2 stainless steel lids @ \$180.00 \$360.00

Acidity test kit \$30.00

4 stainless steel baskets @ \$165.00 \$660.00

1500 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping

	\$3584.00
1512 tin cans, 1 gallon round, friction lid, no bail (42 bags of 36) @ \$29.58	\$1242.36
10 30"x72" work and drying benches @ \$246.00	\$2460.00
Fume hood	\$17500.00
1 roll window screen	\$62.00
300 feet garden hose	\$60.00
3 linoleum knives @ \$1.50	\$4.50
6 stack chairs @ \$22.00	\$132.00
2 rollaway chairs @ \$200.00	\$400.00
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
3 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$199.50
<u>Safety Clothing</u>	
2 pr. rubber boots @ \$16.50	\$33.00
2 pr. rubber bib overalls @ \$26.10	\$52.20
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
2 pr. safety glasses @ \$5.25	\$10.50
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60

2 fire extinguishers @ \$24.00	\$48.00
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Solvents

16 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$3008.00
30 5-Kg bottles of tetrabromoethane @ \$58.30	\$1749.00
2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00

2. Specimen Processing

Tools

10 2" paintbrushes @ \$2.00	\$20.00
2 counter brushes @ \$2.00	\$4.00
10 1/4" paintbrushes @ \$0.35	\$3.90
5 No. 1 fine brushes @ \$0.15	\$0.75
48 bottle brushes (various sizes) @ \$0.29	\$13.92
Metal funnel set	\$7.00
Lab screen set, stainless steel	\$300.00
Trays, stainless steel	
10 10"x6"x2" @ \$12.40	\$124.00
10 12"x7"x2" @ \$15.80	\$158.00
10 16"x9"x2" @ \$14.60	\$146.00
6 lamp magnifiers @ \$131.60	\$789.60
20 dental tools, double-ended explorers @ \$4.00	\$80.00
24 toothbrushes @ \$1.00	\$24.00
Wooden applicators	\$7.74
10 pkg. pipe-cleaners @ \$1.00	\$10.00
12 rolls masking tape @ \$1.40	\$16.80
20 cases cleaning towels @ \$2.60	\$52.00
Mixing bowl set (Rubber Maid Latex Molding)	\$6.00

2 pr. long-nosed pliers @ \$9.14	\$18.28
2 pkg. popsicle sticks @ \$1.99	\$3.98
2 pkg. forceps (curved) @ \$7.21	\$14.42
1 binocular microscope	\$925.00
4 ultrasonic cleaners (large) Branasonic B-72	
@ \$1155.00	\$4620.00
4 Branasonic 72-1 stainless steel covers @ \$30.00	\$120.00
4 Branasonic 72-2 solid insert trays @ \$72.00	\$288.00
4 ultrasonic cleaners (small) Branasonic #12	
@ \$255.00	\$1020.00
6 ear protectors @ \$12.00	\$72.00
6 C-clamps @ \$2.37	\$14.22
7,000 ft. roll twist wire	\$20.00
6 plastic sand-boxes VWR 62662-445 @ \$9.75	\$58.50
100 lbs fine sand	\$20.00
12 bottles of white ink @ \$1.00	\$12.00
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
13 lab coats @ \$21.26	\$276.38
7 lab aprons @ \$6.05	\$42.35
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60
<u>Containers</u>	
12 500 ml (16 oz.) plastic squirt bottles	
@ 6 for \$7.00	\$14.00

12 500 ml (16 oz.) plastic (Red special treated) acetone squirt bottles @ 6 for \$10.69	\$21.38
4 solvent containers @ \$15.12	\$60.48
1 5 gallon nalgene tank w/lid	\$16.00
4 Carboy 5 gallon plastic jars @ \$140.65	\$562.60
6 5 gallon metal drums w/lid @ \$7.25	\$43.50
2 55 gallon drum cradles @ \$78.95	\$157.90
2 55 gallon drum gates @ \$12.05	\$24.10
<u>Solvents</u>	
70 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$13160.00
1 drum Acetone	\$80.00
2 gallons Degreaser soap (Marksen Catalog 5-17529) @ \$15.00	\$30.00
6 cases dishwashing liquid	\$60.00
36 units white glue @ \$1.13	\$40.68
10 gallons glyptal @ \$19.00 gallon	\$190.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$10158.17
TAX - 6.5%	\$7263.09
SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES	\$119002.96
 SUBTOTAL, ALL PREPARATION COSTS	 \$328826.46
 AVERAGE PER SPECIMEN COST OF PREPARATION	 \$32.88

3. Curation

A. Staff

Cost

1. 3 Curatorial Assistants @ \$2551.00 per month	\$19132.50
B. <u>Equipment and Supplies</u>	Cost
Storage Equipment	
3-person IBM work terminal @ \$650.00 per month	\$1625.00
4 lab coats @ \$21.26	\$85.04
5 gallons glyptal @ \$19.00	\$95.00
Gelatin capsules	
1 drum #000 (25,000)	\$14.82
1 drum #00 (25,000)	\$14.82
1 drum #1 (25,000)	\$7.59
Vials	
70 1 dram pkg 72 @ \$6.04	\$422.80
70 1/2 dram pkg. 72 @ \$5.29	\$370.30
Corks	
10 pkg #4 Reg. (500)	\$244.80
10 pkg #2 Reg. (500)	\$212.70
Storage Racks	
Custom made racks, (Storage Rack Systems Inc.)	
22 19-drawer, 25"x28"x76", and	
13 17-drawer, 25"x28"x84", and	
9 24-drawer, 25"x28"x101"	\$12000.00
Custom made drawers, (Storage Rack Systems, Inc.)	
214 specimen drawers (Box 1) 25.81"x23.87"x1.5", and	
142 specimen drawers (Box 2) 25.81"x23.87"x3.5", all with snap-on label holders and labels	\$4000.00
1 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$250.00
8 vial and slide drawers (Bio Equip 8510) @ \$14.00	\$112.00

58 vial trays (85A) for 1/2 and 1 dram vials @ \$1.30	\$76.00
1 16-drawer specimen cabinet (Lane Model 301), including delivery	\$303.00
16 specimen drawers @ \$28.00	\$448.00
Specimen trays	
1000 1"x3"x5/8" @ \$105.00 per M	\$105.00
1000 2"x3"x5/8" @ \$82.50 per M	\$82.50
1000 2"x6"x5/8" @ \$107.50 per M	\$107.50
1000 3"x4"x5/8" @ \$100.00 per M	\$100.00
1000 4"x6"x5/8" @ \$115.00 per M	\$115.00
1000 6"x8"x5/8" @ \$130.00 per M	\$130.00
1000 8"x12"x5/8" @ \$160.00 per M	\$160.00
1000 10"x3"x5/8" @ \$120.00 per M	\$120.00
1000 15"x5"x5/8" @ \$140.00 per M	\$140.00
1000 2"x6"x1" @ \$130.00 per M	\$130.00
1000 3"x4"x1" @ \$120.00 per M	\$120.00
<u>Office Equipment (Lab)</u>	
1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
2 boxes Dymo tape @ \$8.90	\$17.80
24 specimen boxes w/lid 12"x8"x6" @ \$18.00 per doz.	\$36.00
5 pkg. string cord @ \$5.57	\$27.85
1 photo file cabinet	\$171.75
10 5"x8" cardboard file boxes @ \$5.78	\$57.80
10 3"x5" cardboard file boxes @ \$4.35	\$43.50

2 staplers @ \$13.75	\$27.50
General office and laboratory supplies	\$2000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2428.38
TAX - 6.5%	\$1736.29
SUBTOTAL, ALL CURATION COSTS	\$47580.99

AVERAGE PER SPECIMEN COST OF CURATION	\$4.76
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GRAND TOTAL OF ALL COSTS	\$
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AVERAGE PER SPECIMEN TOTAL COST	\$
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4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that two teams could work simultaneously. Therefore, one five-day shift of two teams per week would halve the total salvage time, two five-day shifts of two teams per week would quarter the total time, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

A. Estimated Block Removal Time	Not Available
B. Estimated Block Reduction Time	80 team days (4 team months)
C. Estimated Preparation Time	150 days (7.5 months)
D. Estimated Curation Time	50 days (2.5 months)

5. Collections Management

The time and cost requirements for managing a single collection of this size are small enough to be absorbed by existing staff and budgets of most institutions.

6.2.1.2. Poor preservation

6.2.1.2.1. In situ excavation1. SalvageA. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of 12 weeks, using two excavation teams and one computer team for one 40-hour shift per week.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$12762.00

2. Executive Secretary @ \$2300.00 per month \$6900.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$7830.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

6 team-months @ \$8743.00 per team-month \$52458.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Bone Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

3 team-months @ \$5102.00 per team-month \$15306.00

1. Data Entry Person @ \$2551.00 per month \$7653.00

2. Bone Measurement Person @ \$2551.00 per month \$7653.00

6. Laborer (one per shift) @ \$1931.00 per month \$5793.00

SUBTOTAL OF SALVAGE STAFF \$447808.00

<u>B. Equipment and Supplies</u>	Cost
1. <u>General Site Equipment</u> (rented)	
1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$852.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$21.90
2 24"x42" desks @ \$11.00 per month each	\$66.00
2 chairs @ \$11.50 per month each	\$69.00
1 filing cabinet @ \$17.50 per month	\$52.50
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$225.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$75.00
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$336.00
2 computer tables @ \$10.00 per month each	\$60.00
2 chairs @ \$11.50 per month each	\$69.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$2894.62
2. <u>Excavation Equipment</u> (per deposit)	

1 wheelbarrow	\$90.00
1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$1000.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
100 storage rack system tote boxes @ \$12.00	\$1200.00
4 line levels @ \$2.69	\$10.76
50 Melmat tote boxes 23"x19"x11" @ \$12.00	\$600.00
10000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$52.00
Plastic bags with opaque panel to write on	
6,000 7"x9"x1.5 mil @ \$17.80 per M	\$106.80
1,000 10"x16"x1.5 mil @ \$39.15 per M	\$39.15
1,000 6"x18"x1.5 mil @ \$30.15 per M	\$30.15
2,000 18"x24"x1.5 mil @ \$86.75 per M	\$173.50
10,000 4" paper-wire ties @ \$1.90 per M	\$19.00
1000 black lab marker pens, @ \$8.80 per pkg. of 10	\$88.00
1 case nylon line	\$36.00

500 lb. drum Polyethelene Glycol (PEG-1000)	
@ \$0.75 per lb.	\$375.00
55 lb. Ethyl Cellulose @ \$2.34 per lb.	\$128.70
12 1" paint brushes @ \$2.00	\$24.00
SUBTOTAL	\$4176.96
3. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 round library-type stools @ \$30.00	\$90.00
2 doz. Edmont gloves @ \$32.95 doz.	\$65.90
3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL (Per Team)	\$734.19

4. Computer Team Equipment (per team)

IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2877.50
TAX - 6.5%	\$2057.41
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES (2 EXCAVATION TEAMS, 1 COMPUTER TEAM)	\$33709.87
SUBTOTAL, ALL SALVAGE COSTS	\$481517.87
AVERAGE PER SPECIMEN SALVAGE COST	\$48.15

2. Preparation (based on Pit 91 operation and Wyman's notes in preliminary and final preparation)A. Staff

Cost

These costs are based on an estimated preparation time of 7.5 months for the major specimens and microfossil sorting and 6.5 months for the matrix processing.

1. Processing Supervisor @ \$2899.00 per month	\$21742.50
2. 1 half-time Secretary @ \$2081.00 per month	\$7803.75

3. 2 Preparation Supervisors @ \$2482.00 per month	\$37320.00
4. 2 Ultrasonic Technicians @ \$2139.00 per month	\$32085.00
5. 4 Hand Preparation Technicians @ \$2139.00 per month	\$64170.00
6. Flotation Technician @ \$2366.00 per month	\$15379.00
7. 4 Microsorters @ \$1931.00 per month	\$57930.00
8. 2 Degreaser Operators @ \$2139.00 per month	\$27807.00
SUBTOTAL PREPARATION STAFF	\$264237.25

B. Facility

1. 60'x30' storage and chemical process building with public viewing area and RTD-LACM Public Relations marquee	Cost-\$40000.00
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C. Equipment and Supplies

	Cost
1. <u>Matrix processing</u>	
2 BH-220 Baron-Blakeslee degreasers @ \$2,250	\$4500.00
2 stainless steel lid @ \$180.00	\$360.00
Acidity test kit	\$30.00
4 stainless steel baskets @ \$165.00	\$660.00
1500 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$3584.00
1512 tin cans, 1 gallon round, friction lid, no bail (42 bags of 36) @ \$29.58	\$1242.36
10 30"x72" work and drying benches @ \$246.00	\$2460.00
Fume hood	\$17500.00
1 roll window screen	\$62.00
300 feet garden hose	\$60.00

6 stack chairs @ \$22.00	\$132.00
2 rollaway chairs @ \$200.00	\$400.00
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
3 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$199.50

Safety Clothing

4 pr. rubber boots @ \$16.50	\$66.00
3 pr. rubber bib overalls @ \$26.10	\$78.30
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
3 pr. safety glasses @ \$5.25	\$15.75
1 Sta Lube dispenser	\$9.50
3 cases Sta Lube hand cleaner @ \$32.90 case	\$98.70
15 cases paper towels @ \$6.46	\$96.90
2 fire extinguishers @ \$24.00	\$48.00

Solvents

16 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$3008.00
30 5-Kg bottles of tetrabromoethane @ \$58.30	\$1749.00
2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00

2. Specimen Processing

Tools

10 2" paintbrushes @ \$2.00	\$20.00
2 counter brushes @ \$2.00	\$4.00
10 1/4" paintbrushes @ \$0.35	\$3.90
5 No. 1 fine brushes @ \$0.15	\$0.75
48 bottle brushes (various sizes) @ \$0.29	\$13.92
Metal funnel set	\$7.00
Lab screen set, stainless steel	\$300.00
Trays, stainless steel	
10 10"x6"x2" @ \$12.40	\$124.00
10 12"x7"x2" @ \$15.80	\$158.00
10 16"x9"x2" @ \$14.60	\$146.00
6 lamp magnifiers @ \$131.60	\$789.60
20 dental tools, double-ended explorers @ \$4.00	\$80.00
24 toothbrushes @ \$1.00	\$24.00
Wooden applicators	\$7.74
10 pkg. pipe-cleaners @ \$1.00	\$10.00
12 rolls masking tape @ \$1.40	\$16.80
20 cases cleaning towels @ \$2.60	\$52.00
Mixing bowl set (Rubber Maid Latex Molding)	\$6.00
2 pr. long-nosed pliers @ \$9.14	\$18.28
2 pkg. popsicle sticks @ \$1.99	\$3.98
2 pkg. forceps (curved) @ \$7.21	\$14.42
1 binocular microscope	\$925.00
4 ultrasonic cleaners (large) Branasonic B-72	
@ \$1155.00	\$4620.00
4 Branasonic 72-1 stainless steel covers @ \$30.00	\$120.00
4 Branasonic 72-2 solid insert trays @ \$72.00	\$288.00

4 ultrasonic cleaners (small) Branasonic #12	
@ \$255.00	\$1020.00
6 ear protectors @ \$12.00	\$72.00
6 C-clamps @ \$2.37	\$14.22
7,000 ft. roll twist wire	\$20.00
6 plastic sand-boxes VWR 62662-445 @ \$9.75	\$58.50
100 lbs fine sand	\$20.00
12 bottles of white ink @ \$1.00	\$12.00
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
13 lab coats @ \$21.26	\$276.38
7 lab aprons @ \$6.05	\$42.35
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
15 cases paper towels @ \$6.46	\$96.90

Containers

18 500 ml (16 oz.) plastic squirt bottles	
at 6 for \$7.00	\$21.00
12 500 ml (16 oz.) plastic (Red special treated) acetone squirt	
bottles @ 6 for \$10.69	\$21.38
4 solvent containers @ \$15.12	\$60.48
1 5 gallon nalgene tank w/lid	\$16.00
4 Carboy 5 gallon plastic jars @ \$140.65	\$562.60
6 5 gallon metal drums w/lid @ \$7.25	\$43.50
2 55 gallon drum cradles @ \$78.95	\$157.90
2 55 gallon drum gates @ \$12.05	\$24.10

Solvents

70 1-1-1 Trichloroethane 54 gallon drums	
@ \$188.00	\$13160.00
1 drum Acetone	\$80.00
3 gallons Degreaser soap (Marksen Catalog 5-17529)	
@ \$15.00	\$45.00
7 cases dishwashing liquid	\$70.00
40 units white glue @ \$1.13	\$45.20
10 gallons glyptal @ \$19.00 gallon	\$190.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$10177.56
TAX - 6.5%	\$7276.95
SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES	\$119230.08
SUBTOTAL, ALL PREPARATION COSTS	\$383467.33
AVERAGE PER SPECIMEN COST OF PREPARATION	\$38.35

3. Curation

A. <u>Staff</u>	Cost
2. 3 Curatorial Assistants @ \$2551.00 per month	\$19132.50
B. <u>Equipment and Supplies</u>	Cost
<u>Storage Equipment</u>	
3-person IBM work terminal @ \$650.00 per month	\$1625.00
4 lab coats @ \$21.26	\$85.04
5 gallons glyptal @ \$19.00	\$95.00
Gelatin capsules	
1 drum #000 (25,000)	\$14.82

1 drum #00 (25,000)	\$14.82
1 drum #1 (25,000)	\$7.59
Vials	
70 1 dram pkg 72 @ \$6.04	\$422.80
70 1/2 dram pkg. 72 @ \$5.29	\$370.30
Corks	
10 pkg #4 Reg. (500)	\$244.80
10 pkg #2 Reg. (500)	\$212.70
Storage Racks	
Custom made racks, (Storage Systems, Inc.)	
22 19-drawer, 25"x28"x76", and	
13 17-drawer, 25"x28"x84", and	
9 24-drawer, 25"x28"x101"	\$12000.00
Custom made drawers, (Storage Systems, Inc.)	
214 specimen drawers (Box 1) 25.81"x23.87"x1.5", and	
142 specimen drawers (Box 2) 25.81"x23.87"x3.5", all with	
snap-on label holders and labels @	\$4000.00
1 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$250.00
8 vial and slide drawers (Bio Equip 8510)	
@ \$14.00	\$112.00
58 vial trays (85A) for 1/2 and 1 dram vials	
@ \$1.30	\$76.00
1 16-drawer specimen cabinet (Lane Model 301),	
including delivery	\$303.00
Specimen trays	
1000 1"x3"x5/8" @ \$105.00 per M	\$105.00
1000 2"x3"x5/8" @ \$82.50 per M	\$82.50
1000 2"x6"x5/8" @ \$107.50 per M	\$107.50

1000 3"x4"x5/8" @ \$100.00 per M	\$100.00
1000 4"x6"x5/8" @ \$115.00 per M	\$115.00
1000 6"x8"x5/8" @ \$130.00 per M	\$130.00
1000 8"x12"x5/8" @ \$160.00 per M	\$160.00
1000 10"x3"x5/8" @ \$120.00 per M	\$120.00
1000 15"x5"x5/8" @ \$140.00 per M	\$140.00
1000 2"x6"x1" @ \$130.00 per M	\$130.00
1000 3"x4"x1" @ \$120.00 per M	\$120.00
<u>Office Equipment (Lab)</u>	
1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
2 boxes Dymo tape @ \$8.90	\$17.80
24 specimen boxes w/lid 12"x8"x6"	
@ \$18.00 per doz.	\$36.00
5 pkg. string cord @ \$5.57	\$27.85
1 photo file cabinet	\$171.75
10 5"x8" cardboard file boxes @ \$5.78	\$57.80
10 3"x5" cardboard file boxes @ \$4.35	\$43.50
2 staplers @ \$13.75	\$27.50
General office and laboratory supplies	\$2000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2428.38
TAX - 6.5%	\$1736.29
SUBTOTAL, ALL CURATION COSTS	\$47580.99
 AVERAGE PER SPECIMEN COST OF CURATION	 \$4.76

GRAND TOTAL OF ALL COSTS \$912566.19

AVERAGE PER SPECIMEN TOTAL COST \$91.26

4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that two teams could work simultaneously. Therefore, one five-day shift of two teams per week would halve the total salvage time, two five-day shifts of two teams per week would quarter the total time, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

- A. Estimated Salvage Time 120 team days (6 team months)
- B. Estimated Preparation Time 200 days (10 months)
- C. Estimated Curation Time 50 days (2.5 months)

5. Collections Management

The time and cost requirements for managing a single collection of this size are small enough to be absorbed by existing staff and budgets of most institutions.

6.2.2. Large deposit. Example: 100 cubic meters, 100,000 major specimens, 10 meters depth, 10 square meters surface area.

6.2.2.1. Good preservation

6.2.2.1.1. In situ excavation

1. Salvage

A. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of 20 weeks, using two shifts per week, each including four excavation teams and two computer teams.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$21270.00

2. Executive Secretary @ \$2610.00 per month \$11500.00

3. Shift Supervisor (one per shift)

@ \$2366.00 per month \$26100.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

40 team-months @ \$8743.00 per team-month \$349720.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Bone Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

20 team-months @ \$5102.00 per team-month \$102040.00

6. Laborer (one per shift) @ \$1931.00 per month \$19310.00

SUBTOTAL OF SALVAGE STAFF \$531540.00

<u>B. Equipment and Supplies</u>	Cost
1. <u>General Site Equipment</u> (rented)	
1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$1420.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$36.50
2 24"x42" desks @ \$11.00 per month each	\$110.00
2 chairs @ \$11.50 per month each	\$115.00
1 filing cabinet @ \$17.50 per month	\$87.50
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$375.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$125.00
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$560.00
2 computer tables @ \$10.00 per month each	\$100.00
2 chairs @ \$11.50 per month each	\$115.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$4112.22
2. <u>Excavation Equipment</u> (per deposit)	

1 wheelbarrow	\$90.00
1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$2000.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
800 storage rack system tote boxes @ \$12.00	\$9600.00
4 line levels @ \$2.69	\$10.76
50 Melmat tote boxes 23"x19"x11" @ \$12.00	\$600.00
100000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$5200.00
Plastic bags with opaque panel to write on	
66,000 7"x9"x1.5 mil @ \$17.80 per M	\$1174.80
7,000 10"x16"x1.5 mil @ \$39.15 per M	\$274.65
7,000 6"x18"x1.5 mil @ \$30.15 per M	\$211.05
20,000 18"x24"x1.5 mil @ \$86.75 per M	\$1735.00
100,000 4" paper-wire ties @ \$1.90 per M	\$190.00
1000 black lab marker pens, @ \$8.80 per pkg. of 10	\$88.00
1 case nylon line	\$36.00

SUBTOTAL	\$21414.16
2. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 round library-type stools @ \$30.00	\$90.00
2 doz. Edmont gloves @ \$32.95 doz.	\$65.90
3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL (Per Team)	\$734.19
4. <u>Computer Team Equipment</u> (per team)	
IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00

1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$7186.99
TAX - 6.5%	\$5138.70
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES (8 EXCAVATION TEAMS, 2 COMPUTER TEAMS)	\$84195.59
SUBTOTAL, ALL SALVAGE COSTS	\$615735.59
AVERAGE PER SPECIMEN SALVAGE COST	\$6.16

2. Preparation (based on Pit 91 operation in preliminary and final preparation)

A. Staff Cost

These costs are based on an estimated preparation time of 42.5 months for the major specimens, 7.5 months for microfossil sorting, and 6.5 months for the matrix processing.

1. Processing Supervisor @ \$2899.00 per month \$123207.50
2. 1 half-time Secretary @ \$2081.00 per month \$44221.25
3. 2 Preparation Supervisors @ \$2484.00 per month \$211140.00
4. 4 Ultrasonic Technicians @ \$2139.00 per month \$363630.00
5. 8 Hand Preparation Technicians @ \$2139.00 per month

\$727260.00

6. Flotation Technician @ \$2366.00 per month	\$15379.00
7. 4 Microsorters @ \$1931.00 per month	\$57930.00
8. 2 Degreaser Operators @ \$2139.00 per month	\$27807.00
SUBTOTAL PREPARATION STAFF	\$1570574.75

B. Facility

1. 60'x30' storage and chemical process building with public viewing area and RTD-LACM Public Relations marquee	Cost-\$40000.00
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C. Equipment and Supplies

Cost

1. Matrix processing

Tools

2 BH-220 Baron-Blakeslee degreasers @ \$2,250	\$4500.00
2 stainless steel lid @ \$180.00	\$360.00
Acidity test kit	\$30.00
4 stainless steel baskets @ \$165.00	\$660.00
1 Heavy-Duty Solvent Recovery Still (Baron-Blakesley HRS-20)	\$4560.00
1100 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$2636.00
1008 tin cans, 1 gallon round, friction lid, no bail (28 bags of 36) @ \$29.58	\$828.24
10 30"x72" work and drying benches @ \$246.00	\$2460.00
Fume hood	\$17500.00
1 roll window screen	\$62.00
600 feet garden hose	\$120.00
8 stack chairs @ \$22.00	\$176.00

3 rollaway chairs @ \$200.00	\$600.00
6 shelf cabinets (Arrowstar) @ \$28.30	\$169.80
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
4 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$266.00

Safety Clothing

4 pr. rubber boots @ \$16.50	\$66.00
3 pr. rubber bib overalls @ \$26.10	\$78.30
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
3 pr. safety glasses @ \$5.25	\$15.75
1 Sta Lube dispenser	\$9.50
4 cases Sta Lube hand cleaner @ \$32.90 case	\$131.60
20 cases paper towels @ \$6.46	\$129.20
2 fire extinguishers @ \$24.00	\$48.00

Solvents

16 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$2068.00
20 5-Kg bottles of tetrabromoethane @ \$58.30	\$1166.00
2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00

2. Specimen Processing

Tools

20 2" paintbrushes @ \$2.00	\$40.00
2 counter brushes @ \$2.00	\$4.00
20 1/4" paintbrushes @ \$0.35	\$7.80
10 No. 1 fine brushes @ \$0.15	\$1.50
48 bottle brushes (various sizes) @ \$0.29	\$13.92
Metal funnel set	\$7.00
2 Lab screen sets, stainless steel @ \$300.00	\$600.00
Trays, stainless steel	
20 10"x6"x2" @ \$12.40	\$248.00
20 12"x7"x2" @ \$15.80	\$316.00
20 16"x9"x2" @ \$14.60	\$292.00
6 lamp magnifiers @ \$131.60	\$789.60
50 dental tools, double-ended explorers @ \$4.00	\$200.00
48 toothbrushes @ \$1.00	\$48.00
2 pkg. wooden applicators @ \$7.74	\$15.48
20 pkg. pipe-cleaners @ \$1.00	\$20.00
24 rolls masking tape @ \$1.40	\$33.60
40 cases cleaning towels @ \$2.60	\$104.00
Mixing bowl set (Rubber Maid Latex Molding)	\$6.00
4 pr. long-nosed pliers @ \$9.14	\$36.56
4 pkg. popsicle sticks @ \$1.99	\$7.96
4 pkg. forceps (curved) @ \$7.21	\$28.84
1 binocular microscope	\$925.00
8 ultrasonic cleaners (large) Branasonic B-72	
@ \$1155.00	\$9240.00
8 Branasonic 72-1 stainless steel covers @ \$30.00	\$240.00
8 Branasonic 72-2 solid insert trays @ \$72.00	\$576.00
6 ultrasonic cleaners (small) Branasonic #12	

@ \$255.00	\$1530.00
12 ear protectors @ \$12.00	\$144.00
6 C-clamps @ \$2.37	\$14.22
7 7,000 ft. roll twist wire @ \$20.00	\$140.00
10 plastic sand-boxes VWR 62662-445 @ \$9.75	\$97.50
200 lbs fine sand	\$40.00
120 bottles of white ink @ \$1.00	\$120.00
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
19 lab coats @ \$21.26	\$403.94
13 lab aprons @ \$6.05	\$78.65
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
3 cases Sta Lube hand cleaner @ \$32.90 case	\$98.70
20 cases paper towels @ \$6.46	\$129.20

Containers

24 500 ml (16 oz.) plastic squirt bottles	
@ 6 for \$7.00	\$28.00
24 500 ml (16 oz.) plastic (Red special treated) acetone squirt bottles @ 6 for \$10.69	\$42.76
4 solvent containers @ \$15.12	\$60.48
2 5 gallon nalgene tank w/lid @ \$16.00	\$32.00
6 Carboy 5 gallon plastic jars @ \$140.65	\$843.90
8 5 gallon metal drums w/lid @ \$7.25	\$58.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 55 gallon drum gates @ \$12.05	\$24.10

Solvents

100 1-1-1 Trichloroethane 54 gallon drums	
@ \$188.00	\$18800.00
3 drums Acetone	\$140.00
4 gallons Degreaser soap (Marksen Catalog 5-17529)	
@ \$15.00	\$60.00
12 cases dishwashing liquid	\$120.00
72 units white glue @ \$1.13	\$81.36
10 gallons glyptal @ \$19.00 gallon	\$190.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$11725.83
TAX - 6.5%	\$8383.97
SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES	\$137368.12
SUBTOTAL, ALL PREPARATION COSTS	\$1707942.87
AVERAGE PER SPECIMEN COST OF PREPARATION	\$17.08

3. Curation

A. <u>Staff</u>	Cost
2. 3 Curatorial Assistants @ \$2551.00 per month	\$191325.00
B. <u>Equipment and Supplies</u>	Cost
<u>Storage Equipment</u>	
3-person IBM work terminal @ \$650.00 per month	\$16250.00
4 lab coats @ \$21.26	\$85.04
15 gallons glyptal @ \$19.00	\$285.00
Gelatin capsules	
2 drums #000 (25,000)	\$29.64
2 drums #00 (25,000)	\$29.64

2 drums #1 (25,000)	\$15.18
Vials	
140 1 dram pkg 72 @ \$6.04	\$845.60
140 1/2 dram pkg. 72 @ \$5.29	\$740.60
Corks	
20 pkg. #4 Reg. (500)	\$489.60
20 pkg. #2 Reg. (500)	\$425.40
Storage Racks	
Custom made racks, (Storage Rack Systems, Inc.)	
219 19-drawer, 25"x28"x76", and	
125 17-drawer, 25"x28"x84", and	
86 24-drawer, 25"x28"x101"	\$115000.00
Custom made racks, (Storage Rack Systems, Inc.)	
6263 specimen drawers (Box 1) 25.81x23.87x1.5, and	
2087 specimen drawers (Box 2) 25.81x23.87x3.5, all with	
snap-on label holders and labels @	\$78000.00
2 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$500.00
16 vial and slide drawers (Bio Equip 8510)	
@ \$14.00	\$224.00
116 vial trays (85A) for 1/2 and 1 dram vials	
@ \$1.30	\$150.80
2 16-drawer specimen cabinet (Lane Model 301),	
including delivery	\$606.00
32 specimen drawers @ \$28.00	\$896.00
Specimen trays	
5000 1"x3"x5/8" @ \$105.00 per M	\$525.00
5000 2"x3"x5/8" @ \$82.50 per M	\$412.50
5000 2"x6"x5/8" @ \$107.50 per M	\$537.50

5000 3"x4"x5/8" @ \$100.00 per M	\$500.00
5000 4"x6"x5/8" @ \$115.00 per M	\$575.00
5000 6"x8"x5/8" @ \$130.00 per M	\$650.00
5000 8"x12"x5/8" @ \$160.00 per M	\$800.00
5000 10"x3"x5/8" @ \$120.00 per M	\$600.00
5000 15"x5"x5/8" @ \$140.00 per M	\$700.00
5000 2"x6"x1" @ \$130.00 per M	\$650.00
5000 3"x4"x1" @ \$120.00 per M	\$600.00
<u>Office Equipment (Lab)</u>	
1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
4 boxes Dymo tape @ \$8.90	\$35.60
48 specimen boxes w/lid 12"x8"x6"	
@ \$18.00 per doz.	\$72.00
10 pkg. string cord @ \$5.57	\$55.70
1 photo file cabinet	\$171.75
20 5"x8" cardboard file boxes @ \$5.78	\$115.60
20 3"x5" cardboard file boxes @ \$4.35	\$87.00
4 staplers @ \$13.75	\$55.00
General office and laboratory supplies	\$5000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$22702.49
TAX - 6.5%	\$16232.28
SUBTOTAL, ALL CURATION COSTS	\$457284.67
 AVERAGE PER SPECIMEN COST OF CURATION	 \$4.57

GRAND TOTAL OF ALL COSTS	\$2780963.13
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AVERAGE PER SPECIMEN TOTAL COST	\$27.81
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4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that four teams could work simultaneously. Therefore, one five-day shift of four teams per week would quarter the total salvage time, two five-day shifts of two teams per week would cut it to one eighth, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

- | | |
|-------------------------------|--------------------------------|
| A. Estimated Salvage Time | 800 team days (40 team months) |
| B. Estimated Preparation Time | 800 days (40 months) |
| C. Estimated Curation Time | 500 days (25 months) |

5. Collections Management

To properly manage one collection of this size, at least one half-time Curatorial Assistant position and one quarter-time Secretary would be required. The annual cost of collections management in 1983 dollars is:

Collections Manager (half-time)	
@ \$3384.00 per month	\$20304.00
Secretary (quarter-time) @ \$2081.00 per month	\$6243.00
Shipping, materials and supplies	\$3000.00
TOTAL ANNUAL COST	\$39547.00

6.2.2.1.2. En bloc excavation1. Salvage

As noted above, costs of en bloc removal cannot yet be determined. Costs given here include only the cost of block reduction after removal.

A. Staff

Cost

Costs for block reduction personnel are based on an estimated total time of 40 weeks, using four excavation teams and two computer teams for one 40-hour shift per week.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$42540.00

2. Executive Secretary @ \$2300.00 per month \$23000.00

3. Shift Supervisor (one per shift)

@ \$2600.00 per month \$26000.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

40 team-months @ \$8743.00 per team-month \$349720.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Bone Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

20 team-months @ \$5102.00 per team-month \$102040.00

6. Laborer (one per shift) @ \$1931.00 per month \$19310.00

SUBTOTAL OF BLOCK REDUCTION STAFF \$564210.00

<u>B. Equipment and Supplies</u>	Cost
1. <u>General Site Equipment</u> (rented)	
1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month	\$7.30
2 24"x42" desks @ \$11.00 per month each	\$
2 chairs @ \$11.50 per month each	\$
1 filing cabinet @ \$17.50 per month	\$
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$
2 computer tables @ \$10.00 per month each	\$
(Purchased)	
2 chairs @ \$11.50 per month each	\$
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$
2. <u>Excavation Equipment</u> (per deposit)	

1 wheelbarrow	\$90.00
1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$2500.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
800 storage rack system tote boxes @ \$12.00	\$9600.00
4 line levels @ \$2.69	\$10.76
50 Melmat tote boxes 23"x19"x11" @ \$12.00	\$600.00
100000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$5200.00
Plastic bags with opaque panel to write on	
66,000 7"x9"x1.5 mil @ \$17.80 per M	\$1174.80
7,000 10"x16"x1.5 mil @ \$39.15 per M	\$274.65
7,000 6"x18"x1.5 mil @ \$30.15 per M	\$211.05
20,000 18"x24"x1.5 mil @ \$86.75 per M	\$1735.00
100,000 4" paper-wire ties @ \$1.90 per M	\$190.00
1000 black lab marker pens, @ \$8.80 per pkg. of 10	\$88.00
1 case nylon line	\$36.00

Burlap rolls (1000 yds.) @ \$0.60	\$600.00
200 100 lb. bags plaster @ \$9.00	\$1800.00
20 cans spray paint @ \$1.50	\$30.00
200 ft. roll chicken wire	\$100.00
4 pr. wire cutters @ \$6.00	\$24.00
2 10 lb. sledge hammers @ \$10.00	\$20.00
150 wooden pallets @ \$10.00	\$15000.00
SUBTOTAL	\$39488.16
3. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 round library-type stools @ \$30.00	\$90.00
2 doz. Edmont gloves @ \$32.95 doz.	\$65.90

3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL (Per Team)	\$734.19
4. <u>Computer Team Equipment</u> (per team)	
IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$8289.48
TAX - 6.5%	\$5926.98
SUBTOTAL BLOCK REDUCTION EQUIPMENT AND SUPPLIES (4 EXCAVATION TEAMS, 2 COMPUTER TEAMS)	\$97111.22
SUBTOTAL, ALL BLOCK REDUCTION COSTS	\$661321.22
AVERAGE PER SPECIMEN BLOCK REDUCTION COST	\$6.61
SUBTOTAL, ALL SALVAGE COSTS	\$
AVERAGE PER SPECIMEN SALVAGE COST	\$

2. Preparation (based on Pit 91 operation in preliminary and final

preparation)

A. Staff Cost

These costs are based on an estimated preparation time of 42.5 months for the major specimens, 7.5 months for microfossil sorting, and 6.5 months for the matrix processing.

- | | |
|---|-------------|
| 1. Processing Supervisor @ \$2899.00 per month | \$123207.50 |
| 2. 1 half-time Secretary @ \$2081.00 per month | \$44221.25 |
| 3. 2 Preparation Supervisors @ \$2484.00 per month | \$211140.00 |
| 4. 4 Ultrasonic Technicians @ \$2139.00 per month | \$363630.00 |
| 5. 8 Hand Preparation Technicians @ \$2139.00 per month | |

\$727260.00

- | | |
|--|---------------------|
| 6. Flotation Technician @ \$2366.00 per month | \$15379.00 |
| 7. 4 Microsorters @ \$1931.00 per month | \$57930.00 |
| 8. 2 Degreaser Operators @ \$2139.00 per month | \$27807.00 |
| SUBTOTAL PREPARATION STAFF | \$1570574.75 |

B. Facility

1. 60'x30' storage and chemical process building with public viewing area and RTD-LACM Public Relations marquee

Cost-\$40000.00

C. Equipment and Supplies Cost1. Matrix processingTools

- | | |
|---|-----------|
| 2 BH-220 Baron-Blakeslee degreasers @ \$2,250 | \$4500.00 |
| 2 stainless steel lid @ \$180.00 | \$360.00 |
| Acidity test kit | \$30.00 |
| 4 stainless steel baskets @ \$165.00 | \$660.00 |
| 1 Heavy-Duty Solvent Recovery Still | |

(Baron-Blakesley HRS-20)	\$4560.00
1100 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$2636.00
1008 tin cans, 1 gallon round, friction lid, no bail (28 bags of 36) @ \$29.58	\$828.24
10 30"x72" work and drying benches @ \$246.00	\$2460.00
Fume hood	\$17500.00
1 roll window screen	\$62.00
600 feet garden hose	\$120.00
8 stack chairs @ \$22.00	\$176.00
3 rollaway chairs @ \$200.00	\$600.00
6 shelf cabinets (Arrowstar) @ \$28.30	\$169.80
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
4 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$266.00
<u>Safety Clothing</u>	
4 pr. rubber boots @ \$16.50	\$66.00
3 pr. rubber bib overalls @ \$26.10	\$78.30
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
3 pr. safety glasses @ \$5.25	\$15.75
1 Sta Lube dispenser	\$9.50

4 cases Sta Lube hand cleaner @ \$32.90 case	\$131.60
20 cases paper towels @ \$6.46	\$129.20
2 fire extinguishers @ \$24.00	\$48.00

Solvents

11 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$2068.00
20 5-Kg bottles of tetrabromoethane @ \$58.30	\$1166.00
2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00

2. Specimen ProcessingTools

20 2" paintbrushes @ \$2.00	\$40.00
2 counter brushes @ \$2.00	\$4.00
20 1/4" paintbrushes @ \$0.35	\$7.80
10 No. 1 fine brushes @ \$0.15	\$1.50
48 bottle brushes (various sizes) @ \$0.29	\$13.92
Metal funnel set	\$7.00
2 Lab screen sets, stainless steel @ \$300.00	\$600.00
Trays, stainless steel	
20 10"x6"x2" @ \$12.40	\$248.00
20 12"x7"x2" @ \$15.80	\$316.00
20 16"x9"x2" @ \$14.60	\$292.00
6 lamp magnifiers @ \$131.60	\$789.60
50 dental tools, double-ended explorers @ \$4.00	\$200.00
48 toothbrushes @ \$1.00	\$48.00
2 pkg. wooden applicators @ \$7.74	\$15.48
20 pkg. pipe-cleaners @ \$1.00	\$20.00
24 rolls masking tape @ \$1.40	\$33.60

40 cases cleaning towels @ \$2.60	\$104.00
Mixing bowl set (Rubber Maid Latex Molding)	\$6.00
4 pr. long-nosed pliers @ \$9.14	\$36.56
4 pkg. popsicle sticks @ \$1.99	\$7.96
4 pkg. forceps (curved) @ \$7.21	\$28.84
1 binocular microscope	\$925.00
8 ultrasonic cleaners (large) Branasonic B-72 @ \$1155.00	\$9240.00
8 Branasonic 72-1 stainless steel covers @ \$30.00	\$240.00
8 Branasonic 72-2 solid insert trays @ \$72.00	\$576.00
6 ultrasonic cleaners (small) Branasonic #12 @ \$255.00	\$1530.00
12 ear protectors @ \$12.00	\$144.00
6 C-clamps @ \$2.37	\$14.22
7 7,000 ft. roll twist wire @ \$20.00	\$140.00
10 plastic sand-boxes VWR 62662-445 @ \$9.75	\$97.50
200 lbs fine sand	\$40.00
120 bottles of white ink @ \$1.00	\$120.00
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
19 lab coats @ \$21.26	\$403.94
13 lab aprons @ \$6.05	\$78.65
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
3 cases Sta Lube hand cleaner @ \$32.90 case	\$98.70
20 cases paper towels @ \$6.46	\$129.20

Containers

24 500 ml (16 oz.) plastic squirt bottles	
@ 6 for \$7.00	\$28.00
24 500 ml (16 oz.) plastic (Red special treated) acetone squirt bottles @ 6 for \$10.69	\$42.76
4 solvent containers @ \$15.12	\$60.48
2 5 gallon nalgene tank w/lid @ \$16.00	\$32.00
6 Carboy 5 gallon plastic jars @ \$140.65	\$843.90
8 5 gallon metal drums w/lid @ \$7.25	\$58.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 55 gallon drum gates @ \$12.05	\$24.10
<u>Solvents</u>	
100 1-1-1 Trichloroethane 54 gallon drums	
@ \$188.00	\$18800.00
3 drums Acetone	\$140.00
4 gallons Degreaser soap (Marksen Catalog 5-17529)	
@ \$15.00	\$60.00
12 cases dishwashing liquid	\$120.00
72 units white glue @ \$1.13	\$81.36
10 gallons glyptal @ \$19.00 gallon	\$190.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$11723.33
TAX - 6.5%	\$8382.18
SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES	\$137338.83
 SUBTOTAL, ALL PREPARATION COSTS	 \$1707913.58
 AVERAGE PER SPECIMEN COST OF PREPARATION	 \$17.08

3. Curation

A. <u>Staff</u>	Cost
2. 3 Curatorial Assistants @ \$2551.00 per month	\$191325.00
B. <u>Equipment and Supplies</u>	Cost
<u>Storage Equipment</u>	
3-person IBM work terminal @ \$650.00 per month	\$16250.00
4 lab coats @ \$21.26	\$85.04
15 gallons glyptal @ \$19.00	\$285.00
Gelatin capsules	
2 drums #000 (25,000)	\$29.64
2 drums #00 (25,000)	\$29.64
2 drums #1 (25,000)	\$15.18
Vials	
140 1 dram pkg 72 @ \$6.04	\$845.60
140 1/2 dram pkg. 72 @ \$5.29	\$740.60
Corks	
20 pkg. #4 Reg. (500)	\$489.60
20 pkg. #2 Reg. (500)	\$425.40
Storage Racks	
Custom made racks, (Storage Rack Systems, Inc.)	
219 19-drawer, 25"x28"x76", and	
125 17-drawer, 25"x28"x84", and	
86 24-drawer, 25"x28"x101"	\$115000.00
Custom made drawers, (Storage Rack Systems, Inc.)	
6263 specimen drawers (Box 1) 25.81"x23.87"x1.5", and	
2087 specimen drawers (Box 2) 25.81"x23.87"x3.5", all with	
snap-on label holders and labels	\$78000.00
2 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$500.00

16 vial and slide drawers (Bio Equip 8510)	
@ \$14.00	\$224.00
116 vial trays (85A) for 1/2 and 1 dram vials	
@ \$1.30	\$150.80
2 16-drawer specimen cabinets (Lane Model 301), including delivery	\$606.00
32 specimen drawers @ \$28.00	\$896.00
Specimen trays	
5000 1"x3"x5/8" @ \$105.00 per M	\$525.00
5000 2"x3"x5/8" @ \$82.50 per M	\$412.50
5000 2"x6"x5/8" @ \$107.50 per M	\$537.50
5000 3"x4"x5/8" @ \$100.00 per M	\$500.00
5000 4"x6"x5/8" @ \$115.00 per M	\$575.00
5000 6"x8"x5/8" @ \$130.00 per M	\$650.00
5000 8"x12"x5/8" @ \$160.00 per M	\$800.00
5000 10"x3"x5/8" @ \$120.00 per M	\$600.00
5000 15"x5"x5/8" @ \$140.00 per M	\$700.00
5000 2"x6"x1" @ \$130.00 per M	\$650.00
5000 3"x4"x1" @ \$120.00 per M	\$600.00
<u>Office Equipment (Lab)</u>	
1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
4 boxes Dymo tape @ \$8.90	\$35.60
48 specimen boxes w/lid 12"x8"x6"	
@ \$18.00 per doz.	\$72.00
10 pkg. string cord @ \$5.57	\$55.70
1 photo file cabinet	\$171.75

20 5"x8" cardboard file boxes @ \$5.78	\$115.60
20 3"x5" cardboard file boxes @ \$4.35	\$87.00
4 staplers @ \$13.75	\$55.00
General office and laboratory supplies	\$5000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$22702.49
TAX - 6.5%	\$16232.28
SUBTOTAL, ALL CURATION COSTS	\$457284.67
AVERAGE PER SPECIMEN COST OF CURATION	\$4.57
GRAND TOTAL OF ALL COSTS	-----
AVERAGE PER SPECIMEN TOTAL COST	-----

4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that four teams could work simultaneously. Therefore, one five-day shift of four teams per week would quarter the total salvage time, two five-day shifts of two teams per week would cut it to one eighth, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

- A. Estimated Block Removal Time Not Available
- B. Estimated Block Reduction Time 800 team days
(40 team months)

C. Estimated Preparation Time	800 days (40 months)
D. Estimated Curation Time	500 days (25 months)

5. Collections Management

To properly manage one collection of this size, at least one half-time Curatorial Assistant position and one quarter-time Secretary would be required. The annual cost of collections management in 1983 dollars is:

Collections Manager (half-time)	
@ \$3384.00 per month	\$20304.00
Secretary (quarter-time) @ \$2081.00 per month	\$6243.00
Shipping, materials and supplies	\$3000.00
TOTAL ANNUAL COST	\$39547.00

6.2.2.2. Poor preservation

6.2.2.2.1. In situ excavation1. SalvageA. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of 27 weeks, using three 40-hour shifts per week, each including four excavation teams and two computer teams.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$29778.00

2. Executive Secretary @ \$2300.00 per month \$16100.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$54810.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

60 team-months @ \$8743.00 per team-month \$524580.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Bone Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

30 team-months @ \$5102.00 per team-month \$153060.00

6. Laborer (one per shift) @ \$1931.00 per month \$40551.00

SUBTOTAL OF SALVAGE STAFF \$1093295.00

B. Equipment and Supplies

Cost

1. General Site Equipment (rented)

1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$1988.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$51.10
2 24"x42" desks @ \$11.00 per month each	\$154.00
2 chairs @ \$11.50 per month each	\$161.00
1 filing cabinet @ \$17.50 per month	\$122.50
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$525.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$175.00
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$784.00
2 computer tables @ \$10.00 per month each	\$140.00
2 chairs @ \$11.50 per month each	\$161.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$5329.82
2. <u>Excavation Equipment</u> (per deposit)	
1 wheelbarrow	\$90.00
1 first aid kit	\$25.00

1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$2000.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
800 storage rack system tote boxes @ \$12.00	\$9600.00
4 line levels @ \$2.69	\$10.76
50 Melmat tote boxes 23"x19"x11" @ \$12.00	\$600.00
100000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$5200.00
Plastic bags with opaque panel to write on	
66,000 7"x9"x1.5 mil @ \$17.80 per M	\$1174.80
7,000 10"x16"x1.5 mil @ \$39.15 per M	\$274.65
7,000 6"x18"x1.5 mil @ \$30.15 per M	\$211.05
20,000 18"x24"x1.5 mil @ \$86.75 per M	\$1735.00
100,000 4" paper-wire ties @ \$1.90 per M	\$190.00
1000 black lab marker pens, @ \$8.80 per pkg. of 10	\$88.00
1 case nylon line	\$36.00
500 lb. drum Polyethelene Glycol (PEG-1000) @ \$0.75 per lb.	\$375.00

55 lb. Ethyl Cellulose @ \$2.34 per lb.	\$127.70
12 1" paint brushes @ \$2.00	\$24.00
SUBTOTAL	\$21940.86

3. Excavation Equipment (per team)

4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 round library-type stools @ \$30.00	\$90.00
2 doz. Edmont gloves @ \$32.95 doz.	\$65.90
3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL (Per Team)	\$734.19

4. Computer Team Equipment (per team)

IBM Microcomputer	\$4160.00
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1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$7655.10
TAX - 6.5%	\$5473.39
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES (12 EXCAVATION TEAMS, 2 COMPUTER TEAMS)	\$89679.45
SUBTOTAL, ALL SALVAGE COSTS	\$1182974.45
AVERAGE PER SPECIMEN SALVAGE COST	\$11.83

2. Preparation (based on Pit 91 operation in preliminary and final preparation)

A. Staff Cost

These costs are based on an estimated preparation time of 80 months for the major specimens, 7.5 months for microfossil sorting, and 6.5 months for the matrix processing.

1. Processing Supervisor @ \$2899.00 per month	\$231920.00
2. 1 half-time Secretary @ \$2081.00 per month	\$83240.00
3. 2 Preparation Supervisors @ \$2484.00 per month	\$397440.00
4. 4 Ultrasonic Technicians @ \$2139.00 per month	\$684480.00

5. 8 Hand Preparation Technicians @ \$2139.00 per month	
\$1368960.00	
6. Flotation Technician @ \$2366.00 per month	\$15379.00
7. 4 Microsorters @ \$1931.00 per month	\$57930.00
8. 2 Degreaser Operators @ \$2139.00 per month	\$27807.00
SUBTOTAL PREPARATION STAFF	\$2867156.00

B. Facility

1. 60'x30' storage and chemical process building with public viewing area and RTD-LACM Public Relations marquee	
	Cost-\$40000.00

C. Equipment and Supplies

Cost

1. Matrix processing

2 BH-220 Baron-Blakeslee degreasers @ \$2,250	\$4500.00
2 stainless steel lid @ \$180.00	\$360.00
Acidity test kit	\$30.00
4 stainless steel baskets @ \$165.00	\$660.00
1 Heavy-Duty Solvent Recovery Still (Baron-Blakesley HRS-20)	\$4560.00
1100 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$2636.00
1008 tin cans, 1 gallon round, friction lid, no bail (28 bags of 36) @ \$29.58	\$828.24
10 30"x72" work and drying benches @ \$246.00	\$2460.00
Fume hood	\$17500.00
1 roll window screen	\$62.00
600 feet garden hose	\$120.00

8 stack chairs @ \$22.00	\$176.00
3 rollaway chairs @ \$200.00	\$600.00
6 shelf cabinets (Arrowstar) @ \$28.30	\$169.80
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
4 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$266.00

Safety Clothing

4 pr. rubber boots @ \$16.50	\$66.00
3 pr. rubber bib overalls @ \$26.10	\$78.30
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
3 pr. safety glasses @ \$5.25	\$15.75
1 Sta Lube dispenser	\$9.50
4 cases Sta Lube hand cleaner @ \$32.90 case	\$131.60
20 cases paper towels @ \$6.46	\$129.20
2 fire extinguishers @ \$24.00	\$48.00

Solvents

11 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$2068.00
20 5-Kg bottles of tetrabromoethane @ \$58.30	\$1166.00
2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00

2. Specimen Processing

Tools

20 2" paintbrushes @ \$2.00	\$40.00
2 counter brushes @ \$2.00	\$4.00
20 1/4" paintbrushes @ \$0.35	\$7.80
10 No. 1 fine brushes @ \$0.15	\$1.50
48 bottle brushes (various sizes) @ \$0.29	\$13.92
Metal funnel set	\$7.00
2 Lab screen sets, stainless steel @ \$300.00	\$600.00
Trays, stainless steel	
20 10"x6"x2" @ \$12.40	\$248.00
20 12"x7"x2" @ \$15.80	\$316.00
20 16"x9"x2" @ \$14.60	\$292.00
6 lamp magnifiers @ \$131.60	\$789.60
50 dental tools, double-ended explorers @ \$4.00	\$200.00
48 toothbrushes @ \$1.00	\$48.00
2 pkg. wooden applicators @ \$7.74	\$15.48
20 pkg. pipe-cleaners @ \$1.00	\$20.00
24 rolls masking tape @ \$1.40	\$33.60
40 cases cleaning towels @ \$2.60	\$104.00
Mixing bowl set (Rubber Maid Latex Molding)	\$6.00
4 pr. long-nosed pliers @ \$9.14	\$36.56
4 pkg. popsicle sticks @ \$1.99	\$7.96
4 pkg. forceps (curved) @ \$7.21	\$28.84
1 binocular microscope	\$925.00
8 ultrasonic cleaners (large) Branasonic B-72	
@ \$1155.00	\$9240.00
8 Branasonic 72-1 stainless steel covers @ \$30.00	\$240.00
8 Branasonic 72-2 solid insert trays @ \$72.00	\$576.00

6 ultrasonic cleaners (small) Branasonic #12	
@ \$255.00	\$1530.00
12 ear protectors @ \$12.00	\$144.00
6 C-clamps @ \$2.37	\$14.22
7 7,000 ft. roll twist wire @ \$20.00	\$140.00
10 plastic sand-boxes VWR 62662-445 @ \$9.75	\$97.50
200 lbs fine sand	\$40.00
120 bottles of white ink @ \$1.00	\$120.00
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
19 lab coats @ \$21.26	\$403.94
13 lab aprons @ \$6.05	\$78.65
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
3 cases Sta Lube hand cleaner @ \$32.90 case	\$98.70
20 cases paper towels @ \$6.46	\$129.20

Containers

24 500 ml (16 oz.) plastic squirt bottles	
@ 6 for \$7.00	\$28.00
24 500 ml (16 oz.) plastic (Red special treated) acetone squirt bottles @ 6 for \$10.69	\$42.76
4 solvent containers @ \$15.12	\$60.48
2 5 gallon nalgene tank w/lid @ \$16.00	\$32.00
6 Carboy 5 gallon plastic jars @ \$140.65	\$843.90
8 5 gallon metal drums w/lid @ \$7.25	\$58.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 55 gallon drum gates @ \$12.05	\$24.10

Solvents

100 1-1-1 Trichloroethane 54 gallon drums	
@ \$188.00	\$18800.00
3 drums Acetone	\$140.00
9 gallons Degreaser soap (Marksen Catalog 5-17529)	
@ \$15.00	\$105.00
22 cases dishwashing liquid	\$220.00
90 units white glue @ \$1.13	\$101.70
15 gallons glyptal @ \$19.00 gallon	\$270.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$11747.87
TAX - 6.5%	\$8399.72
SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES	\$137626.25
SUBTOTAL, ALL PREPARATION COSTS	\$3004782.25
AVERAGE PER SPECIMEN COST OF PREPARATION	\$30.05

3. Curation

A. <u>Staff</u>	Cost
2. 3 Curatorial Assistants @ \$2551.00 per month	\$191325.00
B. <u>Equipment and Supplies</u>	Cost
3-person IBM work terminal @ \$650.00 per month	\$16250.00
<u>Storage Equipment</u>	
4 lab coats @ \$21.26	\$85.04
15 gallons glyptal @ \$19.00	\$285.00
Gelatin capsules	
2 drums #000 (25,000)	\$29.64

2 drums #00 (25,000)	\$29.64
2 drums #1 (25,000)	\$15.18
Vials	
140 1 dram pkg 72 @ \$6.04	\$845.60
140 1/2 dram pkg. 72 @ \$5.29	\$740.60
Corks	
20 pkg. #4 Reg. (500)	\$489.60
20 pkg. #2 Reg. (500)	\$425.40
Storage Racks	
Custom made racks, (Storage Rack Systems, Inc.)	
219 19-drawer, 25"x28"x76", and	
125 17-drawer, 25"x28"x84", and	
86 24-drawer, 25"x28"x101"	\$115000.00
Custom made drawers, (Storage Rack Systems, Inc.)	
6263 specimen drawers (Box 1) 25.81"x23.87"x1.5", and	
2087 specimen drawers (Box 2) 25.81"x23.87"x3.5", all with	
snap-on label holders and labels	\$78000.00
2 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$500.00
16 vial and slide drawers (Bio Equip 8510)	
@ \$14.00	\$224.00
116 vial trays (85A) for 1/2 and 1 dram vials	
@ \$1.30	\$150.80
2 16-drawer specimen cabinets (Lane Model 301),	
including delivery	\$606.00
32 specimen drawers @ \$28.00	\$896.00
Specimen trays	
5000 1"x3"x5/8" @ \$105.00 per M	\$525.00
5000 2"x3"x5/8" @ \$82.50 per M	\$412.50

5000 2"x6"x5/8" @ \$107.50 per M	\$537.50
5000 3"x4"x5/8" @ \$100.00 per M	\$500.00
5000 4"x6"x5/8" @ \$115.00 per M	\$575.00
5000 6"x8"x5/8" @ \$130.00 per M	\$650.00
5000 8"x12"x5/8" @ \$160.00 per M	\$800.00
5000 10"x3"x5/8" @ \$120.00 per M	\$600.00
5000 15"x5"x5/8" @ \$140.00 per M	\$700.00
5000 2"x6"x1" @ \$130.00 per M	\$650.00
5000 3"x4"x1" @ \$120.00 per M	\$600.00
<u>Office Equipment (Lab)</u>	
1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
4 boxes Dymo tape @ \$8.90	\$35.60
48 specimen boxes w/lid 12"x8"x6" @ \$18.00 per doz.	\$72.00
10 pkg. string cord @ \$5.57	\$55.70
1 photo file cabinet	\$171.75
20 5"x8" cardboard file boxes @ \$5.78	\$115.60
20 3"x5" cardboard file boxes @ \$4.35	\$87.00
4 staplers @ \$13.75	\$55.00
General office and laboratory supplies	\$5000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$22702.49
TAX - 6.5%	\$16232.28
SUBTOTAL, ALL CURATION COSTS	\$457284.67
 AVERAGE PER SPECIMEN COST OF CURATION	 \$4.57

GRAND TOTAL OF ALL COSTS	\$4645041.37
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AVERAGE PER SPECIMEN TOTAL COST	\$46.45
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4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that four teams could work simultaneously. Therefore, one five-day shift of four teams per week would quarter the total salvage time, two five-day shifts of four teams per week would cut it to one eighth, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

- | | |
|-------------------------------|---------------------------------|
| A. Estimated Salvage Time | 1600 team days (80 team months) |
| B. Estimated Preparation Time | 1200 days (60 months) |
| C. Estimated Curation Time | 500 days (25 months) |

5. Collections Management

To properly manage one collection of this size, at least one half-time Curatorial Assistant position and one quarter-time Secretary would be required. The annual cost of collections management in 1983 dollars is:

Collections Manager (half-time)	
@ \$3384.00 per month	\$20304.00
Secretary (quarter-time)	
@ \$2081.00 per month	\$6243.00

Shipping, materials and supplies	\$3000.00
TOTAL ANNUAL COST	\$39547.00

6.3 Stratified deposits

Example: Page Museum Salvage, 14 cubic yards (10.7 cubic meters), less than a meter in depth, at least 10,000 specimens (not yet prepared), in oxidized asphalt, must be removed en bloc.

1. SalvageA. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of two and one half weeks, using four excavation teams and one computer team for one 40-hour shift per week, plus a further 8 weeks for block reduction.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$2850.00

2. Executive Secretary @ \$2300.00 per month \$1541.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$1749.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

7 team-months @ \$8743.00 per team-month \$61201.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Bone Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

2.5 team-months @ \$5102.00 per team-month \$12755.00

6. Laborer (one per shift) @ \$1931.00 per month \$5156.00

SUBTOTAL OF SALVAGE STAFF \$101045.00

<u>B. Equipment and Supplies</u>	<u>Cost</u>
1. <u>General Site Equipment</u> (rented)	
1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$852.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$7.30
2 24"x42" desks @ \$11.00 per month each	\$22.00
2 chairs @ \$11.50 per month each	\$23.00
1 filing cabinet @ \$17.50 per month	\$17.50
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$150.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$50.00
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$336.00
2 computer tables @ \$10.00 per month each	\$20.00
2 chairs @ \$11.50 per month each	\$23.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$2569.02

2. Excavation Equipment (per deposit)

1 wheelbarrow	\$90.00
1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$1000.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
100 storage rack system tote boxes @ \$12.00	\$1200.00
4 line levels @ \$2.69	\$10.76
50 Melmat tote boxes 23"x19"x11" @ \$12.00	\$600.00
10000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$520.00
Plastic bags with opaque panel to write on	
6,000 7"x9"x1.5 mil @ \$17.80 per M	\$106.80
1,000 10"x16"x1.5 mil @ \$39.15 per M	\$39.15
1,000 6"x18"x1.5 mil @ \$30.15 per M	\$30.15
2,000 18"x24"x1.5 mil @ \$86.75 per M	\$173.50
10,000 4" paper-wire ties @ \$1.90 per M	\$19.00
1000 black lab marker pens, @ \$8.80 per pkg. of 10	\$88.00

1 case nylon line	\$36.00
Burlap rolls (500 yds.) @ \$0.60	\$300.00
100 plaster 100 lb. bags @ \$9.00	\$900.00
10 cans spray paint @ \$1.50	\$15.00
100 ft. roll of chicken wire	\$50.00
2 pr. wire cutters @ \$6.00	\$12.00
1 10 lb. sledge hammer	\$10.00
3 wrecking bars @ \$29.00	\$87.00
2 crowbars @ \$10.00	\$20.00
SUBTOTAL	\$5511.26
3. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00

3 round library-type stools @ \$30.00	\$90.00
2 doz. Edmont gloves @ \$32.95 doz.	\$65.90
3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL (Per Team)	\$734.19
4. <u>Computer Team Equipment</u> (per team)	
IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2978.37
TAX - 6.5%	\$2129.53
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES (4 EXCAVATION TEAMS, 1 COMPUTER TEAM)	\$34891.56
SUBTOTAL, ALL SALVAGE COSTS	\$135936.56
AVERAGE PER SPECIMEN SALVAGE COST	\$13.59

2. Preparation (based on Pit 91 operation in preliminary and final preparation)

A. Staff

Cost

These costs are based on an estimated preparation time of 5 months for the major specimens and 6.5 months for the matrix processing.

1. Processing Supervisor @ \$2899.00 per month	\$14495.00
2. 1 half-time Secretary @ \$2081.00 per month	\$5202.50
3. 1 Preparation Supervisor @ \$2484.00 per month	\$12420.00
4. 2 Ultrasonic Technicians @ \$2139.00 per month	\$21390.00
5. 2 Hand Preparation Technicians @ \$2139.00 per month	\$21390.00
6. 1 Degreaser Operator @ \$2139.00 per month	\$10695.00
SUBTOTAL PREPARATION STAFF	\$85592.50

B. Facility

1. 60'x30' storage and chemical process building with public viewing area and RTD-LACM Public Relations marquee	Cost-\$40000.00
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C. Equipment and Supplies

Cost

1. Matrix processing

Tools

2 BH-220 Baron-Blakeslee degreasers @ \$2,250.00	\$4500.00
2 stainless steel lid @ \$180.00	\$360.00
Acidity test kit	\$30.00
4 stainless steel baskets @ \$165.00	\$660.00
1000 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$2399.00
1008 tin cans, 1 gallon round, friction lid, no bail (28 bags of 36) @ \$29.58	\$828.24
10 30"x72" work and drying benches @ \$246.00	\$2460.00

Fume hood	\$17500.00
1 roll window screen	\$62.00
300 feet garden hose	\$60.00
6 stack chairs @ \$22.00	\$132.00
2 rollaway chairs @ \$200.00	\$400.00
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
3 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$199.50
<u>Safety Clothing</u>	
2 pr. rubber boots @ \$16.50	\$33.00
2 pr. rubber bib overalls @ \$26.10	\$52.20
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
2 pr. safety glasses @ \$5.25	\$10.50
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60
2 fire extinguishers @ \$24.00	\$48.00
<u>Solvents</u>	
11 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$2068.00
20 5-Kg bottles of tetrabromoethane @ \$58.30	\$1166.00

2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00
2. <u>Specimen Processing</u>	
<u>Tools</u>	
10 2" paintbrushes @ \$2.00	\$20.00
2 counter brushes @ \$2.00	\$4.00
10 1/4" paintbrushes @ \$0.35	\$3.90
5 No. 1 fine brushes @ \$0.15	\$0.75
48 bottle brushes (various sizes) @ \$0.29	\$13.92
Metal funnel set	\$7.00
Lab screen set, stainless steel	\$300.00
Trays, stainless steel	
10 10"x6"x2" @ \$12.40	\$124.00
10 12"x7"x2" @ \$15.80	\$158.00
10 16"x9"x2" @ \$14.60	\$146.00
6 lamp magnifiers @ \$131.60	\$789.60
20 dental tools, double-ended explorers @ \$4.00	\$80.00
24 toothbrushes @ \$1.00	\$24.00
Wooden applicators	\$7.74
10 pkg. pipe-cleaners @ \$1.00	\$10.00
12 rolls masking tape @ \$1.40	\$16.80
20 cases cleaning towels @ \$2.60	\$52.00
Mixing bowl set (Rubber Maid Latex Molding)	\$6.00
2 pr. long-nosed pliers @ \$9.14	\$18.28
2 pkg. popsicle sticks @ \$1.99	\$3.98
2 pkg. forceps (curved) @ \$7.21	\$14.42
1 binocular microscope	\$925.00
4 ultrasonic cleaners (large) Branasonic B-72	

@ \$1155.00	\$4620.00
4 Branasonic 72-1 stainless steel covers @ \$30.00	\$120.00
4 Branasonic 72-2 solid insert trays @ \$72.00	\$288.00
4 ultrasonic cleaners (small) Branasonic #12	
@ \$255.00	\$1020.00
6 ear protectors @ \$12.00	\$72.00
6 C-clamps @ \$2.37	\$14.22
7,000 ft. roll twist wire	\$20.00
6 plastic sand-boxes VWR 62662-445 @ \$9.75	\$58.50
100 lbs fine sand	\$20.00
12 bottles of white ink @ \$1.00	\$12.00
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
13 lab coats @ \$21.26	\$276.38
7 lab aprons @ \$6.05	\$42.35
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60
<u>Containers</u>	
12 500 ml (16 oz.) plastic squirt bottles	
at 6 for \$7.00	\$14.00
12 500 ml (16 oz.) plastic (Red special treated) acetone squirt	
bottles @ 6 for \$10.69	\$21.38
4 solvent containers @ \$15.12	\$60.48
1 5 gallon nalgene tank w/lid	\$16.00
4 Carboy 5 gallon plastic jars @ \$140.65	\$562.60

6 5 gallon metal drums w/lid @ \$7.25	\$43.50
2 55 gallon drum cradles @ \$78.95	\$157.90
2 55 gallon drum gates @ \$12.05	\$24.10

Solvents

70 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$13160.00
1 drum Acetone	\$80.00
2 gallons Degreaser soap (Marksen Catalog 5-17529) @ \$15.00	\$30.00
6 cases dishwashing liquid	\$60.00
36 units white glue @ \$1.13	\$40.68
10 gallons glyptal @ \$19.00 gallon	\$190.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$9845.51
TAX - 6.5%	\$7039.54
SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES	\$115340.13

SUBTOTAL, ALL PREPARATION COSTS	\$200932.63
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AVERAGE PER SPECIMEN COST OF PREPARATION	\$20.09
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3. Curation

A. <u>Staff</u>	Cost
2. 3 Curatorial Assistants @ \$2551.00 per month	\$19132.50
B. <u>Equipment and Supplies</u>	Cost
<u>Storage Equipment</u>	
3-person IBM work terminal @ \$650.00 per month	\$1625.00
4 lab coats @ \$21.26	\$85.04

5 gallons glyptal @ \$19.00	\$95.00
Gelatin capsules	
1 drum #000 (25,000)	\$14.82
1 drum #00 (25,000)	\$14.82
1 drum #1 (25,000)	\$7.59
Vials	
70 1 dram pkg 72 @ \$6.04	\$422.80
70 1/2 dram pkg. 72 @ \$5.29	\$370.30
Corks	
10 pkg #4 Reg. (500)	\$244.80
10 pkg #2 Reg. (500)	\$212.70
Storage Racks	
Custom made racks, (Storage Rack Systems, Inc.)	
22 19-drawer, 25"x28"x76", and	
13 17-drawer, 25"x28"x84", and	
9 24-drawer, 25"x28"x101"	\$12000.00
Custom made racks, (Storage Rack Systems, Inc.)	
214 specimen drawers (Box 1) 25.81"x23.87"x1.5", and	
142 specimen drawers (Box 2) 25.81"x23.87"x3.5", all with	
snap-on label holders and labels	\$4000.00
1 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$250.00
8 vial and slide drawers (Bio Equip 8510)	
@ \$14.00	\$112.00
58 vial trays (85A) for 1/2 and 1 dram vials	
@ \$1.30	\$76.00
1 16-drawer specimen cabinet (Lane Model 301),	
including delivery	\$303.00
16 specimen drawers @ \$28.00	\$448.00

Specimen trays

1000 1"x3"x5/8" @ \$105.00 per M	\$105.00
1000 2"x3"x5/8" @ \$82.50 per M	\$82.50
1000 2"x6"x5/8" @ \$107.50 per M	\$107.50
1000 3"x4"x5/8" @ \$100.00 per M	\$100.00
1000 4"x6"x5/8" @ \$115.00 per M	\$115.00
1000 6"x8"x5/8" @ \$130.00 per M	\$130.00
1000 8"x12"x5/8" @ \$160.00 per M	\$160.00
1000 10"x3"x5/8" @ \$120.00 per M	\$120.00
1000 15"x5"x5/8" @ \$140.00 per M	\$140.00
1000 2"x6"x1" @ \$130.00 per M	\$130.00
1000 3"x4"x1" @ \$120.00 per M	\$120.00

Office Equipment (Lab)

1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
2 boxes Dymo tape @ \$8.90	\$17.80
24 specimen boxes w/lid 12"x8"x6" @ \$18.00 per doz.	\$36.00
5 pkg. string cord @ \$5.57	\$27.85
1 photo file cabinet	\$171.75
10 5"x8" cardboard file boxes @ \$5.78	\$57.80
10 3"x5" cardboard file boxes @ \$4.35	\$43.50
2 staplers @ \$13.75	\$27.50
General office and laboratory supplies	\$2000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2428.38
TAX - 6.5%	\$1736.29

SUBTOTAL, ALL CURATION COSTS	\$47580.99
AVERAGE PER SPECIMEN COST OF CURATION	\$4.76
GRAND TOTAL OF ALL COSTS	\$384450.18
AVERAGE PER SPECIMEN TOTAL COST	\$38.44

4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that two teams could work simultaneously. Therefore, one five-day shift of two teams per week would halve the total salvage time, two five-day shifts of two teams per week would quarter the total time, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

A. Estimated Block Removal Time	13 team days (2.5 team weeks)
B. Estimated Block Reduction Time	100 team days (5 team months)
B. Estimated Preparation Time	150 days (7.5 months)
C. Estimated Curation Time	50 days (2.5 months)

5. Collections Management

The time and cost requirements for managing a single collection of this size are small enough to be absorbed by existing staff and budgets of most institutions.

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6.4 Deposits with only small fossils

(These are usually small lenticular masses of asphaltic sand containing no animals larger than rabbits. Taphonomic data on each bone is not necessary, however detailed and accurate geologic mapping is essential.)

1. SalvageA. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of 1 week, using two excavation teams for one 40-hour shift per week.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$1063.50

2. Executive Secretary @ \$2300.00 per month \$575.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$652.50

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

0.5 team-months @ \$8743.00 per team-month \$4371.50

6. Laborer (one per shift) @ \$1931.00 per month \$482.75

SUBTOTAL OF SALVAGE STAFF \$7165.25

B. Equipment and Supplies

Cost

1. General Site Equipment (rented)

1 10'x40' Scotsman trailer with two rooms

Delivery and set up \$188.00

Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$852.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$7.30
2 24"x42" desks @ \$11.00 per month each	\$22.00
2 chairs @ \$11.50 per month each	\$23.00
1 filing cabinet @ \$17.50 per month	\$17.50
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$150.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$50.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$2569.02
2. <u>Excavation Equipment</u> (per deposit)	
1 wheelbarrow	\$90.00
1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$1000.00

2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
4 line levels @ \$2.69	\$10.76
1,000 7"x9"x1.5 mil @ \$17.80 per M	\$17.80
1,000 4" paper-wire bag ties @ \$1.90 per M	\$1.90
1 case nylon line	\$36.00
SUBTOTAL	\$1360.36

3. Excavation Equipment (per team)

4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
3 1" blade cold chisels @ \$6.85	\$20.55
3 1 1/2" wood chisels w/handle @ \$7.00	\$21.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 pair rubber boots @ \$16.50	\$66.00
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 round library-type stools @ \$30.00	\$90.00

2 doz. Edmont gloves @ \$32.95 doz.	\$65.90
3 pr. knee pads @ \$5.00	\$15.00
1 1-1-1 Trichloroethane 54 gallon drum	\$188.00
SUBTOTAL (Per Team)	\$734.19
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$579.78
TAX - 6.5%	\$388.54
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES (2 EXCAVATION TEAMS)	\$6766.08
SUBTOTAL, ALL SALVAGE COSTS	\$13931.33

2. Preparation (based on Pit 91 operation in preliminary and final preparation)

A. Staff Cost

These costs are based on an estimated preparation time of 7.5 months for microfossil sorting and 6.5 months for the matrix processing.

1. Processing Supervisor @ \$2899.00 per month	\$18843.50
2. 1 half-time Secretary @ \$2081.00 per month	\$6763.25
3. 1 Preparation Supervisor @ \$2484.00 per month	\$16146.00
4. Flotation Technician @ \$2366.00 per month	\$15379.00
5. 4 Microsorters @ \$1931.00 per month	\$57930.00
6. 2 Degreaser Operators @ \$2139.00 per month	\$27807.00
SUBTOTAL PREPARATION STAFF	\$142868.75

B. Facility

1. 60'x30' storage and chemical process building with public

viewing area and RTD-LACM Public Relations marquee

Cost-\$40000.00

C. Equipment and Supplies

Cost

1. Matrix processing

2 BH-220 Baron-Blakeslee degreasers @ \$2,250.00	\$4500.00
2 stainless steel lid @ \$180.00	\$360.00
Acidity test kit	\$30.00
4 stainless steel baskets @ \$165.00	\$660.00
1000 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$2399.00
1008 tin cans, 1 gallon round, friction lid, no bail (28 bags of 36) @ \$29.58	\$828.24
10 30"x72" work and drying benches @ \$246.00	\$2460.00
Fume hood	\$17500.00
1 roll window screen	\$62.00
300 feet garden hose	\$60.00
6 stack chairs @ \$22.00	\$132.00
2 rollaway chairs @ \$200.00	\$400.00
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
1 rotary drum pump	\$50.00
1 55 gallon drum truck	\$128.00
1 bung opener	\$35.00
2 55 gallon drum cradles @ \$78.95	\$157.90
2 plastic trash barrels @ \$20.00	\$40.00
2 heavy duty floor fans @ \$308.00	\$616.00
3 lockers, single tier, Model 254800 (3 units) @ \$66.50	\$199.50

Safety Clothing

2 pr. rubber boots @ \$16.50	\$33.00
2 pr. rubber bib overalls @ \$26.10	\$52.20
1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
2 pr. safety glasses @ \$5.25	\$10.50
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60
2 fire extinguishers @ \$24.00	\$48.00

Solvents

11 1-1-1 Trichloroethane 54 gallon drums @ \$188.00	\$2068.00
29 5-Kg bottles of tetrabromoethane @ \$58.30	\$1166.00
2 washing drums (1/2 55 gallon) @ \$15.95	\$31.90
2 barrel stands for washing drums @ \$55.00	\$110.00

2. Specimen ProcessingTools

10 2" paintbrushes @ \$2.00	\$20.00
2 counter brushes @ \$2.00	\$4.00
10 1/4" paintbrushes @ \$0.35	\$3.90
5 No. 1 fine brushes @ \$0.15	\$0.75
Lab screen set, stainless steel	\$300.00
6 lamp magnifiers @ \$131.60	\$789.60
12 rolls masking tape @ \$1.40	\$16.80
2 pkg. forceps (curved) @ \$7.21	\$14.42
1 binocular microscope	\$925.00
6 lab coats @ \$21.26	\$127.56

12 bottles of black ink @ \$7.50 per doz.	\$7.50
1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
1 pkg. of 12 Petrie dishes pyrex 150x20 (25354-127)	\$72.76
2 pen lights and batteries @ \$2.00	\$4.00
1 Sta Lube dispenser	\$9.50
2 cases Sta Lube hand cleaner @ \$32.90 case	\$65.80
10 cases paper towels @ \$6.46	\$64.60
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$7691.51
TAX - 6.5%	\$5499.43
SUBTOTAL PREPARATION FACILITY, EQUIPMENT AND SUPPLIES	\$90106.07
SUBTOTAL, ALL PREPARATION COSTS	\$232974.82

3. Curation

A. <u>Staff</u>	Cost
2. 3 Curatorial Assistants @ \$2551.00 per month	\$19132.50
B. <u>Equipment and Supplies</u>	Cost
<u>Storage Equipment</u>	
4 lab coats @ \$21.26	\$85.04
5 gallons glyptal @ \$19.00	\$95.00
Gelatin capsules	
1 drum #000 (25,000)	\$14.82
1 drum #00 (25,000)	\$14.82
1 drum #1 (25,000)	\$7.59
Vials	

70 1 dram pkg 72 @ \$6.04	\$422.80
70 1/2 dram pkg. 72 @ \$5.29	\$370.30
Corks	
10 pkg #4 Reg. (500)	\$244.80
10 pkg #2 Reg. (500)	\$212.70
1 vial cabinet (Bio Equip 8515) 23"x20"x43"	\$250.00
8 vial and slide drawers (Bio Equip 8510)	
@ \$14.00	\$112.00
58 vial trays (85A) for 1/2 and 1 dram vials	
@ \$1.30	\$76.00
1 16-drawer specimen cabinet (Lane Model 301), including delivery	\$303.00
16 specimen drawers @ \$28.00	\$448.00
Specimen trays	
1000 1"x3"x5/8" @ \$105.00 per M	\$105.00
1000 2"x3"x5/8" @ \$82.50 per M	\$82.50
1000 2"x6"x5/8" @ \$107.50 per M	\$107.50
1000 3"x4"x5/8" @ \$100.00 per M	\$100.00
1000 4"x6"x5/8" @ \$115.00 per M	\$115.00
<u>Office Equipment (Lab)</u>	
1 lock-type supply cabinet	\$110.00
1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
2 boxes Dymo tape @ \$8.90	\$17.80
24 specimen boxes w/lid 12"x8"x6"	
@ \$18.00 per doz.	\$36.00
5 pkg. string cord @ \$5.57	\$27.85
1 photo file cabinet	\$171.75

10 5"x8" cardboard file boxes @ \$5.78	\$57.80
10 3"x5" cardboard file boxes @ \$4.35	\$43.50
2 staplers @ \$13.75	\$27.50
General office and laboratory supplies	\$2000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2383.58
TAX - 6.5%	\$1704.26
SUBTOTAL, ALL CURATION COSTS	\$47056.16
GRAND TOTAL OF ALL COSTS	\$293962.31

4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a deposit of this size, we estimate that two teams could work simultaneously. Therefore, one five-day shift of two teams per week would halve the total salvage time, two five-day shifts of two teams per week would quarter the total time, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

- A. Estimated Salvage Time 10 team days (.5 team month)
- B. Estimated Preparation Time 90 days (4.5 months)
- C. Estimated Curation Time 50 days (2.5 months)

5. Collections Management

The time and cost requirements for managing a single collection of this size are small enough to be absorbed by existing staff and

budgets of most institutions.

6.5 Archaeological sites

6.5.1. Small site. Example: 25 cubic meters, 500 artifacts (mostly lithics), one meter depth, 25 square meters surface area, in normal midden without asphalt.

1. SalvageA. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of 1 week, using four excavation teams and one computer team for one 40-hour shift per week.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$1064.00

2. Executive Secretary @ \$2300.00 per month \$575.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$653.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

1 team-month @ \$8743.00 per team-month \$8743.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Artifact Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

.25 team-month @ \$5102.00 per team-month \$1275.50

6. Laborer (one per shift) @ \$1931.00 per month \$483.00

SUBTOTAL OF SALVAGE STAFF \$12834.00

<u>B. Equipment and Supplies</u>	Cost
1. <u>General Site Equipment</u> (rented)	
1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$852.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$7.30
2 24"x42" desks @ \$11.00 per month each	\$20.00
2 chairs @ \$11.50 per month each	\$23.00
1 filing cabinet @ \$17.50 per month	\$17.50
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$150.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$50.00
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$336.00
2 computer tables @ \$10.00 per month each	\$20.00
2 chairs @ \$11.50 per month each	\$23.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$2569.02
2. <u>Excavation Equipment</u> (per site)	

1 wheelbarrow	\$90.00
1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$1000.00
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
4 line levels @ \$2.69	\$10.76
10 Melmat tote boxes 23"x19"x11" @ \$12.00	\$120.00
500 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$26.00
Plastic bags with opaque panel to write on	
500 10"x16"x1.5 mil @ \$39.15 per M	\$19.58
1,000 4" paper-wire ties @ \$1.90 per M	\$1.90
10 black lab marker pens, @ \$8.80 per pkg. of 10	\$8.80
1 case nylon line	\$36.00
1 lb. Polyethelene Glycol (PEG-1000) @ \$0.75 per lb.	\$0.75
SUBTOTAL	\$1442.39
3. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25

3 1 1/2" paintbrushes @ \$2.00	\$6.00
3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 pr. knee pads @ \$5.00	\$15.00
SUBTOTAL (Per Team)	\$282.74
4. <u>Computer Team Equipment</u> (per team)	
IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2718.31
TAX - 6.5%	\$1943.60
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES	

(2 EXCAVATION TEAMS, 1 COMPUTER TEAM)	\$31845.08
SUBTOTAL, ALL SALVAGE COSTS	\$44679.08
AVERAGE PER ARTIFACT SALVAGE COST	\$89.36

2. Preparation (based on SBr-901 site in preliminary and final preparation)

A. Staff Cost

These costs are based on an estimated preparation time of one week.

1. 1 half-time Secretary @ \$2081.00 per month	\$260.00
2. 1 Preparation Supervisor @ \$2484.00 per month	\$621.00
3. 1 Hand Preparation Technician @ \$2139.00 per month	\$535.00
4. Flotation Technician @ \$2366.00 per month	\$592.00
SUBTOTAL PREPARATION STAFF	\$2008.00

B. Equipment and Supplies Cost

1. General

Tools

50 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$147.00
2 stack chairs @ \$22.00	\$44.00
2 rollaway chairs @ \$200.00	\$400.00
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
2 plastic trash barrels @ \$20.00	\$40.00

3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50

Safety Clothing

1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
2 pr. safety glasses @ \$5.25	\$10.50
10 cases paper towels @ \$6.46	\$64.60
2 fire extinguishers @ \$24.00	\$48.00

2. Specimen Processing

Tools

2 2" paintbrushes @ \$2.00	\$10.00
2 counter brushes @ \$2.00	\$4.00
2 1/4" paintbrushes @ \$0.35	\$0.70
2 No. 1 fine brushes @ \$0.15	\$0.30
Lab screen set, stainless steel	\$300.00
1 large wash tub, galvanized	\$15.00
Trays, stainless steel	
10 16"x9"x2" @ \$14.60	\$146.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
1 lamp magnifier	\$131.60
5 dental tools, double-ended explorers @ \$4.00	\$20.00
5 toothbrushes @ \$1.00	\$5.00
1 binocular microscope	\$925.00
1 plastic sand-boxes VWR 62662-445	\$9.75
100 lbs fine sand	\$20.00
2 bottles of white ink @ \$1.00	\$2.00
2 bottles of black ink @ \$1.00	\$2.00

1 gross crow quill pen points	\$54.36
12 crow quill holders	\$1.59
2 lab coats @ \$21.26	\$42.52
10 cases paper towels @ \$6.46	\$64.60
<u>Solvents</u>	
1 cases dishwashing liquid	\$10.00
10 units white glue @ \$1.13	\$11.30
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$296.05
TAX - 6.5%	\$211.67
SUBTOTAL PREPARATION EQUIPMENT AND SUPPLIES	\$3468.19
SUBTOTAL, ALL PREPARATION COSTS	\$5476.19
AVERAGE PER ARTIFACT COST OF PREPARATION	\$10.95

3. Curation

A. <u>Staff</u>	Cost
1. 1 Curatorial Assistant @ \$2551.00 per month	\$638.00
B. <u>Equipment</u>	Cost
<u>Storage Equipment</u>	
2 lab coats @ \$21.26	\$42.52
1 16-drawer specimen cabinet (Lane Model 301), including delivery	\$303.00
16 specimen drawers @ \$28.00	\$448.00
1 Wide Span Shelf 5'x3'x6'	\$150.00
<u>Office Equipment (Lab)</u>	
1 lock-type supply cabinet	\$110.00

1 4-drawer filing cabinet	\$196.00
1 Dymo-label machine	\$3.75
2 boxes Dymo tape @ \$8.90	\$17.80
1 photo file cabinet	\$171.75
2 staplers @ \$13.75	\$27.50
General office and laboratory supplies	\$1000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$247.03
TAX - 6.5%	\$167.63
SUBTOTAL CURATION	\$3531.98
AVERAGE PER ARTIFACT COST OF CURATION	\$7.06
GRAND TOTAL OF ALL COSTS	\$53687.25
AVERAGE PER ARTIFACT TOTAL COST	\$107.37

4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a site of this size, we estimate that two teams could work simultaneously. Therefore, one five-day shift of two teams per week would halve the total salvage time, two five-day shifts of two teams per week would quarter the total time, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

A. Estimated Salvage Time 20 team days (1 team month)

B. Estimated Preparation Time 7 days

C. Estimated Curation Time 7 days

5. Collections Management

The time and cost requirements for managing a single collection of this size are small enough to be absorbed by existing staff and budgets of most institutions.

6.5.2. Large site. Example: 100 cubic meters, 2,000 artifacts (mostly lithics), one meter depth, 100 square meters surface area, in normal midden without asphalt.

1. Salvage

A. Staff

Cost

Costs for excavation personnel are based on an estimated total salvage time of 4 weeks, using four excavation teams and one computer team for one 40-hour shift per week.

1. Principal Investigator (Project Supervisor)

@ \$4254.00 per month \$4254.00

2. Executive Secretary @ \$2300.00 per month \$2300.00

3. Shift Supervisor (one per shift)

@ \$2610.00 per month \$2610.00

4. Excavation Team (includes one foreman and three excavators)

1. Team Foreman @ \$2366.00 per month

2. 3 Excavators @ \$2139.00 per month each

Total Excavation Team cost,

4 team-months @ \$8743.00 per team-month \$34972.00

5. Computer Team (two people)

1. Data Entry Person @ \$2551.00 per month

2. Artifact Measurement Person @ \$2551.00 per month

Total Computer Team Cost,

1 team-month @ \$5102.00 per team-month \$5102.00

6. Laborer (one per shift) @ \$1931.00 per month \$1931.00

SUBTOTAL OF SALVAGE STAFF \$51329.00

B. Equipment and Supplies

Cost

1. General Site Equipment (rented)

1 10'x40' Scotsman trailer with two rooms	
Delivery and set up	\$188.00
Takedown and return	\$188.00
Monthly lease (3 months minimum) \$284.00	\$852.00
1 telephone line with 2 telephones	
Instalation	\$91.82
Per month \$7.30	\$7.30
2 24"x42" desks @ \$11.00 per month each	\$20.00
2 chairs @ \$11.50 per month each	\$23.00
1 filing cabinet @ \$17.50 per month	\$17.50
1 drafting light table	
@ \$75.00 per month (2 months minimum)	\$150.00
1 drafting stool	
@ \$25.00 per month (2 months minimum)	\$50.00
1 8'x16' Scotsman computer shack	
Delivery and set up	\$158.00
Takedown and return	\$158.00
Monthly lease (3 months minimum) \$112.00	\$336.00
2 computer tables @ \$10.00 per month each	\$20.00
2 chairs @ \$11.50 per month each	\$23.00
(Purchased)	
3 lockers, single tier, Model 254800 (3 units)	
@ \$66.50	\$199.50
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
SUBTOTAL	\$2569.02
2. <u>Excavation Equipment</u> (per site)	
1 wheelbarrow	\$90.00

1 first aid kit	\$25.00
1 fire extinguisher	\$24.00
Lumber	
Wooden pallets	
Storage spacers	
2'x2'x1/2" plywood squares	
2'x3' drying screens	
Miscellany	
Total	\$1000.00
10 cases paper towels @ \$6.46	\$64.60
1 emergency eye-wash kit	\$15.00
4 line levels @ \$2.69	\$10.76
10 Melmat tote boxes 23"x19"x11" @ \$12.00	\$120.00
2000 sequentially numbered racetrack aluminum tags, (Forestry Supplies, Inc.) @ \$52.00 per M	\$104.00
Plastic bags with opaque panel to write on	
2000 10"x16"x1.5 mil @ \$39.15 per M	\$78.30
2,000 4" paper-wire ties @ \$1.90 per M	\$3.80
20 black lab marker pens, @ \$8.80 per pkg. of 10	\$16.60
1 case nylon line	\$36.00
5 lb. Polyethelene Glycol (PEG-1000) @ \$0.75 per lb.	\$3.75
SUBTOTAL	\$1591.81
3. <u>Excavation Equipment</u> (per team)	
4 trowels @ \$6.00	\$24.00
3 8" screwdrivers @ \$3.75	\$11.25
3 1 1/2" paintbrushes @ \$2.00	\$6.00

3 dust pans @ \$2.00	\$6.00
20 dental tools, single end explorers @ \$3.00	\$60.00
1 100 meter tape	\$12.00
4 3 meter tapes @ \$7.29	\$29.16
4 hard hats @ \$5.00	\$20.00
2 brickhammers @ \$15.95	\$31.90
1 plumb bob	\$7.80
1 single jack	\$9.63
2 mattocks @ \$10.00	\$20.00
1 square-point shovel	\$10.00
2 round-point shovels @ \$10.00	\$20.00
3 pr. knee pads @ \$5.00	\$15.00
SUBTOTAL (Per Team)	\$282.74
4. <u>Computer Team Equipment</u> (per team)	
IBM Microcomputer	\$4160.00
1 SAC Sonic Digitizer GP8	\$15000.00
1 Camera 35 mm Minolta X700	\$280.00
1 Motor Drive Auto Winder	\$165.00
1 Minolta 25 mm lens	\$120.00
1 Minolta Multi-Function Data Back	\$200.00
1 Hershey Light Ring	\$300.00
2 hard hats @ \$5.00	\$10.00
SUBTOTAL (Per Team)	\$20235.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$2733.26
TAX - 6.5%	\$1954.28
SUBTOTAL SALVAGE EQUIPMENT AND SUPPLIES (2 EXCAVATION TEAMS, 1 COMPUTER TEAM)	\$32020.13

SUBTOTAL, ALL SALVAGE COSTS	\$83349.13
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AVERAGE PER ARTIFACT SALVAGE COST	\$41.67
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2. Preparation (based on SBr-901 site in preliminary and final preparation)

A. <u>Staff</u>	Cost
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These costs are based on an estimated preparation time of one month.

1. 1 half-time Secretary @ \$2081.00 per month	\$1040.50
2. 1 Preparation Supervisor @ \$2484.00 per month	\$2484.00
3. 1 Hand Preparation Technician @ \$2139.00 per month	\$2139.00
4. Flotation Technician @ \$2139.00 per month	\$2139.00

SUBTOTAL PREPARATION STAFF	\$7802.50
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B. <u>Equipment and Supplies</u>	Cost
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1. General

Tools

50 pails (5 gallon cylindrical full opening top with lug-type lid, rubber gasket seal and handle) @ \$2.37 + \$29.00 shipping	\$147.00
2 stack chairs @ \$22.00	\$44.00
2 rollaway chairs @ \$200.00	\$400.00
3 shelf cabinets (Arrowstar) @ \$28.30	\$84.90
2 plastic trash barrels @ \$20.00	\$40.00
3 lockers, single tier, Model 254800 (3 units)	

@ \$66.50	\$199.50
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Safety Clothing

1 doz. Edmont gloves 42325	\$45.95
1 first aid kit	\$25.00
2 pr. safety glasses @ \$5.25	\$10.50
10 cases paper towels @ \$6.46	\$64.60
2 fire extinguishers @ \$24.00	\$48.00

2. Specimen Processing

Tools

2 2" paintbrushes @ \$2.00	\$10.00
2 counter brushes @ \$2.00	\$4.00
2 1/4" paintbrushes @ \$0.35	\$0.70
2 No. 1 fine brushes @ \$0.15	\$0.30
Lab screen set, stainless steel	\$300.00
1 large wash tub, galvanized	\$15.00
Trays, stainless steel	
10 16"x9"x2" @ \$14.60	\$146.00
2 cases Sta Lube hand cleaner @ \$32.90	\$65.80
Sta Lube dispenser	\$9.50
1 lamp magnifier	\$131.60
5 dental tools, double-ended explorers @ \$4.00	\$20.00
5 toothbrushes @ \$1.00	\$5.00
1 binocular microscope	\$925.00
1 plastic sand-box VWR 62662-445	\$9.75
100 lbs fine sand	\$20.00
2 bottles of white ink @ \$1.00	\$2.00
2 bottles of black ink @ \$1.00	\$2.00
1 gross crow quill pen points	\$54.36

12 crow quill holders	\$1.59
2 lab coats @ \$21.26	\$42.52
10 cases paper towels @ \$6.46	\$64.60

Solvents

2 cases dishwashing liquid	\$20.00
20 units white glue @ \$1.13	\$22.60

RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$298.18
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TAX - 6.5%	\$213.20
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SUBTOTAL PREPARATION EQUIPMENT AND SUPPLIES	\$3493.15
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SUBTOTAL, ALL PREPARATION COSTS	\$11295.65
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AVERAGE PER ARTIFACT COST OF PREPARATION	\$5.65
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3. Curation

A. <u>Staff</u>	Cost
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1. 1 Curatorial Assistant @ \$2551.00 per month	\$2551.00
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B. <u>Equipment</u>	Cost
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Storage Equipment

2 lab coats @ \$21.26	\$42.52
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1 16-drawer specimen cabinet (Lane Model 301), including delivery	\$303.00
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16 specimen drawers @ \$28.00	\$448.00
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1 Wide Span Shelf 5'x3'x6'	\$150.00
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Office Equipment (Lab)

1 lock-type supply cabinet	\$110.00
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1 4-drawer filing cabinet	\$196.00
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1 Dymo-label machine	\$3.75
2 boxes Dymo tape @ \$8.90	\$17.80
1 photo file cabinet	\$171.75
2 staplers @ \$13.75	\$27.50
General office and laboratory supplies	\$1000.00
RESERVE - 10% of equipment and supplies cost, for equipment repair and replacement and unanticipated needs.	\$247.03
TAX - 6.5%	\$176.63
SUBTOTAL CURATION	\$5444.98
AVERAGE PER ARTIFACT COST OF CURATION	\$2.77
GRAND TOTAL OF ALL COSTS	\$100089.76
AVERAGE PER ARTIFACT TOTAL COST	\$50.04

4. Time

The total elapsed time for any task depends on the intensity of effort dedicated to that task. The figure given below for Salvage Time is total team days. For a site of this size, we estimate that two teams could work simultaneously. Therefore, one five-day shift of two teams per week would halve the total salvage time, two five-day shifts of two teams per week would quarter the total time, etc.

Increasing or decreasing the intensity of effort on Preparation or Curation would alter total time accordingly.

- A. Estimated Salvage Time 66 team days (3.3 team months)
- B. Estimated Preparation Time 30 days (1.5 months)

C. Estimated Curation Time 30 days (1.5 months)

5. Collections Management

The time and cost requirements for managing a single collection of this size are small enough to be absorbed by existing staff and budgets of most institutions.