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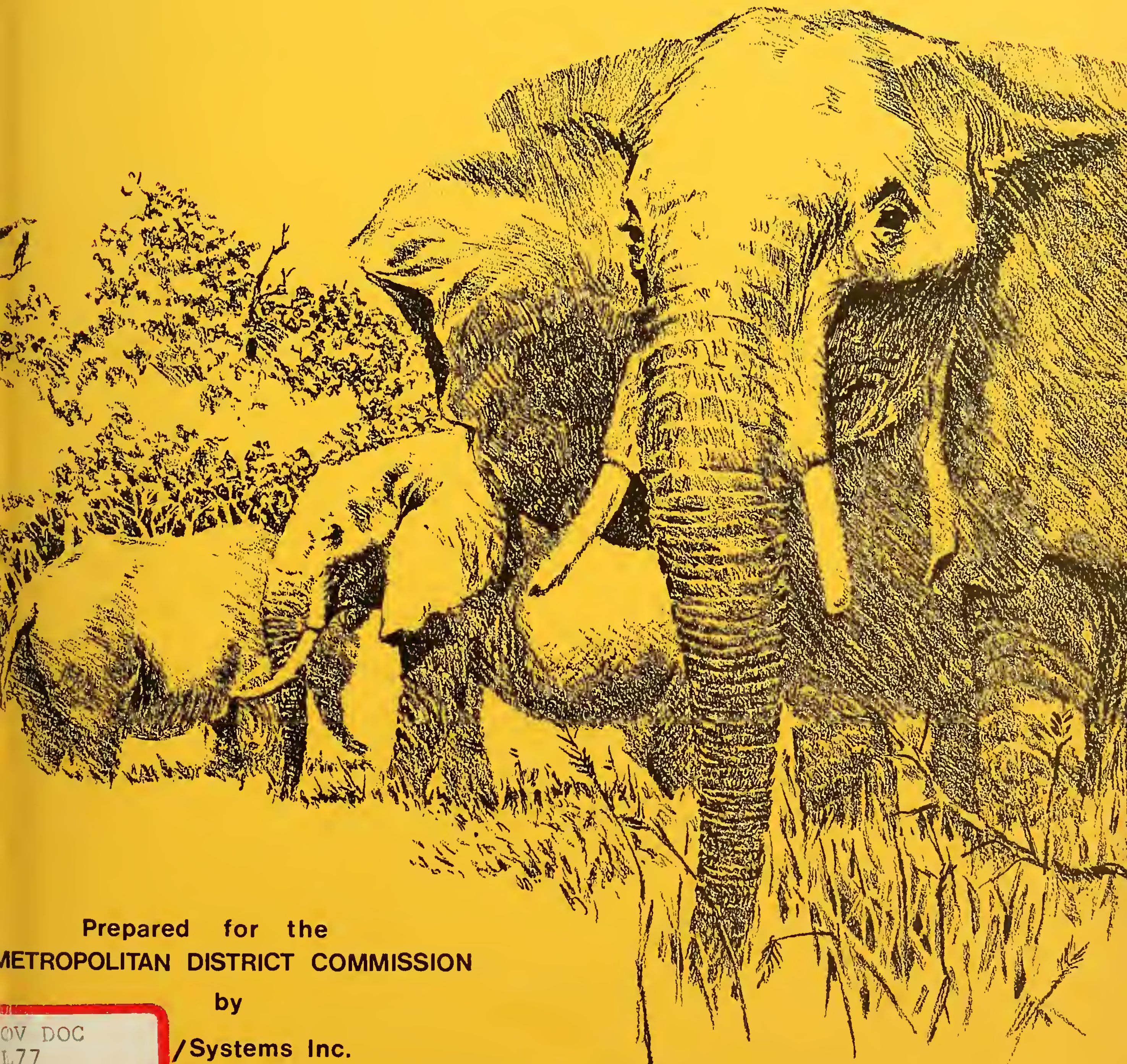
Government Documents Department

Draft Environmental Impact Report

EXPANSION OF THE FRANKLIN PARK ZOO



Prepared for the
METROPOLITAN DISTRICT COMMISSION
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Government Documents Department

Draft Environmental Impact Report

EXPANSION OF THE FRANKLIN PARK ZOO

Prepared for the
METROPOLITAN DISTRICT COMMISSION

by

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December, 1973

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I ENVIRONMENTAL ASSESSMENT FORM

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E. Report will be done

ENVIRONMENTAL ASSESSMENT FORM

This form is provided to assist you in determining whether a proposed project could cause significant environmental damage and thus require an environmental impact report.

EXECUTIVE OFFICE Environmental Affairs DEPARTMENT Met. District Comm.

DIVISION Planning Office OTHER

PROJECT IDENTIFICATION Franklin Park Zoo Expansion

PREDICTED DATES: Commencement 1 Jun. 1973 Completion Nov. 1977

PROJECTED COST $13 million plus interior displays estimated at $2 million.

I. Background Information

1. Give a brief description of the proposed projects(s), and describe how your agency is involved in the project.

   The proposed project involves the expansion, modernization and renovation of the animal exhibits at Franklin Park Zoo. A major new exhibit is proposed involving two to four new pavilions which will provide an all-weather facility for the display of animals from the African continent. The theme will be one of ecological and environmental adaptation of animal species, their niches and interrelationships.

   The MDC owns the Zoo land and buildings and provides major operating funds. A special Act of the Legislature provided that the MDC enter into an operating agreement with the Boston Zoological Society for the management of the Zoo. Thus there is a joint responsibility for the future development as well. The MDC has retained the design consultants who are preparing the new physical plans, the Zoological Society has retained the exhibits designer. Coordination has been close to date and no problems of that nature are anticipated.

2. Describe the geographical area or areas which will be affected by the project(s), including distinguishing natural and man-made characteristics, and a brief description of the present use of the area or areas.

The proposed project will be located in a portion of Franklin Park, which is a major park covering several hundred acres in the Roxbury section of Boston. This park is a portion of the Olmsted Park System or "Emerald Necklace", which begins at Boston Common and stretches to Franklin Park. The present land use is a combination of open space park land, a golf course, an athletic stadium, and existing zoological facilities operated and maintained by the Metropolitan District Commission and the Boston Zoological Society. This park is surrounded by an area proposed for redevelopment and consisting largley of residential areas, with a few commercial developments and institutional facilities.

II. Assessment of Environmental Damage

Answer the following questions by placing a check in the appropriate space; consider both short and long term damage. Wherever "No" is checked, indicate on the lines below the question why there will be no significant damage.

	Short Term Yes	Short Term No	Long Term Yes	Long Term No
1. Could the project(s) affect the use of a recreational area or area of important aesthetic value?	X		X	
2. Are any of the natural or man-made features in affected area(s) unique; that is, not found in other parts of the Commonwealth or nation?	X		X	
3. Could the project(s) affect an historical or archaeological structure or site?	X		X	
4. Could the project(s) affect the potential use, extraction, or conservation of a scarce natural resource?	X		X	
5. Does the project(s) area serve as a habitat, food source, nesting place, source of water, etc. for rare or endangered wildlife or fish species?	X		X	
6. Could the project(s) affect fish, wildlife, or plant life?	X		X	

1. A positive impact is expected

2. The Olmsted Park System may be considered unique.

3. The site is of historical significance.

4. A city park may be considered a scarce natural resource.

5. This answer is "yes" only in that the zoo will house some rare and endangered animals.

6. Some existing plant life may be affected, but this will be offset by additional plantings.

	Short Term Yes	Short Term No	Long Term Yes	Long Term No
7. Are there any rare or endangered plant species in the affected area(s)?				
8. Could the project(s) change existing features of any of the Commonwealth's fresh or salt waters or wetlands?		X		X
9. Could the project(s) change existing features of any of the Commonwealth's beaches?		X		X
10. Could the project(s) result in the elimination of land presently utilized for agricultural purposes?		X		X
11. Will the project(s) require a variance from, or result in a violation of, any statute, ordinance, by-law, regulation or standard, the major purpose of which is to prevent or minimize damage to the environment?		X		X
12. Will the project(s) require certification, authorization or i uance of a permit by any local, state or federal environmental control agency?	X		X	

7. Not known at this time, but it is considered unlikely.

8. The project is located on a high, well-drained section of land with no expected impact on Commonwealth waters other than through storm drainage.

9. There will be no impact on Commonwealth beaches.

10. The site is in an urban park.

11. No violations of existing environmental standards or regulations is foreseen at this time.

12. This project may come under the Federal Clean Air Act.

	Short Term Yes	Short Term No	Long Term Yes	Long Term No
13. Will the project(s) involve the application, use or disposal of potentially hazardous materials?	X		X	
14. Will the project(s) involve construction of facilities in a flood plain?		X		X
15. Could the project(s) result in the generation of significant amounts of noise?	X		X	
16. Could the project(s) result in the generation of significant amounts of dust?	X			X
17. Will the project(s) involve the burning of brush, trees, construction materials, etc.?		X	X	
18. Could the project(s) result in a deleterious effect on the quality of any portion of the state's air or water resources? (If yes, indicate whether surface, ground water, offshore)	X		X	

13. Will the project(s) involve the application, use or disposal of potentially hazardous materials?

There are regulations regarding the disposal of dung from imported or diseased animals.

14. Will the project(s) involve construction of facilities in a flood plain?

The project site is not located on a flood plain.

15. Could the project(s) result in the generation of significant amounts of noise?

There will be construction noise, as well as noise generated from increased traffic.

16. Could the project(s) result in the generation of significant amounts of dust?

Once the project is completed, there will be no exposed land to create a dust problem. Dust control measures will be taken during construction.

17. Will the project(s) involve the burning of brush, trees, construction materials, etc.?

Construction debris will not be burned, but there will be an incinerator on site.

18. Could the project(s) result in a deleterious effect on the quality of any portion of the state's air or water resources? (If yes, indicate whether surface, ground water, offshore)

Air quality may be affected by increased traffic.

	Short Term Yes	Short Term No	Long Term Yes	Long Term No
19. Could the project(s) affect an area of important scenic value?	X		X	
20. Will the project result in any form of environmental damage not included in the above questions?	X		X	

19. It is expected that this impact will be positive.

20. Increased traffic congestion may be a problem.

Zoo architecture may damage landscape values. Jr

III. Statement of No Significant Environmental Effects

A "yes" answer to any of the questions in Section II indicates that the project may cause significant environmental damage, and that an EIR will probably be required. If you have answered "yes" to one or more of the questions, but still think the project will cause no significant environmental damage, indicate your reasons below.

An extensive environmental impact report will be prepared for this project. We would however like to point out the following information.

Environmental impacts are being identified and assessed during the planning stage of this project and prior to final design. It is anticipated that potentially adverse environmental impacts can be eliminated or kept to a minimum through careful planning and design measures.

This planning stage is being conducted with a genuine awareness of the landscape and historical significance of the project site. We also recognize that the project will result in a significant educational resource for the people of Greater Boston and will attract large numbers of people, especially school children. Increased traffic resulting from visitors to the zoo will be an unavoidable impact which must be balanced against the social benefits of the zoo. These major concerns, as well as other related or minor impacts will be examined in the environmental impact report.

IV. Conclusions

Place a check in the appropriate box.

1. ( ) It has been determined that the project will not cause significant environmental damage.* No further reports will be filed.

2. (X) It has been determined that the project may cause significant environmental damage. A draft environmental impact report will be submitted on December 1, 1973 (approximate date).
*See comment under Section III

The draft report will be:

3. ( ) Standard 4. (X) Extensive 5. ( ) Combined

6. Joint, in participation with ____________________, with ____________________ designated as the lead agency.

Signature of Preparing Officer Martin Weiss

Title Dir., Environmental Planning Office

Address MDC, 20 Somerset St., Boston, 02108

Telephone 727-8880

II SUMMARY

A. Description

Expansion of the Franklin Park Zoo

The proposed project will expand, modernize, and renovate the Franklin Park Zoo. Four major pavilions will be constructed to provide an all-weather facility for the display of animals from the African continent.

B. State Identification Number

C. Preparing Agency

Metropolitan District Commission, Planning Office

D. Submittal Dates

Draft: December 21, 1973

Final:

E. Region to be Impacted

The project is located in Franklin Park, which is bordered by the Roxbury, Dorchester and Jamaica Plain sections of Boston. The proposed development will affect these areas specifically, but it will also have general economic, educational, and cultural impacts on the entire metropolitan area and the New England region.

F. Summary of Impacts

The proposed project will represent a significant educational and recreational resource for the entire New England region. It will be located in a section of Boston in need of the financial commitments and renewed public interest associated with a major development of this size. The existing limited zoological facilities on the site will be greatly improved and expanded to the benefit of both visitors and animals. Spin-off usage is also expected in adjacent portions of a seldom used regional park facility.

The project will generate additional traffic loads that will affect existing levels of noise, air pollution and general congestion. It

represents an increased demand for community and regional facilities and services, including water, energy, storm and sanitary sewage treatment, and solid waste disposal. The project will both positively and negatively affect the aesthetics of the Zoo site and Franklin Park, and it will also affect a portion of the Olmsted Park System which is listed in the National Register of Historic Places.

III. PROJECT DESCRIPTION

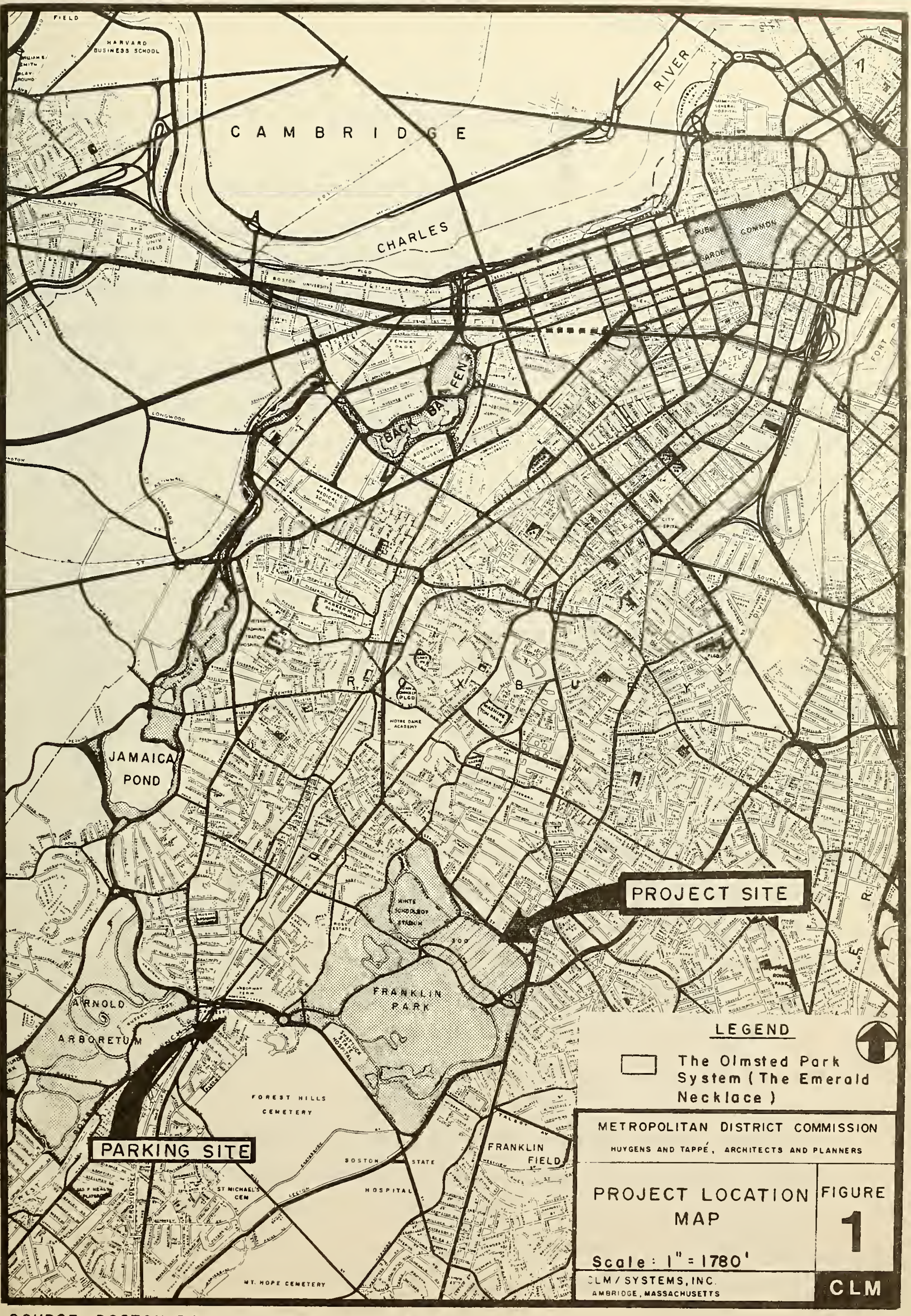
The proposed project is a major expansion of the existing zoological facilities at Franklin Park in Boston being undertaken jointly by the Metropolitan District Commission (MDC) and the Boston Zoological Society (BZS).

A. Goals and Objectives

The objective of the project is to create a year-round facility that will function both as a zoological park devoted to the exhibition, conservation, and breeding of animals and as an educational and recreational resource for the New England region. The planning of the animal exhibits has emphasized the placement of the various designated species of animals into areas that are, as nearly as possible, similar to their natural habitats. In this way, the animals will benefit from an evironment that is more natural than the cages and confined areas common to many zoos, while the zoo visitor will be able to experience seeing the animals at close range and in a more natural setting, thus enhancing the educational experience. While the Boston Metropolitan area is rich in cultural and institutional facilities, it lags behind most major cities in its zoological parks. This project represents a significant improvement over the presently limited Franklin Park Zoo facilities. In future years, it is hoped that other areas of Franklin Park that are now seldom used will become more popular, better maintained, and safer. In addition, the project represents a major financial commitment in a section of Boston presently undergoing extensive redevelopment. These benefits, as well as others of lesser significance are discussed in detail in Section V.

B. Location

The project site is located in the northeast corner of Franklin Park which is bordered by the Roxbury, Dorchester, and Jamaica Plain sections of Boston, (see Figure 1). The development will take place on existing Franklin Park Zoo property (52 acres) presently owned by the Metropolitan District Commission (Chapter 189, Acts of 1965). In addition, 16.25 acres of adjacent park land known as the "Sausage" and owned by the City of Boston



SOURCE: BOSTON REDEVELOPMENT AUTHORITY

will be leased to the MDC under a proposed 99-year agreement. (See Figure 25).

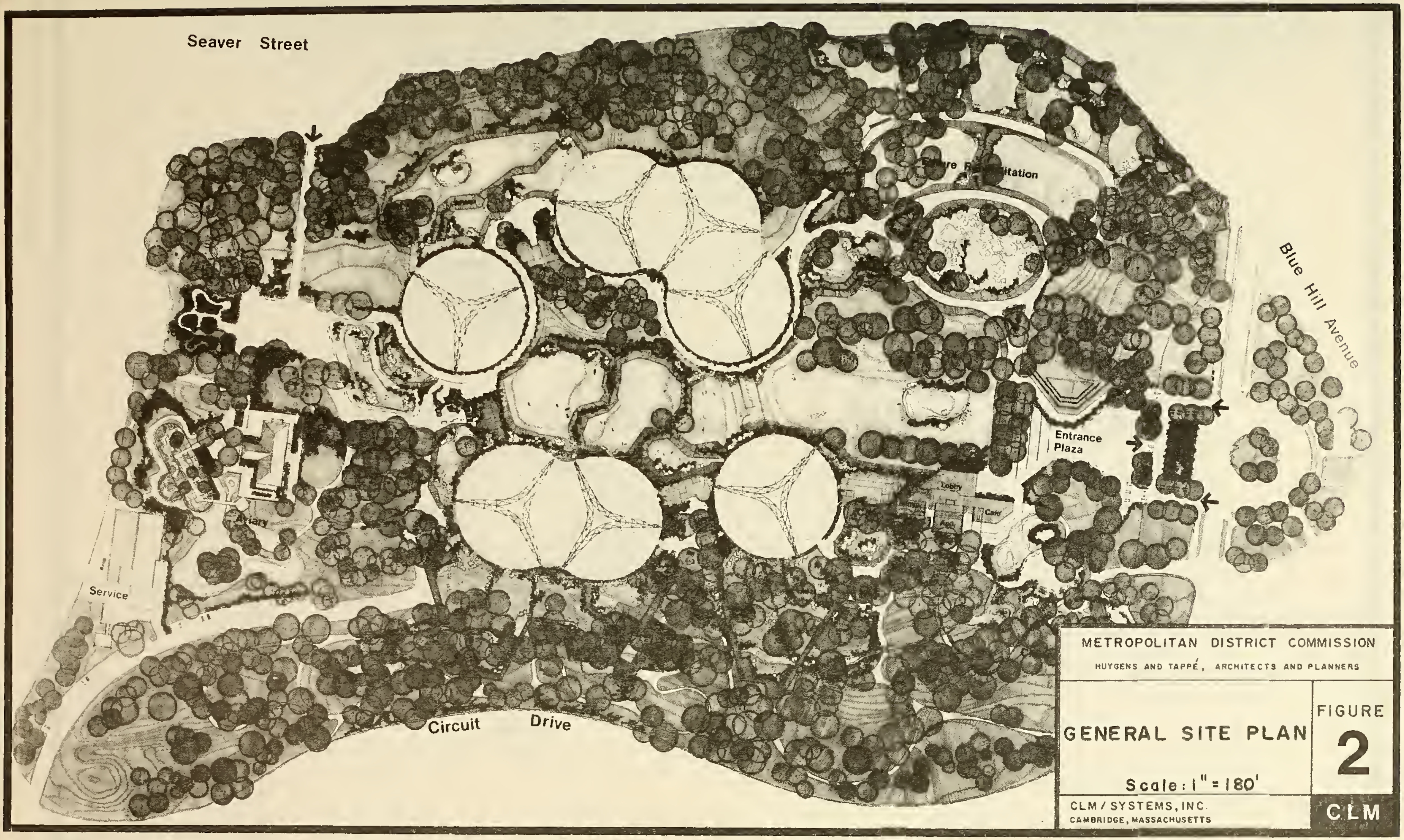
Franklin Park is a part of Boston's Olmsted Park System, a series of parks linked by continuous parkways. This "Emerald Necklace" includes the Boston Common, the Public Gardens, Commonwealth Avenue, the Back Bay Fens, the Muddy River, Jamaica Pond, the Arnold Arboretum, and Franklin Park. This park system is listed in the National Register of Historic Places. The proposed project will affect certain portions of Franklin Park and these impacts on a designated historical area, both adverse and beneficial, will be discussed in Section V.

C. Theme

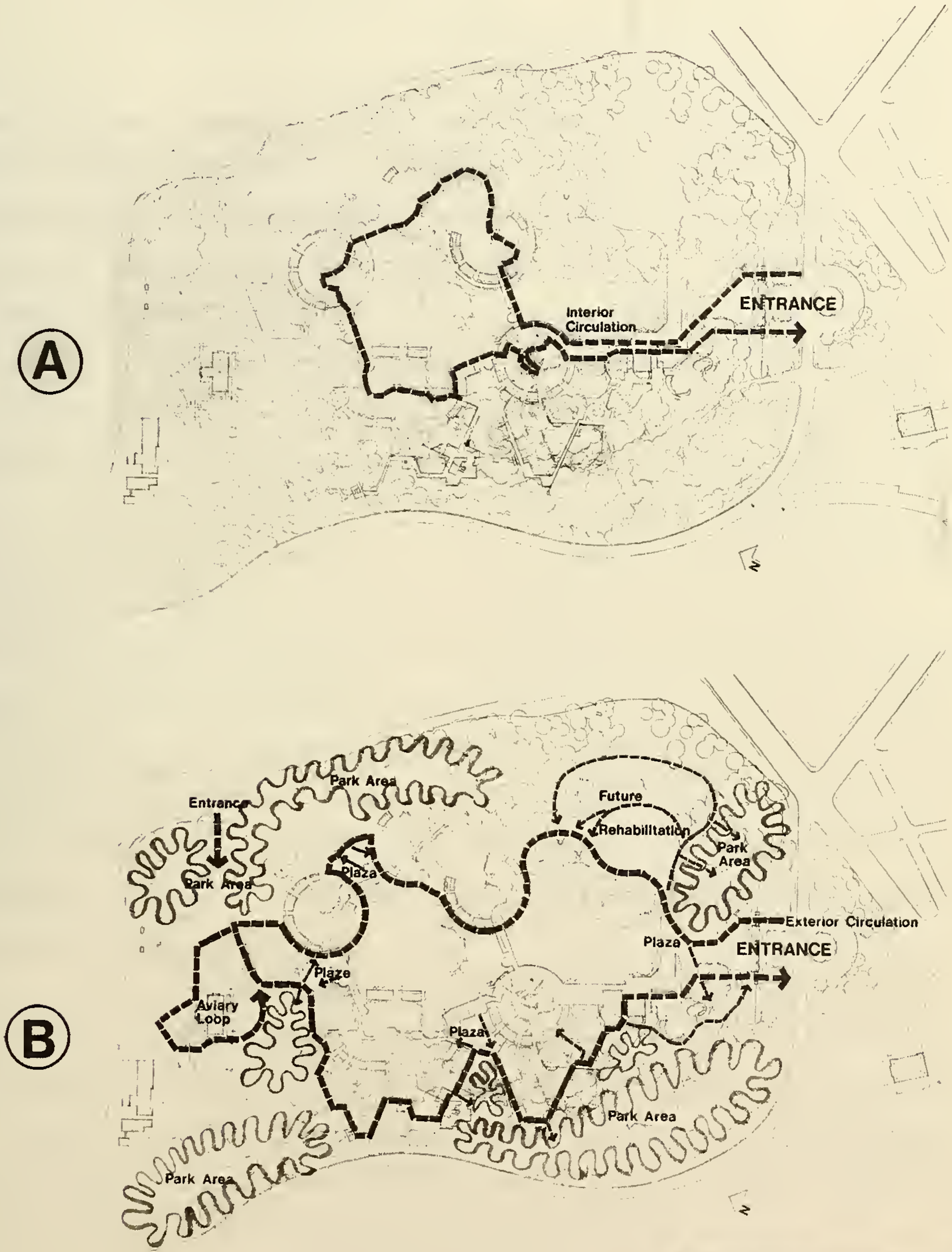
The expanded Zoo will have an African continent theme. This concept is part of the overall plan of the BZS to utilize the three MDC zoos as complementary exhibits. (In addition to Franklin Park, the MDC operates the Walter D. Stone Memorial Zoo in Stoneham and the Blue Hills Trailside Museum). In future years, it is expected that these facilities will include zoological exhibits representing Africa, Asia, North America, South America, Australia, and the Poles.

The proposed African exhibit at Franklin Park will include the major animals and associated small mammals (plus reptiles and birds) found throughout the four regions of that continent (veldt, bush and forest, tropical forest, and desert). (Appendix A contains the animal species list, along with exhibit areas). Each of these regions will be represented within a separate enclosed exhibit pavilion linked to a larger outdoor exhibit area. These four structures are located in what are now defined as open areas within the existing Zoo site, and are shown in Figure 2. (It should be noted that the structure furthest to the north has been relocated since this site plan was drawn. It has been shifted 60 feet closer to Seaver Street).

These indoor exhibit areas will be utilized when weather conditions make outdoor exhibits unfeasible. Thus the Zoo visitor could follow either the interior circulation loop (Figure 3A) or the exterior circulation loop, (Figure 3B), depending on the weather. It is expected that the animals will be indoors roughly six months of the year.



Source: Huygens and Tappé, Inc.



METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

VISITOR CIRCULATION

Scale: 1" = 575'

FIGURE 3

CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS

CLM

Source: Huygens and Tappé, Inc.

D. Structures and Facilities

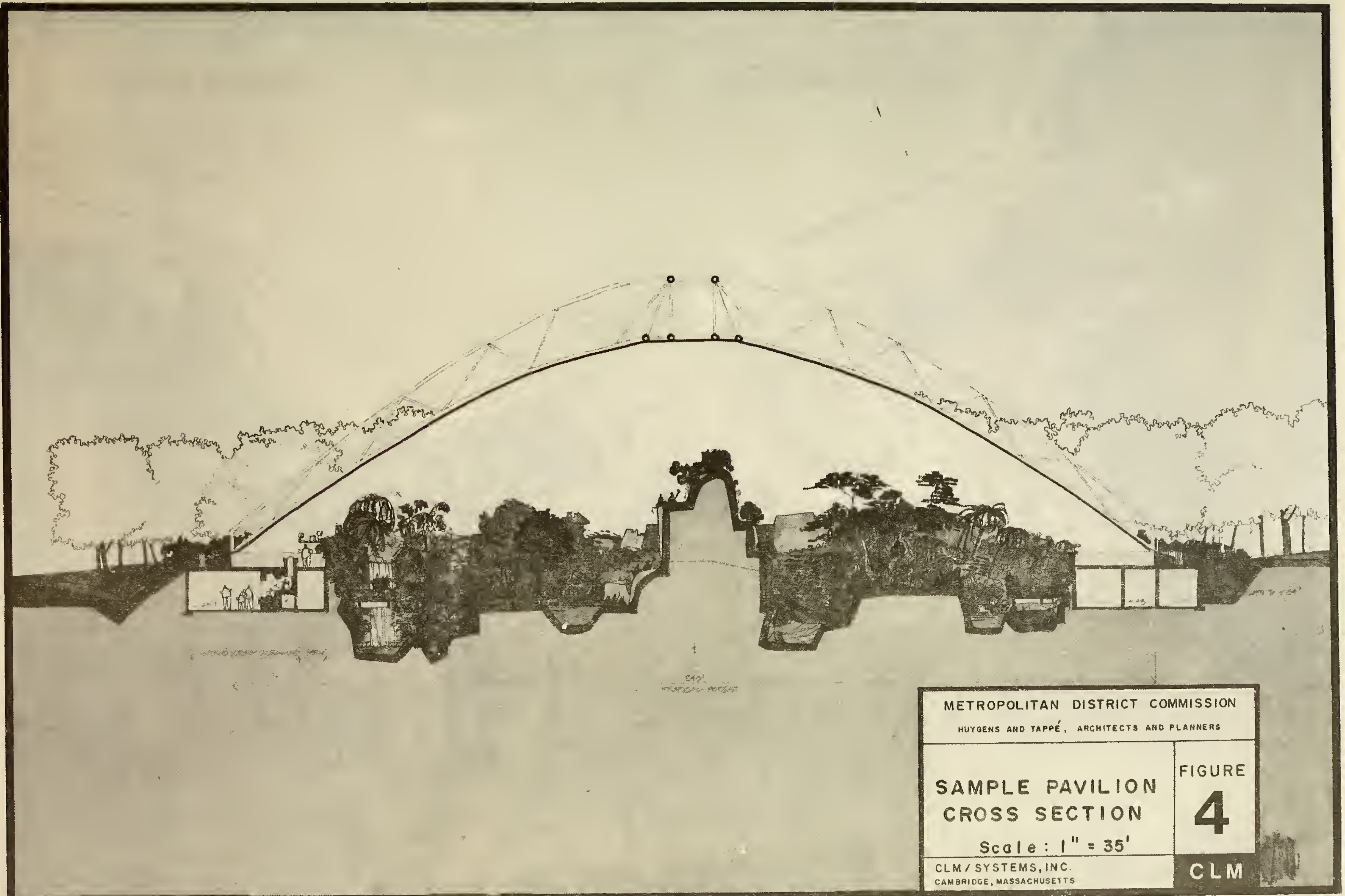
1. Pavilions

The exhibit pavilions will be constructed of a network of steel trusses supporting a system of cables holding a fiberglass reinforced teflon-coated fabric covering. This fabric is translucent in appearance, is non-combustible, self-cleaning, resistant to tear and puncture, and has a life expectancy comparable to or in excess of conventional roofing systems. The fabric is an off-white color in manufacture, but weathers to a greyish-white color. The use of this type of fabric and structure is innovative only in its application to a zoo. Similar structures have been built and used successfully elsewhere in the country.

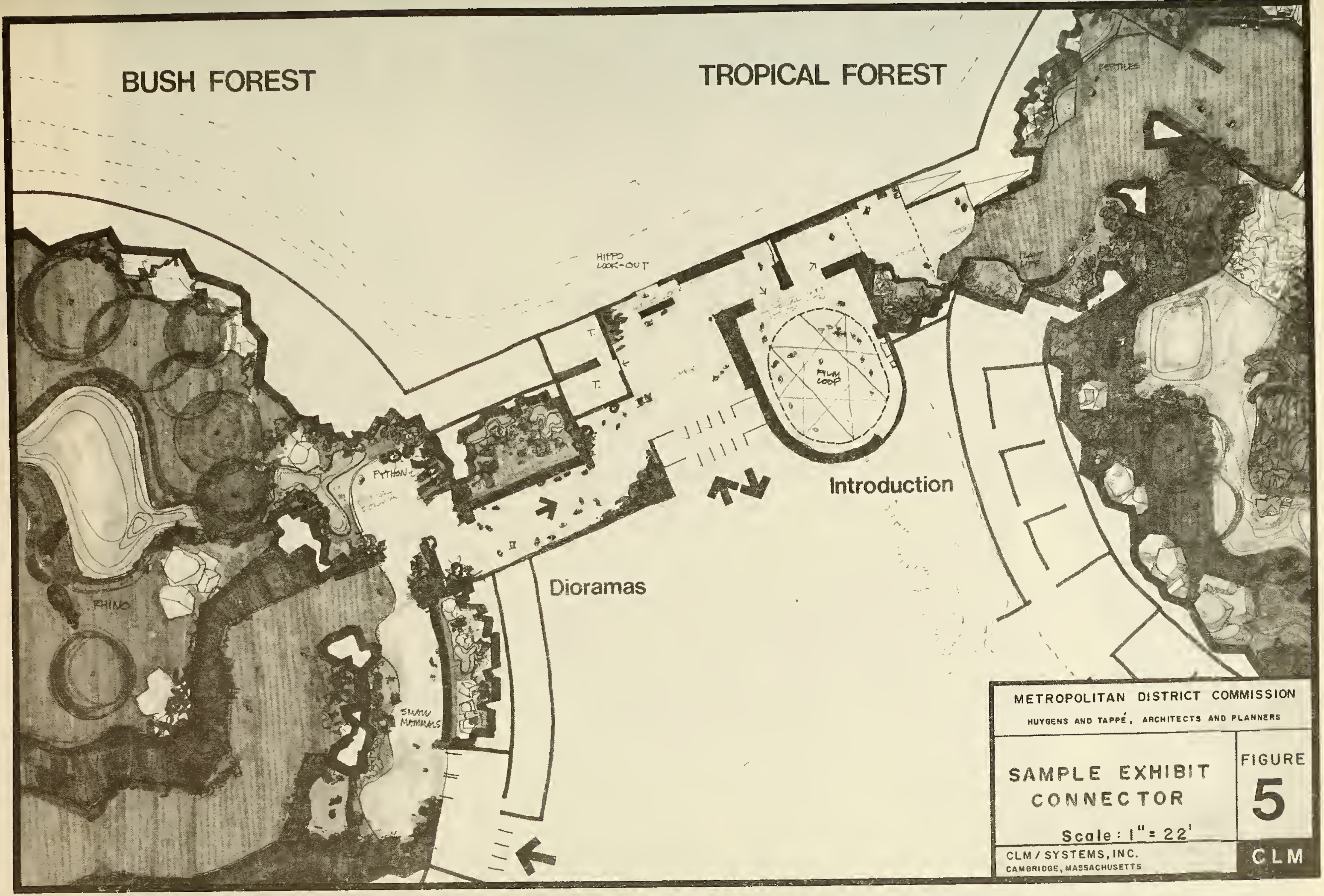
The pavilions will be either single, double, or triple tent configurations as shown on the site plan, all derived from the same structural components. The basic component is a space with a circular boundary (diameter 220 feet), 70 feet above park grade at mid-span. (The fabric itself will not be higher than 55 feet above grade). The edge of each structure comes down to meet a series of earth berms which are developed to continue the lines of the natural topography. Figure 4 shows a cross-section of the Tropical Forest pavilion as an example. The total area covered by these four structures is slightly less than six acres.

Each of these pavilions will be served by concealed connectors to other pavilions containing people walkways, service facilities, small exhibit areas, dioramas, film loops, etc., as shown in Figure 5. In this way, the Zoo visitor will receive an introduction to the major exhibit areas before he actually enters them. Figure 6 shows a photograph of a scale model of the expanded Zoo.

Animal holding areas and other service facilities for feeding, cleaning and general animal care will be located beneath the perimeter of each pavilion as shown in Figure 7. In this way, the animals can be easily shifted to either indoor or outdoor exhibits depending on the weather conditions.



Source: Huygens and Tappé, Inc.


BUSH FOREST
TROPICAL FOREST
HIPPO LOOK-OUT
FILM LOOP
Introduction
PYTHON
Dioramas
RHINO
SMALL MAMMALS
METROPOLITAN DISTRICT COMMISSION
HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS
SAMPLE EXHIBIT CONNECTOR
Scale: 1" = 22'
FIGURE 5
CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS
CLM

Steve Rosenthal Photo

SCALE MODEL OF
ZOO DEVELOPMENT

FIGURE 6

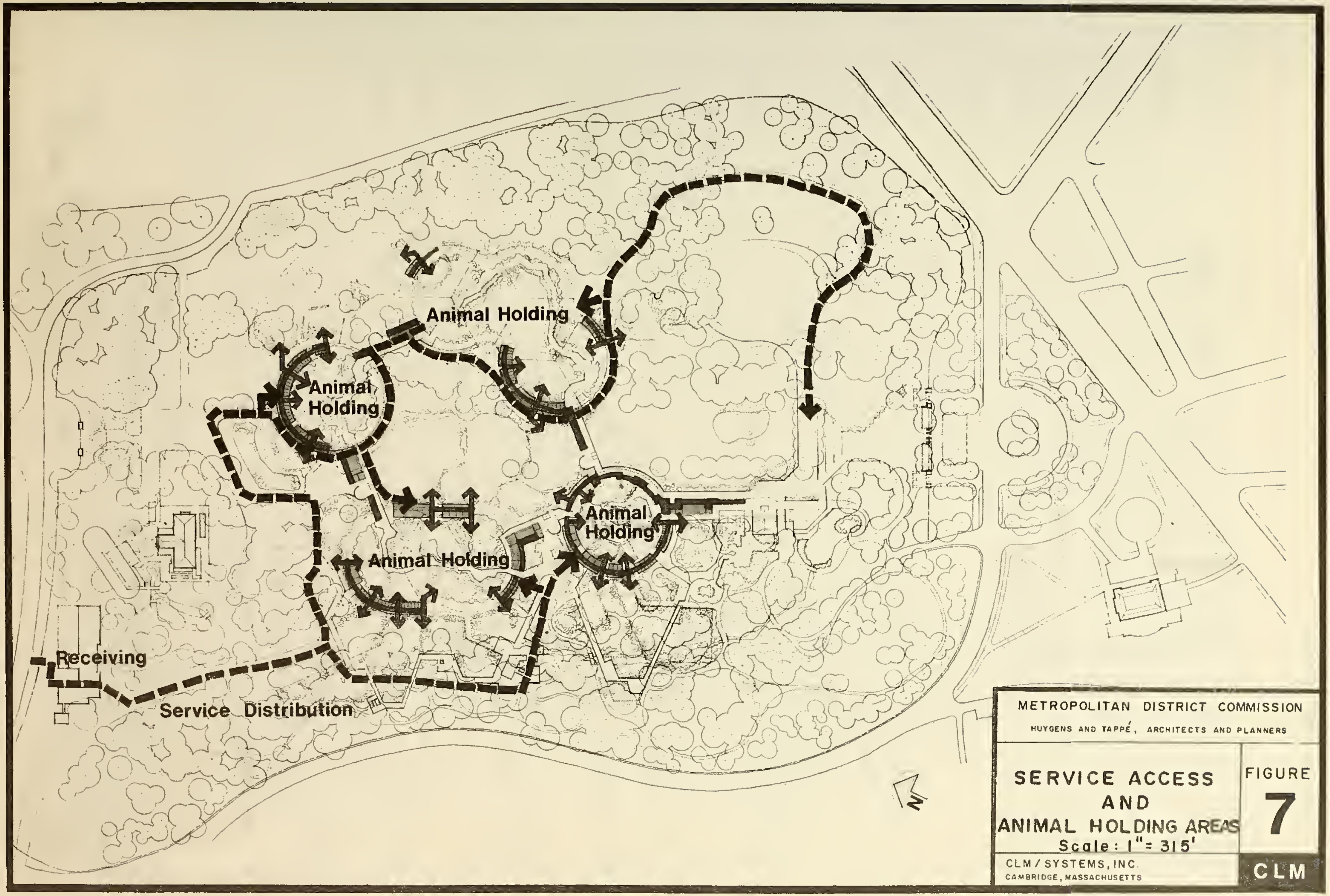

Animal Holding
Animal Holding
Animal Holding
Animal Holding
Receiving
Service Distribution
N
METROPOLITAN DISTRICT COMMISSION
HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS
SERVICE ACCESS
AND
ANIMAL HOLDING AREAS
Scale: 1" = 315'
FIGURE
7
CLM/SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS
CLM

Figure 8 shows the indoor tropical forest exhibit, with the light area running through the center indicating the walkway. In this and all other exhibits, a consistent attempt has been made to screen the Zoo visitors from each other while viewing the animals. This has been done by judicious placement of rocks, trees, and shrubs, as well as by changes in walkway elevation. Figure 9 shows the four major exhibits and their interconnecting pavilions.

2. Land Acquisition

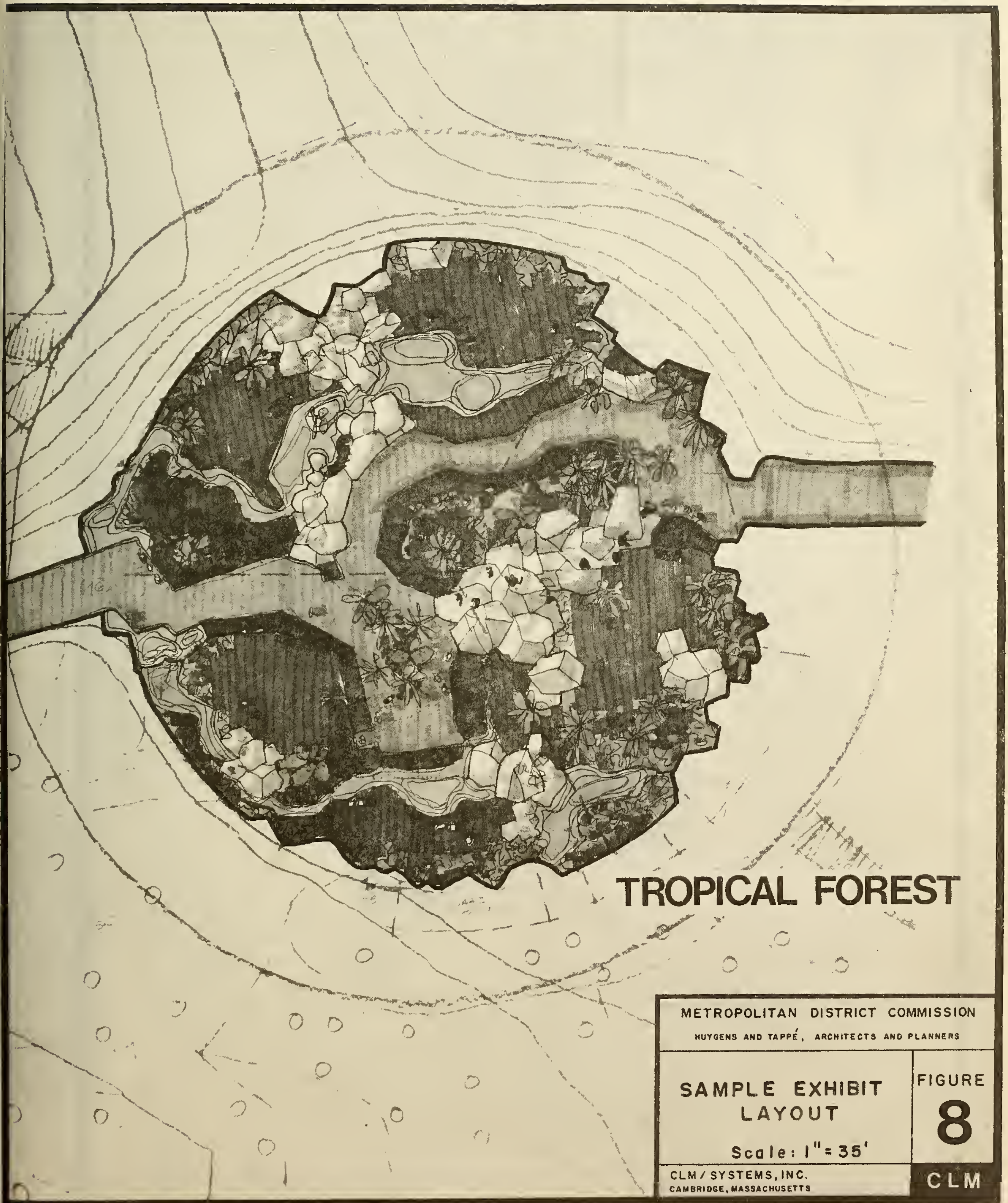
It is proposed that the parcel of land between Glen Lane and Circuit Drive (the "Sausage") will be incorporated into the Zoo program, but will be used primarily as a heavily wooded "buffer" zone between the Zoo grounds and Circuit Drive. No structures will be built on this land, but a network of elevated walkways, paths and fences consistent with USDA[1] requirements will be placed in and around the existing vegetation and natural rock outcroppings to form a series of park use areas. The existing gravel parking lot on a portion of this site will be removed and landscaped, and Glen Lane will be closed to the public and used for both service access and exhibit areas.

3. Existing Buildings and Landscape

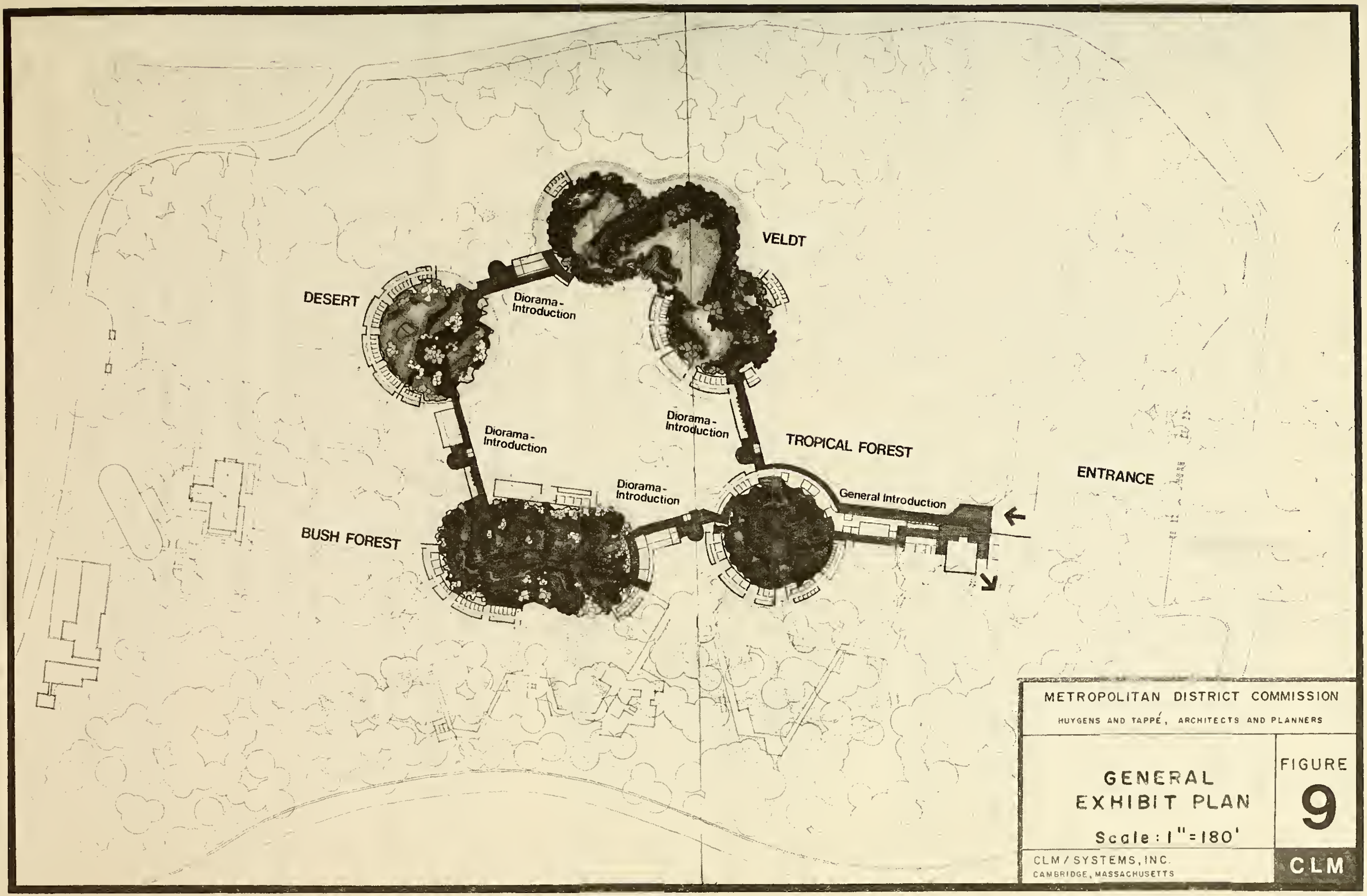
Of the existing buildings, the Elephant House and the Lion House are to be demolished, and the Service Area expanded. The existing Children's Zoo and Range Area will be utilized, as well as the newly constructed Aviary. The existing columns at the Peabody Circle entrance will remain, as will the statues at the opposite end of the site. Long views along the major axis of the site will be maintained so that the scale and detail of existing features of the site will be kept. Upgrading of existing heavily treed areas will be part of the development program and incorporation of picnic and rest areas within the Zoo boundaries will be provided.

4. Additional Facilities

The program for the Zoo includes an extensive educational program, so a small 300 seat auditorium and an educational resource center are designed into the complex. These facilities will be available for use



Source: Huygens and Tappé, Inc.


VELDT
DESERT
Diorama-Introduction
Diorama-Introduction
Diorama-Introduction
Diorama-Introduction
TROPICAL FOREST
ENTRANCE
General Introduction
BUSH FOREST
METROPOLITAN DISTRICT COMMISSION
HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS
GENERAL EXHIBIT PLAN
Scale: 1"=180'
FIGURE 9
CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS
CLM

by neighborhood community groups on a programmed basis. A cafeteria and several refreshment stands will also be located within the complex.

5. Service

Service access within the Zoo is shown in Figure 7. All major pickups and deliveries will be made at the remodeled Service Area, with the materials to be distributed throughout the site by small electric cargo vehicles. There will be access for emergency vehicles throughout the site.

The new Service Area will be an expanded version of the existing facility, and will include a commissary, grain and hay storage, a greenhouse, a paint and carpentry shop, garage space, a new heating and cooling facility, an animal hospital, and an administration center.

6. Animal Wastes

The Zoo will utilize a small approved pathological incinerator to dispose of dead animals and other restricted materials. Animal manure is expected to be disposed of through the use of a liquid composting system similar to the one presently being evaluated for the Bronx Zoo in New York. This system will safely deodorize, pasteurize, biologically decompose, and chemically purify animal wastes, and is presently being used in several large dairies in this country. The project staff is presently evaluating the feasibility of utilizing the methane generated by this composting process.

7. Heating and Cooling Plant

A new central heating and cooling plant will be built in the existing Service Area to supply the heating and cooling medium for the new buildings and several of the existing buildings. The heating plant will consist of multiple water-tube, low temperature hot water boilers (240°-180°F.), utilizing a nitrogen pressurization system, hot water pumps, water treatment, etc. The cooling plant will consist of multiple hot water absorption-refrigeration machines,or electric centrifugal refrigeration machines, chilled water pumps, cooling towers, condenser water pumps, etc.

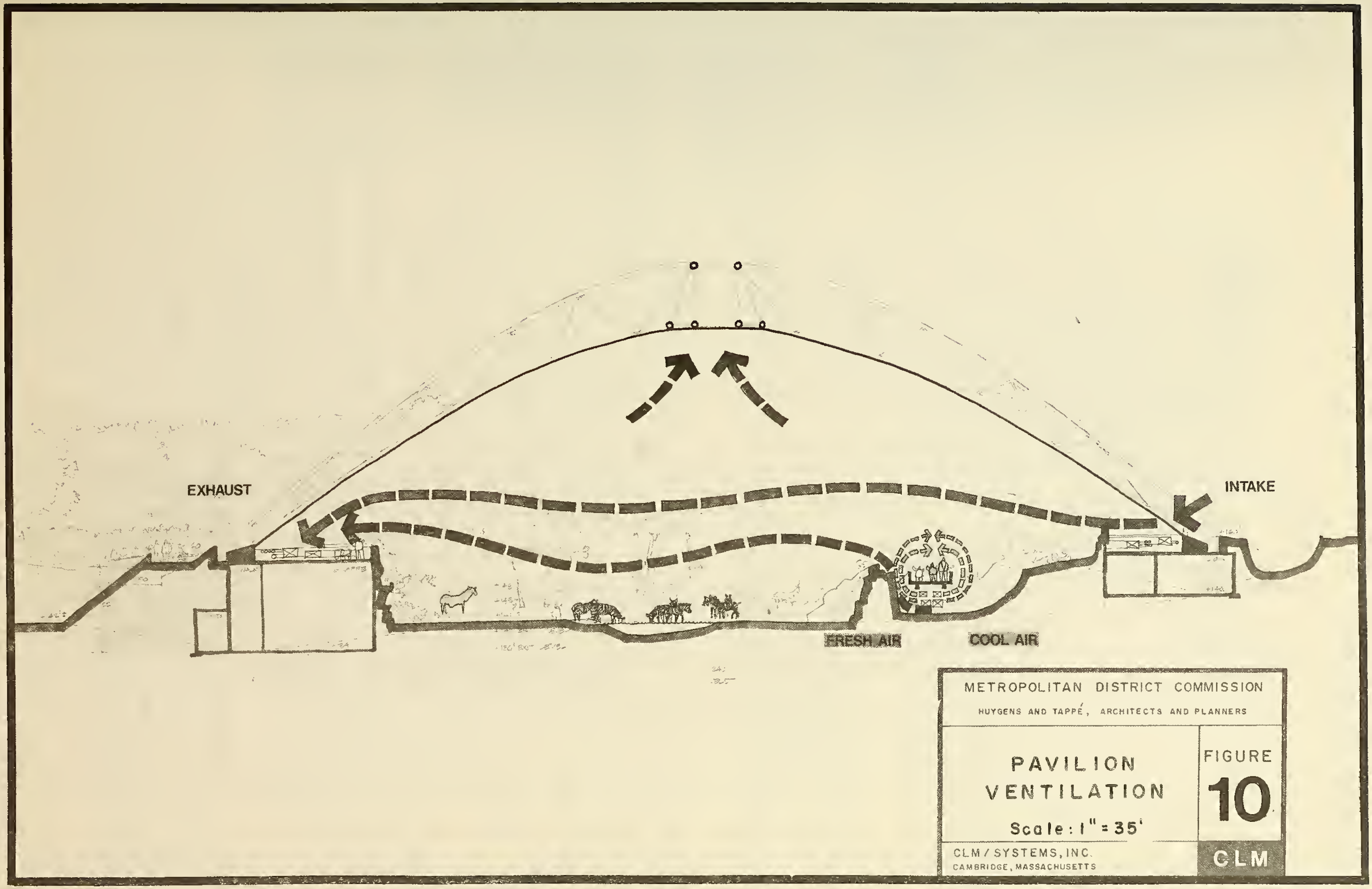
The chilled water and hot water will be distributed to the various buildings through a piping system in an accessible tunnel throughout the project. This tunnel will also be utilized by other services (electric, water, communication, etc.).

The basic air supply and exhaust approach for each building will be as follows:

- An envelope of conditioned air will be created to provide heating and cooling of the people walkways. This system will utilize 100 percent outside air and will provide the only cooling for the exhibit areas and a portion of the heating.
- Supplementary heating will be provided to maintain the exhibit areas at the winter-design condition. This system will be designed so that as the outside air temperature drops below the inside design temperature, less and less outside air will be utilized. This system will also discharge its air in the area of the people walkways and be drawn back through the structure to the perimeter. (See Figure 10).
- There will be an exhaust system to move large quantities of air through the structure for the purpose of purging the interior of the building. The air will be drawn in from the perimeter and discharged through an exhaust fan located outside of the structural compression ring at the top of each building.
- An animal quarters ventilation system will provide ventilation and heating for the animal areas. The air for the system will be drawn from the exhibit area (when possible) or from the outdoors.
- If it becomes necessary, a system will be installed for recirculation of air so as to provide localized air motion for plant life.
- Exhaust air from the complex will be passed through a heat recovery cycle before being discharged to the atmosphere.
- Manually controlled misting devices will be provided in the Tropical Forest pavilion for humidity control.

8. <u>Emergency Power</u>

The proposed project will include an emergency electric power system located in the heating and cooling plant. This system will be adequately sized and diesel driven with automatic transfer switches located in each building. Egress lighting, fire and communication systems, and all heating motors will be connected to the emergency system.



Source: Huygens and Tappé, Inc.

9. Fire Systems

The following fire systems shall be provided:

- Interior fire alarm
- Automatic smoke detection
- Sprinkler alarm
- Fire standpipe
- Exterior fire alarm

Fire hydrants will be located at intervals of approximately 500 feet. Access to these hydrants by fire-fighting equipment will be over the interior service roads used by Zoo service vehicles.

10. Water Supply

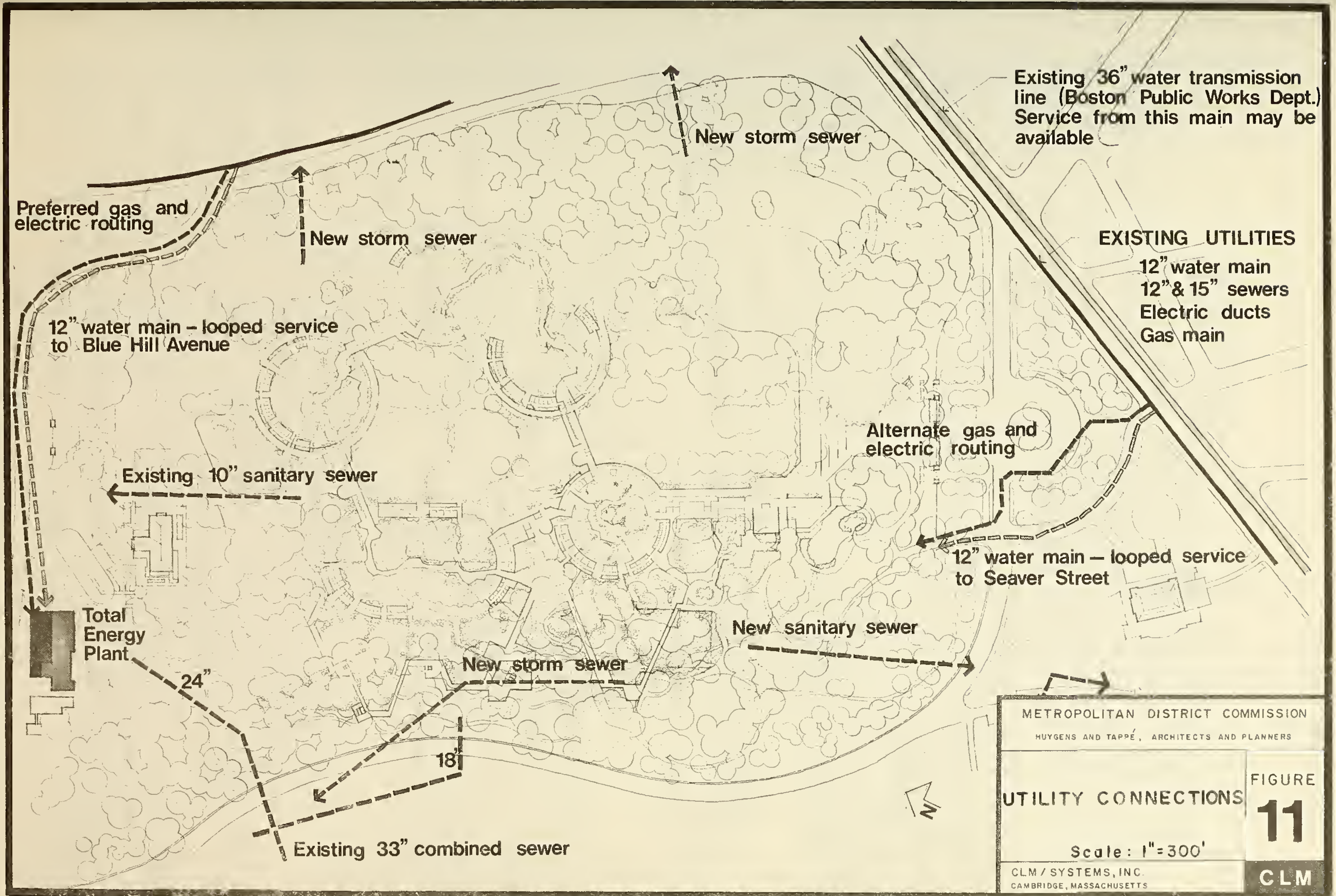
Water for both fire protection and general Zoo operations will be supplied from the 36-inch water main on Blue Hill Avenue. A 12-inch loop encompassing the pavilions will supply service to each pavilion and fire hydrant.

This connection to the City water system has been worked out with Boston Department of Public Works personnel, and is conditional on the completion of the deep rock tunnel connection to the Chestnut Hill Reservoir. This project is presently under construction, with completion expected in December, 1974. The present pressure in the existing main is 42 psi. When the tunnel is completed, the pressure will be increased to about 55 psi. This should be adequate for both Zoo operations and hydrant protection.

Based on early schematic drawings, it is estimated that the peak Zoo demand under normal conditions will be 1,000 gallons per minute. Since the water system serves the dual function of everyday supply and fire fighting, the ultimate capacity in the event of a fire will be 2,500 gpm.

11. Sanitary Sewage

A new sanitary sewage system will be provided to service the Zoo, and will discharge into the existing 2'9" sewer located west of Circuit Drive, with some additional flow into a 10-inch sewer near the golf course clubhouse. Where feasible, existing sewer lines within the Zoo will also be used (See Figure 11).



Source: Cosentini Assoc.

12. Storm Drainage

Each pavilion will be surrounded by a concrete drainage trough in order to collect storm water from the roof surface. These troughs plus the water moats and ponds in the exhibit areas are designed to delay the runoff from a ten-year design storm without flooding. The extent of the delay will depend on a Boston Parks Department determination of the available capacity of the 2'9" sewer near Circuit Drive. Piping from the troughs will be sized to limit the flow, thereby creating a delayed run-off condition. The remainder of the site will be drained as it is presently, eventually connecting to the 2'9" sewer. Where possible, the water from these detention troughs will be used to recharge the water moats and ponds. In addition, the feasibility of using this runoff water for irrigation of the interior exhibits is presently under investigation by the project staff.

Although the City of Boston presently has a combined sewerage system, separate sanitary and storm sewers will be run from the Zoo to the existing 2'9" sewer to allow for separate City sewer systems in the future.

13. Electricity and Gas

Incoming electric service from Boston Edison Company will be from Seaver Street, connecting to the new central heating and cooling plant. Gas service will be provided from the main in Seaver Street. (See Figure 11). Based on early schematic drawings, the maximum estimated electricity and fuel loads are 5,000 KVA and 40,000,000 BTU per hour respectively.

14. Admissions and General Operation

On October 9, 1973, the Massachusetts Legislature enacted Chapter 890 of the Acts of 1973 which allows for an entrance fee to be charged at the Franklin Park Zoo, with revenues to accrue to the Zoo. In addition, it was stipulated that the Zoo will be open for a reasonable period of time each day free of charge, that persons 65 years of age and over and uniformed members of the U. S. Armed Forces will enter at half-price, and that school children in groups from the MDC Parks District communities will enter the Zoo without charge on a scheduled basis.

Although it has not been officially decided, the BZS is considering having free admission to the Zoo during the first hour of operation of each day. During other times, the expected admission charge will be between $1.75 and $2.50 for adults and between $.75 and $1.00 for children, depending on the actual age distribution of Zoo visitors and the revenue needed for break-even operation.

The proposed Zoo will be operated in the same manner as the existing one. The MDC will own the Zoo's capital facilities, and will pay the BZS an annual fee for assuming full management responsibility, in addition to paying the salaries of the Zoo's civil service employees. Operating revenues from shuttle bus charges, admissions, rides, tours, food sales, and private contributions will be used to maintain the new Zoo. The site is expected to be open from 10:00 a.m. to 7:00 p.m. throughout the year. The full-time staff will be approximately 170 employees, with supplementary hiring during the peak summer season.

15. Expected Attendance

Experience in other cities throughout the country has shown that there are vast differences in the levels of attendance achieved by zoos. These attendance levels depend on such factors as the proximity, magnitude and quality of similar or competing attractions, the zoo location, ease of access, and the characteristics of the zoo and its management. Table 1 shows the design projections of attendance at the Franklin Park Zoo through 1986, as estimated by Economic Research Associates. Approximately 1,500,000 visitors are forecast for 1976.

Since the project is designed as an all-weather facility, the effects of adverse weather on attendance can be minimized. As shown, July and August are expected to be the months of highest attendance, reflecting the influx of tourists as well as the availability of more leisure time to area residents. Judicious scheduling of school visits can be used to alter the attendance distribution if necessary.

Table 2 shows the projected average attendance on weekdays and Sundays. Sunday attendance is expected to account for the

greatest share of weekly attendance throughout the year, although that relative share will drop during the spring and summer months when tourists are present in greater numbers during the week. (An important aspect of the attendance distribution is that between 40 and 65 percent of all Zoo visitors will arrive on weekends, when traffic loads in the project area are light). The peak day attendance is expected on Sundays in July and August when 15,339 visitors are forecast for 1976, and 16,566 for 1986.

Economic Research Associates also estimates that based on studies at the New England Aquarium, 70 percent of the Zoo visitors will come from Boston Metropolitan area and surrounding towns within a 50-mile radius, 20 percent will come from the rest of New England, and 10 percent will be tourists from outside New England.

16. Parking

An important aspect of the project development has been the provision for safe and efficient access to the Zoo and the availability of parking for the general public. In a September 1973 feasibility study for the proposed project, a 1200 car parking garage was recommended for the site now occupied by the Refectory. This recommendation met with opposition because of historical, aesthetic, and general environmental considerations. Since that time, a number of meetings have been held between the project staff and various representatives of the City and other interested parties in an effort to develop an acceptable alternative. The final parking recommendation is a direct result of this joint effort.

The parking demand was developed by Economic Research Associates based upon attendance at other zoo sites and qualified by local factors within the New England Region. Experience at other facilities has shown that roughly 90 percent of all zoo visitors arrive by private automobile and charter bus service. An average occupancy rate of 3.5 persons per car for weekend visitors, and 2.2 persons per car for weekdays has been assumed. Peak in-grounds Zoo attendance values will range from 30 percent of the daily total in the winter months to 50 percent during summer months.

TABLE 1

PROJECTED MONTHLY DESIGN ATTENDANCE AT FRANKLIN PARK ZOO

Month	Percent of Annual Attendance	Thousands of Visitors		
		1976	1981	1986
January	4%	60	62	65
February	5%	75	77	81
March	7%	104	108	113
April	10%	150	155	162
May	12%	180	186	194
June	11%	165	170	178
July	15%	225	232	243
August	15%	225	232	243
September	7%	105	108	113
October	6%	90	93	97
November	5%	75	77	81
December	3%	45	46	49
TOTAL	100%	1,497	1,549	1,619

SOURCE: Economic Research Associates.

TABLE 2

FRANKLIN PARK ZOO
PROJECTED DAILY DESIGN ATTENDANCE

Month	Weekdays				Sundays			
	Percent of Weekly Attendance	Number of Visitors			Percent of Weekly Attendance	Number of Visitors		
		1976	1981	1986		1976	1981	1986
January	7%	967	1,009	1,058	45%	6,278	6,485	6,780
February	7%	1,313	1,348	1,418	45%	8,438	8,663	9,113
March	7%	1,654	1,718	1,798	45%	10,634	11,043	11,556
April	8%	2,790	2,883	3,014	35%	12,208	12,614	13,185
May	8%	3,272	3,382	3,527	35%	14,315	14,795	15,432
June	12%	4,604	4,744	4,967	30%	11,511	11,859	12,417
July	12%	6,136	6,326	6,626	30%	15,339	15,816	16,566
August	12%	6,136	6,326	6,626	30%	15,339	15,816	16,566
September	7%	1,709	1,758	1,839	45%	10,989	11,300	11,822
October	7%	1,432	1,479	1,543	45%	9,203	9,507	9,918
November	8%	1,463	1,502	1,580	40%	7,316	7,512	7,900
December	8%	837	855	911	40%	4,184	4,276	4,556

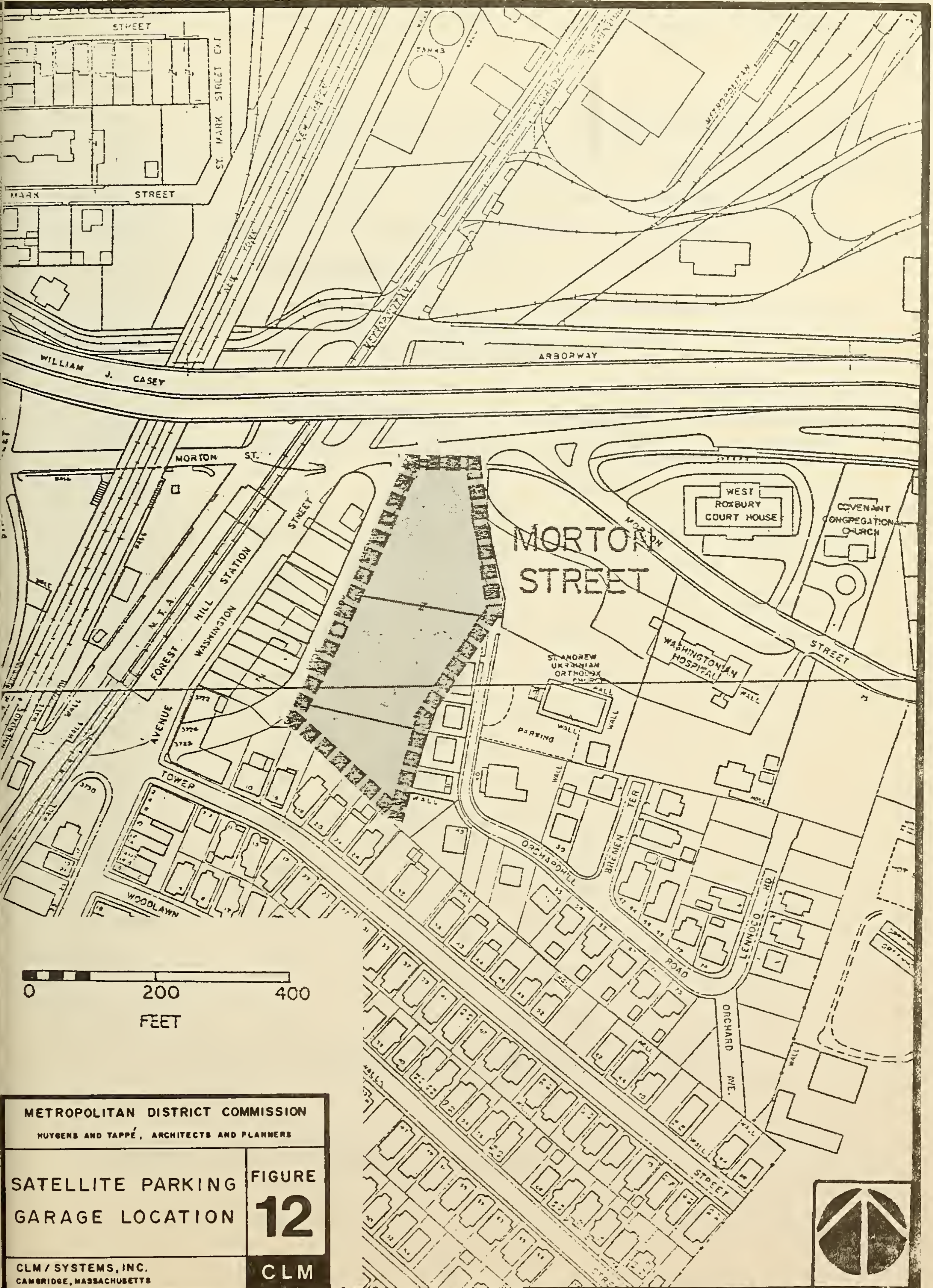
SOURCE: Economic Research Associates

Table 3 shows the average parking demand for the design year 1986 based on these factors. Demand for spaces in 1976 should be roughly 8 percent less than those shown for 1986.

Zoo employees will park along a portion of Glen Lane near the Service Area, where space will be provided for approximately 50 cars. It is proposed that all Zoo visitors travelling by private automobile will be directed to a large parking garage located in the Forest Hills Area. (See Figures 1 and 12). This garage would be built by the Massachusetts Department of Public Works under the Federally assisted Fringe Parking Program, and will be of sufficient capacity to accommodate both commuter parking and Zoo parking due to the difference in peak usage periods. It is expected that the parking fee will be less than $1.00 per day.

This garage was initially proposed as part of the Boston Transportation Planning Review (BTPR) Southwest Corridor Study in conjunction with the planned modifications to the MBTA Orange Line in the area. Although the facility is only in the planning stage, the Executive Office of Transportation and Construction is negotiating contracts for both a Fringe parking demand study and an environmental impact statement, and expects construction to be finished in time for the completion of the Zoo development. It should be stressed that this parking facility is being built to accommodate commuter vehicles. The actual number of spaces that will be provided has not been determined at this time, but will be developed at a future date through a complete demand analysis. For the purpose of this report, only the environmental impacts associated with Zoo generated traffic will be considered.

After parking at the garage, visitors will be transported to and from the front entrance of the Zoo on double decker buses operating solely between the satellite lot and the Zoo. These buses will travel a one-way distance of 1.5 miles along Circuit Drive, with an estimated trip time of five minutes. Eight buses will be required to provide service



METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

SATELLITE PARKING GARAGE LOCATION

FIGURE 12

CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS

CLM

Source: Boston Redevelopment Authority

at a 1.3 minute headway during peak periods (3000 passengers per hour). On off-peak days, only four of the vehicles will be utilized, which increases the headway to 2.6 minutes. The fare structure is expected to be 25 cents for adults and 10 cents for children, which will generate additional revenue for Zoo operations.

TABLE 3
1986 PARKING DEMAND*

Month	Parking Demand		Number of Weekends**	Number of Weekdays
	Weekends**	Weekdays		
January	523	130	8	23
Feburary	703	174	9	19
March	1040	257	9	22
April	1356	493	10	20
May	1785	649	9	22
June	1596	1016	10	20
July	2130	1355	10	21
August	2130	1355	8	23
September	1368	338	10	20
October	1020	252	9	22
November	711	226	8	22
December	351	112	10	21

*1976 Demand is estimated at 8 percent less than values given.

**Includes Holidays

SOURCE: Alan M. Voorhees & Associates.

17. Future Plans

This environmental impact report will deal with the project as presented. At this time, there are no definite plans or funding for specific future exhibits at the Franklin Park Zoo that have not been considered in this report. In the event that there is a proposed expansion of the project at some later date, the environmental impacts of that expansion will have to be assessed at that time.

18. Landscaping

It should be emphasized that the proposed project, although primarily a zoological park, will also be a unique botanical/horticultural experience as well. Since the beginning of the project, a great deal of effort has gone into an examination of the wide variety of factors affecting the design, installation and maintenance of the plant materials both on the interior and the exterior of the proposed structures. Several other zoos and conservatories have been visited, and many specialists have been contacted in an effort to anticipate and solve future problems. These specialists include Dr. Dennis Brown, Director of the New York Botanical Gardens, and Dr. Stuart Dunn, Professor of Botany at the University of New Hampshire.

(a) Exterior Landscaping

Generally speaking, the exterior design intent is to utilize as much of the existing vegetation as possible. New planting will increase the total vegetative cover to approximately fifty percent over and above what presently exists. It should be noted that a number of trees will be removed, many of which are diseased or in poor condition from either age or storm damage.

The new exterior planting will provide more variation in plant species, which will diminish the possibility of major areas being wiped out by a single disease,(i.e., Dutch Elm). There will be a rather significant increase in the amount of shrubs, ground cover and various flowering plant materials which are not presently in the park. New

plantings of evergreen trees to provide year-round foliage for visual variety and screening are also planned.

Whenever possible, plant materials that approximate the appropriate African plant material will be utilized indoors. A list is being prepared of plant materials that will accomplish this in form, texture, and flowering or fruiting habits, and that will also be tolerant to New England growing conditions. Within the established design parameters, emphasis will be placed on creating a park-like atmosphere that combines variety, appropriate vegetation and other site improvements with minimum maintenance.

(1) <u>Tree Protection, Moating and Erosion</u>

Wherever possible, existing vegetation will be utilized and protected from construction and from the abuse anticipated from the animals. Moating is but one of the techniques that will be employed to protect vegetation. Fencing (hidden from the visitors' line of sight), specially constructed tree guards and grates, and special surface treatment to keep soil from being compacted around the roots are some of the protection techniques anticipated for use. Where moating (or other excavation) occurs, the excavation will be kept beyond the "drip line" of the crown in order to disturb as little of the root system or soil as possible.

Erosion caused by the action of animals will require "other than normal" precautions. Special surfacing may be used in certain situations, but as the design progresses, the various exhibits will have to be treated area by area. There will be a loss of groundcover in certain animal areas, although the indoor/outdoor exhibit potential will make it possible to move animals to interior exhibits even during favorable weather to "rest" an area made barren by animals.

(b) Interior Planting

To date, several zoological and botanical gardens have successfully dealt with lighting and temperature requirements similar to those of the expanded Zoo, but on a smaller scale. A great deal has been learned from these efforts, and all indications are that success can be achieved at the scale of the new Franklin Park Zoo. Plant materials are being investigated that normally thrive on lower than full sunshine light levels, and which can also tolerate the project design temperatures.

(1) Climate Control

The re-creation of an African climate indoors will be done only to a limited extent. Thus the Tropical Forest will be more humid than the Bush Forest, and the Desert will be less humid than the Veldt, but this will not reproduce exactly the African climate. This is possible because plants will be specifically chosen to tolerate temperature minimums and maximums as shown in Table 4.

Although the minimum design temperature is 50 degrees Fahrenheit, some chilling damage would be expected if the temperature dropped to 40 degrees for several days.

In the event of a major power failure, portable heaters and emergency generators may provide adequate temporary heat to maintain minimum temperatures.

It is anticipated that some artificial lighting will be required. The pavilion fabric is presently being analyzed by the Sylvania and DuPont testing laboratories in an effort to determine the percentage of light emissions and the quality of that light. These results will indicate the natural lighting conditions, which will then be supplemented by artificial means.

The final selection of the interior plant material will take place after further development of the Zoo final design. It is anticipated that most of the interior plant material will come from the warm southern and western states and will be specially selected and shipped in order to control quality and survival.

TABLE 4

MINIMUM TEMPERATURE, HUMIDITY, AND LIGHT LEVELS

Exhibit	Temperature (^{O}F) Day	Night	Humidity (%) Day	Night	Light (foot candles per 16-hour day)
Veldt	65	50	40	40	1000
Tropical Forest	70	50	40	70	1000
Bush Forest	65	50	30	30	1000
Desert	60	50	20	20	1500

Source: Moriece and Gary Inc.

(2) Irrigation

The irrigation system presently planned for use in both interior and exterior areas has a combination of automatic and manual control. In certain areas an automatic system can be successfully and economically employed, but throughout the site, hose bib connections will be provided for manual distribution of water. Within the interior exhibits themselves, the distribution of plant nutrients may be accomplished along with the irrigation. This procedure will allow for better and more rapid distribution of nutrients and will eliminate burning caused by build-up or over-concentration of dry fertilizers. In addition, a method of utilizing storm runoff from the pavilion detention troughs for irrigation purposes is currently being investigated.

(3) Support Facilities and Staffing

There will be a definite necessity for the provision of nearby greenhouse facilities for holding, nursing, and propagating

supplementary plant materials for both indoor and outdoor use. Although it is difficult to estimate at this point, support greenhouse requirements should be in the neighborhood of 5,000 square feet. This greenhouse will not accommodate extremely large plants which will be used in some exhibits; these plants will be handled at an off-site facility.

Staffing of the proposed Zoo will require that, among other things, the grounds maintenance crew be technically qualified and highly motivated. Presently it is estimated that a full-time crew of from 8 to 12 will be necessary to perform the essential maintenance requirements for the interior and exterior areas and support greenhouses.

19. Educational Program

Decisions on specific educational programs to be offered at the Zoo have not yet been finalized. It is the intention, however, to provide for education on a wide variety of levels.

Education of the average visitor will be built into each exhibit using a number of techniques, including film loops, and descriptive signs containing multiple levels of information.

The BZS Education Committee has directed particular attention toward designing suitable programs for grade school classes. Current thinking in this area indicates that the most reasonable way to insure a meaningful trip for a particular class is to have the individual teacher play a large part in the program design. It has been proposed that a work area and library be available to teachers for their planning. The Zoo as a whole is to function as a resource center for teachers, providing back-up information and technical aid which may or may not be related to a class visit.

The idea of having a class visit the Zoo for several consecutive days is being considered. It is felt that a prolonged visit will provide an opportunity for children to more fully integrate the Zoo experience with other studies, such as geography, culture, and art, which could be taught in "classrooms" provided by the Zoo.

A variety of mini-courses have been proposed for the high school level; possible subjects include: animal behavior, comparative anatomy, and physiology. Plans are also being made for youth groups at the Zoo. These would include junior curators, junior keepers, etc. In addition, at the college and graduate level, it is hoped that opportunities can be provided for supervised research.

Although these various programs are not finalized at this time, there will be a continuing effort to maximize the educational potential provided by a facility of this type.

20. Cost, Financing, and Construction Schedule

The facility will cost an estimated $15,000,000. Of this total $8,000,000 has already been allocated to the MDC by the Massachusetts Legislature, $5,000,000 will be raised by the BZS from private contributions, and the remainder is expected to come from programs within the Federal Government, although these funds are not committed at this time.

Construction will begin in early 1975, and will proceed while existing exhibits remain open to the public. It is hoped that some of the new exhibits will be open during the Bicentennial Year (1976), but final completion of all phases of the project is not expected until 1977.

21. Project Staff

Huygens and Tappe, Inc.	Architects and Planners
Weidlinger Associates	Consulting Engineers
Cosentini Associates	Mechanical Engineers
Moriece and Gary, Inc.	Landscape Architects
Alan M. Voorhees and Associates, Inc.	Transportation Consultants
CLM/Systems, Inc.	Environmental Consultants
Charles B. Soloman, Construction Consulting	Cost Consultants
Economic Research Associates	Economic Consultants
Laventhal Krekstein Horwath & Horwath	Economic Consultants

IV. THE ENVIRONMENT TO BE AFFECTED

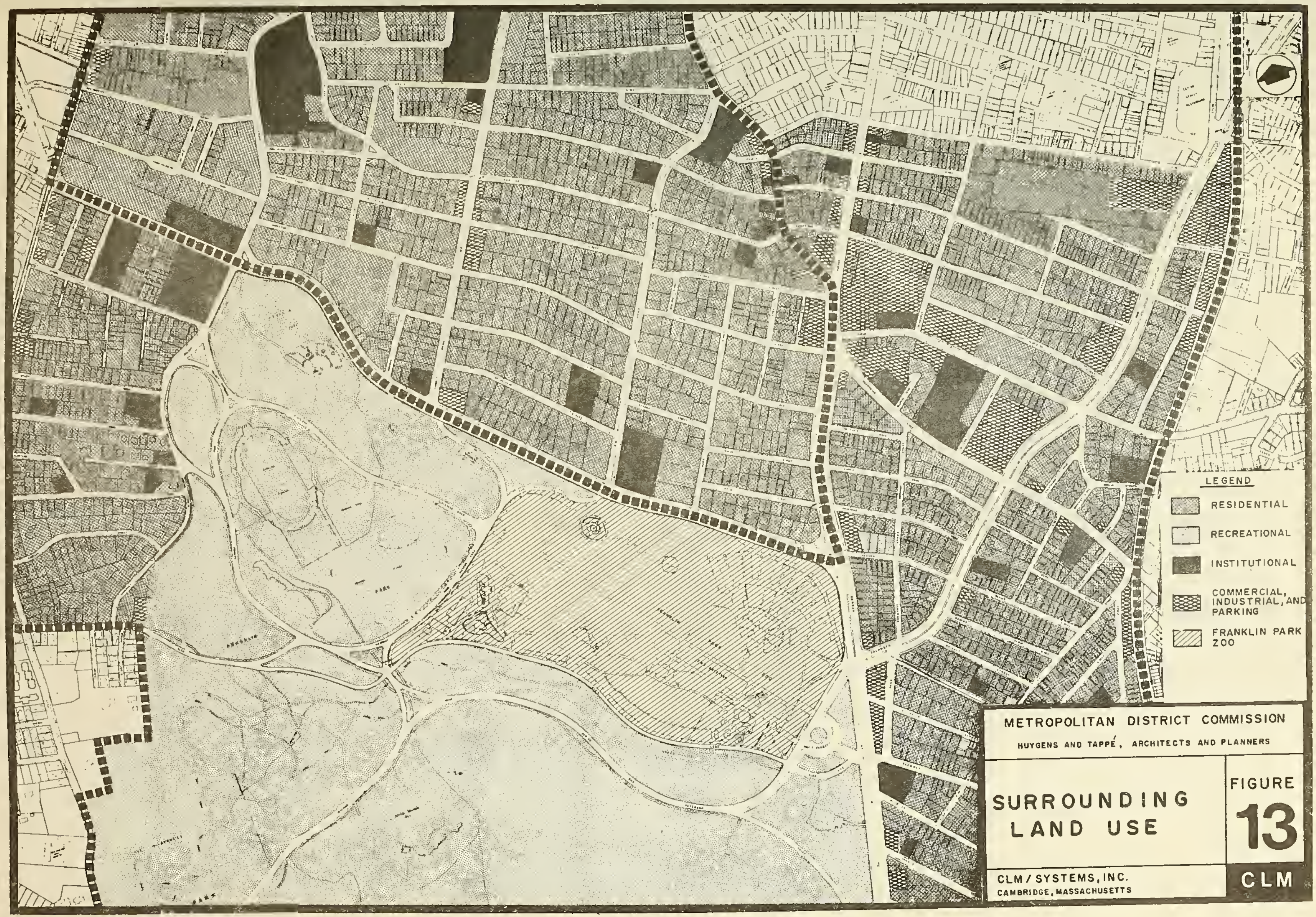
A. Surrounding Area

1. Land Use

The area surrounding Franklin Park to the north consists primarily of low to middle income residential neighborhoods with a substantial minority group population. There are a few major industries in an industrial strip located about a mile from the Zoo site. Commercial establishments are generally located along Blue Hill Avenue and several other roadways. The area also contains a relatively high proportion of institutions, such as schools, rest homes, and churches. Figure 13 shows the existing land use in the Zoo area.

The area surrounding the southern portion of Franklin Park contains two major institutions, the Lemuel Shattuck State Hospital for Incurable Diseases, and the Boston State Mental Hospital. Four very large cemeteries, (Forest Hills, Mt. Hope, Calvary, and New Calvary) are located to the south of the hospitals, as shown in Figure 1. The other institution in the area is the Prendergast Preventorium, which is between the Calvary and the New Calvary Cemeteries. The Preventorium was originally a camp for children suffering from asthma and tuberculosis, and is now used as a city-run camp for children.

Near the satellite parking garage at Forest Hills, land use varies from block to block. The MBTA Orange Line runs through this area on elevated tracks, with a stop at the Forest Hills Station, 200 feet from the proposed parking structure. Roughly paralleling the MBTA right-of-way is the Penn Central mainline, which is in use at this time, and is also elevated over several roadways. The remainder of the area is composed of a mix of single-story commercial establishments, old two-and three-story wood frame residences, several churches, a hospital, the West Roxbury Court House, several surface parking lots, and a large MBTA storage yard for buses and trolleys.



Source: CLM/Systems, Inc.

The Forest Hills area is expected to undergo extensive redevelopment in future years. The BTPR Southwest Corridor Study examined this area and proposed a number of changes, including the relocation of the MBTA Orange Line, the construction of a new Forest Hills station, and the possible depression of the Penn Central mainline. As discussed previously, a large parking garage is planned for the area, as well as major improvements in the existing street system. There is also the possibility of the construction of a major four or six lane arterial street running parallel to Washington Street that would swing to the east and link to the Southeast Expressway near Massachusetts Avenue. No decision has been made to either build or not build this major arterial.

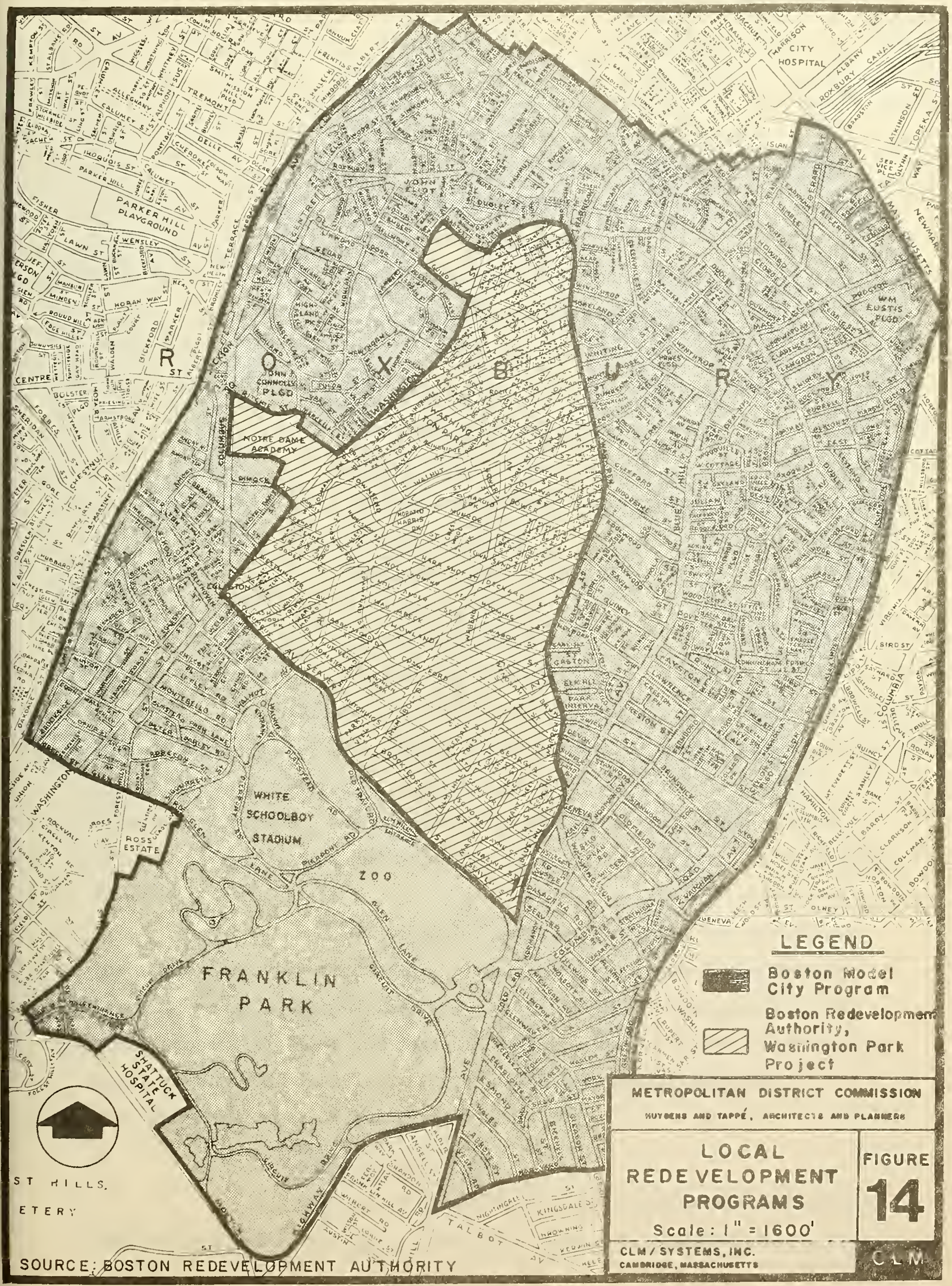
In general, it can be stated that the Forest Hills area will undergo significant changes over the next several years. The exact nature of these changes is, however, quite uncertain at this time.

The densely developed neighborhoods bordering the northern portions of Franklin Park are presently undergoing extensive programs of renewal and redevelopment. The two major programs are the Washington Park Urban Renewal Project and the Boston Model City Program.

(a) <u>Boston Redevelopment Authority</u>

The Boston Redevelopment Authority's Washington Park Urban Renewal Area is located directly to the north of the Zoo site, as shown in Figure 14. The goals and objectives of this project are designed to improve community life in the area through the construction renovation of physical facilities.

The most recent comprehensive progress report on the Washington Park Area is dated December, 1972. At that time 1,512 new residential units had been completed, 166 were under construction, and approximately 244 were proposed. Residential rehabilitation had been completed on 4,533 units, and was either committed or underway on 29 units. Additional completed construction included:


ROXBURY
FRANKLIN PARK
WHITE SCHOOLBOY STADIUM
ZOO
SHATTUCK STATE HOSPITAL
NOTRE DAME ACADEMY
JOHN CONNOLLY PLGD
PARKER HILL PLAYGROUND
CITY HOSPITAL
WM EUSTIS PLGD
ROSS ESTATE
LEGEND
Boston Model City Program
Boston Redevelopment Authority, Washington Park Project
METROPOLITAN DISTRICT COMMISSION
HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS
LOCAL REDEVELOPMENT PROGRAMS
Scale: 1" = 1600'
FIGURE 14
CLM/SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS
CLM
SOURCE: BOSTON REDEVELOPMENT AUTHORITY

YMCA

YMCA addition

Boys' Clubs of Boston, Roxbury Chapter

Neighborhood Shopping Center

Light Industrial Park

Five parks and playgrounds

Washington Park Community Park

M.D.C. skating rink and swimming pool

Outdoor sports and recreation facilities

Recreation and community center

Trotter Elementary School

Grove commercial development, Washington Street

Three churches

Roxbury Civic Center

- Police Station
- Courthouse

Sewer and water line improvements

Construction was underway on the Roxbury Ecumenical Center and on street and lighting improvements. Future projects being planned include a library at the Roxbury Civic Center, three public elementary schools, and a Roxbury Comprehensive Community Health Center. A light industrial development was also proposed for Washington Park.

The Boston Redevelopment Authority has recognized the necessity and desirability of a considerably upgraded zoo facility for the Boston Metropolitan Area. The BRA did express concern over some specific planning and design issues that have been or are currently being resolved through joint effort. These will be discussed in subsequent sections of this report.

(b) Boston Model City

The Boston Model City Area is comprised of Roxbury, North Dorchester, and part of Jamaica Plain. As a result, it includes

Franklin Park and the project site, as shown in Figure 14. The Model Cities Program was created by Congress in 1966 in an attempt to solve some of this country's urban problems. It was hoped that a comprehensive experimental program could be designed to improve the quality of life in the specified Model City Area.

A comprehensive plan and inventory was developed for the Model City Area, and subsequently numerous services have been made available to area residents. The following list includes some of the programs which are presently functioning in the Boston Model City Area:

- Family Life Centers-Medical and Social Services
- Model City Child Care Program
- Model City Drug Program
- Adult Education
- Higher Education Program
- Youth Program-education and recreational
- Street Academy-for (public) school dropouts
- Community Development Corporation
- City Services
- Programs for Spanish-speaking residents
- Programs for Children with learning problems
- Programs for the elderly:
  Senior Action Centers (5)
  Home Aide Program-housekeeping
  Nutrition Project-serving hot meals
  Supportive Services Program-handles housing and social security problems

Construction of facilities for these programs and for various housing improvement projects is generally done by private contractors, with the Model City Agency approving plans and monitoring progress of the work.

An important project which is planned for the near future is the development of part of the presently unused "Boch Rambler" site, lying across from Peabody Circle at the Zoo entrance. This site had been considered early in the Zoo design phase for potential joint use as a Model

City project and a site for Zoo parking. The joint use concept has been abandoned in deference to community plans, but could be reconsidered if the thinking of the community changes. Model City funds have been designated for the establishment of a Family Life Center to be located in the existing building. Architects are preparing preliminary drawings for this project. The exact use of the remainder of the site has not yet been determined, although current thinking within the Model Cities Planning Department is to attempt to redevelop the commercial strip along Blue Hill Avenue near the Zoo entrance in a manner that would complement the Zoo's African exhibit concept. The design is to convert existing stores to an African oriented theme, with suggested development including an import shop, (specializing in African and Asian imports), a fashion boutique, an African restaurant, a fabrics center, an African-American crafts center, and an African-Asian bookstore.

The Boston Model City Program is scheduled to end on June 30, 1974, but it is anticipated that a number of its activities will be continued in some form. The Mayor has indicated that Model City's planning function may be taken over by the City; the hospitals now associated with the various Family Life Centers may in some cases be able to continue their programs; and groups of citizens, as individuals or as non-profit corporations may continue other programs.

2. Traffic, Parking and Public Transportation

(a) Existing Traffic Conditions

The project area is served by five major thoroughfares, as shown in Figure 15. Circuit Drive (or Jewish War Veterans Drive), is a four-lane scenic road through Franklin Park which serves as a connector to the Arborway and areas to the west, with an existing annual average daily traffic (AADT) load of 11,200 vehicles per day. Blue Hill Avenue is an eight-lane, heavily travelled arterial running north-south, with an existing AADT of 48,700 vehicles. Columbia Road is a six-lane roadway to eastern areas. It connects with the Southeast Expressway, and carries 17,200 vpd. The fourth major connector is Seaver Street, a six-

lane facility providing local service to areas to the northwest of the park. Present AADT is 29,800 vehicles. Finally, Morton Street is a six-lane divided roadway providing service from the southeast, with an AADT of 29,000 vehicles near Cemetery Road. Most of this traffic travels to the William Casey Highway (Forest Hills overpass) which has an existing AADT of 42,000 vehicles. This in turn connects to the Arborway.

Secondary roads in the project area include the American Legion Highway, Talbot Avenue, Warren Street, Columbus Avenue, and Washington Street. These roads as well as the other major thoroghfares can be seen in Figures 1 and 15. Table 5 shows the posted speed limits as well as the operating speeds of the major roads.

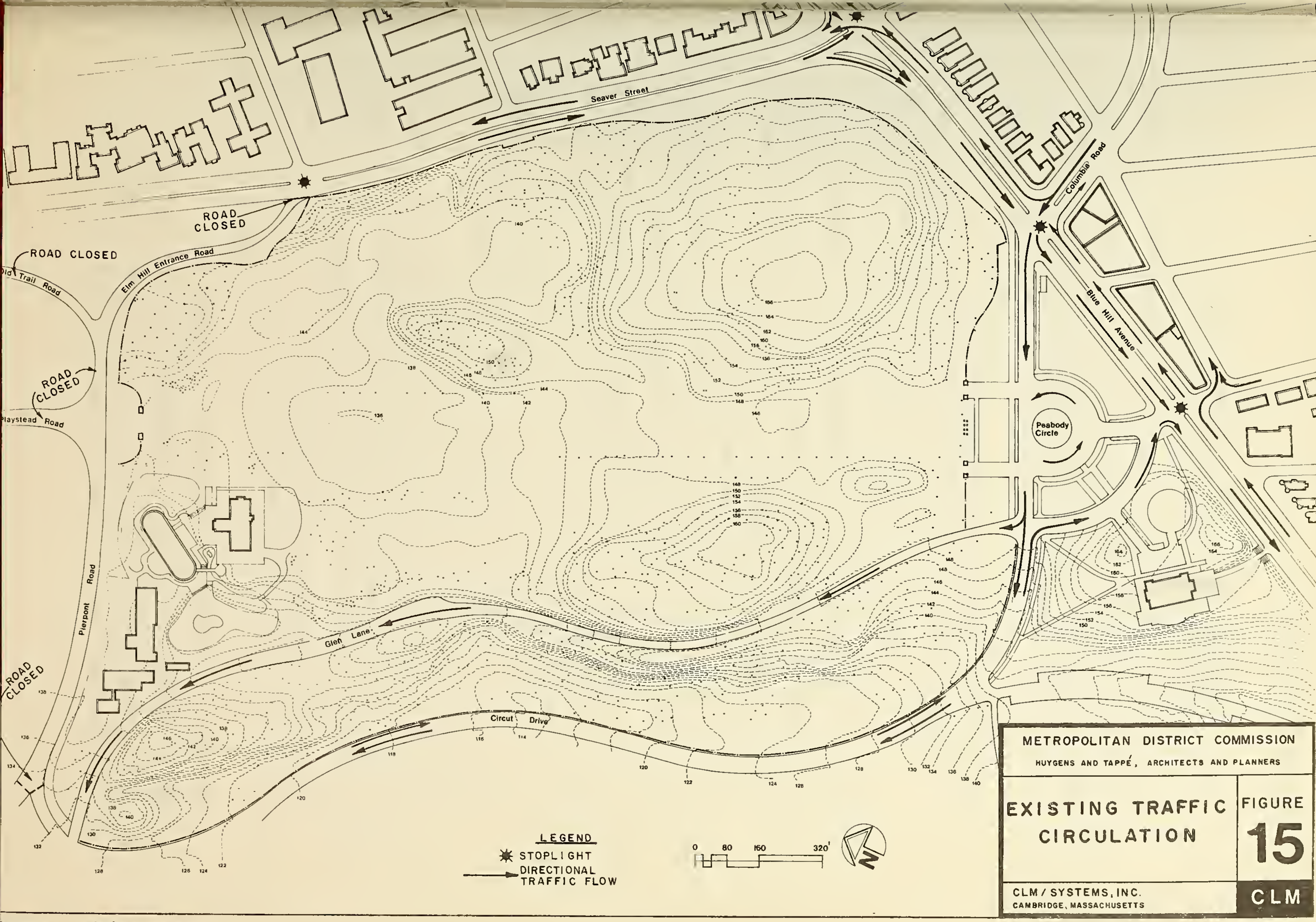
Most roads in the project area have a significant seasonal variation in traffic volumes, with the heaviest loads occurring during the summer. For example, near the project site, Blue Hill Avenue will have a weekday traffic volume of 53,800 vehicles during July, and 47,100 during March.[2] Table 6 shows the daily traffic volumes during the peak traffic season for both weekdays and Sundays[3]. (Winter volumes can be estimated at 87 percent of these peak values). This data has also been forecast for 1976, when the project will be completed, as well as for 1986, using an annual growth rate of 1.6 percent.

TABLE 5
SPEED LIMITS IN PROJECT AREA

Facility	Posted Speed Limit	Recorded Off-Peak Operating Speed
Blue Hill Avenue	35 mph	35 mph
Seaver Street	NA*	35 mph
Morton Street	45 mph	45 mph
American Legion Highway	40 mph	40 mph
Circuit Drive	30 mph	30 mph

*NA: Not Available

Source: Alan M. Voorhees & Associates



Source: CLM/Systems, Inc.

Table 7 shows the hourly traffic distributions on Blue Hill Avenue and Circuit Drive for both weekdays and Sundays. Circuit Drive and Morton Street follow the expected traffic patterns of commuter oriented roadways, with sharp morning and evening peaks between the hours of 7 to 9 a.m. and 4 to 6 p.m. Although Blue Hill Avenue does show these rush hour peaks, they are not as pronounced as on Circuit Drive.

Table 8 shows selected weekday and Sunday hourly traffic volumes estimated for 1976 and 1986 on Blue Hill Avenue, Circuit Drive, and Morton Street during the peak season. (1973 volumes are approximately 95 percent of those given for 1976). It should be noted that these values correspond to the traffic volumes on specific segments of these two roads. Because of the numerous intersecting side streets, the volumes may differ from block to block on the same street.

As shown in Table 8, traffic flow is quite heavy on Blue Hill Avenue, and may reach over 4,000 vehicles per hour on weekdays in 1976. Morton Street peak hour traffic is estimated at 2,555 vehicles, while 1100 vehicles are predicted for the peak hour on Circuit Drive. (This corresponds to 3800 vph on Blue Hill Avenue, 2427 vph on Morton Street and 1044 vph on Circuit Drive in 1973). The peak hour on Sundays for these roadways is at 3:00 to 4:00 p.m., when 2750 vehicles are forecast for Blue Hill Avenue, 617 for Circuit Drive, and 1914 for Morton Street in 1976.

In addition to the volume counts, several 30-minute classification counts were performed to determine the heavy-duty vehicle mix on the major roadways on both weekdays and Sundays. Heavy-duty truck traffic is not permitted on Circuit Drive or the Arborway connector (except to service the Zoo), but both Blue Hill Avenue and Seaver Street had an average of 7 percent heavy-duty vehicles during the week, and less than one percent on Sundays.

Approach capacities were calculated for major intersections using City of Boston turning movement counts, existing traffic signal timings, and approach geometrics as inventoried by Alan M. Voorhees & Associates. These capacities were then compared to the actual traffic

TABLE 6

AVERAGE TRAFFIC VOLUMES DURING PEAK SEASON *

(Vehicles per day)

acility	1973		1976**		1986**	
	Weekdays	Sundays	Weekdays	Sundays	Weekdays	Sundays
ue Hill Avenue between American Legion Highway and Glenway Rd.	53,800	43,700	56,425	45,833	66,136	53,720
ue Hill Avenue at Columbia Rd.	45,150	36,700	47,353	38,490	55,503	45,115
ue Hill at Seaver Street	41,500	33,600	43,525	35,240	51,016	41,305
rcuit Drive	12,400	8,400	13,005	8,810	15,243	10,326
aver Street at Blue Hill Avenue	32,900	29,300	34,506	30,730	40,434	36,018
olumbia Road	19,000	16,900	19,927	17,725	23,357	20,775
enway Road	17,450	15,500	18,300	16,256	21,451	19,054
orton Street	29,000	26,070	30,415	27,342	35,650	32,048

Off-Season traffic can be estimated at 87% of these values.

Future traffic levels were calculated assuming a 1.6% yearly increase.

urce: Alan M. Voorhees & Assoc.
CLM/Systems, Inc.

TABLE 7
HOURLY TRAFFIC DISTRIBUTIONS

(percent of 24 hour total)

TIME PERIOD	BLUE HILL AVE. Weekday	BLUE HILL AVE. Sunday	CIRCUIT DRIVE AND MORTON STREET Weekday	CIRCUIT DRIVE AND MORTON STREET Sunday
2 - 1 A.M.	1.9	4.9	1.4	3.5
- 2	1.2	4.8	0.8	2.4
2- 3	0.8	3.6	0.5	1.1
3- 4	0.5	2.4	0.4	0.8
4- 5	0.5	1.7	0.4	0.4
5- 6	1.2	1.0	0.9	0.6
6- 7	3.8	1.1	3.3	1.4
7- 8	6.2	1.7	7.1	2.6
8- 9	5.5	2.1	7.1	2.7
9- 10	4.5	2.8	5.8	3.2
1 - 11	4.1	3.7	4.9	5.1
1 - 12	4.6	4.6	4.5	6.0
1 - 1 P.M.	5.1	5.5	4.8	6.7
1- 2	5.5	5.7	5.0	6.8
2- 3	5.3	5.7	5.6	6.5
3- 4	6.7	6.0	6.3	7.0
4- 5	7.1	5.6	8.4	6.8
5- 6	6.9	5.3	8.5	6.1
6- 7	5.4	5.6	5.3	6.4
7- 8	5.6	6.0	4.9	5.9
8- 9	5.0	6.1	4.3	5.7
- 10	4.8	5.3	3.8	4.9
- 11	4.5	4.8	3.5	4.4
- 12	3.3	4.0	2.5	3.0

SOURCE: Alan M. Voorhees & Assoc.

TABLE 8
SELECTED PEAK SEASON HOURLY TRAFFIC VOLUMES[1]
(Vehicles Per Hour)

Time Period	BLUE HILL AVE[2]				CIRCUIT DIRVE[3]				MORTON STREET[4]			
	Weekdays		Sundays		Weekdays		Sundays		Weekdays		Sundays	
	1976	1986	1976	1986	1976	1986	1976	1986	1976	1986	1976	1986
Morning Peak Hour												
- Weekdays 7-8 A. M.	3,500	4,102			923	1,082			2,160	2,531		
- Sundays 11-12 A. M.			2,108	2,470			529	620			1,640	1,923
Off-Peak Hour												
- Weekdays 2-3 P. M.	2,990	3,505			728	853			1,703	1,996		
- Sundays 5-6 P. M.			2,429	2,847			537	629			1,668	1,955
Afternoon Peak Hour												
- Weekdays 4-5 P. M.	4,006	4,695			1092	1,280			2,555	2,995		
- Sundays 3-4 P. M.			2,750	3,223			617	723			1,914	2,243

1. Existing traffic volumes can be estimated at 95 percent of those given for 1976.

2. Blue Hill Avenue between American Legion Highway and Glenway Road.

3. Circuit Drive to the west of Zoo site.

4. Morton Street near Cemetary Road.

SOURCE: Alan M. Voorhees & Associates; CLM/Systems, Inc.

demand for the 4:30-5:30 p.m. peak period, which is considered the "worst case" situation. A volume to capacity (V/C) ratio was calculated to indicate the capability of the intersection to handle future traffic increases. This ratio can be categorized into three groupings:

- Volume to Capacity Ratio less than 0.75
  Those segments of the roadway which not only have sufficient capacity to handle existing volumes, but also provide for traffic growth in the near future.

- Volume to Capacity Ratio between 0.75 and 0.99
  Sections of roadway with sufficient capacity at present, but which, to a varying degree, provide for little future growth.

- Volume to Capacity Ratio 1.0 or Greater
  Indicates sections where additional capacity is currently required.

In addition, a level of service was determined for each intersection, using the <u>Highway Capacity Manual</u>.[4] Level of service definitions for stoplight controlled intersections are as follows:

A - No vehicle waits longer than one red indication. Typically the approach appears quite open, turning movements are easily made and nearly all drivers find freedom of operation.

B - This represents stable operation. Many drivers begin to feel somewhat restricted within platoons of vehicles.

C - Stable operation continues. Occasionally drivers may have to wait through more than one red indication, and back-up may develop behind turning vehicles. This is the level typically associated with urban design practice.

D - Delays to approaching vehicles may be substantial during short peaks within the peak period, but enough cycles with lower demand occur to permit periodic clearance of developing queues, thus preventing excess backups.

E - This represents the most vehicles that any particular intersection approach can accommodate. There may be long queues of vehicles waiting upstream of the intersection, and delays of several signal cycles are possible.

F - This represents jammed conditions. Backups from locations downstream or on the cross-street may restrict or prevent movement of vehicles out of the approach.

Tables 9, 10, and 11 summarize the results of this intersection analysis for existing, 1976, and 1986 "worst case" conditions respectively. Intersections with existing problems include: Blue Hill Avenue at Seaver Street because of the major left turn movements from the northbound Blue Hill Avenue approach, and Blue Hill Avenue at Columbia Road because of the high volume of the Columbia Road approach. These tables show that significant capacity is available on the street system around the Zoo to accommodate growth in the near future. The only intersection showing major capacity deficiencies by 1986 is Blue Hill Avenue at Seaver Street. The other intersections, (with the exception of Blue Hill Avenue at American Legion Highway), will each have only one approach at capacity.

It should be noted that near the proposed satellite parking lot, the Forest Hills rotary presently operates at a theoretical Level of Service D, although on observation, this rotary actually operates quite efficiently. Also, in the immediate vicinity of the satellite lot, the existing traffic conditions are very congested during peak hours. Due to the complicated network of streets in that area, analysis by individual intersections would not be meaningful. It can be stated, however, that during peak hours the whole Washington Street/Arborway area operates at Level of Service E.

In addition to this intersection analysis, Circuit Drive was examined to determine its future capabilities as an urban arterial, and it was found to have a V/C ratio of 0.29 and a Level of Service A.

TABLE 9

INTERSECTION ANALYSIS, EXISTING CONDITIONS

(4:30-5:30 P. M. Peak Period)

Approach	Existing Volume	Design Capacity*	Volume to Capacity Ratio	Existing Level of Service
Blue Hill at Seaver				
Blue Hill (SB)	949	1000	0.94	C
Blue Hill (NB)				
Left	530	350	1.51	E
Straight & Right	388	925	0.41	
Seaver (EB)				
Right	950	NA**	NA	C
Straight & Left	441	450	0.98	
Seaver (WB)	243	250	0.97	C
Blue Hill at Columbia				
Blue Hill (NB)	899	1480	0.61	A
Blue Hill (SB)	1498	2200	0.68	A
Columbia (WB)	1444	1100	1.31	E
Blue Hill at Glenway				
Blue Hill (NB)	1067	2400	0.44	A
Blue Hill (SB)	2045	2650	0.77	A
Glen Lane	861	1000	0.86	A
Blue Hill at American Legion Highway				
Blue Hill (NB)	975	1550	0.63	A
Blue Hill (SB)				
Right	1003	NA	NA	A
Straight	1292	2080	0.62	
American Legion Highway (EB)	445	700	0.64	A

*At Level of Service C

**NA - Does not apply

Source: Alan M. Voorhees & Associates

TABLE 10
INTERSECTION ANALYSIS, 1976 CONDITIONS
(4:30-5:30 P. M. Peak Period)

Approach	Volume	Design * Capacity	Volume to Capacity Ratio	Level of Service
Blue Hill at Seaver				
Blue Hill (SB)	992	1000	0.99	C
Blue Hill (NB)				
Left	554	350	1.58	E
Straight & Right	406	925	0.44	
Seaver (EB)				
Right	NA	NA**	NA	C/D
Straight & Left	461	450	1.02	
Seaver (WB)	254	250	1.02	C/D
Blue Hill at Columbia				
Blue Hill (NB)	940	1480	0.64	A
Blue Hill (SB)	1566	2200	0.71	A
Columbia (WB)	1510	1100	1.37	E
Blue Hill at Glenway				
Blue Hill (NB)	1116	2400	0.47	A
Blue Hill (SB)	2138	2650	0.81	A
Glen Lane	900	1000	0.90	B
Blue Hill at American Legion Highway				
Blue Hill (NB)	1020	1550	0.66	A
Blue Hill (SB)				
Right	NA	NA	NA	A
Straight	1351	2080	0.65	
American Legion Highway (EB)	465	700	0.66	A

*At Level of Service C

**NA - Does not apply

Source: Alan M. Voorhees & Associates

TABLE 11
INTERSECTION ANALYSIS
1986 CONDITIONS
(4:30 -5:30 p.m. Peak Period)

Approach	Volume	Design Capacity*	Volume to Capacity Ratio	Level of Service
Blue Hill at Seaver				
Blue Hill (SB)	1152	1000	1.15	D/E
Blue Hill (NB)				
Left	643	350	1.84	E
Straight & Right	471	925	0.51	
Seaver (EB)				
Right	NA	NA**	NA	D/E
Straight & Left	535	450	1.16	
Seaver (WB)	295	250	1.18	D/E
Blue Hill at Columbia				
Blue Hill (NB)	1090	1480	0.74	A
Blue Hill (SB)	1818	2200	0.83	A
Columbia (WB)	1752	1100	1.59	E
Blue Hill at Glenway				
Blue Hill (NB)	1295	2400	0.54	A
Blue Hill (SB)	2482	2650	0.94	B
Glen Lane	1045	1000	1.04	C/D
Blue Hill at American Legion Highway				
Blue Hill (NB)	1183	1550	0.76	A
Blue Hill (SB)				
Right	NA	NA	NA	A
Straight	1568	2080	0.75	
American Legion Highway (EB)	540	700	0.77	A

*At Level of Service C

**NA - Does not apply

Source: Alan M. Voorhees & Associates

Circuit Drive will continue to have ample capacity through 1986, and will remain at Level of Service A.

It should be noted that this analysis has been conducted for the "worst case" situation--that of the evening rush hour, when traffic is roughly 25 percent heavier than the average daylight hour. If this factor is applied to the volumes in Tables 9, 10, and 11, it becomes clear that any serious congestion that occurs is presently confined to the peak travel periods of 7:30 to 8:30 a.m. and 4:30 to 5:30 p.m.[5] If the traffic volumes continue to increase, and if no improvements are made to the intersections near the Zoo, this congestion problem will gradually spread to other hours of the day.

(b) Zoo Generated Traffic

Present attendance at the Children's Zoo averages around 2500 visitors on clear Sundays during the summer. Using the same assumptions that are being applied to the proposed Zoo expansion, this means that 90 percent of this number, or 2250 people arrive by private transportation. Assuming 3.5 people per car, this means that approximately 643 cars are presently travelling back and forth to the Zoo on a peak summer day. If this total is then distributed over the day using a modified version the arrival and departure patterns shown in Figure 33 (modified to reflect a two-hour rather than a three-hour stay) this means that during the peak hour (1:00 to 2:00 p.m.), there are approximately 85 arrivals and 91 departures, or a total of 176 vehicles either coming or going during the hour. If these vehicles are then distributed over the various roadways around the Zoo using directional splits estimated by Alan M. Voorhees and Associates, it can be clearly seen that existing Zoo traffic is a very small fraction of the total area traffic on the peak attendance days, and is even less significant on off-peak days. For example, it is estimated that 45 percent of Zoo traffic travels from the southwest up Circuit Drive, (and back the same way). This means that 80 Zoo generated cars travel on Circuit Drive between 1:00 and 2:00 p.m. on Sundays, when the existing traffic load is 570 vehicles. Zoo generated traffic on Blue Hill Avenue during the same time period is 53 cars, which is less than two percent of the present 2940 vehicles.

(c) Traffic Safety

Many intersections in the Franklin Park area have accident levels far above what might be expected with proper traffic control devices. (See Table 12). In particular, Blue Hill Avenue experiences a succession of dangerous intersections that could be improved considerably by both proper circulation patterns within many of the adjacent street networks and a good signal system operation, while the two traffic rotaries near the Forest Hills area are also dangerous and in need of improvement. The Massachusetts Department of Public Works is aware of these problems and has plans for future modifications.

The most dangerous intersection in the area is that of Blue Hill Avenue and Columbia Road at the Park entrance where 61 accidents occurred in 1970, as reported in the Areawide TOPICS Plan, Roxbury-Jamaica Plain, prepared for the Massachusetts Department of Public Works and the Federal Highway Administration in 1972. In addition, there were 37 accidents at the Blue Hill Avenue/Glenway Road intersection. At both these locations, operating conditions are hazardous due to the lack of separate traffic signal turning phases, separate turning lanes and adequate signal visibility.

Forty-five accidents occurred at the intersection of Blue Hill Avenue and Seaver Street in 1970. Present operating conditions are hazardous due in part to the lack of separate left turn storage for the movement from inbound Blue Hill Avenue to westbound Seaver Street. Signal visibility is also a problem at this intersection.

The intersection of Seaver Street and Elm Hill Avenue was the site of 31 accidents in 1970. Present traffic operating conditions are hazardous due to the lack of sufficient advance signal visibility and geometrics which do not adequately separate traffic movements.

In the vicinity of the proposed satellite parking garage, there were 42 accidents at the rotary where Circuit Drive, Forest Hills Street, and the William J. Casey Highway converge, and 46 accidents at the small "rotary" where Washington Street and the Arborway converge.

TABLE 12

DANGEROUS INTERSECTIONS NEAR FRANKLIN PARK

(No. of Accidents)

	Intersections	1970 Accidents
1.	Blue Hill Avenue/Circuit Drive Columbia Road	61
2.	Washington St. /Arborway Rotary	46
3.	Blue Hill Avenue/Seaver Street	45
4.	Forest Hills St. /Circuit Drive/William J. Casey Highway Rotary	42
5.	Blue Hill Avenue/Glenway Street	37
6.	Blue Hill Avenue/American Legion Highway	31
7.	Seaver Street/Elm Hill Avenue	31

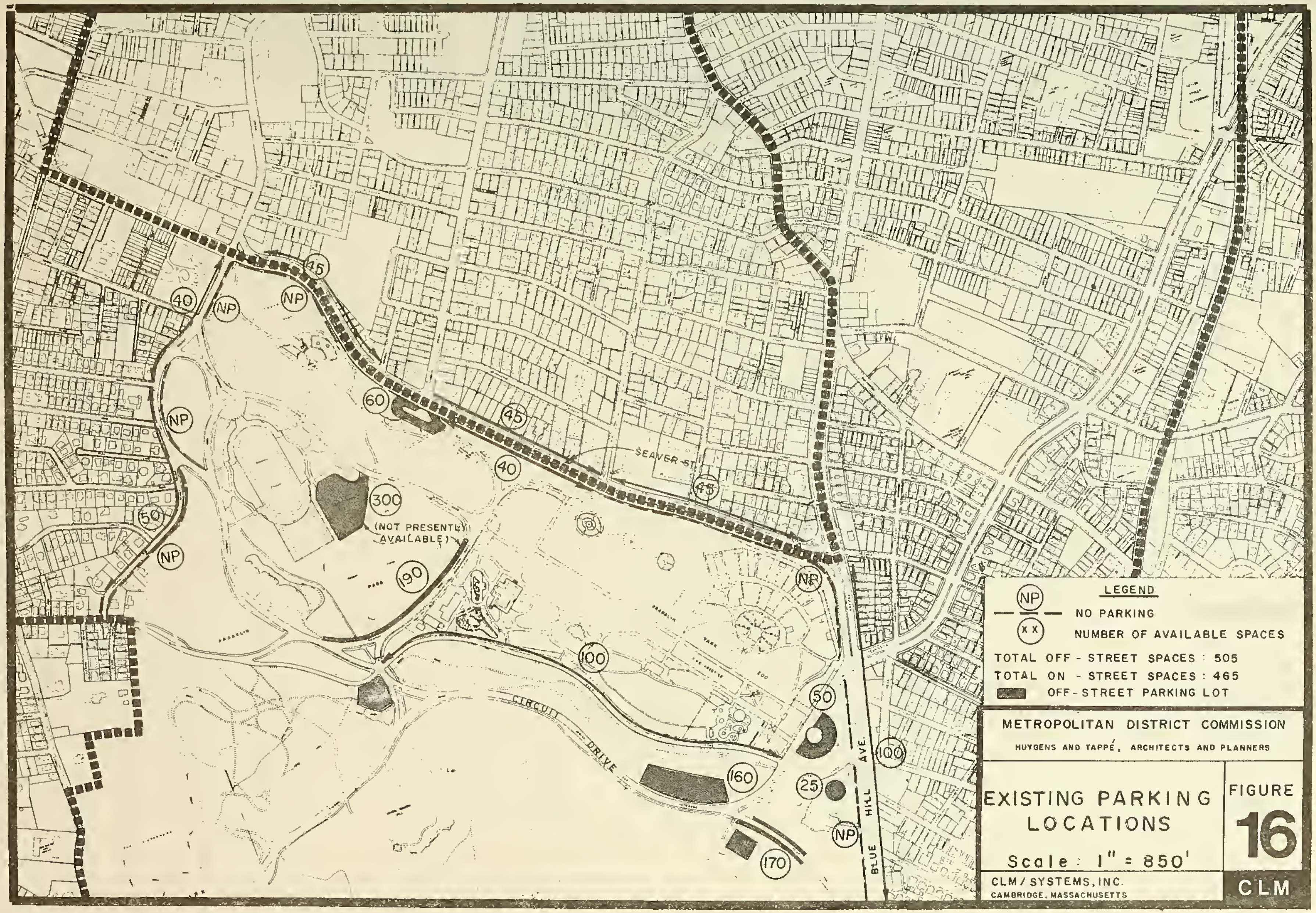
SOURCES: Areawide TOPICS Plan, Roxbury-Jamaica Plain (Boston) Massachusetts: Tippetts-Abbett-McCarthy-Stratton, Chestnut Hill, Mass., Sept. 1972.

Areawide TOPICS Plan, West Roxbury-Roslindale-Hyde Park, (Boston) Massachusetts: Tippetts-Abbett-McCarthy-Stratton, Chestnut Hill, Mass., Oct. 1972.

(d) Parking Availability

As shown in Figure 16, there are six off-street parking areas available to the general public and within easy walking distance to the Zoo. The total number of vehicles which can be accommodated by these lots is approximately 505. (See Table 13). All of these lots are within the Franklin Park complex.

There are two off-street parking areas within the complex which are currently not available for general use since the Park roads leading to them are blocked off. These lots, in the vicinity of White Stadium (300 spaces) and on Pierpont Road (190 spaces) can accommodate approximately 490 vehicles.



Source : CLM/Systems, Inc.

A spot inventory during the mid-afternoon period for a Saturday and Sunday indicates the actual usage of these six off-street lots. This weekend usage is shown in Table 13.

TABLE 13

EXISTING OFF-STREET PARKING

General Location	Approx. Number Of Spaces	Inventoried Parked Vehicles	
		Saturday	Sunday
A. "Sausage" Area	160	11	24
B. Off Circuit Drive, opposite the Golf Course Clubhouse	170	46	58
C. Around Peabody Circle	50	36	49
D. Seaver St. Lot, across from Humbolt Ave.	60	NA	NA
E. Circuit Drive at Pierpont Rd.	40	0	0
F. Refectory Area	25	0	0
Total	505		

NA: Not Available

SOURCE: Alan M. Voorhees & Associates

Also shown in Figure 16 is the existing number of on-street parking spaces on the streets contiguous to Franklin Park and within easy walking distance to the Zoo. At the present time, parking is allowed along Seaver Street (210 vehicles) except between 7:00 and 10:00 a.m., Monday thru Saturday. Parking is not allowed on the west (Zoo) side of

Blue Hill Avenue. However, approximately 100 spaces are available on the east side. Walnut Avenue and Sigourney Street combined can accommodate approximately 90 vehicles, but these spaces are quite distant from the site entrance. Other streets contiguous to the Park, including Forest Hills Avenue and the American Legion Highway have parking spaces, but they are not considered within easy walking distance. Within the Franklin Park Complex, Glen Lane presently accommodates approximately 100 vehicles on the north (Zoo) side of the street.

The areas to the northeast of Seaver Street and to the southeast of Blue Hill Avenue in the Zoo vicinity are largely residential and do have on-street parking. For the purpose of this analysis, however, these spaces are considered residential parking, and are unavailable to Zoo visitors. The other on-street spaces previously mentioned are presently used by both Zoo visitors and local residents. On an average weekday, approximately 25 to 50 cars may be parked at any one time on Glen Lane, while the other spaces on Blue Hill Avenue and Seaver Street are roughly 75 percent occupied. On sunny weekends, Glen Lane will have 50 or more parked cars on it, while the other street spaces are approximately 50 percent occupied.

Table 14 shows the available on-street parking within easy walking distance of the Zoo. Total available parking, both on-street and off-street, is thus 970 spaces at the present time, with parking demand coming from the Zoo, the golf course, and other local land uses.

TABLE 14

EXISTING ON-STREET PARKING

Street	Approximate Number of Spaces
1. Blue Hill Ave. (East Side)	100
2. Seaver St. (North Side) (No parking 7-10 a.m. Mon. thru Sat.)	175
3. Walnut Avenue	40
4. Sigourney Street	50
5. Glen Lane	100
Total	465

Source: Boston Redevelopment Authority; Alan M. Voorhees & Assoc. CLM/Systems, Inc.

(e) Zoo Parking Demand

As discussed previously, approximately 643 cars travel to the existing Zoo on a peak Sunday during the summer. These cars arrive and depart in a pattern similar to that shown in Figure 33 (although the length of stay is shorter than the three hours used in the figure). Thus roughly 116 cars arrive between 10:00 a.m. and 11:00 a.m., and 105 cars between 11:00 and 12:00 noon, at which time there are also a few departures. During the remainder of the day, the departures are slightly heavier than the arrivals, so it can be estimated that the peak parking accumulation from present Zoo operations is between 200 and 250 cars on a peak season Sunday. (Other days have sharply lower parking demands). This number of cars is easily handled by the 50 spaces at Peabody Circle, 160 spaces in the "Sausage" area, and the 100 spaces along Glen Lane, leaving many parking spaces in the area open for golfers or local residents.

(f) Public Transit Service

(1) Bus Transit

As shown in Figure 17, there are four bus routes which operate along the streets contiguous to Franklin Park. All routes with the exception of MBTA Route 21 operate every day. The cost per ride is 20 cents. The following is a brief description of each of the four routes:

- MBTA Route 16 between Egleston Square, Franklin Park and Andrew Station along Seaver Street, Blue Hill Avenue and Columbia Road. The headway along this route is 10 minutes or less on weekdays. On Saturdays, Sundays, or Holidays buses operate between Franklin Park and Andrew Station at a 20 minute headway.
- MBTA Route 21 between Ashmont and Forest Hills Stations along Morton Street.

Service along this route is available only during the weekday peak hours. Headways vary between 15 and 20 minutes.

- MBTA Route 22 between Ashmont and Dudley Stations along Blue Hill Avenue and Talbot Avenue.

  During the week, the headway along this route is 10 minutes or less. On Saturday the headways are 12 minutes and on Sundays and Holidays, service is at 20 minute intervals.

- MBTA Route 29 between Mattapan Square and and Egleston Square along Blue Hill Avenue and Seaver Street.

  On weekdays and Saturdays, the headway along this route is 10 minutes or less. On Sundays and Holidays, the headway varies between 12 and 15 minutes.

(2) Rail Transit

No MBTA rail transit lines have stations within the immediate vicinity of Franklin Park. However, as shown in Figure 17 the Orange Line, the Red Line, and the Green Line have stations in the general vicinity of the Zoo, with access directly via one of the previously described bus routes. The following is a brief description of each of the three rail transit lines in the area:

- Orange Line operating between Everett Station and Forest Hills.

  The headway along this line is 10 minutes or less on weekdays and Saturdays and between 10 and 15 minutes on Sundays and Holidays.

Bus service is available from Egleston Station to the Zoo via MBTA bus routes 16 and 29. The total time required for the connecting trip between Elgeston Station and the Zoo is approximately 11 minutes.

- Green Line Arborway operating between the Park Street subway station and Forest Hills.

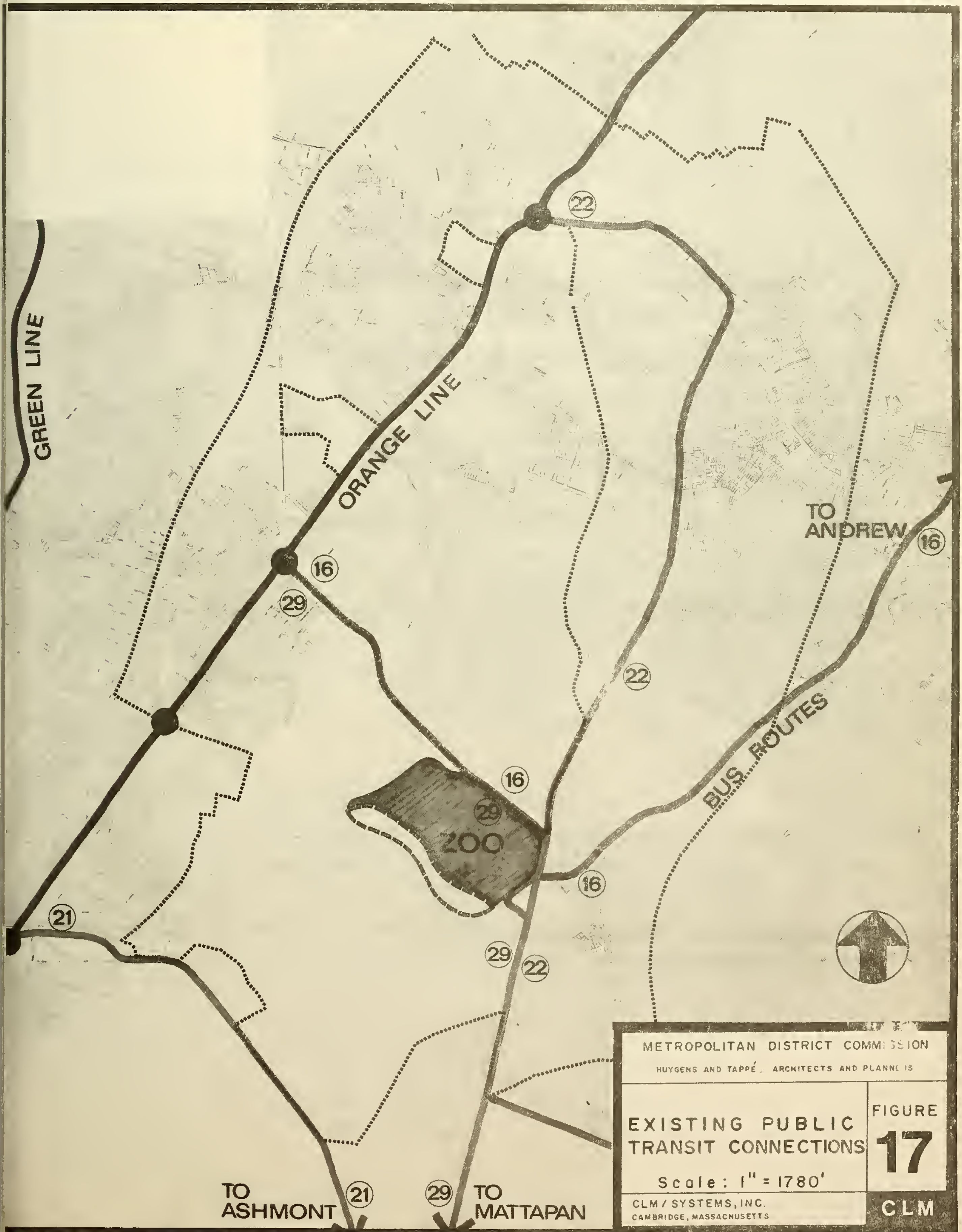
  The headway along this line is 10 minutes or less on weekdays and Saturdays and between 10 and 15 minutes on Sundays and Holidays.

  Connector service between Forest Hills and the intersection of Morton Street and Circuit Drive via MBTA bus route 21 is available at 15 to 20 minute headways only during the weekday peak hours. The total time required for the connecting trip between Forest Hills and the Zoo is approximately 21 minutes by bus and approximately 20 minutes walking the entire distance.

- Red Line operating between Harvard Square and Ashmont.

  The headway along this line is 10 minutes or less on weekdays and Saturdays and between 10 and 15 minutes on Sundays and Holidays.

  Connections can be made between the Red Line to the Zoo from the Andrew, Ashmont and Mattapan Stations via MBTA bus routes 16, 22, and 29 respectively. The total time required for the connecting trip between the Zoo and the three Red Line Stations is 25 minutes from Andrew Station, 20 minutes



SOURCE: ALAN M. VOORHEES & ASSOC.

from Ashmont Station and 20 minutes from Mattapan Station.

Table 15 summarizes connections which can be made between the Franklin Park Zoo and the three rapid transit rail lines which serve the general area.

TABLE 15

BUS CONNECTIONS BETWEEN

MBTA RAIL TRANSIT LINES AND FRANKLIN PARK

MBTA Transit Line	Connecting Station	Connecting Bus Route(s)	Weekend Headways	Approx. Distance From Park[1]	Total Travel Time[2]
Orange Line	Egleston Sta.	16, 29	12-15 min.[3]	1 mi.	11 min.
Green Line	Forest Hills	21	15-20 min. (weekday peak hours only)	1 mi.	21 min.[4] 20 min. walk
Red Line	Andrew Sta.	16	20 min.	3 mi.	25 min.
	Ashmont Sta.	22	20 min.	2 mi.	20 min.
	Mattapan Sq.	29	12-15 min.	2 1/2 mi.	20 min.

1. Scaled from MBTA System Route Map
2. Total bus travel time for connecting trip is assumed to be approximately equal to waiting time (one-half the bus headway) plus bus travel time (distance at 12 mph) plus walking time (distance at 3 mph).
3. Route 29 has 12-15 minute headways, route 16 has 20 minute headways.
4. The closest bus stop is the intersection of Morton Street and Circuit Drive (approximately 1/2 mile from the Park).

SOURCE: CLM/Systems, Inc.

(3) Future Public Transit Service to Franklin Park

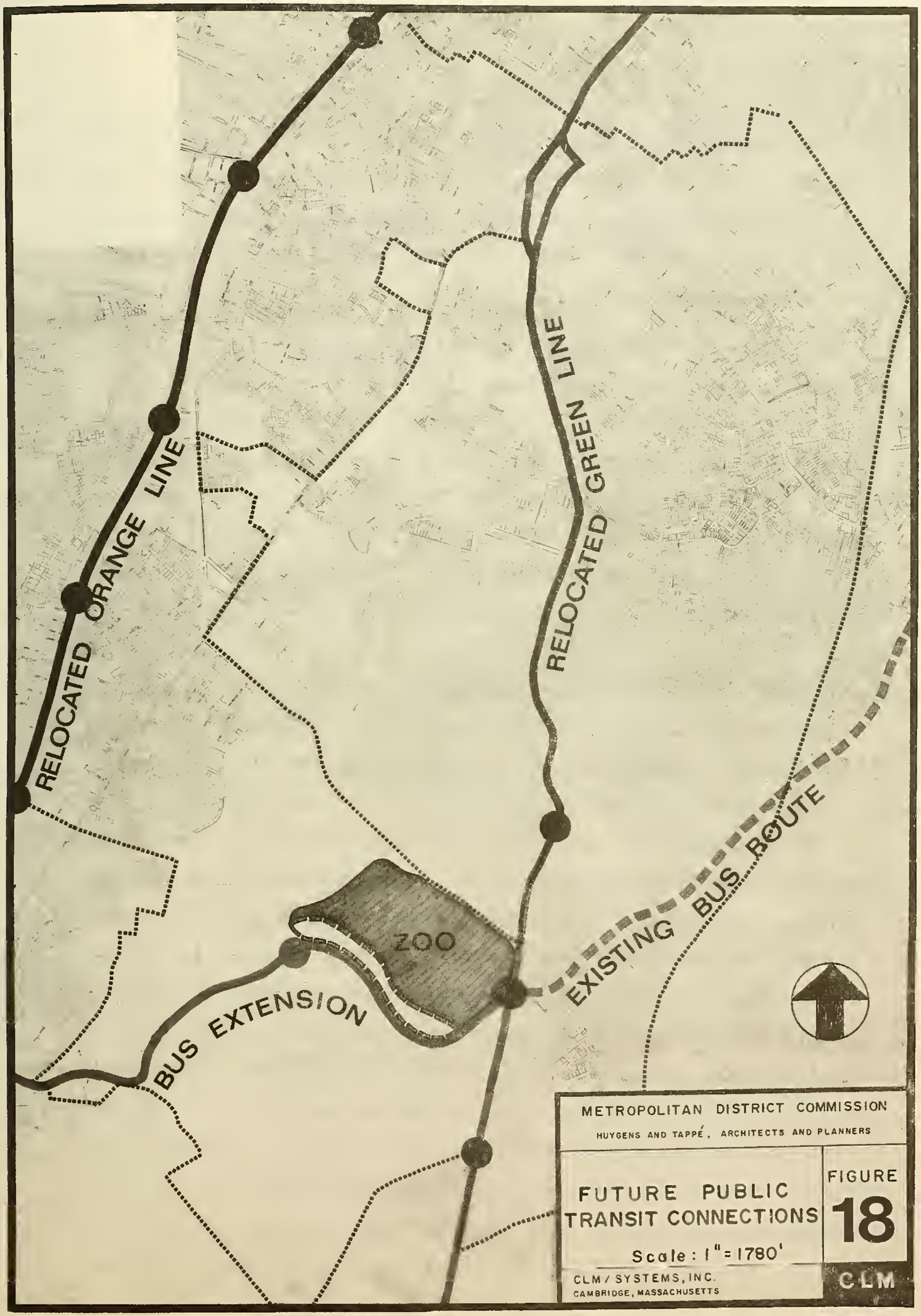
In approximately 10 years, the MBTA plans to begin detailed design of major rail transit changes in the vicinity of Franklin Park.[6] The proposed changes are shown in Figure 18 and include the following elements:

- Orange Line: Relocate Orange Line along right-of-way for Southwest Expressway. Remove existing elevated structure along Washington Street. Provide new stations as shown in Figure 18.

  (The MBTA is planning to remove the Arborway-Park Street trolley line operation when the Orange Line is relocated. Buses will replace this service).

- Green Line: A new service from Park Street Station to Mattapan Station. This line will pass along Tremont Street to Berkeley Street to Washington Street to Warren Street, up Warren Street to Blue Hill Avenue and along Blue Hill Avenue to Mattapan Station.

It is assumed that these changes will not be operational for at least 15 to 20 years.



SOURCE: ALAN M. VOORHEES & ASSOC.

3. Air Quality

There are no major sources of air pollution or noxious odors from industrial emissions in the vicinity of the project site. There are, however, a number of domestic incinerators used in apartment houses for solid waste disposal. In addition, there are several very heavily travelled roadways, and a Zoo incinerator used mostly for animal wastes.

(a) Carbon Monoxide Monitoring and Prediction

Over a period of three weeks from August 14th to September 4th of this year, (which included Labor Day weekend), a continuous sampling of ambient levels of carbon monoxide (CO) was conducted at the Endicott School, 40 feet from Blue Hill Avenue and 100 feet from the intersection of Blue Hill Avenue and Glenway Road. (Receptor A in Figure 22). This site was chosen because of its proximity to a heavily used intersection, as well as its location near the Zoo entrance.

Under the supervision of personnel of the Massachusetts Department of Public Health, Bureau of Air Pollution Control, the monitoring equipment was installed in the school and calibrated on a daily basis when possible.[7] (The sampling probe extended from a classroom on the northern side of the school). As a result of this effort, over 400 hours of valid CO measurements were obtained. These continuous measurements were averaged on an hourly basis, and the results are shown in Appendix B, along with associated wind data obtained from the Blue Hills weather station, which is roughly four miles from Franklin Park. A summary of this hourly data is provided in Table 16, which shows that the highest one hour average measured over the three week period was 15.0 parts per million (ppm), with the second highest 13.2 ppm. The national standard established by the Environmental Protection Agency for a one-hour CO average is 35 ppm, not to be exceeded more than once per year, so this one-hour standard was not exceeded at the project site.

TABLE 16
HIGHEST AND SECOND HIGHEST AMBIENT CARBON MONOXIDE LEVELS
(Measured from 8/14/73 to 9/4/73 at Endicott School)

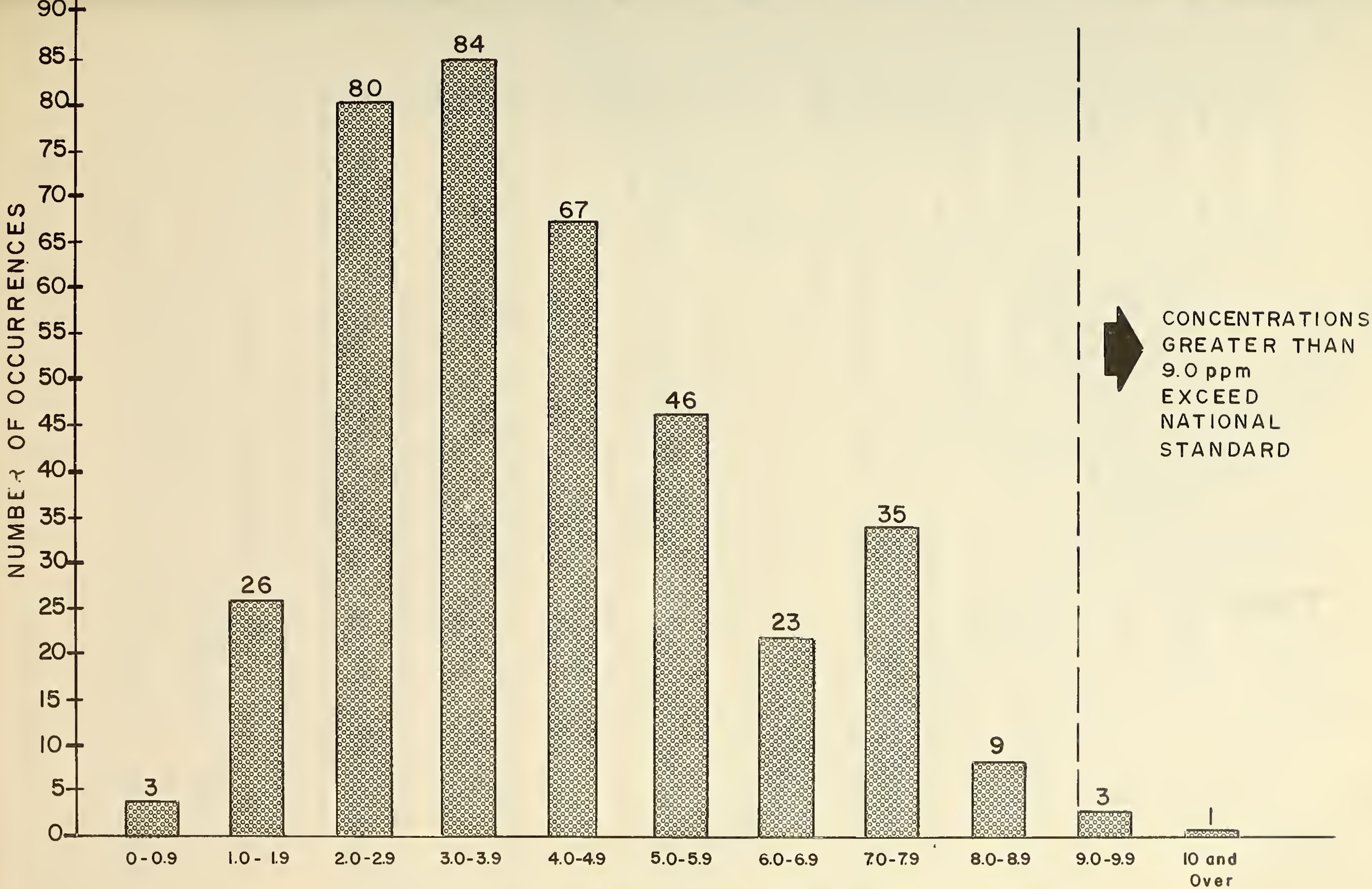
	Carbon Monoxide (ppm)			
	One-Hour Average		Eight-Hour Average	
	Highest	2nd Highest	Highest	2nd Highest
Endicott School	15.0	13.2	10.2	9.9
National Standard	35.0 (Maximum one-hour concentration not to be exceeded more than once per year)		9.0 (Maximum eight-hour avg. concentration not to be exceeded more than once per year)	

Source: CLM/Systems, Inc.

The hourly mreasurements were then averaged over continuous eight hour periods, the results of which are summarized in Table 17. The national ambient air quality standard for an eight-hour average CO concentration is 9 ppm, not to be exceeded more than once per year. As shown in Figure 19, this eight-hour standard was exceeded four times out of 377 valid averages. All four of these high averages occurred in succession on Saturday evening, September 1, 1973, which was part of the heavily travelled Labor Day weekend. (The weather that day was hot and humid, with scattered clouds and low winds from a westerly direction, changing to southeast). The highest eight-hour concentration was 10.2 ppm and the second highest was 9.9 ppm.

In summary, Figure 19 shows that carbon monoxide levels were generally low in the project area, although on occasion they approached (and four times exceeded), the national ambient air quality standard for an eight-hour average.

(MEASURED AT ENDICOTT SCHOOL, 8-14-73—9-4-73)



8 HOUR CARBON MONOXIDE CONCENTRATION (ppm)

(377 TOTAL 8-HOUR AVERAGES)

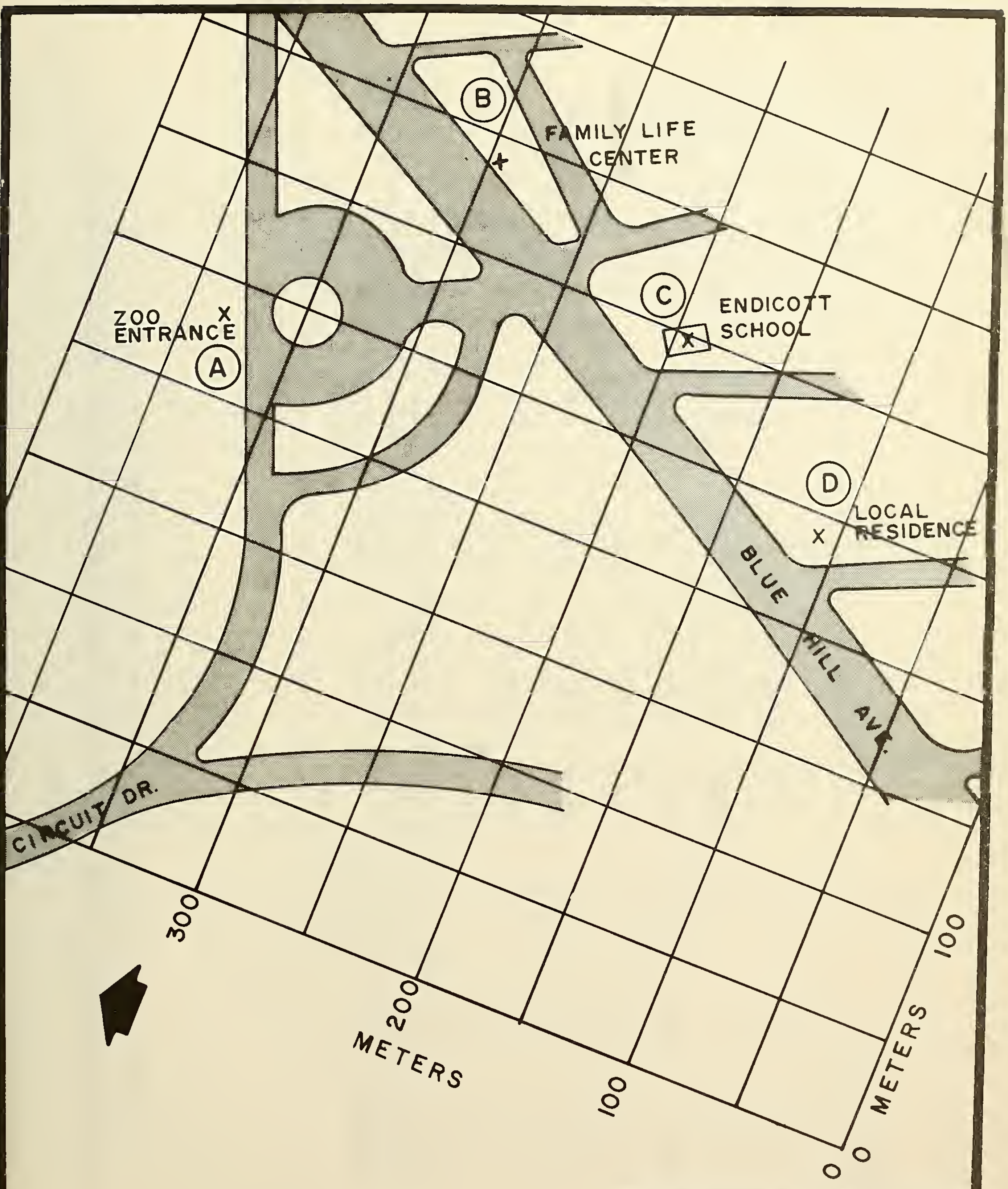
Source: CLM/Systems, Inc.

FIGURE 19

In addition to the continuous CO sampling, a computer model was used to predict existing concentrations at several different locations in the Zoo area under specified conditions.[8] Before this was done, seven different calibration runs were conducted to be compared with the measured concentrations at the Endicott School. These calibration runs were initialized using the expected traffic flow, wind speed, wind direction, and stability class for each specific time period. It was also necessary to input an emission factor for each road segment. It was found that an emission factor based on a low vehicle speed of 5 mph produced the best correlation. This may be because the CO monitor was located very close to a stoplight-controlled intersection where idling vehicles are generally present on either roadway at any given time. These idling vehicles would thus produce a significant portion of the measured CO.

Table 17 shows a summary of the calibration data and predicted results in comparison to the measured CO levels. It should be noted that the predicted values only account for the CO contributions from vehicles on Blue Hill Avenue and Circuit Drive near the Endicott School, and that variations due to buildings or other barriers are not included. Since it does not include any background levels, the model should predict lower concentrations than those measured, which is in fact the case in six out of seven calibration runs. Thus some amount of background CO should be added to the result of each calibration run in order to obtain a more complete prediction.

The purpose of this calibration effort was to show how the model's predictions differ from measured values. This is important when the model is used to predict trends in future concentrations at locations where there is no measured data. For example, Table 18 shows eight-hour average CO concentrations predicted by the computer model for four different receptor locations in the Zoo area.[9] (See Figure 20). These concentrations were calculated for the "worst case" conditions using existing traffic levels. (The wind direction that causes



METROPOLITAN DISTRICT COMMISSION
HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

MAP FOR AIR POLLUTION MODEL

FIGURE 20

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CLM

TABLE 17

COMPARISON OF MEASURED CARBON MONOXIDE CONCENTRATIONS WITH PREDICTED VALUES

(Measured at the Endicott School, August 14, 1973-September 4, 1973)

		Vehicles Per Hour		Emission Factor g/m sec.						
Date	Time	Blue Hill Avenue	Circuit Drive	Blue Hill Avenue	Circuit Drive	Wind Direction & Speed (mph)	Stability Class (1 to 5)	Measured CO Concentration (ppm)	Predicted CO Concentration (ppm)	Net Difference (ppm)
8/17	7- 8 am	3300	876	.112	.0296	NW 4	2	6.0	3.8	-2.2
8/17	8- 9 am	2940	833	.100	.0283	WNW 3	2	5.0	4.6	-0.4
8/17	9-10 am	2420	716	.072	.0208	W 2	2	4.0	5.1	+1.1
8/22	7- 8 pm	3000	605	.102	.0204	N 12	3	3.0	1.3	-1.7
8/23	4- 5 pm	3800	1035	.129	.0350	W 8	2	5.0	2.3	-2.7
8/27	7- 8 am	3300	876	.112	.0296	WSW 6	4	9.2	7.3	-1.9
8/27	4- 5 pm	3800	1035	.129	.0350	NNW 14	2	5.2	1.3	-3.9

Source: CLM/Systems, Inc.

the peak CO levels varies from receptor to receptor.) These predictions are all for a wind less than one mile per hour during stable atmospheric conditions. It should be noted that these predictions are subject to the same general variations from actual values that were seen in Table 17, that they do not include background CO levels, and also that these are peak values due to eight successive hours of meteorological conditions that occur quite infrequently in this region.

Under these conditions, however, the predicted CO concentrations in the Zoo area would range from 5.11 ppm at a local residence to 18.05 at the site of the proposed Model Cities Family Life Center. This high value is due largely to the location of the site, which is very close to both Blue Hill Avenue, Columbia Road, and Circuit Drive.

Table 18 also shows the predicted CO levels under average weather and traffic conditions. These values do not include background levels, so they are also expected to be low. Under these conditions, the CO concentrations range from 2.14 ppm to a high of 4.71 ppm, again at the Family Life Center.

TABLE 18

PREDICTED CARBON MONOXIDE CONCENTRATIONS NEAR ZOO ENTRANCE

Receptor	Wind Direction	Worst Case* Predicted 8-Hour CO Level (ppm)	Average Case** Predicted 8-Hour CO Level (ppm)
A: Zoo Entrance	S	9.87	2.22
B: Proposed Family Life Center	SW	18.05	4.71
C: Endicott School	NNW	8.47	2.77
D: Local Residence	NNW	5.11	2.14

* The "worst case" condition assumes wind speed less than one mile per hour, stable atmospheric conditions, and peak eight hour traffic flow.

** The average condition assumes a wind speed of 13 miles per hour, neutral stability, the same wind direction as the "worst case", and average daytime traffic flow.

Source: CLM/Systems, Inc.

Because of the late date of the decision to use a satellite parking garage at Forest Hills, it was not possible to monitor the air quality in that area. However, it is not unreasonable to assume that pollutant concentrations in that area will be similar to those near the Zoo entrance. This should be true for three main reasons.

(1) Large open spaces are located to the east (the Arnold Arboretum) and to the west (Franklin Park and Forest Hills Cemetery).

(2) Traffic volumes in the area (42,000 vpd on the William Casey Highway/Arborway, and 29,000 on Washington Street)[10] are actually significantly lower than those near the Zoo entrance, where Blue Hill Avenue, Circuit Drive, and Columbia Road converge (53,800, 12,400, and 19,000 vpd respectively).

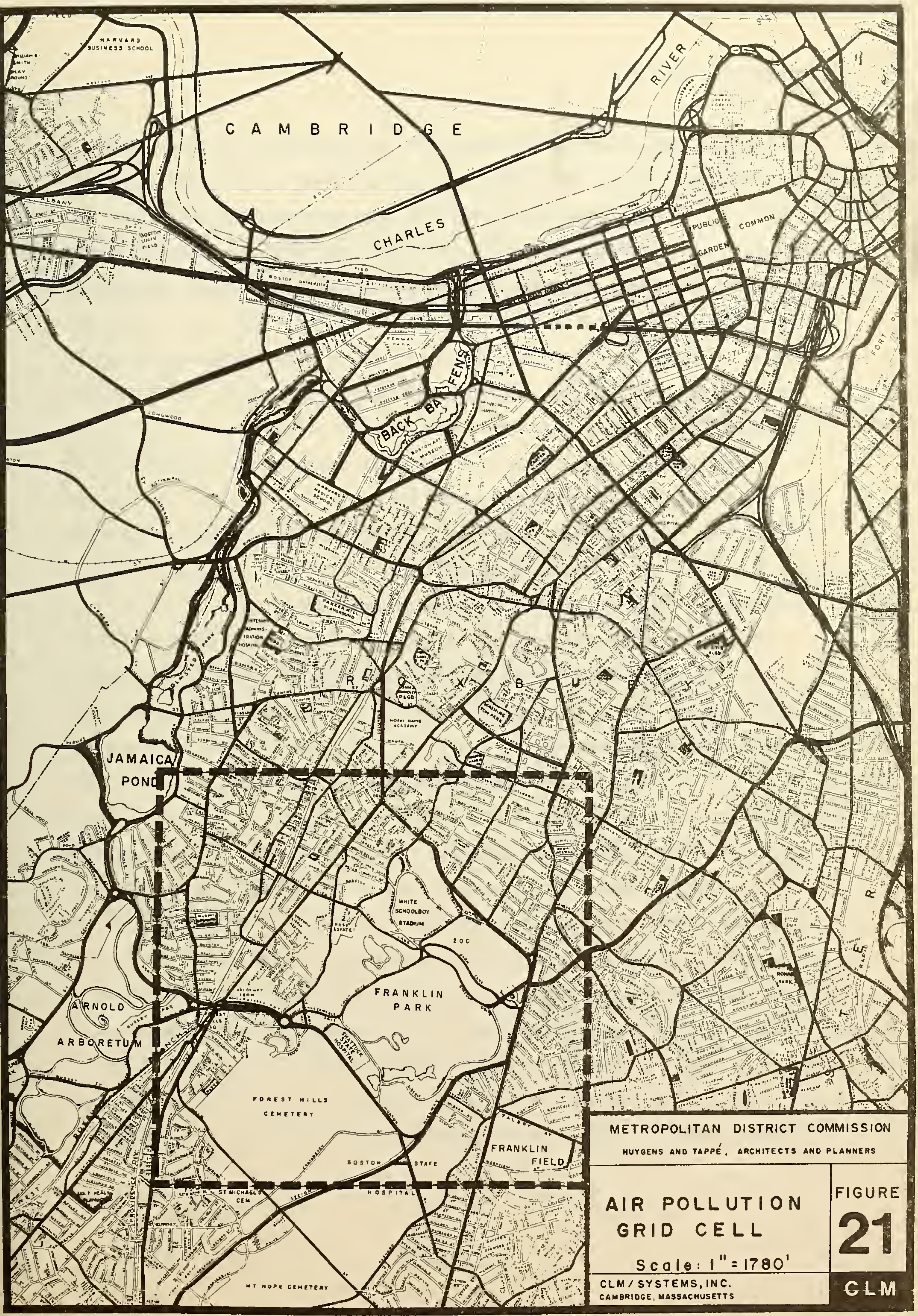
(3) The majority of this traffic moves smoothly up the Forest Hills overpass without any delay due to stoplight controls.

Thus for the purposes of this report, it will be assumed that the general air quality in the Forest Hills area is similar to that measured and predicted at the Zoo entrance.

(b) Emission Density Estimates

The complicated reaction processes of nitrogen oxides (NO_x) and hydrocarbon (HC) emissions in the atmosphere make it useful to examine these pollutants on an area source basis. Carbon monoxide will also be examined in this way for comparison purposes. Figure 21 shows one grid cell developed for the Environmental Protection Agency's "Proposed Transportation Control Plan for the Metropolitan Boston Air Quality Control Region." This grid cell includes the project site, portions of the major roadways serving the area, and the satellite parking garage site, (a total of four square miles).

Travel data developed for this grid cell as part of the EPA transporation plan for Boston is summarized in Table 19 . Using this data, it is possible to calculate a total daily quantity of motor



METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

AIR POLLUTION GRID CELL

Scale: 1" = 1780'

FIGURE 21

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vehicle generated emissions for the entire grid cell, using the latest emission factors for different vehicle categories. These emission factors were developed for each vehicle class taking into account the age distribution of the vehicles, the speed distributions within the grid cell, a weighted mileage factor, a deterioration factor for air pollution control equipment, and the latest EPA emission factors for each model year. Emission factors that account for the pollution control extension granted to automobile manufacturers by the EPA are not available at this time.

Table 20 shows the results of these calculations for 1973 conditions. The total motor vehicle generated hydrocarbon emissions in the project area are estimated to be 203 kg/mi^2/day. The total motor vehicle generated NO_x emissions are estimated at 166 kg/mi^2/day, and the total for CO is 1,278 kg/mi^2/day.

In the Transportation Control Plan, it is estimated that in the 250 square mile study area surrounding Boston, 137,900 kilograms of hydrocarbons were emitted by motor vehicles per day as of December 31, 1972. (There are no equivalent NO_x emission figures). This corresponds to an emission density of approximately 550 kg/mi^2/day, which is over twice the calculated level for the Zoo area.

These vehicle emissions must be added to the hydrocarbon emissions from stationary sources to provide a total emission density. Since detailed HC emission data is not available for the small project grid cell, it is assumed that the same quantity of HC emissions will enter the air from stationary sources in the Zoo area as from motor vehicles. (This estimate is expected to be high because the Zoo grid cell is predominately open space and does not contain many stationary HC sources).

Thus it is estimated that in addition to the 203 kg/mi^2/day vehicle generated HC emissions, there will be 203 kg/mi^2/day HC emissions from stationary sources, for a total HC emission density

TABLE 19

FRANKLIN PARK GRID CELL - 1973* TRAVEL DATA

Vehicle Type	Daily Vehicle Miles of Travel (VMT)
Light Duty Vehicles	110,337
Heavy Duty Vehicles (Diesel, 6000 lb. G.V.W.*)	2,727
Heavy Duty Vehicles (Gas, 6000 lb. G.V.W.)	4,720
TOTAL	117,781

*Gross Vehicle Weight

Proportion of Travel by Speed Classifications

Speed	Percentage of Total VMT
50	0.0
40	24.1
30	52.7
20	23.2
TOTAL	100.0

*This data was expanded from that given for 1970 by applying a 1.6% annual growth rate.

Source: Alan M. Voorhees and Assoc.

TABLE 20

1973 EMISSION DENSITIES FOR HYDROCARBONS, NITROGEN OXIDES, AND CARBON MONOXIDE
(Calculated for a 4-Square Mile Grid Cell)

	1973 Vehicle Miles Travelled (VMT)	HC Emission Factor (g/mi)	Daily HC Emissions (g/day)	NO_x Emission Factor (g/mi)	Daily NO_x Emissions (g/day)	CO Emission Factor (g/mi)	Daily CO Emission (g/day)
Light Duty Vehicles	110,334	6.53	720,481	4.73	521,880	41.65	4,595,411
Heavy Duty Vehicles (Diesel)	2,727	3.40	9,272	34.00	92,718	20.4	55,631
Heavy Duty Vehicles (Gas)	4,720	17.68	83,450	10.35	48,852	97.89	462,041
TOTALS	117,781		813,203		663,450		5,113,083

Hydrocarbons (HC):

$813,203 \text{ g/day} \div 4 \text{ mi}^2 \approx 203 \text{ kg/mi}^2\text{/day}$

Nitrogen Oxides (NO_x)

$663,450 \text{ g/day} \div 4 \text{ mi}^2 \approx 166 \text{ kg/mi}^2\text{/day}$

Carbon Monoxide (CO)

$5,113,083 \text{ g/day} \div 4 \text{ mi}^2 \approx 1,278 \text{ kg/mi}^2\text{/day}$

SOURCE: CLM/Systems, Inc.

of approximately 406 $kg/mi^2/day$ in the Zoo area. This is only one-third of the average 1,228 $kg/mi^2/day$ estimated for the entire Boston region in the Proposed Transportation Plan .

This plan also estimated that it would be necessary to reduce the areawide HC total to 97,000 kg/day in order to meet the national standards by 1975. This corresponds to an average of 388 $kg/mi^2/day$, which is only slightly lower than the conservative estimate for the existing Zoo area.

The same study estimated that 997,570 kilograms of carbon monoxide were emitted per day within the Region as of December 31, 1970. This corresponds to an emission density of 3,994 $kg/mi^2/day$, which is over three times the level calculated for the Zoo area. (The CO emission density calculated in the Transportation Control Plan is roughly similar throughout much of the Route 128 region, with the exception of the Boston core and East Boston areas). This study also pointed out that the emission density equivalent to the 9.0 ppm national standard is about 8000 $kg/mi^2/day$, which is over six times the calculated level in the project grid cell.

It should be emphasized that these calculations only indicate an average pollutant level over the grid cell. Since the area around the Zoo is predominantly open space, it seems reasonable that these calculations would be lower than those from surrounding more densly populated grid cells.

The preceeding discussion has attempted to show the total quantity of HC and CO emissions in the Zoo area in relation to those from the entire Boston region. From this point of view, although the project site is located very close to the most densly populated sections of the region, hydrocarbon and carbon monoxide emissions are roughly one-third of the average over the 250 square mile area. It is not possible to relate the HC or NO_x emissions to the national ambient air quality standards, although it is possible for CO. This is because of the complex manner in which HC and NO_x react to form photochemical oxidants in the

atmosphere over the entire metropolitan area. These two pollutants must be examined in a regional context.

The values given in this section will be used in comparison with projected future levels to show the magnitude of the Zoo impact on air quality. All that can realistically be said about the local levels of HC and NO_x is that since the project site lies within the Boston Air Quality Control Region where these standards are occasionally exceeded, then the local concentrations may also occasionally exceed the national standards. This is true even though the project grid cell, (Figure 21) is largely open space and is, by itself, not a major emission source.

(c) Incinerator

The existing Zoo operates an incinerator to dispose of restricted animal bedding and wastes, dead animals, and certain trash items. The unit is approximately 10 years old, and is a single-chamber pathological type incinerator:

> These are incinerators used to dispose of animal remains and other organic material of high moisture content. Generally, these units are in a size range of 50 to 100 pounds (22.7 to 45.4 kilograms) per hour. Wastes are burned on a hearth in the combustion chamber. The units are equipped with combustion controls and afterburners to ensure good combustion and minimal emissions.[11]

This incinerator is operated around two hours per day, disposing of approximately 2,000 pounds of waste each week.[12]

The quantity of pollutants emitted by this incinerator is small, even though it is 10 years old. Sulfur oxides, carbon monoxide, and hydrocarbon emissions are assumed negligible, while approximately eight pounds of particulates and three pounds of nitrogen oxides are emitted each week, or 0.6 and 0.225 pounds per hour of operation respectively. To date, there have been no complaints against this incinerator filed with the State Department of Public Health.

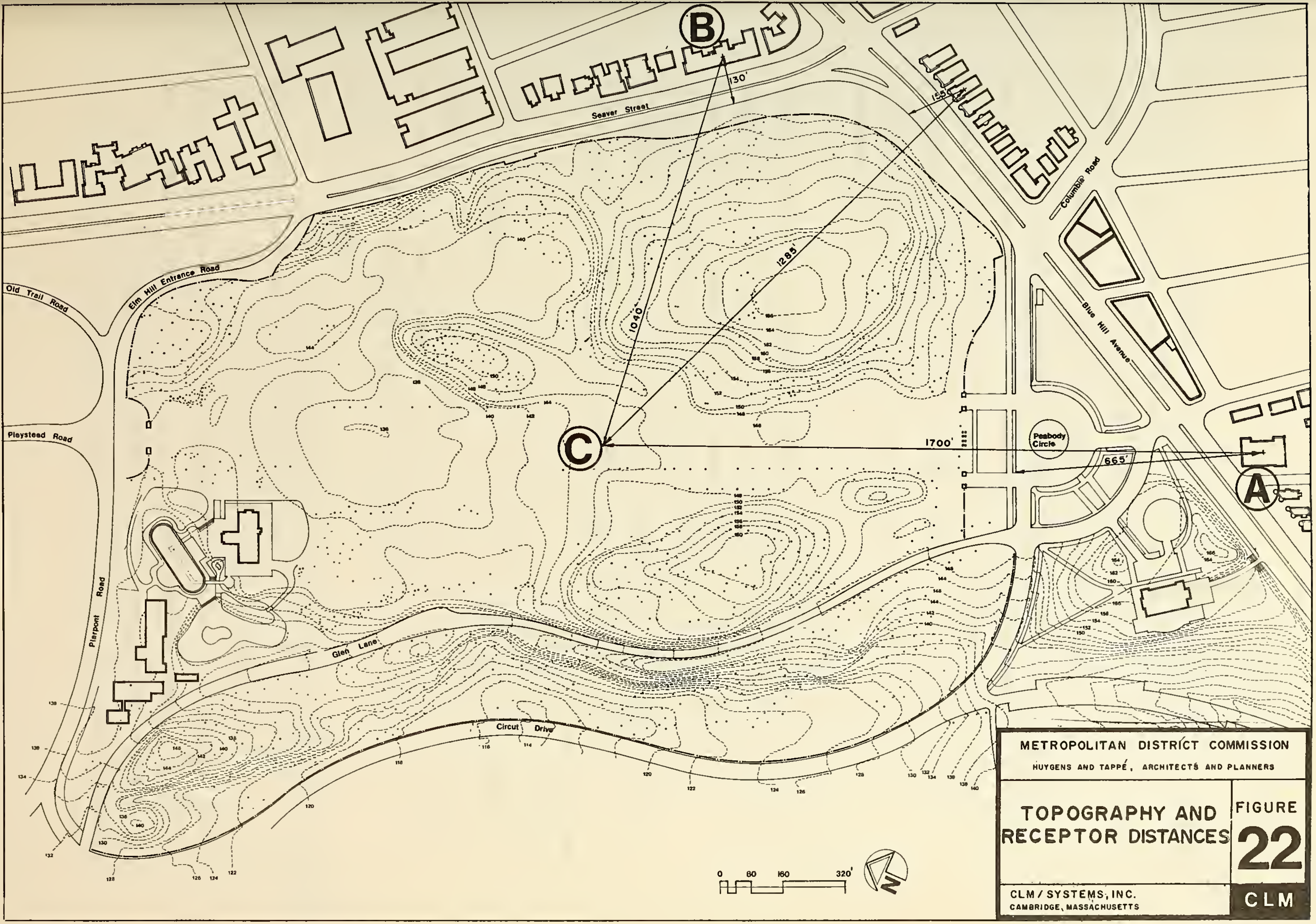
4. Noise Levels

The project site is bordered by several heavily travelled roadways whose traffic generates a significant amount of noise. Other noise sources such as heavy industries or airports are not located in the project vicinity. Thus, since traffic is the dominant noise factor in the area, and accurate traffic data is available, the National Cooperative Highway Research Program Report 117, Highway Noise, A Design Guide for Highway Engineers was utilized for calculations of existing noise levels at three different receptor locations on or near the project site.

Receptor A is the William E. Endicott School located next to the intersection of Blue Hill Avenue and Glenway Road, receptor B is an apartment house near the Seaver Street and Blue Hill Avenue intersection, and receptor C is the approximate center of the Zoo grounds. These locations are shown in Figure 22 .

An additional receptor (at the Washington Hospital) was examined in the Forest Hills area. This site was chosen because it represents the closest sensitive receptor to the Casey Highway/Arborway area. The nearest residence is nearly 600 feet from these streets.

In the vicinity of the proposed satellite parking garage, two additonal non-vehicular sources of noise are the elevated MBTA transit line and the Penn Central mainline. Noise from both of these systems can be as high as 80 or 90 dBA at 50 feet, but its occurrence is only intermittent and of short duration relative to the constant noise from trucks and automobiles. It is estimated that the MBTA Orange Line headway is around five minutes, so roughly 25 to 30 trains would stop at Forest Hills during peak hours. During the same one-hour period, over five times as many trucks might pass through the streets in the area. In general, it is obvious that the noise from train and subway sources will dominate over traffic noise for short periods, especially at receptors close to the elevated. Since future Zoo traffic will converge on the satellite parking site which is only 200 feet from the elevated MBTA tracks, it is estimated that the peak or (or L_{10}) noise level in that area would



METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

TOPOGRAPHY AND RECEPTOR DISTANCES

FIGURE 22

CLM / SYSTEMS, INC.
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be between 70 and 80 dBA. At other receptor locations further removed from the transit line, the noise levels will be those associated with vehicular traffic on local streets. This is especially true at the hospital receptor, which lies over 600 feet from the transit line.

The local traffic data discussed previously was utilized in the noise calculations, with adjustments made for topography, buildings, barriers, depressed or elevated roadways, changes in grade, surface roughness, vegetation, traffic signals, and so on. A noise level was calculated for each receptor location during a peak period and an off-peak period for both weekdays and Sundays.

Table 21 shows the calculated peak hour traffic noise levels for both weekdays and Sundays. (In this Table, the L_{10} level can be thought of as the peak noise level, exceeded less than 10 percent of the time, while L_{50} represents the average level exceeded less than 50 percent of the time). The off-peak noise levels (1:00-2:00 p. m. weekdays, 10:00-11:00 a. m. Sundays) were never more than two dBA lower than those during peak hours at these particular receptors.

It was found that except for the receptor in the center of the Zoo, (C), the recommended noise guidelines for each receptor type are presently exceeded during peak hours on both weekends and weekdays. Weekdays are noisier of course, but the levels are still exceeded on weekends. It should also be noted that traffic flow in the project area on Saturdays is roughly equivalent to weekday flow, so the same calculations apply.

Table 21 also shows that the weekdav high noise levels in the project area are almost entirely due to truck noise. Since the noise measurement unit (dBA) is a logarithmic quantity, the sum of two noise sources is generally close to the value of the noisiest source. For example, adding truck noise of 83 dBA to car noise of 63 dBA yields a total noise level of 83 dBA. On Sundays, truck traffic is less than one percent of the hourly volume, so automobile noise predominates. Since the total traffic

TABLE 21

EXISTING OUTDOOR NOISE LEVELS AT SELECTED RECEPTORS
(Noise Levels in dBA)

	Receptors											
	A			B			C			Washington Hospital		
Weekday	Trucks	Cars	Total	Trucks	Cars	Total	Trucks	Cars	Total	Trucks	Cars	Total
Peak Hour L_{10} (4:30-5:30 pm)	83	63	83	84	68	84	57	41	57	62	60	64
Peak Hour L_{50} (4:30-5:30 pm)	73	60	73	69	60	69	51	37	51	57	58	61
Sundays												
Peak Hour L_{10} (1:00-2:00 pm)	NEG[1]	63	63	NEG	63	63	NEG	41	41	NEG	57	57
Peak Hour L_{50} (1:00-2:00 pm)	NEG	60	60	NEG	58	58	NEG	37	37	NEG	55	55
Recommended Daytime Levels	School[2]			Residence[2]			Recreation Area[3]			Hospital[2]		
$-L_{10}$	61			56	56		70			56		
$-L_{50}$	55			50	50		NA[4]			50		

1 NEG - Negligible

2 Recommended Design Criteria from National Cooperative Highway Research Program Report 117

3 Design noise level from Federal Highway Administration PPM 90-2

4 NA - Not Available

Source: CLM/Systems, Inc.

volumes are quite heavy, this car noise still exceeds the recommended levels for residences.

In summary then, it can be stated that the existing volume of heavy trucks on Blue Hill Avenue, Seaver Street, and Washington Street creates weekday noise levels that significantly exceed recommended levels at selected receptors (except on the Zoo grounds). On Sunday, the truck flow is reduced, so automobiles become more of a noise factor, but the total traffic volume in these areas is still sufficiently high that the noise exceeds appropriate recommended levels. In the Forest Hills area, train and elevated MBTA operations will produce the L_{10} or peak levels at those receptors close to the tracks. At more remote locations, the vehicular traffic on local streets will become important, as described above.

5. Aesthetics and Public Attitude

The existing Franklin Park is in relatively poor condition due to neglect and insufficient maintenance over the years. The golf course needs extensive work, the wooded areas are choked with weeds and undergrowth, many trees need pruning and limb work, and in general, although the park has tremendous potential as a scenic urban park, this potential is not being fulfilled at this time. Many sections are run-down and overgrown, while others are considered unsafe and are avoided by the public.

Accurate crime reports are difficult to obtain for the Park itself, but many people in the Boston area do not visit Franklin Park because they fear being attacked or robbed in the area. A Metropolitan Area Planning Council report on "Criminal Activity and Vandalism" in the Olmsted Park System states that the main offenses reported within the Park are auto theft and robbery.

Crime in the Park has been reduced in the last year due to more police surveillance and the closing of certain roads to automobile traffic, but fear associated with the area still persists to a great degree. Until this fear is removed, Franklin Park will remain a neighborhood park rather than the regional facility it was intended to be.

Beyond the borders of Franklin Park and other nearby open spaces (cemeteries, hospitals, etc.), the area is densely developed and is in a generally deteriorating condition. Near the satellite parking location, the existence of the elevated MBTA Orange Line, the Penn Central mainline, and the elevated Casey Highway, plus old wood frame buildings and a large storage lot for trolleys and buses all combine to produce an area of little aesthetic value.

6. Olmsted Park System

Frederick Law Olmsted, acknowledged as the first American landscape architect, was the creator of Boston's extensive park system. Olmsted's first major achievement was the design of Central Park, New York, in 1858. About fifteen years later, after having achieved considerable fame as a park designer, Olmsted was retained by the Boston Park Commission as the Landscape Architect for the Back Bay Fens, the Muddy River, Jamaica Pond, the Arnold Arboretum, and Franklin Park.

There were three purposes behind Olmsted's original park system: to create needed municipal open space while solving an engineering problem (specifically the flooding and resulting pollution problems in the Fens area); to link newly annexed parts of the city with its historic center; and to provide a variety of forms of recreation.

The original park system included Boston's existing parks, the Common, and the Public Garden, which were linked to the Olmsted Plan by the Commonwealth Avenue Mall. Planning for the system was significantly influenced by the carriage society of the time. It was expected that park users would follow the inter-connected series of

greenways from the downtown Common through the Back Bay Fens, the Muddy River, Olmsted Park, the Arborway, Jamaica Pond, the Arnold Arboretum, arriving finally at Franklin Park, (See Figure 1). This large, regional-sized country park was to be the goal of a Sunday afternoon's drive, and was designed mainly to give urban dwellers an opportunity to experience the variety and beauty of a natural setting.

The major portion of the park system was completed in 1900. (Olmsted's design for the park system was carried out much as he envisioned, except in Franklin Park where certain design details were not completed). Over the years, however, changes have been made in or near many of the parks. For example: in the early 1960's the Back Bay Fens and Charlesgate were divided by the Massachusetts Turnpike Authority; the on/off ramps of Storrow Drive were built over the Fens near Charlesgate and a Sears parking lot was built at Brookline Avenue. Changes to Franklin Park will be discussed in detail in the next section

The park system was placed on the National Register of Historic places in December, 1971. Its official recognition was based on the following statement of significance:

> The comprehensive park system which Frederick Law Olmsted Sr. planned for the City of Boston in the late 1870's is one of the nation's outstanding examples of a multi-use open space and the landscape architect's finest design project in New England. Olmsted's work on the system, which became known as the "Emerald Necklace around Boston", created a strong precedent, for it included all the design and planning elements which later landscape architects have applied to regional planning on a large scale. [13]

Components included at that time were: Back Bay Fens, Muddy River, Olmsted Park, Jamaica Park, Arborway and Franklin Park. (The Arboretum had been declared a National Historic Landmark previously). Protection for sites on the National Register comes under the 1966 Historic Preservation Act. This provides that anyone planning a

project involving Federal funds or a Federal license must notify the President's Advisory Council on Historic Preservation if the project could result in possible harm to the Historic Site.

(a) Olmsted Historic District

A bill has been presented several times to the Massachusetts Legislature which calls for the establishment of the Olmsted Historic District. This District would include the Back Bay Fens, the Riverway, the Jamaicaway, Olmsted Park, the Arborway, and the Arnold Arboretum.

The creation of such a Historic District would permit control of construction in areas adjacent to parklands, as well as limiting changes in the parks themselves.

While the District does not include Franklin Park, it is anticipated that if the bill is ever passed, an effort may be made to extend the District to include Franklin Park. This proposal has been presented to the Legislature three times, but has never been able to secure the necessary approval.

7. Franklin Park

(a) History

In the early 1880's the City of Boston acquired approximately 500 acres of land in West Roxbury for the purpose of creating the large rural park that was to be the terminus of Olmsted's Park System. Three hundre and thirty-four acres were devoted to the Country Park, which, in Olmsted's words, was "....designed to be prepared and taken care of exclusively with reference to the enjoyment of rural scenery...."[14] Olmsted suggested that picnics, small family parties, archery and tennis might suitably take place in the Country Park, along with tennis and croquet in Ellicottdale. A dairy was planned for Scarboro Hill, which was to supply refreshments such as fresh milk and eggs. In addition to the Country Park and its components, Olmsted designated ten separate secondary uses for the remainder of Franklin Park which

are shown in Figure 23 and are described briefly as follows:

The Playstead: 30 acres for athletics and spectator events, with refreshment stand built on a rock outcropping called the Overlook.

The Greeting: a tree-lined series of parallel carriage roads and walkways half a mile in length.

The Music Court: an outdoor concert area.

The Little Folks Fair: a children's area with swings, toy booths, goat carriages, etc.

The Deer Park: an area for a small herd of deer.

The Refectory: an outdoor refreshment concession.

Long Crouch Woods: "...to be held subject to lease to a suitable organization for a Zoological Garden."[15]

The Steading: for Commissioner's Offices.

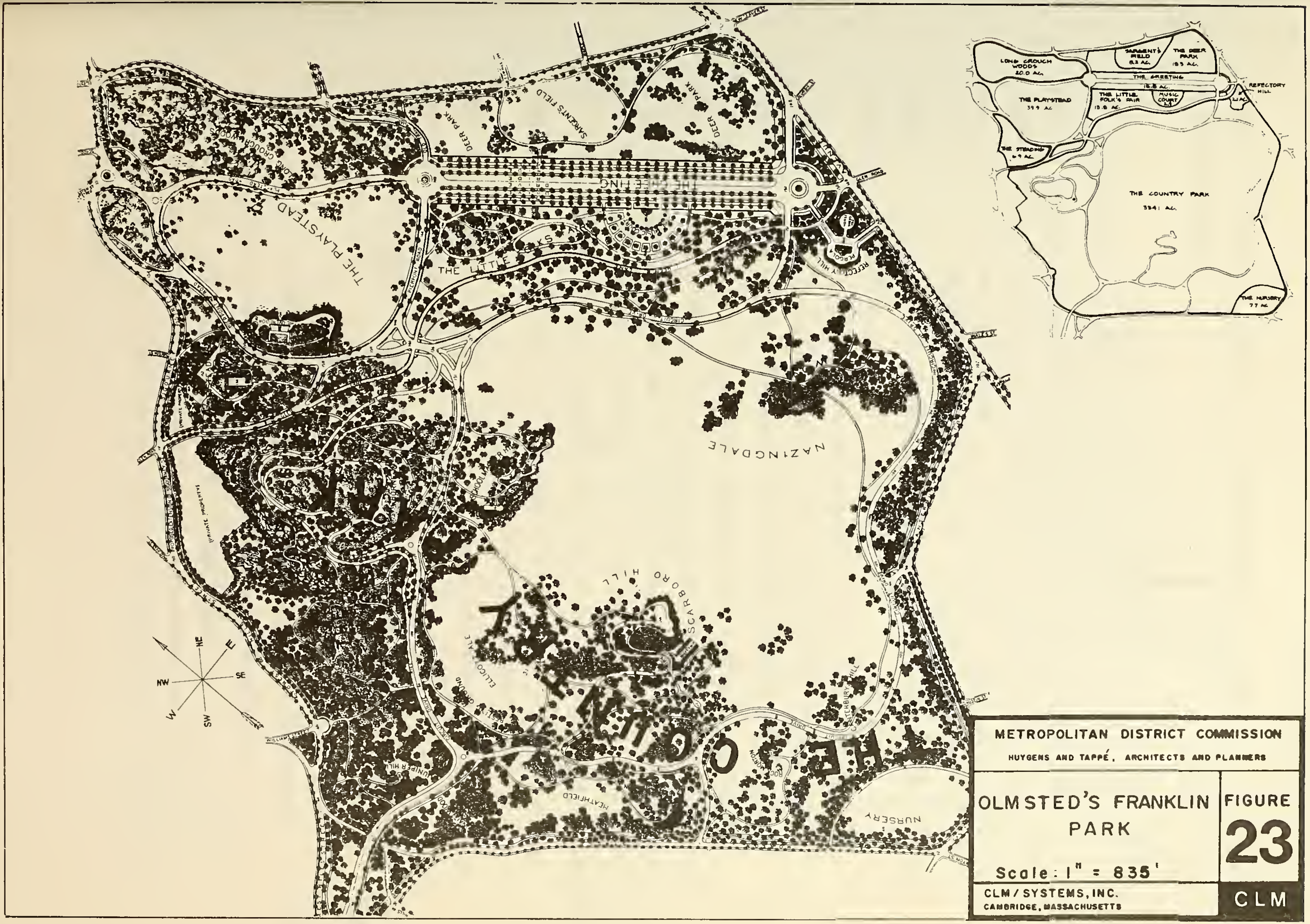
Nursery: service garden for the Park.

Sargent's Field: playground for baseball and tennis.

(The details of Olmsted's design for the Zoo site will be discussed in a subsequent section).

The general layout of Franklin Park, especially the Country Park and the road and pathway system, was carried out much as Olmsted had envisioned in his original plan in 1884. However, many of the secondary elements were not built at that time. These included the Music Court, the Little Folks' Fair, the Deer Park, the Steading, the Greeting, and the Dairy and Sheepfold (in the Country Park). Figure 24 shows the park and its components after the partial execution of Olmsted's plan.

In addition to the omissions from Olmsted's design, there have been a number of additions to the Franklin Park Plan over the years. The earliest such addition was made in the early 1890's when public demand initiated the construction of Scarboro Pond for ice



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HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

OLMSTED'S FRANKLIN PARK

Scale: 1" = 835'

FIGURE 23

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CLM

skating. Subsequent additions to Franklin Park were made by other landscape architects.

Although the Park was quite popular in its early years, by 1900 attendance had already begun to drop off. A golf course was built in the Greensward pasture in the early 1900's in an attempt to renew interest in the Park. The Refectory, having been unsuccessful as a restaurant, was converted to a library branch, and later to a golf facility. World War II victory gardens were planted on the golf course and in the Playstead. By 1948, golfing activities had resumed, and a golf clubhouse was built to the west of the Refectory.

In 1949, White Schoolboy Stadium was built in the Playstead. This of course constituted a major physical change from Olmsted's original plan. Trustees of the George Robert White Fund turned the stadium over to the City of Boston with the intention that the School Department would have full charge of the facility's operation, care, and maintenance. The Stadium is busiest in the spring, when two or three track meets take place on different Saturdays. The other major activity is for football on Thanksgiving, when attendance is between ten and fifteen thousand. Regular Saturday football games in the fall attract around 2,000 people.

Another major change from Olmsted's original plan occurred in 1949 when 13.6 acres of the Park were granted to the State Department of Public Health by the City of Boston. The Lemuel Shattuck State Hospital for Incurable Diseases was built on the site, and opened in 1954.

In 1966 the ruins of the Overlook became the site of the Playhouse-in-the-Park. Programs at the Playhouse are organized by the Elma Lewis School of Fine Arts, and take place every night from July 4 through Labor Day. Facilities include bleachers, stage settings, equipment trailers, and a food concession. Attendance at individual performances varies widely but the annual estimate for the program is over 100,000 people.

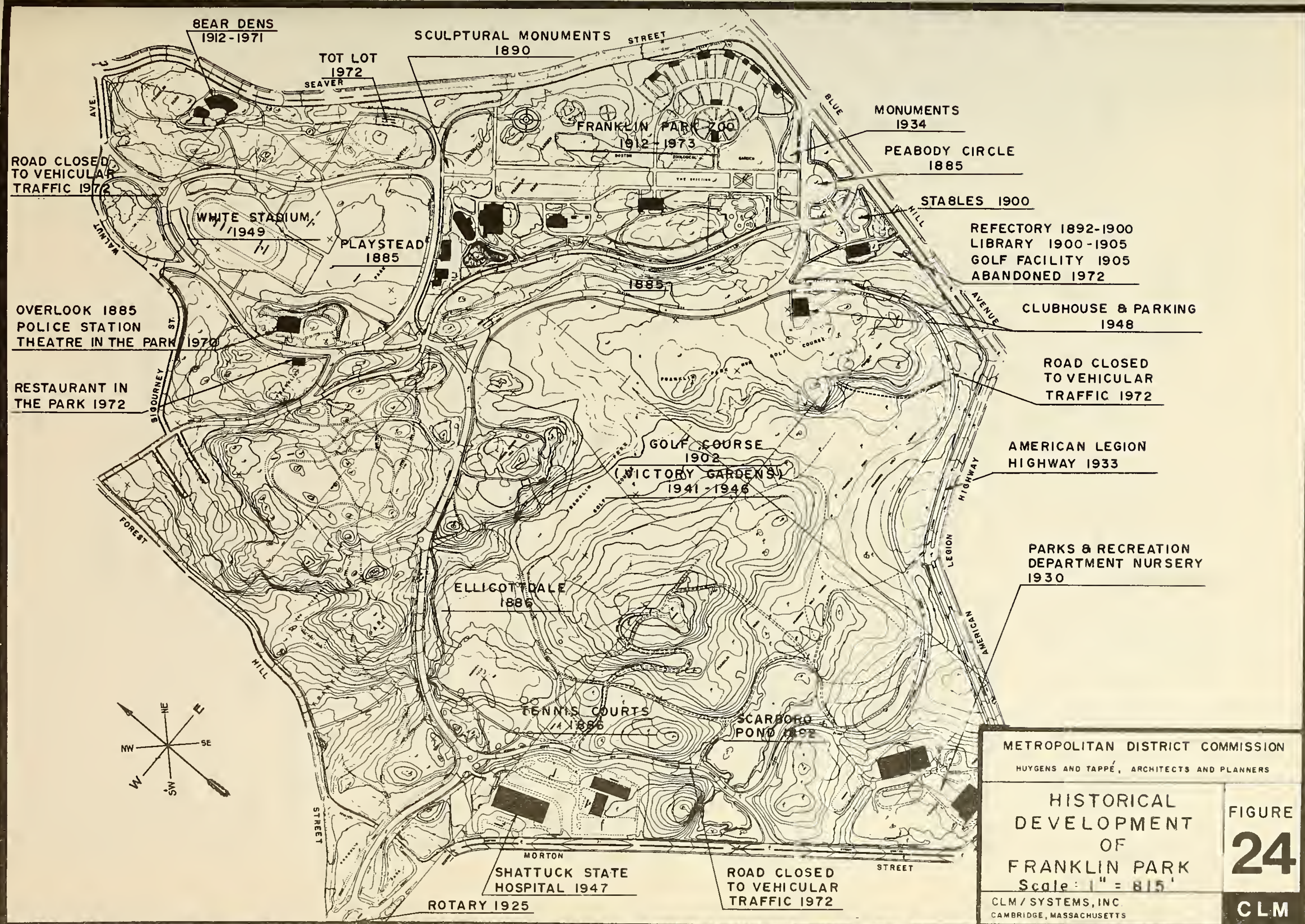
A parking lot was built in 1971 along Circuit Drive to provide for visitors to the Zoo and golf course. In 1972 the Boston Parks Department made the decision to close off all roads in the Park except Glen Lane and Circuit Drive in an effort to control traffic and crime problems. These changes, as well as those previously discussed are shown in Figure 24 which summarizes the development of Franklin Park.

(b) Existing Conditions

At the present time, Franklin Park suffers from lack of use, inadequate funding and manpower for maintenance,[16] a public fear of crime, and limited access by public transit. Joseph E. Curtis, the former Commissioner of the Boston Parks and Recreation Department has stated: "It is generally recognized that Franklin Park is in a condition of advanced physical deterioration and that its facilities are inadequate and are often misused."[17]

The Park now functions primarily as a neighborhood park. A study by Perry Dean Hepburn and Stewart made the following observations:

> Neighborhood parks depend on immediate proximity to homes and business using them for success. Franklin Park, because it is a convenient walk for only a limited number of people, is a failure as a neighborhood park because of its overwhelming size. It now represents a wasted resource.
>
> Frederick Law Olmsted, the original landscape architect of the Park, commented many times that a park the size of Franklin Park's 500 acres could only be justified economically if it serviced an entire region with appreciation of its natural beauty. Yet, Franklin Park has taken on a primarily neighborhood usage because it is almost completely undeveloped as the major regional facility it was intended to be.[18]



SOURCE: MORIECE AND GARY INC.

B. The Zoo Site

1. Topography

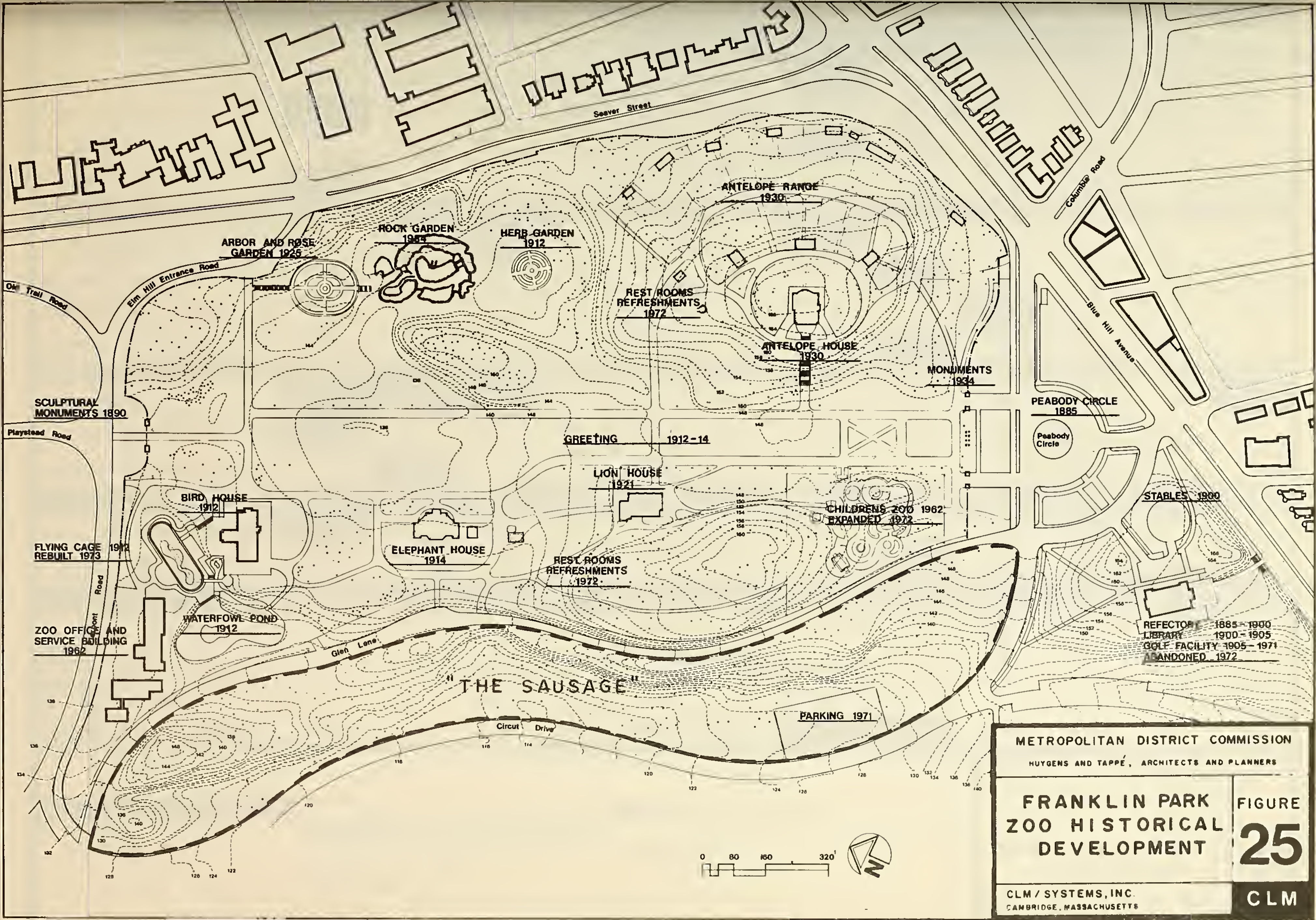
The topography of Franklin Park is extremely varied, with an elevation ranging between 90 and 190 feet, with rock outcroppings, heavily wooded areas, steep embankments, rolling open spaces and small water bodies.

The existing Zoo site, however, is relatively flat with little variation in elevation, as shown in Figure 22. Only the eastern corner of the site has any major differences, as it rises to 166 feet from the Greeting elevation of 146 feet. There is a small wooded knoll in the center of site and slightly to the east of the Greeting, and another more gradual hill near the existing Children's Zoo. The Greeting itself drops 10 feet in evelation, from 146 feet near the Blue Hill Avenue end, to 136 feet near the Aviary.

The parcel of land called the "Sausage" (which is to be leased from the City of Boston for the Zoo expansion), slopes steeply away from the Zoo towards Circuit Drive. (See Figure 25). This sudden change in elevation also occurs along the Seaver Street boundary of the Zoo, where stone ledges drop almost vertically to street level, a distance of fifteen or twenty feet in some spots. The high ground on the east and west borders of the Zoo combined with the heavy growth of large trees in those areas, tends to isolate the Zoo from the outside urban community quite effectively.

2. Climate

Franklin Park is situated in the Northeastern climatic zone and is subject to broad meteorological fluctuations, as can be seen in Figure 26. Temperatures, for example, may range from -4^{o} to $+98^{o}$ F. During the months of May through October, the average temperature will range between 55 degrees and 74 degrees, which will be warm enough for outdoor animal exhibits. During the remainder of the year, many animals will need to be moved to indoor exhibits.



METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

FRANKLIN PARK ZOO HISTORICAL DEVELOPMENT

FIGURE 25

CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS

CLM

SOURCE: MORIECE AND GARY INC.

TEMPERATURE

MONTHLY AVERAGE	29.9°	30.3°	37.7°	47.9°	58.8°	67.8°	73.7°	71.7°	65.3°	55.0°	44.9°	33.3°
DAILY MAXIMUM	36.8°	37.4°	44.6°	55.7°	67.5°	76.3°	81.9°	800°	73.4°	62.7°	51.9°	40.1°
DAILY MINIMUM	23.0°	23.1°	30.7°	40.0°	50.1°	59.2°	65.4°	63.3°	57.1°	47.2°	37.8°	26.5°
RECORD HIGH / YEAR*	62° 1967	58° 1967	66° 1966	82° 1964	93° 1964	94° 1967+	95° 1968	93° 1968+	92° 1966	85° 1968	69° 1966	70° 1966
RECORD LOW / YEAR*	-4° 1968+	-3° 1967	6° 1967	22° 1965	37° 1967	46° 1965	54° 1965	47° 1965	38° 1965	32° 1966+	21° 1967	-3° 1968

PRECIPITATION

NORMAL MONTHLY TOTAL	3.94"	3.32"	4.22"	3.77"	3.34"	3.48"	2.88"	3.66"	3.46"	3.14"	3.93"	3.63"
MAXIMUM MONTHLY TOTAL/YEAR	9.54" 1968	5.87" 1958	11.00" 1953	7.82" 1958	13.38" 1954	8.63" 1959	8.12" 1959	17.09" 1955	8.31" 1954	8.68" 1962	7.74" 1963	6.58" 1957
MINIMUM MONTHLY TOTAL/YEAR	0.92" 1955	1.15" 1958	1.48" 1962	1.24" 1966	0.53" 1964	0.48" 1953	0.52" 1952	1.25" 1966	0.35" 1957	0.96" 1967	1.72" 1952	1.03" 1955
MAXIMUM IN 24 HOURS/YEAR	2.07" 1958	2.65" 1958	4.13" 1968	2.09" 1954	5.74" 1954	2.46" 1960	2.42" 1959	8.40" 1955	5.64" 1954	4.26" 1962	3.33" 1955	2.27" 1967

SNOW-SLEET

MEAN TOTAL	12.9"	11.3"	8.2"	0.7"	TRACE	0.0	0.0	0.0	0.0	TRACE	1.3"	7.3"
MAXIMUM MONTHLY TOTAL/YEAR	32.5" 1948	23.7" 1962	31.2" 1956	3.3" 1967	TRACE 1967+	0.0	0.0	0.0	0.0	TRACE 1964+	10.0" 1938	26.8" 1947
MAXIMUM IN 24 HOURS/YEAR	12.8" 194[illegible]	19.4" 1958	17.7" 1960	3.1" 1956	TRACE 1967+	0.0	0.0	0.0	0.0	TRACE 1964+	3.0" 194[illegible]	[illegible] 1960

WIND

MEAN HOURLY SPEED/DIRECTION	[illegible] mph NW	14.7 MPH WNW	14.5 MPH NW	13.3 MPH WNW	12.9 MPH SW	12.0 MPH SW	11.3 MPH SW	11.2 MPH SW	11.5 MPH SW	12.5 MPH SW	13.4 MPH SW	14.2 MPH WNW
FASTEST MILE SPEED-DIRECTION/YR.	52 SW 1960	54 E 1960	43 ENE 1958	52 NW 1963	50 NE 1967	44 NNW 1958	45 N 1964	65 NNW 1958	57 S 1960	45 NW 1963	58 SW 1958	49 NW 1962

SUNSHINE

MEAN NUMBER OF DAYS SUNRISE-SUNSET: CLEAR	9	8	8	7	6	7	7	9	11	11	8	9
PARTLY CLOUDY	7	7	8	8	11	10	12	11	8	8	8	8
CLOUDY	15	13	15	15	14	13	12	11	11	12	14	14
PERCENT POSSIBLE SUNSHINE	53%	57%	57%	56%	58%	63%	65%	65%	64%	61%	52%	54%

GENERAL NOTES

* DATA INDICATED HAS OCCURRED IN PREVIOUS YEARS

1. ALL CLIMATOLOGICAL INFORMATION BASED ON
CLIMATOGRAPHY OF THE U.S. NO 60-19
CLIMATES OF THE US - MASSACHUSETTS
LOGAN INTERNATIONAL AIRPORT
BOSTON, MASSACHUSETTS
LATITUDE 42°22'N LONGITUDE 71°02'W ELEVATION 15 FEET

2. AS PER THE CHIEF CLIMATOLOGIST FOR THE [illegible] COMMISSION, DISCREPANCIES BETWEEN FIGURES AT LOGAN AIRPORT AND FRANKLIN PARK [illegible] SHOULD BE ADJUSTED ACCORDINGLY
- TEMPERATURE VARIATION [illegible]
- PRECIPITATION VARIATION NEGLIGIBLE
- WIND VARIATION [illegible]
- SUNSHINE VARIATION NEGLIGIBLE

METROPOLITAN DISTRICT COMMISSION
HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

CLIMATOLOGICAL INFORMATION

FIGURE 26

CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS

CLM

Source: Moriece and Gary, Inc.

The wind blows generally from the southwest during the summer months, with average velocities between eleven and thirteen miles per hour. This wind shifts to the northwest and increases in average velocity during the winter months, giving rise to a considerable chill factor. Wind roses for each month can be seen in Figure 27.

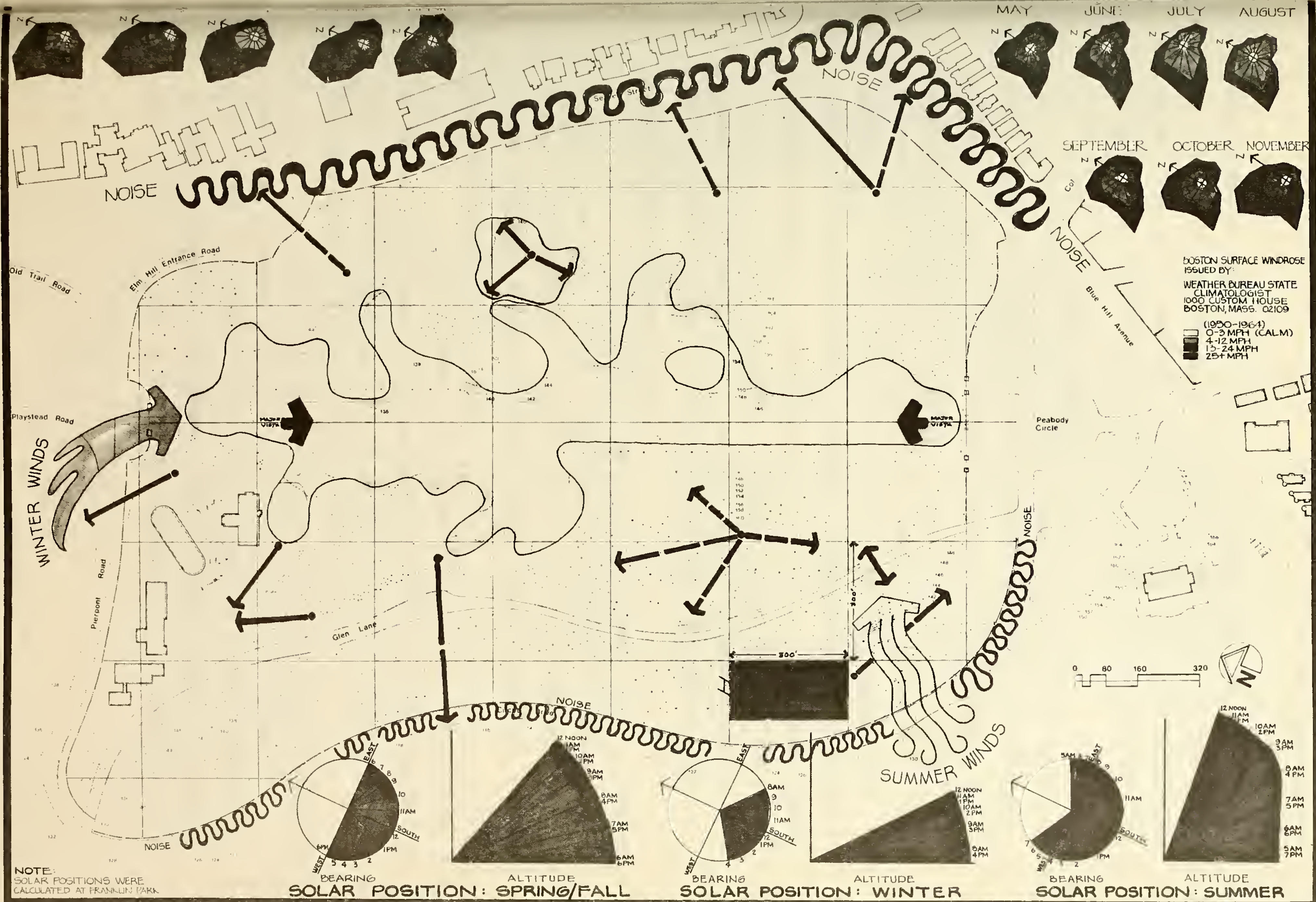
Sun angles are low at the project site, especially during the winter. As shown in Figure 27 , the summer sun is nearly 70 degrees above the horizon at 12:00 noon, (where 90 degrees would be directly overhead). During the winter, the sun is less than 30 degrees above the horizon at noon. In addition, the summer daylight hours are approximately 4:30 a.m. to 7:30 p.m., (15 hours), while the winter daylight hours are from 7:30 a.m. to 4:30 p.m., (9 hours).

Figure 26 shows the mean number of days during each month in this region which are either clear, partly cloudy, or cloudy. This cloud-cover data, combined with the low sun angles, short daylight periods, and dense growths of tall trees have all been important factors in the design of the exhibit buildings and the landscaping.

The Boston area has no "dry season" in that for most years the longest stretch of days with no measurable precipitation does not extend much more than two weeks. Much of the rainfall from June to September comes from showers or thunderstorms, while during the rest of the year, low pressure systems pass fairly regularly, bringing precipitation on an average of one day in three. The major snow season extends from December through March.

3. Existing Wildlife

An inventory of native animal species naturally inhabiting the project site has not been conducted. The site is used frequently by humans, and has no streams or ponds outside of Zoo exhibits. Thus, the number of habitats on the site which are available to wild animals is diminished, compared to the remainder of Franklin Park. Therefore, it is assumed that animals on the site are those common to most city parks.



SOURCE: MORIECE AND GARY, INC.

SUNLIGHT, WIND, AND OPEN SPACE INFORMATION

FIGURE 27

Representative species include the grey squirrel, the ring neck pheasant, the cottontail rabbit, the eastern chipmunk, the eastern gartersnake, and crows, rats, mice, starlings, sparrows, seagulls and pigeons. Species that have been sited include red tail hawk, screech owl and raccoon.

4. Trees and Vegetation

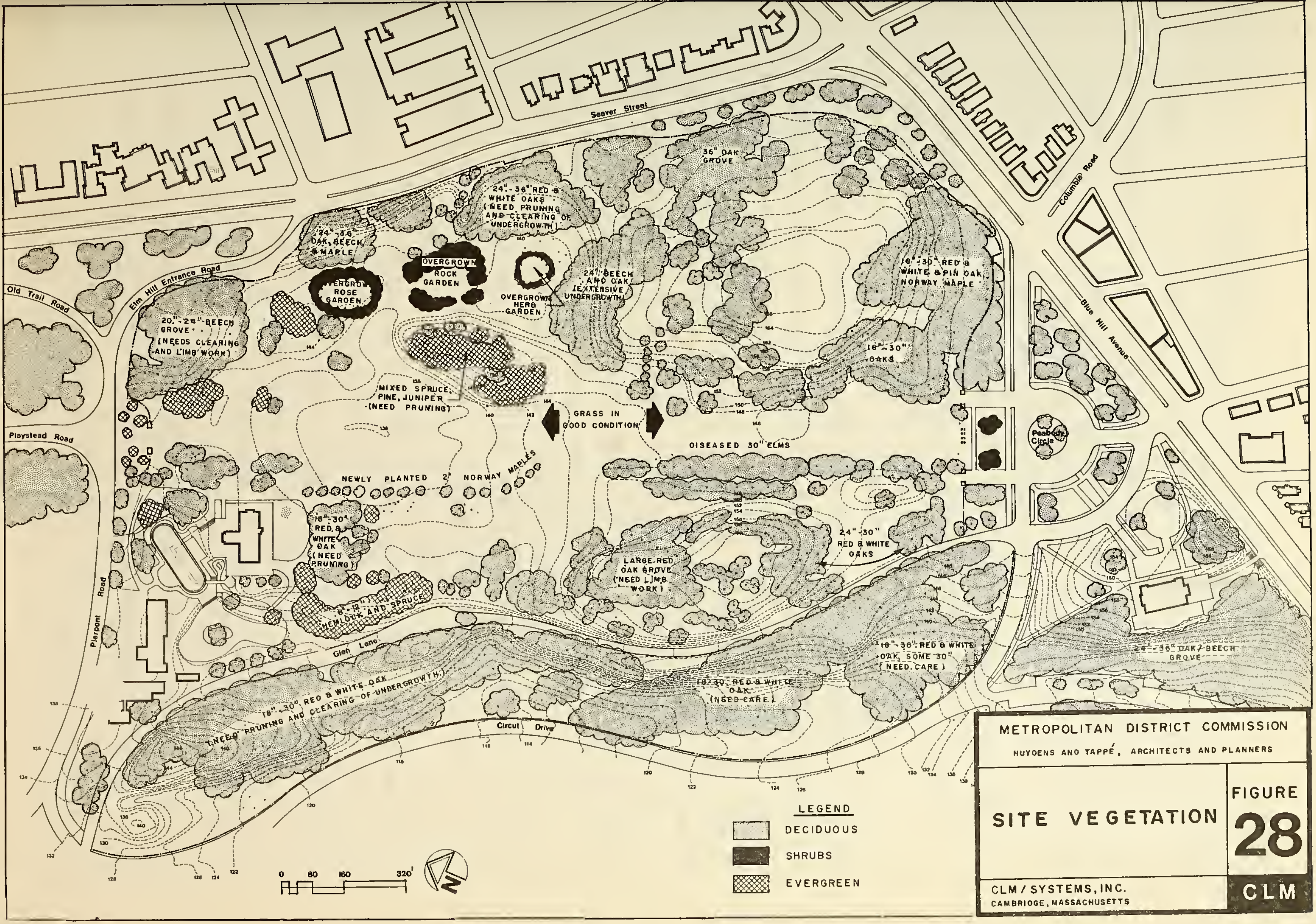
The Zoo site has many large oak, elm, maple, linden, and beech trees, in addition to some evergreens and shrubs, as shown in Figure 28. Some of the larger trees stand over 70 feet tall, with the largest tree on the site measuring 46 inches in diameter. The Seaver Street side of the site is covered with a heavy growth of large oak trees which provide a very effective visual barrier from the buildings and roadways of the surrounding community. Another long screen of heavy tree growth covers the western boundary of the Zoo near Circuit Drive.

Other noteworthy stands of trees include a mature beech grove in the northern corner of the site, a small evergreen covered knoll west of the rock garden, and an extremely high, full canopied grove of oak trees near Columbia Road.

The Greeting area is grass covered and stretches over 2000 feet from one end of the site to the other. Originally the Greeting was bordered by parallel lines of elm trees, many of which have been destroyed by the Dutch Elm disease. Those few that are still standing are dying and will soon have to be removed.

Three garden areas located along the Seaver Street side of the Zoo are presently abandoned and overgrown. The rose garden has very few roses remaining, the herb garden contains no cultivated herbs, and the rock garden is choked with weeds and shrubs.

Practically all of the trees on the project site need pruning, limb work, or removal in the case of those either dead or dying. Undergrowth is quite heavy in some areas and will require extensive clearing. In general, the trees and vegetation at the site are varied and extensive, but are also in need of thorough, periodic maintenance.



Source: Moriece and Gary, Inc.

5. Aesthetics

As discussed previously, there is extensive vegetation and tree cover at the Zoo site, most of which is in need of additional maintenance. For example, many diseased or dead trees should be removed, while others need pruning and limb work. In addition, the ground cover is overgrown and wild in certain seldom used sections like the garden areas along Seaver Street.

There are also several buildings, (the Lion House, the Elephant House, and the Antelope House) which are in poor condition and need either removal or renovation.

Although the Zoo site is in need of extensive work, certain aspects of it are still very striking. One obvious example is the Greeting, which provides an unobstructed vista almost one-half mile in length down the center of the site. Although this large open space is used predominantly as a walkway for Zoo visitors, and although many of the remaining elms bordering it are diseased and in need of removal, the Greeting stands out as a significant feature of the site. (Figure 29).

Figure 27 shows the major viewing corridors at the site, both unobstructed (solid arrows) and partially obstructed (broken arrows). The shaded area represents open space with no tree cover.

Another feature of the Zoo site is the beech grove located in the northern corner. This is a very pleasant picnic area, although it is not used extensively at this time.

The present Franklin Park Zoo is used by many nearby residents as a community park. Some simply use it as a pleasant crossing to the northern sections of the Park, in that they can either walk through the site directly or bicycle down Glen Lane in order to reach the White Stadium and Playhouse in the Park areas. Other local residents use the Zoo site as open space for relaxing, picnicing, or playing. Admission is only charged in the Children's Zoo, so other animal exhibits are free and can be enjoyed at any time.

Source: CLM/Systems, Inc.

EXISTING VIEW DOWN THE GREETING

FIGURE 29

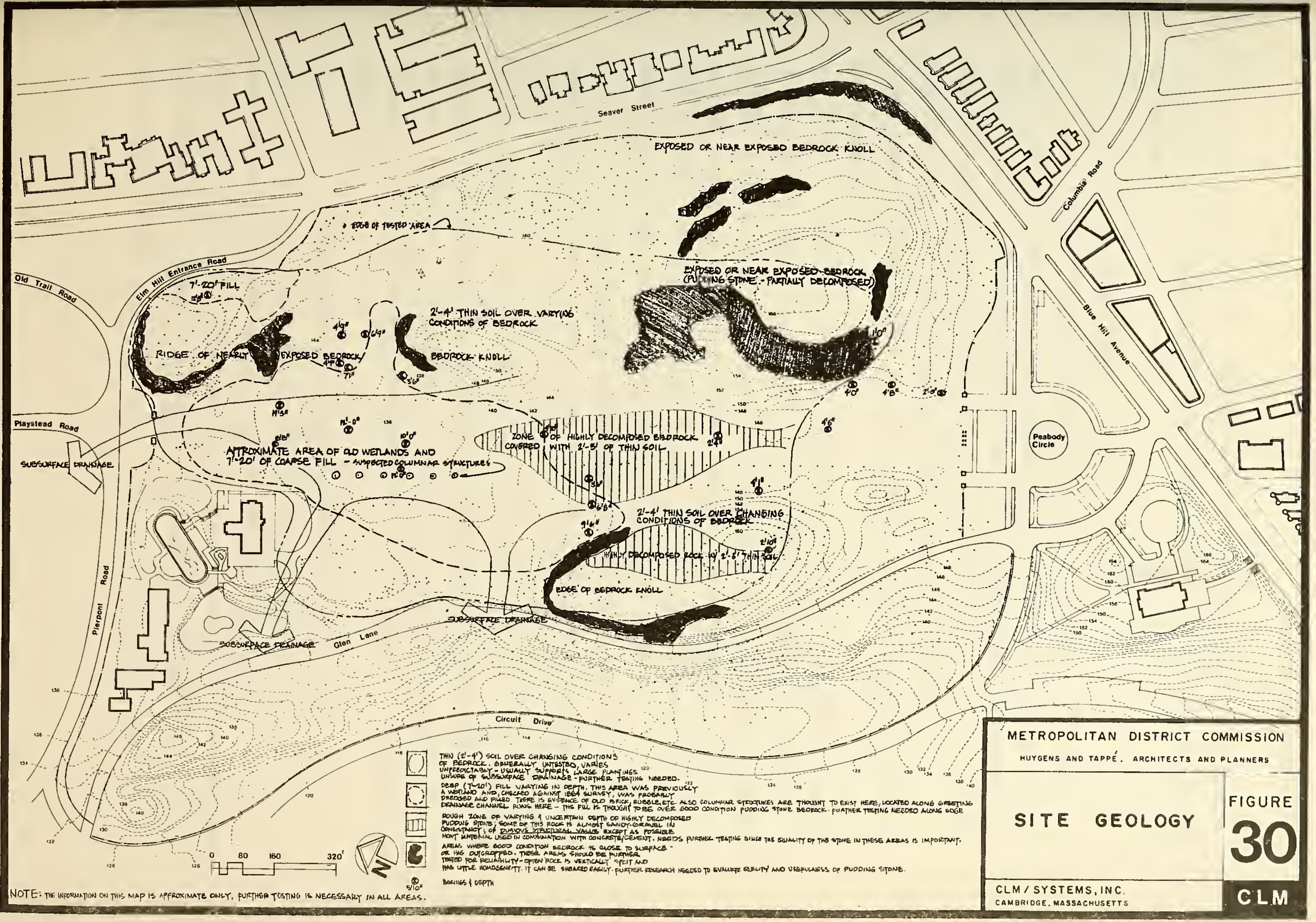
The residents of the taller buildings on Seaver Street that overlook the site presently have a view of open space and vegetation. The existing Zoo buildings are either partially obscured from view by trees or are too small to be objectionable. This view, however, is enjoyed by only those in the taller buildings. The large 60 or 70 foot trees along Seaver Street provide a solid visual barrier for the lower residences, except of course during the wintertime when foliage is not present.

6. Geology

The project site has the general shape of a shallow valley, with rock ridges that drop sharply towards Seaver Street on the east and Circuit Drive on the west. In the years before Olmsted and Shurtleff altered the terrain, the northern section of the site where the Greeting now terminates was once a wetland area, with soild and decomposed rock washing into it from the higher elevations. This area has long since been filled in, with depths to bedrock of 7 to 20 feet at the present time, as determined by a preliminary soil-rock analysis.

The bedrock under the site consists largely of layers of Roxbury pudding stone on top of solid granite. This pudding stone is a conglomerate in which pebbles and stones of different shades and sizes are embedded. It greatly resembles rough aggregate concrete, and can be utilized in the Zoo exhibits. At certain locations, this pudding stone is either exposed or lies just below the surface of the site, as shown in Figure 30 . This is especially evident near the Antelope House and Range Area. In other areas of the site, including a large part of the Greeting, this pudding stone has become highly decomposed, to the point where it is of dubious structural value except as a possible moat material.

The site generally has a two to four foot layer of thin soil lying over varying conditions of bedrock. Figure 30 shows the locations where borings were taken as well as the depths to bedrock. This figure also shows the approximate subsurface drainage pattern, which runs towards the northwest corner of the site.



Source: Moriece and Gary, Inc.

(It should be emphasized that this information is based on a preliminary geological survey, and that further testing is planned for the entire site).

7. Storm Drainage

Storm runoff presently runs either overland or through an in-ground drainage system from the Zoo to the Franklin Park Golf Course. Some of this runoff combines with the golf course drainage and flows underground until it discharges into Scarboro Pond. The remainder flows into a brick 33-inch combined sewer, which connects to the Boston sewer system. (The outflow of Scarboro Pond also flows into the City system).

Since the Zoo site is largely open land, a significant amount of rainfall is absorbed and retained in the ground, reducing the surface runoff. Thus a runoff coefficient for the existing grounds is estimated at 0.25, meaning that 25 percent of the rainfall on the existing site will appear as direct runoff. This is in contrast to the relatively impervious urban area nearby, where the runoff coefficient is estimated at 0.60.

In past years, storm runoff from the Zoo has contributed to back-ups and flooding at several points in the surrounding drainage system. The sources of these problems have been corrected so that over the last two years, Zoo runoff has been adequately handled by the existing system.[19] When back-ups have occurred, the problem has been due to clogged drains or pipes, not lack of capacity. During heavy storms, the drains are now kept free of leaves and debris so drainage can proceed normally.

The peak storm runoff from the existing Zoo site (at the connection to the City sewage system) can be estimated for a 10-year design storm at 45 cubic feet per second. This calculation assumes a rainfall intensity of 3.5 inches per hour, an estimated time of concentration of 40 minutes, a drainage area of 52 acres, and a runoff coefficient of 0.25, as described above.

Although it is doubtfull that the present drainage system under the Golf Course could handle a 10-year storm without backing up the storm sewers, the accumulated runoff would eventually drain away if the system were maintained and kept free of debris.

8. Sanitary Sewage

The existing Zoo sanitary sewage system connects to the Boston Parks and Recreation Department sewer system under the golf course. (A map of the existing in-ground Zoo utilities is being prepared at this time.) This sanitary sewage, combined with storm drainage (if there is any) flows out towards Morton Street, where it joins the Boston sewer system. The capacity of the City System and the treatment of this combined sewage will be discussed in a subsequent section on Water Quality.

The sanitary sewage from the Zoo consists largely of water from the cleaning of animal holding facilities, combined with a relatively small volume of sewage from Zoo visitors and staff. The latter amount can be estimated at five gallons per visitor per day, so that on a peak day in the summer when perhaps 3,000 people visit the existing Zoo, 15,000 gallons of sanitary wastes might be generated.

The U.S. Department of Agriculture has specific regulations concerning the disposal of wastes from certain restricted animals. These restricted wastes are collected and are incinerated at the Zoo service area on a daily basis. Other unrestricted wastes are cleared from the animal areas and either incinerated, composted, or put in containers which are picked up three or four times per week. The animal areas are then hosed down and made sanitary.

The water from these cleaning operations makes up the bulk of the sanitary sewage flow from the Zoo. In order to estimate the present load from the Zoo, it is reasonable to assume that roughly 75 percent of water that enters the Zoo grounds eventually leaves via the sewage system. The remaining 25 percent would include the visitor usage, the

water lost by evaporation and absorption, the water consumed by the animals, and the water used to fill the ponds.

During 1972, the Zoo used 6,885,000 cubic feet of water, or approximately 50 million gallons.[20] Since cleaning operations take place on a daily basis, this works out to a water usage of 137,000 gallons per day. Of this, an estimated 75 percent reaches the sewage system so that 100,000 gallons of water per day can be estimated as the sewage flow from cleaning operations.

The total Zoo sanitary sewage is estimated at 115,000 gallons per day. This flows into the City of Boston system and is treated at the Deer Island sewage treatment plant, which handled a daily average of 340 million gallons (of sanitary sewage and storm drainage) in 1972.

The existing pipes between the Zoo, the golf course, and the City sewerage system have been able to handle the Zoo sanitary sewage without any recurring problems. (Some of the pipes within the site are old and need to be replaced, but they do handle existing operations). Also, it should be noted that the impact from Zoo sanitary sewage on the City sewerage system is minimal in light of the tremendous volume of City wastes now being treated.

9. Water Quality

As discussed previously, the present Zoo storm runoff flows into the sewer system under the Franklin Park Golf Course. Then, flowing through either a 33 inch combined sewer or an eight inch storm sewer leading to Scarboro Pond, the drainage eventually reaches the Boston sewer system. Sanitary sewage from the site also flows through the golf course system on the way to the City system near Morton Street.

Sewage from that section of the City is piped to the Deer Island Treatment Plant in Boston Harbor. On the way to Deer Island, the combined flow of storm runoff and sanitary wastes undergoes screening and grit removal before reaching the main treatment plant

where it receives further primary treatment, is chlorinated, and then discharged into the harbor.

Deer Island was designed to provide primary treatment to 343 million gallons of sewage per day (both sanitary sewage and storm runoff). Maximum capacity is approximately one billion gallons per day. Treatment time varies with total flow, so that on days with heavy rainfall and consequently high sewage flows, settling time is reduced. This is compensated by the fact that the sewage is significantly diluted by the rainwater. The 1972 average daily flow at Deer Island was approximately 340 million gallons per day.

It should be pointed out that during extensive rainy periods or during extremely heavy storms, the Boston sewer system can fill to capacity. When this happens in the portion of the system leading from the project area, the excess flow is diverted to a detention chamber at Cottage Farm near Boston University where it will receive primary treatment, be chlorinated, and then discharged to the Charles River. In this way the storm runoff and sanitary sewage from the project will undergo primary treatment before entering either the Charles River or Boston Harbor. Secondary treatment of this sewage would, of course, be more desirable, since additional organic matter would be treated, but this treatment capability is not available at Deer Island at the present time. The total sewage and runoff from the site is obviously a very small fraction of the total City flow, so the impact of the existing Zoo on water quality in the Boston area can be considered minimal.

One important aspect of the Zoo sewage flow is the water from the cleaning operations in the animal areas. As discussed in the previous sections a significant amount of the total Zoo sanitary sewage flow comes from the water used to wash out the animal holding facilities. At the present time, these holding areas are cleared of manure, straw, and other solids, and then washed down on a daily basis. Extreme care is taken when animals are hospitalized to ensure that there is no possibility of spreading contaminants off the Zoo property through the

sewer system. In addition, the Zoo is presently inspected quarterly by the United States Department of Agriculture Animal and Plant Health Inspection Division to insure that precautions are taken which prevent the dissemination of diseases. It is reasonable to assume that the danger of contamination to the water in the Boston area due to the washing of animal areas has been minimized.

10. Solid Waste

The Zoo disposes of approximately 175 cubic yards of solid waste per week during the peak season. At present there are two 25 cubic yard containers which are emptied three times a week, and one six cubic yard container which is usually emptied four times a week.

The basic components of this solid waste are refuse generated by Zoo visitors and wastes from unrestricted animals, including manure, hay, bedding, and other miscellaneous materials. (Restricted animal wastes are either composted or incinerated on the Zoo site.)

The refuse is hauled from the site by private contractor to the City of Boston sanitary landfill in West Roxbury, where wastes are compacted and then buried. Filling operations have reached the perimeter of the site and additional layers are now being added to the top of the landfill. The State has been empowered by the Legislature to find another location for the City's refuse, but as of December, 1973, no alternatives had been named. The City has no other land suitable for landfill operations. Until a decision is made on an alternative site, layers will be added continually to the top of the present landfill.[22]

11. Utilities

At the present time, the Zoo is connected to gas, water, and electrical utility lines in Seaver Street and Blue Hill Avenue.

The Zoo used 18,480,000 cubic feet of gas,[23] and 6,885,000 cubic feet[24] of water (about 50 million gallons) over the last twelve month

billing period. A summary of consumption data from the Zoo's fifteen electrical meters has not been made. Boston Edison estimates, however, that the Zoo's use of electricity ranges between 200 and 400 kilowatt hours per month.[25]

The only utility service that is not adequate for present Zoo demand is water, in that the water pressure inside the Zoo grounds is not high as it should be for normal operations. The situation is partially attributable to low water pressure in the mains in the street, and possibly to partially clogged pipes in the Zoo's water system.

12. The Franklin Park Zoo

(a) History

The proposed project site was envisioned by Olmsted as the appropriate location for many of the "gregarious activities" which were to take place in Franklin Park. This area was to contain the Little Folks Fair, Sargent's Field, the Deer Park, the Music Court, and the Greeting, none of which were executed as Olmsted had planned. The Little Folks Fair was to have been an entertainment area for children, containing toy booths, swings, goat carriages, and similar amusements. Sargent's Field was designed as a playfield to supplement the Playstead. A small herd of deer was planned for the Deer Park, and the Music Court was designed as an amphitheater for outdoor concerts.

The Greeting in Olmsted's orginal plan was a series of pathways for pedestrians and wheeled vehicles. As originally designed, this meeting ground, or promenade area was one-half mile long and had three parallel rows of trees on each side of a central open space. The width of the open space, (measured from trunk to trunk of the innermost rows of trees), was designed to be approximately 100 feet .

Olmsted's plans also called for a zoo containing a variety of native animals to be located in the Long Crouch Woods and operated by a zoological society. (This area, as well as the others previously discussed, is shown in Figure 23).

Olmsted's idea for a zoo was abandoned in favor of the establishment of a major zoological facility with animals from all over the world. Arthur Shurtleff, who received his training with Olmsted's firm, prepared a master plan for the Zoo in 1911. (Figure 31A). Since Olmsted's plans for the Music Court, Greeting, Little Folks Fair, and Deer Park had not been carried out, the portion of the Park bounded by Seaver Street, Blue Hill Avenue, and Glen Lane was included in Shurtleff's Zoo master plan. Including the 22.5 acre Long Crouch Woods, the total land area designated for the Zoo was 81 acres. Shurtleff's plan called for 13 heated exhibition buildings, an administration building, several bear dens, a flying cage, 39 outdoor pens with shelters, and a deer park. Although the intent was to construct a major zoological garden, Shurtleff himself said of the plan "...much of it might never be built - but provision is made for its possibility".[26]

Shurtleff incorporated the concept of Olmsted's Greeting into his plans for the Zoo, using the long tree-lined corridor as a pedestrian mall and as the organizational spine for the exhibit buildings. The Greeting was built between 1912 and 1914 with an approximate width of 160 feet.

Between 1912 and 1914, the bird house, bear dens, waterfowl pool, and elephant house were completed, with the lion house being added in 1920. In 1930, the antelope house was built with Federal WPA funds. Two gardens were built on the Zoo site; a rose garden in 1928 and a rock garden, supervised by the Shurtleff firm, in 1932.

With the depression and World War II, the Zoo was permitted to fall into disrepair and became the victim of extensive vandalism. No concerted effort was made to reverse the declining condition.

In 1954, the firm of Shurcliff and Shurcliff prepared a second master plan for the Zoo. (The Shurtleff name had been changed to Shurcliff). This plan was aimed at consolidating various sections of the Zoo which were too far apart as a result of the partial execution of the 1911 plan.

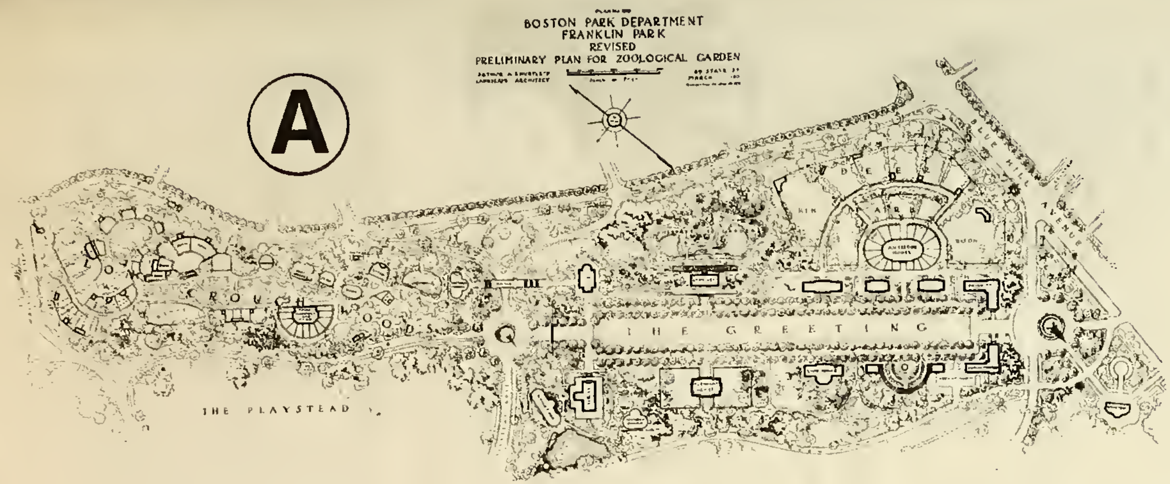
> If the zoo had been built as planned, there would have been little unused space between the exhibits, and hence no complaints would have been made about having to walk long distances between them. However, only four heated buildings and the Bear Dens, the Flying Cage, and twenty-four outdoor pens with shelters were actually built. Except near the Antelope House, these are mostly located at considerable distances from each other so that there is usually a long walk, between them. In fact, the Bear Dens are actually 1,600 feet from the nearest exhibit in use today. [27]

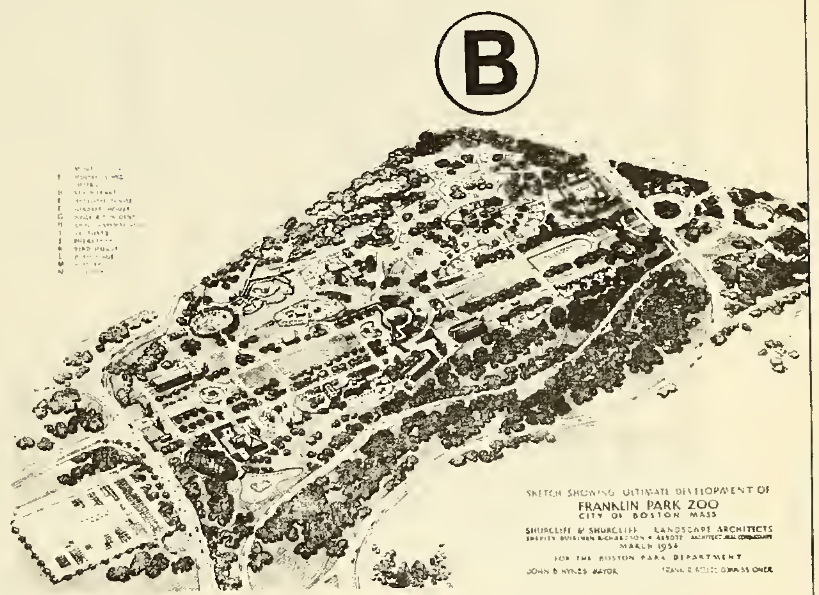
In order to accomplish the consolidation, the construction of a major exhibition building near the center of the Greeting was proposed. It was felt that this would bring the Greeting into scale with the pedestrain use of the Zoo. The 1954 plan states:

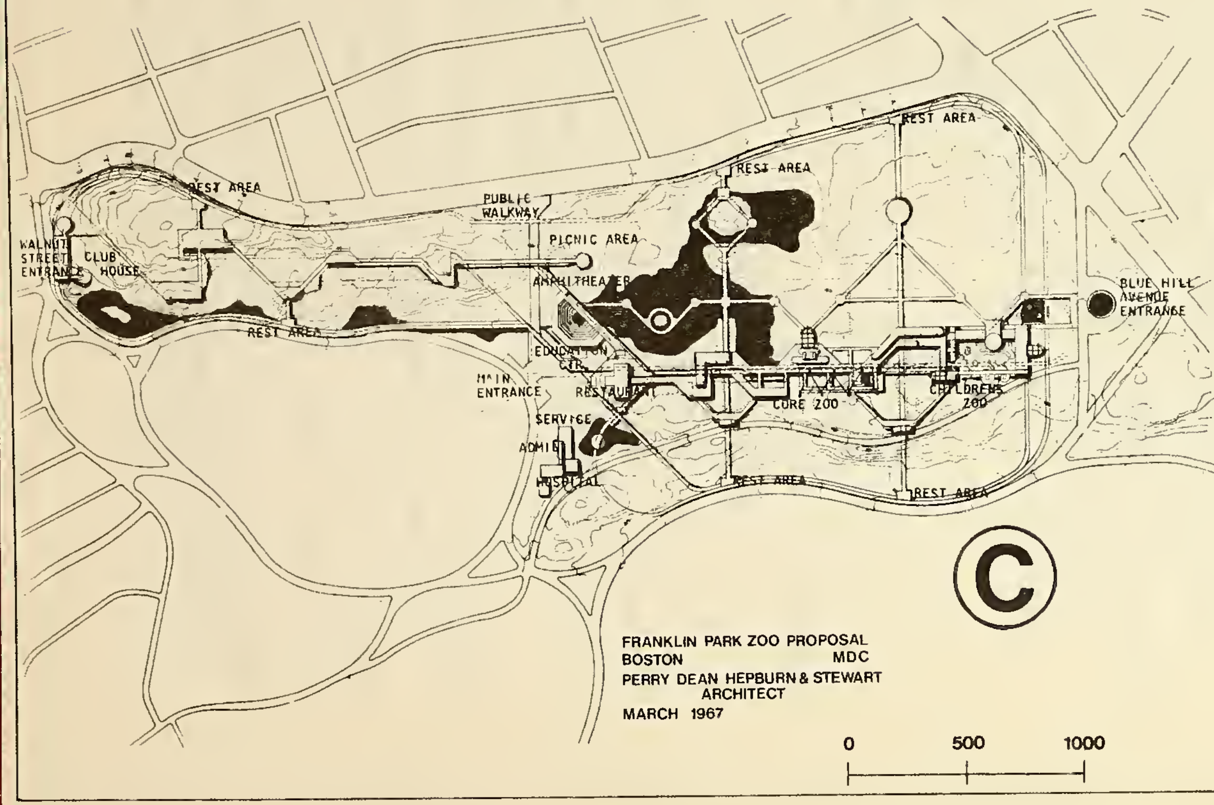
> We realize that the proposal to place a building in the center of the Greeting will seem radical to many who have regarded this long vista as a permanent feature of the Zoo. In defense of our choice, we should like to point out that, even after the major building has been built in the approximate center of the Greeting, there will still be a vista just under 1,000 feet in length in each direction from the new building to the gates... In short, we feel that we are creating two architectural compositions, each of which is better than the existing one. At the same time the scale is so much improved that visitors will not feel aprehensive at the sight of long distances which they believe they will have to walk. [28]

Mr. Arthur A. Shurcliff, the designer who laid out the Zoo in 1912, was in favor of this alteration of the Greeting. [29]

This 1954 master plan also proposed numerous new exhibits and a children's Zoo, but the plan was never carried out. Figure 31B shows a sketch of the plan.







METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

FRANKLIN PARK ZOO MASTER PLANS

FIGURE 31

CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS

CLM

In 1958 the Metropolitan District Commission took over the responsibility and cost of running the Zoo from the Boston Parks Department. Walter D. Stone was appointed MDC Zoo director, and received technical assistance from the Massachusetts'Zoological Society (MZS). In 1962, the Children's Zoo, suggested in the Schurcliff and Shurcliff master plan, was redesigned and built along with a service area, a heating plant, an animal hospital, and Zoo offices.

Perry Dean Hepburn and Stewart prepared a third master plan for the Zoo in 1967. The plan recommended expansion of the entire scope of the Zoo, proposing a long core of facilities housing animal exhibits, interconnected by a year-round enclosed walkway. As shown in Figure 31C this plan included a large lagoon crossed by several walkways. This lagoon covered a significant portion of the Greeting. It was estimated that this Zoo would cost 20 million dollars, but funds were not acquired and no part of the project was carried out. Many of the concepts brought forth in this study have, however, been used in the development of the current Zoo plan. These include the use of a central service core, and various exhibit and animal grouping ideas.

(b) Present Condition

A report by the Special Commission created by the State Legislature to study the Franklin Park Zoo and other MDC zoological facilities, (dated May 23, 1969), described in considerable detail the deplorable condition of the facilities at Franklin Park Zoo at that time.[30] At the Commission's recommendation, full responsibility for management of both zoos was given to the Boston Zoological Society (formed from the Massachusetts Zoological Society), In July, 1970.

Since the MDC and the BZS have taken over management of the Franklin Park Zoo, much progress has been made in restoring buildings and exhibits. The Bear Dens and Lion House have been abandoned as unacceptable exhibits, but extensive renovation has taken place in the Range Area and the Bird House complex. Fences and pens in the Range have been repaired and replaced, the animal holding facilities have been rebuilt and provided with automatic feeding systems, alarms,

and heating coils buried in the concrete floors. Eight moated exhibits have also been installed in the Range.

The creation of Bird World constitutes the first new exhibition to be constructed in the Franklin Park Zoo in the last forty years. The outdoor walk through exhibit in the Aviary will feature free-flying birds from around the world in naturalistic habitats. Inside the bird house there will be an educational entrance area, five environmental exhibits, staff rooms, a quarantine area, and a future developmental education center. Waterfowl ponds by the bird house have also been remodeled. Bird World recently received an award for Municipal Planting from the American Association of Landscape Contractors.

Repairs were made to the roofs of the Antelope House, the Service Center, and Administration buildings. Although the Antelope House is not a modern exhibit building, it will, along with the Range exhibits, provide one completed area for visitors while the construction of new exhibits is underway.

The condition of the grounds in the Zoo area was definitely deteriorated when the Legislative Commission made its report. Since that time, over 200 trees have been added to the Park through MDC replanting programs and donations by BZS members. Improvement in the grounds is also attributed to maintenance provided by the MDC and the BZS.

The formal gardens in the Zoo area, (the Rock Garden, the Herb Garden, and the Rose Garden), are still very much in need of maintenance. Undergrowth has in most cases obscured the original design of the gardens, and few of the original plantings have survived. The waterfall in the Rock Garden is not operating and the rockery needs to be reset.

Public facilities have been improved by the addition of two restroom/concession buildings in 1972. These were carefully designed and landscaped under a contract with Geometrics, Inc. The Boston Zoological Society has also been working on a system of labeling and directional signs which provide multiple levels of information to the Zoo visitor, and which deal effectively with the vandalism problem.

The engineer's report in the 1967 zoo development plan prepared by Perry, Dean, Hepburn and Stewart cited numerous problems with the design of the main building in the Children's Zoo. In the past, the BZS has chosen to view this more as a maintenance problem and has concentrated on upgrading the building, rather than on planning for its replacement.

Deterioration of the Elephant House was dealt with by improving the animal quarters, and closing the building to the public, thus allowing viewing of the elephants only when they are outside. (Presently the building is open because three black rhinoceroses have been purchased for the Zoo and are on temporary display in the Elephant House). Complete renovation of the facility would be extremely costly, and even temporary repairs were estimated in 1971 to be in the $100,000 range. [31]

The Roxbury-North Dorchester Community Beautification Program has expressed interest in designating the Rose Garden as a memorial to Martin Luther King. However, no definitive action has been taken to date.

As of June, 1973, there were 156 animal specimens at the Franklin Park Zoo. [32] This number is low however, since the renovation of the bird house and construction of the aviary necessitated the temporary transferral of many bird specimens to the Stone Zoo in Stoneham. Of the 663 bird specimens at Stoneham, 256 belong at Franklin Park, bringing the total specimen inventory to 421.

Admission is presently charged only at the Children's Zoo, so any estimate of total Zoo attendance is only an approximation. The Children's Zoo drew approximately 214,000 visitors in 1972, and expects to draw approximately the same in 1973. BZS officials have stated that except for local residents who use the Zoo as a park area, the large majority of the people who come to the Franklin Park Zoo do attend the Children's Zoo. Thus annual attendance for the entire Zoo is estimated at 300,000 visitors.

Records for 1972 indicate that on hot, clear Sundays, in August, (a peak month), an average of 2,500 people visited the Children's Zoo. Sunny weekdays in May had an average of 877 visitors.

The Children's Zoo opens in late April or early May, and closes in late October or November. Animals on the Zoo site are kept in their heated holding areas or are moved to the Children's Zoo facilities during the winter.

V ALTERNATIVES TO THE PROPOSED PROJECT

The following section will describe the possible alternatives to the proposed project. A discussion of the costs and benefits of each alternative will be included in Section V of this report.

A. No Action

An obvious alternative would be to leave the Franklin Park Zoo in its present state, with no expansion whatsoever. The funds allocated for Zoo improvements would have to be re-distributed by the State Legislature. All other aspects of present operations would continue without change.

B. Build at Another Location

Another alternative to the proposed action is to build the Zoo at a different location. This new site could be in a downtown, city, suburban, or regional location. Since it would probably require partial funding by the Commonwealth, new legislation would have to be enacted. A new agreement would have to be negotiated with the BZS if their management services were required for the new facility. In this alternative, it must be assumed that the same budget would apply as for the proposed project, and that none of the existing zoological facilities would remain at Franklin Park.

C. Modify the Project

1. No Parking Garage

For this alternative, the major deviation from the proposed project is that no major parking garage and no local street or surface lot parking would be available for Zoo visitors. This would be an effort to discourage private transportation trips into the Zoo, and would require extensive changes to the existing public transit system to accommodate the Zoo visitors.

2. Alternative Parking Locations

This alternative would place the Zoo parking garage at any of several alternate locations in the area, as well as at satellite locations away from the Zoo.

3. Build a Smaller Zoo at Franklin Park

This alternative considers a reduction in the magnitude of the Zoo expansion. This would either involve a renovation of existing buildings, or the construction of new facilities on a smaller scale, and could conceivably be accomplished with the money allocated by the State Legislature, since the Zoo would remain at Franklin Park.

4. Alter the Site Plan

This alternative utilizes the same basic resources as the proposed plan, but orients them differently on the site. There are, of course, many possible building and exhibit orientations, but only the most plausible will be discussed.

5. Change the Type of Exhibit

This alternative would replace the African Continent theme of the proposed project with one representing animals and vegetation from climates compatible with that of New England. This Zoo would still be located in Franklin Park, and all funding aspects would remain the same. Depending on the scope of the revised project, less indoor exhibit area could be provided with fewer mechanical services needed for the control of temperature and humidity.

VI ENVIRONMENTAL IMPACTS

A. The Proposed Project

1. Local and Regional Impacts

(a) Traffic

The expanded Zoo is expected to attract 1.5 million visitors upon completion in 1976 or 1977. Studies at similar facilities have indicated that 90 percent of the Zoo visitors will arrive by private transportation. This is due in part to the fact that a zoo visit is often a group outing of families, friends, classrooms, etc., and that these groups are much simpler to transport by car or chartered bus than by public transit.

It is also estimated that vehicle occupancy will be 2.2 visitors per car on weekdays, and 3.5 visitors per car on weekends. Based on these projections, in 1976 approximately 2510 cars will travel to and from the Zoo on peak weekdays, and nearly 3945 on a peak Sunday. Similar forecasts for 1986 are 2710 and 4260 respectively.

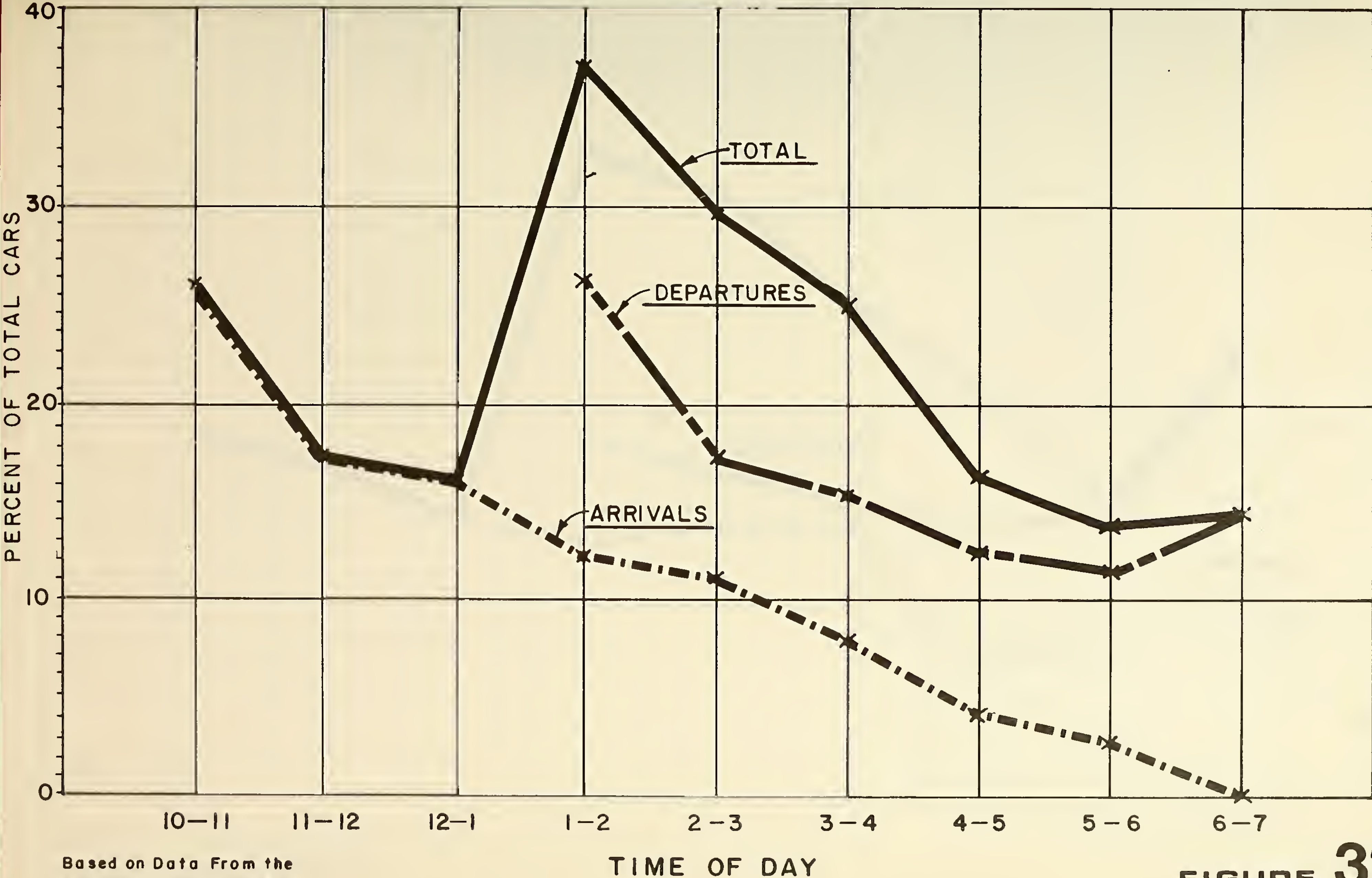
In order to assess the impact of the traffic generated by the Zoo, it is first necessary to distribute the daily arrivals and departures over the hours that the Zoo remains open. Figures 32 and 33 show the estimated arrival and departure patterns of Zoo visitors on weekdays and weekends as a function of time of day. These graphs were based on a 1972 study at the National Zoological Park in Washington, D.C.[33] An average Zoo visit was assumed to be three hours long, which is possible during both winter and summer because of the indoor/outdoor exhibits. Adding the arrivals and departures together for any hour gives the total flux of private vehicles in and out of the satellite parking area. Figures 32 and 33 show that the peak impact from Zoo generated traffic will occur between 1:00 and 2:00 p.m. on both weekdays and weekends. On weekdays, however, the highest total traffic volumes from the combination of Zoo traffic and existing traffic will occur during the evening rush hour, 4:00 to 5:00 p.m. Although it is true that the

maximum Zoo generated traffic will occur on Sundays, the combination of a higher occupancy factor and the generally lower Sunday traffic flows indicate that the maximum traffic congestion will occur on weekdays. (The net Zoo impact on local traffic will be higher on Sundays, but the actual congestion will be lower than that expected on weekdays). The morning rush hour will not be affected since the Zoo will not be open.

Although the greatest impact from Zoo generated traffic will occur near the satellite garage, it should be recognized that the Zoo will also add traffic to the major regional roadways leading to Franklin Park. The following is a summary of the major access routes to the area and the expected fraction of total trips expected along each combination of connectors, as estimated by Alan M. Voorhees and Associates.

		% of Total Trips
Northern Corridor		
-	Columbus Avenue to Washington Street	3.0
-	Arborway	3.0
-	Rout 1 to Arborway	7.4
-	Southeast Expressway to Columbia Road to Circuit Drive	17.1
-	Columbia Road to Ciruit Drive	6.8
-	Blue Hill Avenue to Circuit Drive	2.2
Southern Corridor		
-	Blue Hill Avenue to Morton Street	5.7
-	Route 1 to Arborway	9.5
-	Washington Street	3.8
-	Southeast Expressway to Gallivan Boulevard to Morton Street	4.7
-	Hyde Park Avenue	1.8
Western Corridor		
-	Arborway	35.0
	TOTAL	100.0

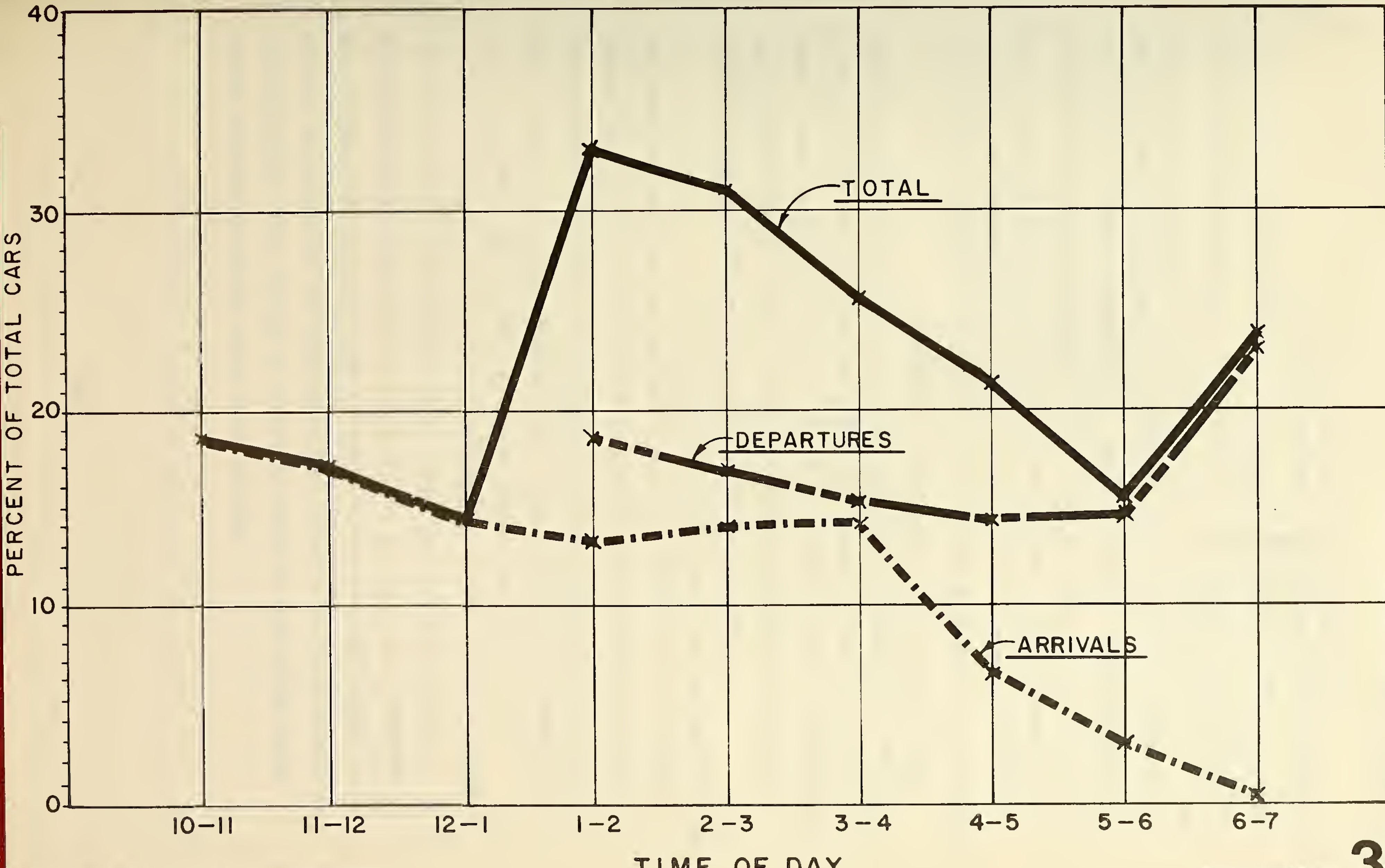
WEEKDAY ARRIVAL AND DEPARTURE PATTERN



Based on Data From the
National Zoological Park
Wash. D.C.

FIGURE 32

SUNDAY ARRIVAL AND DEPARTURE PATTERN



Based on Data From the National Zoological Park. Wash. D.C.

FIGURE 33

(1) Traffic Impact Near the Zoo Entrance

An estimated 26.1 percent of the Zoo visitors will travel to the Forest Hills area along Circuit Drive, unless they are directed along another route. On a peak 1976 weekday, this represents 655 vehicles, distributed throughout the day. In addition to these private vehicles, nearly 50 one-way bus trips (25 round trips) will occur along Circuit Drive. These shuttle buses will not affect the intersections near the site entrance since they will quickly load and unload by Peabody Circle, having travelled directly up Circuit Drive. School buses will also load and unload children across from the Zoo entrance. Peabody Circle will be used only for buses so local traffic flow will not be impeded.

In addition, any impact from trucks making deliveries and pickups at the Zoo is assumed to be negligible. This is due to the fact that Zoo supplies are generally brought to the site in bulk, often in quantities large enough to last for a week or more. BZS officials have estimated that only four or five deliveries a day may occur at the new Service Area when the expanded Zoo is in operation.

Thus the main impact from the Zoo traffic in the entrance area will be from private vehicles. If the 655 cars that will utilize Circuit Drive on a peak 1976 weekday are distributed over the Zoo hours of operation, the maximum increase in traffic would occur from 1:00 to 2:00 p.m., when 243 extra vehicles will pass through the area where Blue Hill Avenue, Columbia Road, and Circuit Drive intersect. General traffic flow during this time period is 23 percent lower than the peak 4:00 to 5:00 p.m. rush hour volumes, however, so the actual congestion will be much less than that normally experienced later in the evening without Zoo traffic. During this 4:00 to 5:00 p.m. period, an estimated 105 vehicles will be added to the local streets and intersections. This change is extremely small in light of the large traffic volumes presently using these streets.

As an extension of the analysis from Section IVA (2a), this peak hour Zoo traffic has been added to the various projected intersection traffic flows near the Zoo entrance, and volume/capacity ratios and Level of Service estimates have been calculated to show how minor the Zoo impact actually is during the peak hour. Table 22 shows the results of these calculations for 1976. If this table is compared to Table 10, it can be seen that the Level of Service of the intersection at Glen Lane and Blue Hill Avenue drops from B to C (which is the design capacity), and that the V/C ratios have only increased slightly at two intersections - Glen Lane at Blue Hill Avenue, and Blue Hill Avenue at Columbia Road.

Since the Columbia Road approach to Blue Hill Avenue presently exceeds the theoretical intersection capacity during the peak hour, the additional Zoo traffic (although only 30 vehicles) will make the situation worse. If the same analysis is applied to 1986 conditions, similar changes occur.

It was previously pointed out that with normal traffic growth, each intersection in the Zoo entrance area will have at least one segment operating at or above capacity by 1986. The only intersection with major capacity deficiencies, however, will be Blue Hill Avenue at Seaver Street, which will be negligibly affected by Zoo traffic (11 cars during the peak hour).

In summary, Zoo traffic near the Zoo entrance will only represent a very small percent of future peak hour volumes, which is when the maximum congestion will occur. Certain approaches to these intersections will equal or exceed design capacity in future years even without Zoo development, and any additional traffic will add to existing problems. During other hours of the day, the net impact from Zoo traffic will be higher, but the resulting congestion will be less than that during the peak hour. Zoo generated vehicles will thus tend to increase traffic levels the most during the hours when capacity is available.

TABLE 22

INTERSECTION ANALYSIS,

1976 CONDITIONS WITH ZOO DEVELOPMENT

(4:30-5:30 p.m. Peak Period)

Approach	Volume	Design* Capacity	Volume to Capacity Ratio	Level of Service
Blue Hill at Seaver				
Blue Hill (SB)	992	1000	0.99	C
Blue Hill (NB)				
Left	554	350	1.58	E
Straight & Right	406	925	0.44	
Seaver (EB)				
Right	NA	NA**	NA	
Straight & Left	461	450	1.02	C/D
Seaver (WB)	254	250	1.02	C/D
Blue Hill at Columbia				
Blue Hill (NB)	940	1480	0.64	A
Blue Hill (SB)	1566	2200	0.71	A
Columbia (WB)	1539	1100	1.40	E
Blue Hill at Glenway				
Blue Hill (NB)	1116	2400	0.47	A
Blue Hill (SB)	2138	2650	0.51	A
Glen Lane	987	1000	0.99	C
Blue Hill at American Legion Highway				
Blue Hill (NB)	1020	1550	0.66	A
Blue Hill (SB)				
Right	NA	NA	NA	A
Straight	1351	2080	0.65	
American Legion Highway (EB)	465	700	0.66	A

* At Level of Service C

** NA - Does not apply

Source: Alan M. Voorhees and Associates

(i) Improvements

The 1972 Areawide TOPICS plan for the Roxbury-Jamaica Plain section of Boston recommended significant changes to the Blue Hill Avenue, Columbia Road intersection, as well as the Blue Hill Avenue, Seaver Street intersection. These changes will include rechannelization and resignalization, with provision for separate turning lanes and phases, pedestrian indications, and a general improvement of traffic flow. The MDPW TOPICS coordinator has indicated that construction on these improvements might begin in 1975 or 1976.

(2) Forest Hills Area

As discussed previously, several significant developments are planned for the Forest Hills area, including the MBTA Orange Line relocation, major roadway improvements, and the construction of a fringe parking garage for commuters that will be used for Zoo parking as well. Because of these future developments, it is not possible to fully assess the future impact of traffic from Zoo visitors.

Based on 1976 attendance estimates, the Zoo will attract 6,136 visitors on a peak weekday in August, which will result in approximately 2,510 private vehicles traveling to the satellite lot from various remote locations. Based on the arrival pattern shown in Figure the peak Zoo impact would occur from 1:00 to 2:00 p.m., when the garage area would experience a total inflow and outflow of approximately 930 cars (plus 47 shuttle buses, based on a 2.6 minute headway). During the 4:00 to 5:00 p.m. period, the Zoo generated traffic is estimated at 402 private vehicles plus 47 shuttle buses. All of these buses would travel on Circuit Drive, but the cars would travel on different roadways leading to the area.

Alan M. Voorhees and Associates have estimated that 26.1 percent of all Zoo generated traffic will travel to and from the satellite lot along Circuit Drive, 54.9 percent along the Arborway, 10.4 percent along Morton Street, and the remaining 8.6 percent along either Hyde Park Avenue or Washington Street.

Table 23 relates this Zoo generated traffic for 1976 and 1986 to the projected future traffic volumes on these five roadways without any Zoo development. It can be seen that the maximum impact from the Zoo falls on Circuit Drive, where 1976 traffic volumes will increase by 44.6 percent during the 1:00 to 2:00 p.m. period, and by 13.9 percent during the 4:00 to 5:00 p.m. period. This, of course, is highly significant in light of existing traffic flow, since the peak hour is between 4:00 and 5:00 p.m., while 1:00 to 2:00 p.m. is an off-peak hour. In this way, the Zoo traffic will have the highest impact on Circuit Drive during the periods where daytime traffic is light. Further, it should be noted that the projected 1976 1:00 to 2:00 p.m. traffic with the Zoo (940 vehicles) is lower than the projected 4:00 to 5:00 p.m. peak hour traffic without the Zoo (1092 vehicles). The same is true for 1986. Although the Zoo will add a significant amount of traffic to Circuit Drive, the hours when this impact is the greatest will have lighter traffic than the evening rush hour if no Zoo were built. The evening rush hour volume will increase by 13.9 percent to 1244 vehicles, but this is expected to cause no problems at all since the hourly design capacity of Circuit Drive is 3600 vehicles.

The Arborway will also be affected by the Zoo generated traffic, although the net impact is roughly one-half that experienced on Circuit Drive. Once again, the peak Zoo traffic will occur during a time when general traffic flow is light, such that the total is still less than that during the evening rush hour without the Zoo. The Zoo-related traffic increase on the Arborway during the 4:00 to 5:00 p.m. peak period will be about 5.9 percent, or an additional 221 vehicles. It should be noted that based on recent traffic counts in the area,[34] 60 percent of the evening rush hour traffic travels to the east on the Arborway, and 40 percent to the west. Zoo traffic on the Arborway during this period will be almost entirely departing vehicles travelling westbound so the Zoo will not add to the peak directional flow.

On other feeder streets in the area, the peak hour impacts are between 0.7 and 1.6 percent, while the 1:00 to 2:00 p.m. period increase is never more than 6.4 percent.

TABLE 23

WEEKDAY IMPACT OF ZOO TRAFFIC ON LOCAL STREETS*

(Vehicles per Hour)

Roadway	1976						1986					
	1:00 - 2:00 p.m.			4:00 - 5:00 p.m.			1:00 - 2:00 p.m.			4:00 - 5:00 p.m.		
	w/o Zoo	with Zoo	% Change	w/o Zoo	with Zoo	% Change	w/o Zoo	with Zoo	% Change	w/o Zoo	with Zoo	% Change
Circuit Drive**	650	940	44.6	1092	1244	13.9	762	1074	40.9	1280	1443	12.7
Arborway	2239	2750	22.8	3761	3982	5.9	2623	3174	21.0	4406	4644	5.4
Morton St.	1521	1618	6.4	2555	2997	1.6	1783	1887	5.8	2995	3040	1.5
Washington St.	1545	1608	4.1	2596	2633	1.0	1811	1879	3.8	3043	3073	1.0
Hyde Park Ave.	639	655	2.5	1074	1081	0.7	749	767	2.4	1259	1267	0.6

* Future traffic levels were predicted based on a 1.6% annual increase.
Hourly distribution of non-Zoo traffic was based on observed frequencies in the area.

** Numbers for Circuit Drive include shuttle buses.

In terms of the general traffic flow on the feeder streets leading to the traffic garage, the peak Zoo traffic will occur on Sundays, when general traffic flow is light. On weekdays, the Zoo will add to peak hour traffic in varying amounts, (with the heaviest increase falling on Circuit Drive, which has the most excess capacity). The major impact from Zoo traffic will fall during those daytime hours when non-Zoo traffic is lightest, and the smallest impact will occur during the peak hours, thus tending to smooth out hourly traffic variations on the different roadways.

It must also be recognized that all of this Zoo generated traffic will travel to and from one location - the satellite parking garage. If this garage were built without any changes in the local street network, the Zoo traffic would worsen conditions in a localized area that is already very congested and which presently operates at Level of Service E during peak hours. However, part of future development plans for the area call for major street improvements so that commuters and Zoo visitors can utilize the fringe parking garage without any significant congestion problems. (The parking garage will require a Federal and State Environmental Impact Statement to be approved before construction). The impact of the Zoo traffic will then fall upon the improved street network, which will have sufficient capacity at that time.

(3) <u>Traffic Congestion During Construction</u>

The traffic on the major streets around the project will be disturbed during the construction of the Zoo due to heavy vehicles entering and leaving the site, as well as by installation of the various utility services, which will connect to either Seaver Street or Blue Hill Avenue, as shown in Figure 11. General construction of the Zoo facilities will take place over approximately a two year period, although the demand for heavy vehicles will vary considerably over this period. It should be noted that an attempt has been made to balance cut and fill operations, so a minimum of trucking of fill will be required.

(b) Air Quality

One obvious effect of the expanded Zoo is that traffic will be generated on the various roadways leading to the Franklin Park area. The peak Zoo traffic will occur on Sundays, but as pointed out in the discussion on traffic, weekdays will experience the heaviest total traffic flows on both a daily and an hourly basis. Since the worst conditions would thus occur on a weekday during the Zoo peak season, this is the "worst case" traffic volume to be evaluated in terms of air pollution potential.

Zoo traffic will clearly add to existing air pollutant levels, with the largest net increase occurring near the satellite parking facility. To fully quantify this impact is impossible at this time, due to the future changes planned for the Forest Hills area. It is possible, however, to discuss this possible impact relative to the change experienced near the Zoo entrance and within the four square mile grid cell surrounding the Park.

(1) Zoo Entrance

As discussed previously, a combination of continuous carbon monoxide monitoring and a computer model have been used to estimate the existing CO concentrations at various locations near the Zoo entrance. These concentrations vary widely from receptor to receptor, depending mainly on the distance from the major roadways and intersections. In general, it was shown that the national ambient air quality standard for CO (the eight-hour average), would be exceeded under extended "worst case" conditions but not under average conditions. These Federal standards state that the level of 9.0 ppm is not to be exceeded more than once per year. Thus existing ambient air near the Zoo entrance does not meet this requirement.

In future years, however, as newer cars with more pollution control equipment are added to the vehicle population, and older uncontrolled cars are scrapped, pollutant emission rates will drop

significantly. Although general traffic volumes will also increase, it is expected that air quality will improve over present conditions.

This trend in future carbon monoxide concentrations has been examined near the Zoo entrance, where Columbia Road, Blue Hill Avenue, and Circuit Drive converge. Based on predicted future traffic volumes and hourly distributions, as well as the additional Zoo generated traffic on these roadways (visitors driving to the satellite lot plus shuttle buses) it is possible to examine the effect that increased traffic and future pollutant emission factors will have on the local air quality.

Allan M. Voorhees and Associates has estimated that about 26 percent of the Zoo visitors will travel down Circuit Drive to the satellite lot. On a peak weekday in 1976, this could mean an increase of over 1300 one way trips (650 round trips), plus 423 shuttle bus trips, all on a roadway with a forecast traffic volume of 13,000 vpd. Table 24 shows the effect this increased traffic will have on CO concentrations at several selected receptors near the Zoo entrance during "worst case" conditions. (Figure 20). Several items must be kept in mind in interpreting this data. The first and perhaps most important consideration is that this table is not intended as an accurate prediction of future CO levels. Instead it is intended to serve as an indicator of the trend CO concentrations are expected to follow near the Zoo in future years, based on estimates of traffic volume and the emission characteristics of the various vehicle types. (Table 17 showed the type of variations between measured and predicted values that might be expected from using this dispersion model in the Zoo area). Since future EPA emission standards for motor vehicles are subject to change, an additional element of uncertainty is present in the calculations for future years.

Table 24 demonstrates two major items of importance. The first is that without the Zoo development, but with a compounded annual increase in traffic volumes of 1.6 percent, the predicted CO concentrations will drop from 1973 levels, simply because the average

TABLE 24

PREDICTED EIGHT HOUR CARBON MONOXIDE CONCENTRATIONS NEAR ZOO ENTRANCE

(Worst Case Analysis)*

Receptor	Wind Direction	1973 (ppm)	1976 (ppm) w/o Zoo	1976 (ppm) With Zoo	1976 Increase	1986 (ppm) w/o Zoo	1986 (ppm) With Zoo	1986 % Increase
A: Zoo Entrance	S	9.87	6.98	7.36	5.4%	3.49	3.67	5.2%
B: Proposed Family Life Center	SW	18.05	12.94	13.21	2.1%	6.47	6.60	2.0%
C: Endicott School	NNW	8.47	6.04	6.50	7.6%	3.02	3.24	7.3%
D: Local Residence	NNW	5.11	3.66	3.74	2.2%	1.83	1.87	2.2%

* The "worst case" conditions assumes wind speed less than one mile per hour, stable atmospheric conditions, and peak eight hour traffic flow.

NOTE: These predictions do not account for the one-year extention of pollution control levels granted to automobile manufacturers by the EPA.

Source: CLM/Systems, Inc.

TABLE 25

PRESENT AND FUTURE EMISSION DENSITY ESTIMATES*
(kilograms/mile^2/day)

Pollutant	1973	1976** w/o Zoo	1976** With Zoo	1976** Increase	1986** w/o Zoo	1986** With Zoo	1986** Increase
Hydrocarbons (HC)	203	131	136	3.8%	49	51	4.1%
Nitrogen Oxides (NO_x)	166	147	157	6.8%	76	84	10.5%
Carbon Monoxide (CO)	1,278	887	924	4.2%	288	297	3.1%

* From motor vehicles only.

** The emission rates used for these calculations do not reflect the one year pollution control extension granted to automobile manufacturers by the EPA.

Source: CLM/Systems, Inc.

additional traffic plus similar estimates for 1986 affect the total emission densities of carbon monoxide, nitrogen oxides, and hydrocarbons. (It is assumed that the number of trucks making pickups and deliveries at the Zoo is minimal). In this table, the same general trend towards lower emissions with increased traffic but no Zoo development is seen again. The largest Zoo generated contribution to the grid cell is 6.8 percent of the total NO_x emissions in 1976, and 10.5% in 1986. Other increases are all on the order of four percent. (It should be noted that the NO_x increase is largely due to the diesel engine shuttle buses, since the high temperatures and large quantities of excess oxygen involved in diesel combustion are conducive to high NO_x emissions).

Once again it can be seen that the general grid cell air quality will improve significantly due to the lower emissions of future vehicles, and that this improvement is many times larger than the expected small increase from Zoo generated traffic.

(3) Satellite Garage Area

It is clear that the maximum air pollution impact of the Zoo generated traffic will be in the vicinity of the satellite parking garage, where an estimated 2510 visitor vehicles may park during a peak weekday in 1976. This would correspond to a maximum hourly traffic increase of approximately 1000 vehicles, (including 47 buses). Although this will cause a significant increase in pollutant emissions in the immediate vicinity of the garage site, the net air pollution impact of this traffic will diminish sharply away from the garage itself since Zoo visitors will travel to and from the area on a number of different roadways, all of which have very high traffic volumes relative to the added Zoo traffic. (See Table 23).

It was previously demonstrated that the effect of a major portion of this traffic flow (26% plus buses) on air quality near the Zoo entrance was actually quite small, and that more importantly, the estimated increase in pollutants from this Zoo traffic was many times

smaller than the decrease expected from the lower emission rates of future vehicle populations. Although the Zoo will add traffic to major arteries leading to the Forest Hills area, on the average, 1976 and 1986 pollutant concentrations are estimated to be between 25 and 60 percent lower than present concentrations along these roadways, even including the small relative increases expected from Zoo traffic.

This report will not attempt to quantify the expected increase in air pollutant concentrations in the immediate vicinity of the satellite parking garage, since at this time, future traffic patterns in the Forest Hills area are highly uncertain due to the major changes planned for the area over the next few years. When these changes are finalized, they will be subject to both Federal and State environmental impact review, which will, of necessity, include the impacts of Zoo traffic.

(4) Other Air Pollution Sources

The expanded Zoo will operate a small approved pathological incinerator for the disposal of dead animals and other restricted materials. Because of the design of these types of incinerators, emissions are low with correct operation, and are assumed to be negligible.

The large amount of manure expected from the Zoo animals is a potential source of odors both inside the pavilions and in the area surrounding the Zoo site. Experience at other zoos indicates that odor problems are directly related to the thoroughness of maintenance programs. In view of this, at the Franklin Park Zoo the exhibit area will be cleaned each day after closing hours, and areas occupied by animals at night will be cleaned during the day. Manure will be placed in the liquid composting system which will be carefully regulated to supress odors. In addition, the air within the pavilions will be vented so that no odor buildup will occur. In general, these precautions should prevent odors from becoming objectionable both within the Zoo itself and outside the site boundaries.

There will be airbourne dust during construction due to movement of heavy equipment, as well as clearing and stripping of vegetation. This dust will be minimized by the following precautions.

- Water will be used, where necessary, for control of dust during land clearing operations;
- All open bodied trucks will be covered when in motion while carrying materials likely to give rise to airborne dusts;
- Landscaping operations such as grading, application of fertilizers, etc., will be conducted in such manner as to prevent dust from becoming airborne; and
- Construction debris will not be burned on the site.

(c) Noise

The expansion of the Zoo will affect local noise levels only as a result of construction operations and generated traffic. It is difficult, however, to fully describe these traffic noise impacts, since the actual impact varies greatly with receptor location relative to the roadways carrying the increased traffic. Although the following discussion will emphasize the three receptors shown in Figure 22 and another receptor in the Forest Hills area, it should be emphasized that noise levels at other locations will be higher and lower than those indicated. For example, Receptor C is the approximate center of the Zoo site. Noise levels at this location will be much lower than those at the entrance gate simply because of the difference in distance.

As a point of reference for the following discussion, it should be noted that an increase of 10 decibels will sound subjectively twice as loud to the human ear.

(1) The Zoo Entrance Area

Zoo traffic will affect the noise levels near the Zoo entrance because of both the increased automobile traffic travelling to and from the satellite garage on Circuit Drive and the shuttle bus service right at the entrance gate. As discussed previously, peak weekday noise levels in this area are presently dominated by heavy duty truck traffic.

On weekends this truck noise becomes insignificant, but automobile volumes are still high enough to exceed recommended noise levels at selected receptors. Employing the same type of analysis presented in the previous two sections of this report, it is possible to add the Zoo generated traffic to predicted future volumes in order to assess the impact of the development during different time periods and on different days. Table 26 shows the results of this analysis, using the same calculation methods outlined in Section IV A (4). (The receptors are shown in Figure 22). This table shows that without the Zoo development, noise levels will increase by approximately one dBA between 1973 and 1986 due to the natural increase in traffic volumes.

If the expanded Zoo is built, peak hour weekday noise levels will not be affected at three receptor locations, due to the dominant truck noise. Directly in the entrance gate area, however, the noise from accelerating and decelerating buses will be significant, but will not be as noticeable or as continuous as the very loud trucks travelling on Blue Hill Avenue.

On Sundays, the increased Zoo traffic near the entrance area is not sufficient to increase noise levels significantly except at the Zoo itself. The noise increase to be experienced at the center of the Zoo is estimated to be approximately seven dBA, solely due to the shuttle bus service at the front entrance. (Although buses share many basic design characteristics with trucks, they are generally quieter due to their larger mufflers and enclosed engine compartment. Noise levels ten or twenty feet from an accelerating bus are in the 80 to 87 dBA range.[35] Zoo visitors in the immediate vicinity of the entrance gate will be exposed to this level of noise intermittently as buses drive away. Inside the Zoo the bus noise will diminish as a result of both distance and the shielding effects of buildings and other barriers. As the buses drive along Circuit Drive, the natural terrain of the Sausage will act as a very effective noise barrier due to the sharp drop in elevation. Within the Sausage itself, the buses will be audible, but their noise levels will be lower because they will be at cruising speeds (18 mph). Thus the noise impact within the main part of the Zoo will be mainly due to the buses at the entrance gate.

TABLE 26

FUTURE PEAK HOUR NOISE LEVELS
WITH AND WITHOUT ZOO DEVELOPMENT*

(L_{10} Noise Levels in dBA)

Receptors	1973	1976 w/o Zoo	1976 With Zoo	1976 Increase	1986 w/o Zoo	1986 With Zoo	1986 Increase
A. Endicott School							
- Weekdays	83	83	83	0	84	84	0
- Sundays	63	64	64	0	64	64	0
B. Local Residence							
- Weekdays	84	84	84	0	85	84	0
- Sundays	63	64	64	0	64	64	0
C. Center of Zoo							
- Weekdays	57	58	58	0	58	58	0
- Sundays	41	42	49	7	42	49	7
Washington Hospital							
- Weekdays	64	65	66	1	65	66	1
- Sundays	57	58	66	8	58	66	8

* The weekday peak hour is 4:30-5:30 p.m.
The Sunday peak hour is 1:00-2:00 p.m.
This is motor vehicle related noise only.

Source: CLM/Systems, Inc.

In general then, in the vicinity of the Zoo entrance, weekday noise levels will not change the Zoo development due to the overriding influence of existing heavy truck traffic. On Sundays when this truck noise diminishes, the shuttle buses will increase levels within the Zoo itself, although the resulting noise levels will be significantly lower than the weekday levels. (The Federal Highway Administration's recommended design noise level for recreation areas is 70 dBA, which will only be exceeded within the first hundred feet of Peabody Circle).

(2) <u>The Forest Hills Area</u>

In the Forest Hills area, the existing peak noise levels are due in large part to the MBTA elevated transit line. With increasing distance from the tracks, motor vehicle traffic becomes more significant. Thus at the Washington Hospital, (which is 600 feet from the transit line), the additional Zoo generated traffic will become significant from a noise standpoint. Table 26 shows that the net increase at the hospital during the peak hour on weekdays is expected to be on the order of one decibel. On weekends when local truck traffic diminishes, the shuttle buses become the dominant noise factor, increasing the peak hour level by an estimated eight dBA. Thus the noise level during the Sunday peak hour will be roughly equivalent to the weekday peak hour level at the hospital. Local residences are several hundred feet further from the Forest Hills overpass area, so the resulting noise levels will be three or four decibels lower than those at the hospital.

In the immediate vicinity of the satellite parking garage, noise from Zoo generated automobiles will be lower than that from shuttle buses, weekday truck traffic, and the MBTA transit line. (Although it is possible that the Orange Line will be relocated and depressed below grade, this development will be many years in the future). On weekdays, the shuttle buses will also be "quieter" than the background noise levels, but on Sundays, noise from these buses will be dominant near the garage itself, just as it was directly at the Zoo entrance gate. This means that levels up to 85 dBA could be experienced at short

distances from the accelerating and decelerating buses. Several hundred feet away, this noise will be reduced significantly by both distance and intervening rows of structures.

A general statement of the noise impact from the Zoo generated traffic is that automobile noise will not result in any significant increase in ambient noise levels, while the shuttle bus service will increase general noise levels only on Sundays when local truck noise is not present. The effect of this bus noise will be the greatest in the immediate vicinity of the two loading and unloading areas.

(3) Construction Noise

The construction operations at the Franklin Park Zoo will generate noise over approximately a two-year period. Work will not take place on weekends. The effect of this noise will be experienced predominantly by people living along Seaver Street or in the residential and commercial areas along Blue Hill Avenue. Some noise will be experienced at the golf course or other areas of Franklin Park bordering the Zoo. In addition, since certain sections of the Zoo will be open to the public while other construction operations are in progress, there will be a noise impact within the Zoo.

It is clear that the level of construction noise experienced at any location will vary considerably depending on the distance from the noise source. In an effort to quantify this construction noise impact, it will be assumed that construction operations will take place at the center of the Zoo grounds. This will, in a sense, give an indication of the average noise level. It will also be assumed that the noise levels will be reduced by six decibels when the observation distance is doubled.

Table 27 shows the typical noise levels at construction sites for major developments like parking garages, amusement parks and recreation areas. These values are given for five different observation distances. Figure 22 shows approximate distances from selected locations outside the Zoo to both the Zoo center and the closest boundary. Thus it is possible to obtain a rough estimate

of the peak construction noise level (when the operation is closest to the receptor) as well as the average level over the entire construction period. It must be understood that Table 27 represents noise levels that apply to a general type of facility. There will be both positive and negative discrepancies from these levels depending on the specific design of each development. For instance, the construction of buildings at the Zoo may well be quieter than indicated in the table due to the fabric covering being utilized. However, there will be limited blasting opeations at some locations, so other noise levels may be greater than indicated. These estimates also do not take into account any attenuation from topography or vegetation.

The values in Table 27 reflect only construction noise, and should be added to ambient noise levels from Section IV in order to fully assess the impact. As discussed previously, the noise levels in the Zoo area are dominated by heavy truck traffic. This traffic noise is presently loud enough and close enough to the community that except for construction operations right on the Zoo border, the total noise levels from both traffic and construction will be roughly equal to the existing traffic noise. (See Section IV A(4) for a brief discussion of decibel addition). In other words, the existing ambient noise levels are high enough that construction operations will either blend in with background levels, or, in extreme cases, be noticeable but only slightly bothersome.

(4) Miscellaneous Noise

Noise from Zoo animals during the nighttime has been a problem at other zoos located near populated areas. At the expanded Franklin Park Zoo however, animals will be kept in their indoor holding areas overnight, so no noise problem is expected.

Inside the pavilions, there may be an additional problem of noise caused by rain striking the suspended fabric. A consulting firm has been hired to analyze this problem and to recommend methods for reducing the possible impact on the Zoo visitor. It is felt that use of waterfalls, flowing water and recorded animal sounds will all be effective in masking the sound of rainfall.

TABLE 27

TYPICAL NOISE LEVELS FROM CONSTRUCTION OF AMUSEMENT PARK OR RECREATION AREA*

(in dBA)

Construction Operation	Observation Distance (In Feet)				
	100	200	400	800	1600
Ground Clearing	78	72	66	60	54
Excavation	83	77	71	65	59
Foundations	71	65	59	53	47
Erection	78	72	66	60	54
Finishing	83	77	71	65	59

*These values were calculated from those given for 50 feet using the relationship that doubling observation distance reduces sound intensity by 6 decibels.

Source: Environmental Protection Agency, Report to the President and Congress on Noise, March, 1972. U.S. Government Printing Office, Washington, D.C., page 2-104.

(d) Energy

Based on preliminary design information, it is estimated that the maximum connected electrical load of the new Zoo will be 5,000 KVA. This electricity will reach the Zoo through a connecting line to Seaver Street.

The heating and cooling operations are expected to require a maximum of 40,000,000 BTU/hour, to be provided by either gas or oil service. (This will be decided during the final design phase of the project).

Representatives of the Boston Edison Company, the Boston Gas Company, and other potential utility sources have all indicated that they feel they will be able to serve the exapnded Zoo upon its completion in 1976 or 1977 without affecting the service to other customers within the region or within the local community.[36] It should be emphasized, however, that the proposed Zoo expansion represents a large increase in energy consumption over the existing faciltiy.

Because of this increased demand, the project has been designed to conserve energy in many different ways: there will be heat exchangers in the pavilion exhaust systems; vents will be installed for recirculation of warm air; trees will be planted to divert cold winds from the surfaces of the pavilions; indoor exhibits will not be used during hot summer months unless weather is bad; only the interior visitor walkways will be cooled during the summer; a central heating and cooling plant will be utilized for maximum efficiency and economics; plants and vegetation are being selected that produce the desired landscaping effect but which do not require tropical temperatures; and finally, the pavilions have been depressed below grade, thus taking advantage of natural heat from the earth and reducing the surface area exposed to winter wind and cold.

As they are presently envisioned, the pavilions will have only the teflon fabric separating interior air from exterior air. (It is estimated that this fabric has a conductance factor (U) of 1.0). In light of recent forecasts of a national energy shortage, the project staff is now examining the economics and structural feasibility of providing some means of additional insulation for each pavilion. In addition to the cost of the insulation, the structures would then have to be designed to support a live load of 30 pounds per square foot due to the possibility of snow and ice accumulations that would adhere to the insulated fabric. There would thus be a requirement for more numerous or heavier cables and structural members, as well as a need for more artificial lighting due to blockage of sunlight by the insulation and/or accumulations of snow and ice.

Although an investigation of the ramifications of providing insulation material is presently being conducted, for the purpose of this report it can only be stated that many energy conserving processes and designs have been incorporated into the project, but that additional energy savings could be realized by the use of insulation.

(e) Storm Drainage

One of the design features of the new Zoo is the provision for large troughs around the perimeter of each pavilion to catch storm water from the roof surfaces. These troughs will be linked to the various water moats and ponds so that a large water detention capability is available in the event of a very intense storm. This system will accommodate a ten year design storm without flooding.

Drainage from this network will be to the pipe system under the golf course. It is planned that the pipes leading from the Zoo to the 33-inch golf course pipe will be small enough to limit the flow in that pipe so as not to exceed its capacity. These pipe sizes will be determined in conjunction with Boston Parks Department personnel). Thus it can be stated that although the development of the Zoo site will increase the impervious ground area from approximately 7.9 acres to 15.6 acres, thr runoff detention system will maintain a peak runoff rate that will not cause the capacity of the receiving pipe system to be exceeded. Although the total volume of runoff will be increased by the development, the peak runoff rate will be controlled at an acceptable level, which is not the case presently. In this way, any local flooding potential is expected to be reduced as a result of the Zoo development. In addition, the feasibility of utilizing the collected runoff water for interior irrigation is presently being investigated.

(f) Sanitary Sewage

As previously discussed, the sanitary sewage from the Zoo will consist largely of water from the cleaning of animal holding facilities, combined with a relatively small volume of sewage from Zoo visitors and staff. At five gallons per visitor per day, an estimated 85,000 gallons of sanitary sewage might be generated on a peak day. The contribution from Zoo cleaning operations is much more difficult to quantify,

but it is felt that the volume of the expanded Zoo cleaning operations might be as much as six times the present volume, which was estimated at 100,000 gallons per day. This brings the total sanitary sewage flow to an estimated 685,000 gallons on a peak day after completion of the expansion, where the comparable figure is 115,000 gpd under present conditions.

This sanitary sewage will flow into a 33-inch pipe under the golf course which eventually connects to the City sewer system leading to the Deer Island treatment plant in Boston Harbor.[37] Although a new EPA regulation requires at least secondary treatment for sewage by 1976, the Deer Island treatment plant has been granted an extension because of the tremendous volumes generated by the combined storm runoff and sanitary sewage system in Metropolitan Boston. Initially the Zoo sanitary sewage will receive only primary treatment before being passed to Boston Harbor. The design capacity of the Deer Island plant is approximately 343 mgd, with an average annual flow of 340 mgd in 1972.

It should then be noted that the expanded Zoo operations might increase the Zoo sewage volume by an estimated 570,000 gpd. Although the total Zoo volume is less than one fifth of one percent of the Deer Island plant's annual flow, the increase must be recognized as an additional load on a treatment plant that is already incapable of meeting EPA standards by 1976.

(g) Water Quality

The Zoo expansion will affect regional water quality only as a result of storm runoff and sanitary sewage connections to the Boston sewage system. The sanitary sewage load is estimated to increase by 570,000 gallons per day over present levels, and the storm runoff volume is expected to increase by varying amounts, depending on future storm duration and intensities. Since this combined sewage will be treated and released to Boston Harbor, the Zoo will have an impact on water quality, although it will be extremely small. This will be especially true when secondary treatment is provided as a result of an implementation plan presently being developed by the MDC, the State Water Pollution Control Board, and the Federal Government.

It should be noted, however, that the Zoo sanitary sewage is largely due to the washing down of animal areas, and thus that the total sewage volume will be almost entirely water. (Manure and bedding material will be collected and disposed of in the liquid composting system described in the Project Description).

It should also be emphasized that the U. S. Department of Agriculture enforces strict regulations created to minimize the dissemination of diseases from zoological facilities. Extreme care will be taken when animals are hospitalized to avoid spreading contaminants off the Zoo property through the sewer system.

In summary, it is expected that although the total volume of storm and sanitary sewage is expected to increase as a result of the Zoo expansion, this increase will result in a very minor impact on regional water quality due to the carefully regulated disease controls, and the very dilute composition of the Zoo generated sewage, the volume of which will only be a tiny fraction of the total volume handled by the Deer Island plant.

(h) Water Supply

The proposed Zoo expansion will result in an increased demand for water. The existing Zoo used close to 50 million gallons of water in 1972, while future operations could use over 300 million gallons per year because of the increased number of animal areas to be washed down, as well as the added moats and ponds. Peak usage might be 1,000,000 gallons per day.

The Metropolitan District Commission provides the main supply of water to the Boston region. Presently the regional rate of consumption is 312 million gallons per day, which exeeds the safe water yield of the MDC watershed (300 million gallons per day).[38] This problem will be handled by several planned capacity expansions, including the addition of a new water source of 72 mgd from the Connecticut River, which will then provide additional capacity for approximately 15 years based on projected population and usage increases. This capacity expansion is currently

in the design stage, although Legislative approval has been obtained for its construction. Completion is expected in early 1977,[39] which will coincide with the final completion date of the Zoo expansion. Although the Zoo will generate an increased demand on the regional water supply, there should be adequate capacity to handle this demand.

It should also be pointed out that the Zoo design does conserve water usage, since the detention troughs around the pavilions will be utilized to collect storm water for use in the moats and ponds and possibly even for interior irrigation. Also, the fabric being used to cover the pavilions washes clean with rainwater, so additional water will not be needed to keep the structures clean.

As described in the Project Description, the proposed Zoo will obtain its water from a 36-inch main in Blue Hill Avenue located across from the Peabody Circle entrance. The water will be used for both fire fighting and general Zoo operations.

This connection with the City water system was agreed upon by the Boston Public Works Department, under the condition that present expansion operations to the pipe and tunnel system are completed before any connection is made. Thus, it can be stated that the City is satisfied that the additional Zoo demand will have no adverse effect on local and regional water pressure and service once improvements to the distribution system have been completed.

(i) Solid Waste

Solid waste for the proposed project will be composed of wastes generated by Zoo operations and visitors, but will not include any animal wastes. Animal wastes will be disposed of on the Zoo site. It is expected that uncompacted wastes from visitors and operations will amount to approximately 10 cubic yards per day during the off-season.[40] Assuming a six-month peak season, 3,600 cubic yards of waste would be generated during that period, and 1,800 cubic yards of waste would be generated in the off-season. The annual total would thus be 5,400 cubic yards of uncompacted solid waste.

It is anticipated that refuse generated by the new Zoo will be handled in a manner similar to that of the existing Zoo. The waste will be hauled by a private contractor to a nearby solid waste disposal facility, which at the present time is the City of Boston sanitary landfill in West Roxbury.

As discussed previously, the existing West Roxbury landfill has already reached capacity. It is expected that this facility will be replaced with some other approved solid waste facility by the 1976/1977 Zoo completion date.

(j) Aesthetics and Public Attitude

The proposed project will have both positive and negative impacts on the aesthetics of the Zoo site and surrounding area.

(1) Positive Impacts

Section IV B(12b) discussed the relatively rundown condition of the existing Zoo grounds. It is obvious that the new Zoo will be better maintained because of the increased public interest generated by the new exhibits. The proposed landscaping and moating discussed in Section III will be quite interesting and extensive and will be well protected from both people and animals. There will also be areas of the Zoo where families can relax or picnic, as is the case presently. (See Figure 3 B). New plantings will increase the total vegetative cover to approximately fifty percent over and above what presently exists. Although a number of trees will be removed, many of them are presently either dead or diseased.

The superstructures of the new pavilions will be approximately 70 feet above grade at their mid-span, and the perimeter of each structure will be buffered by earth berms which have been developed to continue the lines of the natural topography within the existing site. The height of the pavilions will be less than the height of many of the larger trees on the site. In addition, the structures will be obscured from many locations outside the Zoo grounds by existing stands of dense vegetation as well as the natural topography of the area. Where

necessary, fast growing dense trees will be planted on the site borders to further isolate the Zoo from the surrounding urban area. In terms of extensive new landscaping and moating, as well as careful building design and location, the project site should be both useful and aesthetically pleasing.

As a result of this project, it is hoped that other areas of Franklin Park will begin to generate the usage, interest, and therefore, the maintenance and protection necessary for a safe, enjoyable park. An example of how Franklin Park may become safer, and, therefore, more popular with the public can be found in crime records for the Park over the last year. In May, 1972, the Boston Police implemented a program whereby twelve patrolmen were stationed in the Park area during the day, and four patrolmen in the evening. Traffic was controlled by blocking off roads in the Park, with the exception of Glen Lane and Circuit Drive. The MDC also increased police protection at the Zoo site. The result of these efforts was a decrease in reported crimes and much greater Park attendance by children and adults.

Increased usage of the Park area by the public might reduce both the crime rate and the general fear of crime which is presently associated with the Park area. A study by the Metropolitan Area Planning Council on "Criminal Activity and Vandalism" in the Olmsted Park System concludes that:

> Most people feel that Park areas are dangerous; therefore they don't use the Park. Any area that is rarely frequented becomes a prime site for criminal activity. The fact is that there are few crimes reported within the park boundaries, and only fear of possible crime keeps people from enjoying the park more often and consistently. Constant use of the park could lessen the opportunity for crime and create a safer park. [41]

The development of the Zoo may thus help to create a situation where more and more people could enjoy the aesthetic beauty of Franklin Park itself.

The proposed site plan does alter the existing layout of the Greeting area, as described previously. Although this change can be viewed as a negative aesthetic impact, it can also be considered a positive impact. The Greeting presently gives the Zoo visitor a long, unobstructed view across the site. (Figure 29). The proposed plan will place animal exhibits across this area, such that the vista will become a panoramic animal display, which should be a very striking feature of the new Franklin Park Zoo. (Figure 6 shows a scale model of the Zoo. Since this picture was taken, the pavilion at the far end of the Greeting has been relocated so that it is now 60 feet closer to Seaver Street on the right). The long view has still been retained in large part, but it has also been accented by the presence of the African animals.

(2) <u>Negative Impacts</u>

There will also be some negative aesthetic impacts associated with the project. The first and most obvious is that an existing site which is now relatively open will become more densly developed with buildings, walkways, moats, and exhibit areas. The same is true to a lesser extent in the Sausage area, where exhibits and walkways, (but no buildings) will be placed. The Sausage is presently 16.25 acres of park land, and as such is a valuable regional asset. This section of land will be leased to the MDC, but will still be City of Boston property.

The project will also alter the existing character of the Greeting, which has been in existence for close to sixty years. Presently it is possible to stand outside the Zoo grounds and look through to the monuments on the other end. With the proposed plan, this view from the outside is purposely blocked to isolate the Zoo experience from the urban environment outside. Once inside the Zoo, the Greeting area will be viewed as a panoramic animal display, which is a significant change from the existing open space usage.

A variety of evergreens will be introduced throughout the site which will both screen and complement the structures and moats on a year-round basis. Some of the proposed plantings will be close proximity to the structures themselves, where others will be located at strategic points to block long lines of sight. Since these plantings will not succeed in totally screening the buildings, there will be a possibility of sunlight reflections. Glare is expected to be of short duration and limited intensity because of both the location of the pavilions in pockets between major growths of trees and the tentlike curves of the suspended fabric which will tend to scatter light, but this potential problem should be recognized.

The Zoo site (with the exception of the Children's Zoo) is presently used by neighborhood residents as a free park. This will no longer be the case once an admission charge is required, although certain free admission hours will be established as discussed previously. The remainder of Franklin Park will still be available for general recreational usage. Portions of the Sausage will not be fenced in and will be left for general park use.

The Zoo site (and Glen Lane) are also used presently as access corridors for local residents walking or bicycling to and from the Playsted area (White Stadium, Theatre in the Park, etc.). Once the Zoo grounds are closed off, these people will be forced to travel around the site along either Circuit Drive or Seaver Street, both of which are heavily traveled roadways. Adequate pedestrian safeguards (stoplights, sidewalks, etc.) should be developed to ensure public safety.

One unavoidable aspect of the Zoo development will be the generation of additional traffic. Although the parking garage will be located in the Forest Hills area, Zoo visitors will add to existing loads on most of the major arteries in the area. This will include additional traffic on Circuit Drive through Franklin Park, due

to visitors driving to and from the parking garage as well as the numerous shuttle bus trips. Since as many as 94 one-way shuttle trips (47 round trips) are expected during peak conditions, this will have an obvious impact on the aesthetics of the Park, especially from the standpoints of noise and bus visibility. Although the generated traffic in the immediate vicinity of the Zoo has been reduced by the use of a remote satellite lot, the use of large double decker shuttle buses through the Park must be considered a negative aesthetic impact.

In the area of the satellite lot, the real impact of the Zoo generated traffic will be experienced. In this location, however, the aesthetic impacts are not as significant simply due to the existing and proposed future land use. The area is densely developed, is deteriorating in sections, and will undergo major changes in the future. Although the general impact of the Zoo generated automobile and bus traffic in the area should be recognized, the net change from existing conditions will not be that significant from an aesthetic standpoint.

(k) Impact on Wildlife

Wild animals living on the project site can move to other parts of Franklin Park during the construction and operation of the expanded Zoo. Because of the availability of a more natural habitat in close proximity to the project site, no adverse impact on wildlife species is expected as a result of the project. BZS officials also state that experience at the new Aviary indicates that more migratory birds will be attracted to the proposed Zoo because of the increased number of ponds and water moats.

(l) Public and Animal Health

The U.S. Department of Agriculture Animal and Plant Health Inspection Division will be responsible for inspection of the new Zoo facilities. The existing Franklin Park Zoo is currently inspected on a quarterly basis. In addition to inspection of the site drainage, physical plant, and methods of operation, regulations require that a veterinarian be available for periodic examination of all animals and for post mortems on those that die. The disposal of restricted animal wastes and dead animals must be accomplished within the Zoo property, either through burial or incineration. The USDA must

also take all actions considered necessary to prevent the dissemination of diseases from the zoological park.

In view of these Federal regulations, no health danger to the community or the region is anticipated as a result of the expansion of Franklin Park Zoo.

(m) Education

One very significant benefit of the proposed project is that it will be a valuable educational resource for the general public as well as for the regional school systems.

Part of this benefit arises from the fact that the Zoo will have both indoor and outdoor exhibits, and that it will operate year-round. An outdoor Zoo is limited by the weather, and is available for classroom visits only during the spring and part of the fall. This new facility will permit groups to be reliably scheduled throughout the school year, thus avoiding the disappointment and re-scheduling problems caused by bad weather. Teachers will have more flexibility in planning a trip to the Zoo so that it fits into the correct sequence in their class program. Classroom visits can also be scheduled throughout the year in order to avoid crowded exhibit areas.

It is intended that the proposed Zoo will be of significantly higher educational and visual quality than the present facility. The educational aspect of the proposed Zoo has been one of the primary considerations in the planning process. As described in the Project Description, the exhibits are planned to closely resemble the natural animal habitats. Where possible, different animal types will be grouped together as they are found naturally, instead of being segregated by species as is the case in many zoos. Information and orientation areas are planned for each major geographical exhibit, in addition to the extensive use of descriptive signs at each specific exhibit. An innovative education program and resource center are also planned as part of the new Zoo. This program is intended to serve all educational levels, from young school children to individuals interested in research.

(n) Economics

It is estimated that the proposed Zoo facility will attract approximately 1,500,000 visitors per year in 1976. As described previously, the area around the Zoo consists of low to middle income residential neighborhoods, with some small commercial establishments, and a rather large proportion of institutions. At present, the area does not have any facilities of widespread regional interest which would draw a significant number of outsiders on a regular basis.

It is expected that visitors to the Zoo will create a demand for local services and commodities. For example, gasoline and meals will probably be sought by many visitors on their way to and from the Zoo (although there will be in-grounds refreshment stands). Futher opportunities for local business may be found in a variety of Zoo-oriented shops as evidenced in the Model City development envisioned for Blue Hill Avenue and described in Section 4A (1b).

Although it is contingent on a number of factors, one possible effect of the Zoo-oriented "spin-off" businesses might be an escalation in the value of land near the Zoo. At the present time it is not possible to predict accurately the degree to which this phenomenon might take place or those who would be positively and negatively affected by its occurrence. The Zoo by itself is not expected to significantly affect the commercial and residential property values in the vicinity of the Park. However, the various redevelopment programs previously discussed, (BRA and Model City), combined with the presence of a major new facility like the Zoo could generate renewed interest and bring other new developments into the area. Taken all together, this could lead to general economic growth in the community.

On a regional level, the project is expected to have a significant impact as a tourist attraction. In a report to the Legislature by the Special Commission on the Franklin Park Zoo and other Metropolitan Destrict Commission Zoological Facilities, it was observed that:

> A good zoo has an important impact on business and tourism. In the United States each year more people visit zoos than attend all professional sports events combined. A major zoological facility at Franklin Park would be the sole attraction of this type in all New England. [42]

Economic Research Associates has estimated that 70 percent of the Zoo visitors will be from the local area (within a 50 mile radius), while 20 percent will be from New England and 10 percent from outside New England. Thus close to 500,000 visitors per year could be drawn to the Boston area from various remote locations. Although it is impossible to tell how many of these people would still come to this area if the Zoo were not built, it is clear that the additional tourists will have a significant impact on the regional economy. For example, the Boston Chamber of Commerce estimates that 1.5 million tourists visited the City during 1972, and that each one spent an average of $40 in the area. [43] Since visitors to the Zoo will come from many different locations, the economic impact of this project will be highest in the Boston area, but it will also be significant throughout the entire New England region.

(1) Construction

The contractor for the Zoo will be required to comply with the Executive Memorandum on Minority Hiring (Altshuler Plan), which calls for 30 percent minority hiring trade by trade by 1974. [44] Since the area surrounding the Zoo has a large minority population, it is anticipated that a significant portion of those jobs will be held by area residents. Between 250 and 300 construction jobs will be created by the Zoo expansion.

In addition to direct employment, the construction phase will necessitate the purchase of building materials, equipment and services from local contractors.

(2) Operations

The Zoo presently employs approximately 71 persons in permanent jobs. Sixty of these are MDC employees, who qualified for their jobs and are paid according to the Massachusetts Civil Service System. The remaining eleven employees are BZS employees.

The proposed new Zoo will support approximately 170 permanent employees representing an increase of nearly 100 jobs over the present level of employment. Peak season hiring will be used to supplement the permanent staff.

(3) Funding

At the present time, funds for the Franklin Park Zoo come from both the BZS and the MDC. The BZS is a private, non-profit organization and the MDC is a State-appointed Commission. Funds available to the BZS are from various sources; membership fees, straight donations, admission fees from the Children's Zoo, and fund-drive revenues. In addition to its private sources, the BZS receives from the MDC between $150,000 and $200,000 as an annual management fee. As a State Commission, the MDC is funded by the State, and its budget is appropriated annually by the Legislature.

Exact figures for expenditures by both groups on the Franklin Park Zoo are not available, as the accounting procedures do not differentiate between the Franklin Park Zoo and the Stone Zoo in Stoneham. The combined figures do, however, give an indication of the relative amount of money contributed by each group.

In the 1973 Fiscal Year, July 1, 1972 through June 30, 1973, MDC expenditures at the two zoos totalled $796,857.91,[45] plus the $150,000 BZS management fee. BZS total expenditures for the same period were $569,955.[46] These totals include salaries paid to all personnel at both zoos.

The entrance fee for the expanded Zoo facility has been calculated at the level that would make the Zoo self sustaining, assuming that the BZS and MDC contributions remain at their present levels. The importance of this assumption is reflected in the fact that with no additional expenditures by the MDC, there will be no increase in the number of tax dollars needed to support the proposed new Zoo facility.

(o) Police and Fire Protection

No large increase in the demand for police or fire protection is expected as a result of the proposed project. Buildings to be constructed on the site will comply with all relevant codes and regulations, and thus will not present any special danger or fire hazard. (The fabric used to cover the structures is fire resistant). The net effect on the fire department will be that of an expanded facility to be serviced. Firefighting and emergency access will be provided throughout the site. Also, because of the tremendous quantities of water used in Zoo operations, adequate water pressure for fire fighting purposes will be available throughout the site.

Past experience has shown that vandalism has been kept to a minimum or virtually eliminated in areas that are well maintained, supervised and kept free of litter and possible missles. At the new Zoo, a basic concept of constant repair and clean-up will be practiced at all times. The presence of employees in public areas will increase security. Thus it is expected that the existing level of MDC police supervision at the Zoo site will be sufficient for expanded operations.

If the expanded Zoo generates spin-off usage of adjacent Franklin Park areas as is expected, the amount of supervision by the City of Boston police may change from the present security level. The exact nature of this change cannot be estimated until it is known how densely the various park sections will be utilized. If in fact the usage increases sharply and public fear of the area declines, police supervision may also diminish.

(p) General Community and Governmental Reaction

When the 1972 Franklin Park Zoo Feasibility Study was released, a great deal of public and governmental comment ensued. This was due to several design considerations including the proposal for a single Zoo pavilion spanning seven acres and the recommendation of the use of the Refectory Site for a 1200 car parking garage. Since that time, various meetings have been held between the BZS, the MDC, the project staff, the BRA, the Boston Model City Agency, the Mayor's Office, the Boston Parks Department and many other governmental agencies, citizen groups, and concerned individuals in an effort to anticipate and solve problems at an early stage. The project as presented in this report includes several major compromise solutions between these various interested parties, perhaps the most significant of which is the decision to use a satellite parking facility and a shuttle bus system rather than some form of adjacent parking.

A point to be emphasized is that virtually all of the controversy about this project has centered on certain design concentrations, while the general concept of an expanded Zoo in Franklin Park has been well received. Appendix C contains selected letters dealing with the Zoo expansion.

A meeting was held on August 24, 1973 to discuss the historical impact of the proposed project. The following organizations were invited to attend: The Boston Society of Landscape Architects; the Preservation Committee of the Boston Society of Architects; The Society for the Preservation of New England Antiquities; The Boston Landmarks Commission; the Massachusetts Historical Commission; The Sierra Club; the Arnold Arboretum; the Jamaica Hills Association; the Trustees of Reservations; the Dorchester Historical Society; and the New England Olmsted Sesquicentennial Committee. In addition, a number of individuals were invited including: Professor Charles Harris, the Chairman of the Harvard University Department of Landscape Architecture; Norman T. Newton, the Charles Eliot Professor of Landscape Architecture, Emeritus (Harvard University); and Cynthia Zaitzevsky,

a PhD candidate in History at the Harvard University Graduate School of Arts and Sciences.

In addition to the project staff, those attending the meeting included two representatives from the Boston Landmarks Commission, two representatives of the Massachusetts Historical Commission, Professor Newton, Cynthia Zaitzevsky, and a representative from the Boston Society of Landscape Architects who also is a partner in the firm of Olmsted Associates. A letter from the Chairman of the Olmsted Sesquicentennial Committee is enclosed in Appendix C.

During this meeting, a brief summary of the historical development of Franklin Park was presented, followed by a discussion by the architects showing the chronology of the project design with respect to building and exhibit locations. The pros and cons of all the different design alternatives were presented, followed by the proposed project layout and landscaping scheme. There were no major objections to the proposed design as presented. The fact that the "Sausage" area will be used largely as a buffer from Circuit Drive met with general approval, as did the proposed exhibit usage of the Greeting. The major concern expressed about the Greeting centered on its value as a visual axis or panorama, and not on the historical usage as intended by Olmsted.

Included in Appendix C are letters from the MDC Design Review Committee discussing the project as presented in late September, 1973, and a letter from Professor Emeritus Norman T. Newton describing his personal reaction to the project design.

(q) Rodent Control

Since the expanded Zoo will store large quantities of grain, hay, and other animal food items, it is expected that rodents will be attracted to the site. Presently, rodent control is handled by a private pest exterminator under contract to the MDC. This same procedure is anticipated for the expanded Zoo, and no problems are expected.

(r) Animal Security

Many potentially dangerous animals will be located near a densely populated urban area, so it should be stressed that every effort has been taken to insure that the exhibits and animal holding areas are escape-proof. The dimensions of the moats and barriers have been taken from existing zoos where experience has shown them to be totally effective in restraining the animals. The cages and animal holding areas will be modern and equally secure.

2. Impact on the Olmsted Park System

Since the project site is located in Franklin Park, which is part of the Olmsted Park System, the proposed Zoo expansion will have an impact on this historically significant park system. The development of both the Park and the "Emerald Necklace" as a whole were discussed previously, but several aspects of this development should be re-emphasized. The first is that Olmsted intended that Franklin Park would be used by residents of the entire Boston region, not just by those living nearby, as is the case presently. Secondly, he planned for the northern section of the Park to contain zoological exhibits, children's play areas, a music court, a deer park, and a long promenade area called the Greeting which was to be a meeting place for those arriving at the Park by carriage. In this way, he had placed "gregarious" activities in one section of the Park, leaving the remainder to be enjoyed on a more private and serene basis.

The Park was well used in its early years, but as its popularity declined, numerous attempts were made to renew the public interest. These attempts included the construction of tennis courts, a golf course, and Scarboro Pond, as well as the provision of motorized tours of the Park in 1905. Over the years, however, the popularity of the Park has continued to drop to the extent that it is presently used primarily as an over-sized neighborhood park badly in need of maintenance.

The proposed expansion of the Zoo will attract many people to the Franklin Park area who would not have come otherwise. Much as Olmsted intended, the project site will then have a high density usage, which is expected to generate spin-off usage in nearby sections of the Park. In this sense then, the project is consistent with the intent of the original Olmsted plan.

It is appropriate that a zoo should be part of a park. In fact, it is difficult to imagine any other realistic use of the project site that would consistently attract people in sufficient numbers to increase the usage of the remainder of the Park.

The Zoo expansion will alter one dominant feature of the original Olmsted Plan, in that the Greeting is intended for use as a panoramic animal display rather than a pedestrian and carriage promenade area. This means that the use of the Greeting is being changed, but its impact as a visual axis is not.

It should also be pointed out that although there was an original Olmsted Plan for the project site, all development on the site was the result of zoo master plans developed at later dates. For example, the Greeting was built as a result of the 1911 Shurleff plan, although it was first presented in Olmsted's Franklin Park Plan. In order to make the project site consistent with the Olmsted Plan, the site would have to be totally re-built, since very little of it presently exists as he had envisioned.

In summary then, the Olmsted Park System is listed in the National Register of Historic Places because of its significance as "one of the Nation's outstanding examples of a multi-use open space and the landscape architect's finest design project in New England". As a major component of this park system, Franklin Park is presently utilized by a small fraction of the people it was intended to serve. The proposed Zoo expansion will attract many people to the Franklin Park

area, and thus is considered to be consistent with the intent of the original design, although it does alter certain specific site details. The most significant change will be to the Greeting area, which will no longer be a pedestrian corridor, but instead will be a panoramic animal display. However, although the use of the Greeting will change, its visual impact as a large open space (or park axis) will be retained.

3. Impact on the Zoo Itself

(a) Animals

It is important to recognize that a zoo has certain basic obligations to the wild animals it keeps in captivity. Although it is not generally possible to allow animals to seek out their own food and defend themselves, it is possible to promote as much interaction and play behavior as possible. In this project, the animal exhibits have been designed to be spacious, while the emphasis in animal selection has been to provide both the variety of species necessary for an exciting zoo and the number of specimens necessary for increased interaction and breeding. In this respect, the expanded Zoo will be a tremendous improvement over the existing facilities from the point of view of the animals themselves. People coming to view the animals will be treated as the introduced, extraneous element so as not to obscure the primary purpose of providing these natural surroundings.

(b) Air Pollution

Section VI A (1b) discussed the expected impact of the increased air pollution generated by Zoo traffic. One aspect of this impact will be experienced within the Zoo grounds by the animals on display. They would be exposed to the same concentrations of pollutants as the general public. Although there is no specific information available that deals with the effects of air pollution on specific species of African animals, it should be pointed out that the National Ambient Air Quality Standards were established by the EPA at levels that included consideration of pollutant effects on animal health. Since future pollutant concentrations in the Zoo area are expected to be low, no danger to the animal population is anticipated.

One pollutant of special concern to animals is lead, which enters both humans and animals during eating, drinking, and breathing. This is because all natural food and water contain small quantities of lead, but most importantly, urban air contains varying concentrations of atmospheric lead, largely as a result of automobile emissions. Although the concentration of atmospheric lead falls off sharply with increasing distance from a roadway, there is still a significant amount of lead present in urban ambient air.

At the Bronx Zoo in New York, autopsies on dead animals and blood or fecal samples from live animals have been analyzed to determine the impact of ambient lead on the Zoo specimens. Although this study has not been published, the results indicate that of the animals kept outdoors, only the large cats and primates had developed high levels of lead, some approaching clinical toxicity. Hoof stock and other species were not significantly affected. The fecal lead levels from the large cats kept outdoors were ten times higher than those kept indoors. Similarly, the lead levels in the blood of the outdoor cats were two times higher than those kept indoors. In no case, however, has the death or sickness of any animal been attributed to lead poisoning from ambient air, so zoo operations are continuing without change.[47]

In order to relate this information to the proposed project it should be noted that the expected impact from ambient lead at the Franklin Park Zoo is expected to be significantly lower than that at the Bronx Zoo for two main reasons. The first is that the proposed Zoo does not have the tremendous volume of automobile traffic along its borders as is the case at the Bronx Zoo, which is bordered on three sides by heavily traveled New York City arteries, including two major expressways. Secondly, all Zoo animals will be indoors approximately six months of the year. Although there is no representative lead air pollution data for comparison between the two different zoos, it is reasonable to assume that the animals kept at the Franklin Park Zoo will be exposed to significantly lower lead concentrations than those at the Bronx

Zoo, and that Franklin Park animals will, therefore, not be endangered by the ambient lead levels. The actual design of the proposed Zoo does allow for the possibility that if for any reason the lead concentrations found in certain Zoo specimens approach toxic levels at some point in the future, the animals can be moved to indoor exhibits very easily, which will significantly reduce any further exposures to ambient lead. (In addition, there will be no lead-based paint used in any of the animal areas, since this has proved to be a lead source at other zoos).

(c) Noise

As discussed previously, the proposed project will not significantly affect the general traffic noise level in the vicinity of the Zoo except on Sundays. Table 26 shows that the noise levels calculated for the Zoo grounds are quite low compared to those at receptors near the major roadways. This noise level within the Zoo will be experienced by both the general public and the animals on display.

Scientific literature dealing with the effects of noise on laboratory and farm animals is not extensive, but can provide some clues regarding the possible effects on Zoo animals. This evidence suggests that many animals can tolerate short periods of intense sound, and can become conditioned over long periods to peak sound intensities up to 120 decibels.[48] In general, animals appear to adjust quite well to noisy environments. It is thus expected that there will be no adverse impact on the Zoo animals from local traffic noise because the levels are very low compared to animal tolerance levels.

(d) Plants and Vegetation

The new Zoo will introduce many new plants and trees to the project site and will expose existing vegetation to the potential for increased animal and human abuse, so there is a risk that vegetative mortality may be higher than planned in this large scale undertaking. Plants are being selected based on many considerations, including tolerance of low light levels, freedom from insects and disease, and general temperature sensitivity. With any type of plant material, insects and disease will be a problem from time to time. Due to the nature

of the design concept (localized plant "pockets" and beds), control will be greatly enhanced. It is also intended that a holding and treatment area for plant material will be established so that as nearly as possible, the plants will be free from problems prior to installation.

An important aspect of interior air circulation will be the control of fungus and mildew in the exhibits. This will be accomplished by the use of fan equipment in problem areas for simple re-circulation of air.

In the event of a power failure, emergency power generation capability is available which, in conjunction with portable heating units, should be sufficient to maintain minimum temperatures until electrical service returns.

There is also no anticipated problem to the exterior vegetation from reflective heat from pavilion surfaces. This is because the plants and trees being chosen for these outdoor areas are hardy varieties specially selected for their abilities to withstand temperature extremes.

In summary, although the proposed Zoo expansion will be utilizing interior vegetation on a scale that has not been attempted before, and although the existing site vegetation will be exposed to increased abuse, many precautions are being taken to insure that any damage or loss of vegetation is minimized.

B. Alternatives

1. No Action

This alternative would leave the Franklin Park Zoo in its present condition, with no expansion whatsoever.[49] Funds allocated for the expansion would be re-distributed by the State Legislature. All other aspects of present Zoo operations would continue without change.

(a) Positive Impacts

There are a number of positive impacts or benefits associated with this alternative. First, since there will not be an

expansion, $8,000,000 of appropriated funds would not be spent and would reduce State expenditures by the same amount. In addition, none of the adverse environmental impacts connected with the project would be experienced.

There are a number of positive impacts or benefits associated with this alternative. First, since there would not be an expansion, funds allocated by the Legislature would not be spent, so State expenditures would be reduced by $8,000,000. In addition, none of the adverse environmental impacts connected with the project would be experienced:

- There would be no increase in traffic generation over that level expected from the existing Zoo.
- The local and regional air pollution levels would not be increased by Zoo traffic.
- There would not be an increased Zoo demand for utility services (water, sewage treatment, electricity and gas).
- The 16.25 acre "Sausage Area" would remain undisturbed park land.
- The open spaces, (and most noteably the Greeting), would remain open on the Zoo site.
- No trees would be destroyed on the Zoo site.
- Local residents would continue to have a free neighborhood park for their enjoyment.
- There would not be changes made to the Zoo portion of the Olmsted Park System, which is listed in the National Register of Historic Places.

- Since there would be no construction operations, there will also not be any disruption of traffic, increased dust levels, or possible construction noise impacts.
- A relatively small number of animals would be kept in captivity, rather than the larger numbers planned for the new facility. (This is a positive impact only to those individuals and organizations who oppose the concept of a Zoo).

(b) Negative Impacts

There are also a number of negative impacts or costs associated with the "no action" alternative. Perhaps the largest is that the City of Boston (and the entire New England region) would remain without a major zoological facility as an educational and recreational resource.

The fact that there is a need for a regional zoo is quite apparent. The Boston area presently has three zoos. The largest is the Franklin Park Zoo followed by the Walter D. Stone Memorial Zoo in Stoneham, and the Blue Hills Trailside Museum which is a very small zoo near Milton. As of June, 1973, the total animal specimens on display at these three zoos was 1154.[50] Although only 156 of these animals were located in Franklin Park at that time, many birds were being kept at the Stone Zoo during construction of the new Aviary. The actual number of specimens designated for Franklin Park was approximately 421. In contrast, selected zoos in other large cities had the following numbers of specimens in 1972:[51]

- The New York Zoological Park (Bronx Park) 3,619 total specimens.
- Busch Gardens in Tampa, Florida, 2,990 specimens.
- The Pittsburgh Zoological Gardens, 2,102 specimens.
- Columbus Zoological Gardens, 3,953 specimens.

Perhaps more indicative than these numbers is the fact that many of the most popular animal exhibits are missing at Franklin Park. For example, there are no giraffe, hippopotamus, monkey, lion, gorilla, or reptile exhibits, to name just a few.

In 1969, the Special Commission established by the Legislature to study the Franklin Park Zoo and other MDC zoos gave the following reasons in favor of a major zoological facility in the Greater Boston Area.

> A zoo is a major part of a fully developed urban life, one of the few types of facilities that can offer an educational and recreational experience for the entire family...One only needs to visit a good zoo to observe the wholesome recreational potential available.
>
> Major cities throughout the country and the world have important zoological facilities. The Commission has never encountered even one witness who has seen a worse zoo than at Franklin Park. A good zoo contributes to the stature of a city just as do a good symphony, library and professional basketball team. Annual zoo attendance on a world-wide basis now probably exceeds a staggering 300 million people, yet a good major zoo cannot be seen in New England. A decent zoo facility at Boston would avail to the people of all New England a recreational and educational experience they have been missing which is available to residents throughout the rest of the United States and most of the world. A new zoo in Boston is necessary to keep pace with the many cities which have long had them, recently built them or are now planning them. [52]

Other costs associated with the "no action" alternative include the following:

- The African theme is part of a total BZS program for the three MDC zoos, which would then have to be altered.
- Animals at the Zoo would continue to be kept in outdated and often inadequate exhibit areas.

- This major facility would not be built in a section of the City badly in need of development. Other associated losses would include: the economic loss to the area of visitor purchases of goods and services; a loss of both construction jobs and operational jobs; and a more intangible loss of possible renewed interest in (and reduced fear of) an area often avoided and considered dangerous by the general public.
- Franklin Park would remain lightly used, as there would be no spin-off usage as a result of the new Zoo.
- The upkeep of the existing Zoo would remain the same, so there would be no additional manpower or money for badly needed grounds improvements.

2. Build at Another Location

Another alternative to the proposed action is to build the Zoo at a different location. Since the Zoo would probably require partial funding by the Commonwealth, new legislation would have to be enacted, and a new budget would have to be voted for the project, as such funds are not transferable. The existing Zoo at Franklin Park would be closed if a larger scale Zoo were built elsewhere in the Boston area.

(a) Positive Impacts

The new Zoo site could be located in a downtown, city, suburban, or regional location. There is virtually no possibility of a downtown zoo in Boston because of the existing land use. Possible locations would include the Commons or the Public Gardens, but it is obvious that there would be tremendous opposition to any such proposals.

The best possibility for a city location for the Zoo would be in Franklin Park. In fact, it is quite remarkable that this option even exists in a city the size of Boston.

There are, of course, many possible locations for a suburban or regional zoo in the Boston Metropolitan area. Depending

on where such a zoo would be located, the cost of acquiring the necessary land (100 to 150 acres, allowing for future expansion), could easily exceed $1,000,000, thus decreasing the funds for zoo development.

It is obvious that the possibility of a large recreational facility like a zoo could generate a significant amount of opposition at any location in the Boston region. The type of environmental impacts described for this project would be applicable at other locations, but the fact that the proposed project does not sharply alter the existing land use in Franklin Park does help to reduce the magnitude of the impacts in that area. This, of course, would not be true for a different location.

The possibility of other locations for the Zoo has been investigated in the past. A 1967 study for the MDC by the firm Perry Dean Hepburn and Stewart reached the following conclusions:

> Land area available, number of people served, public transportation, range of exhibits, experiences possible, and opportunity for growth were indicated as the major site criteria for locating a zoo. The locations of downtown, city, suburban, and regional zoo types were tested against these criteria as were site alternatives in the Massachusetts area corresponding to these locations. In both cases, the zoo in a large park within the city answered these critera best... Franklin Park appears to be an admirable site in spite of the loss of its direct subway connection...and it is certainly the best in city location available. [53]

The Legislative Special Commission studying the Zoo reported in 1969 that the new zoo facility should be located in Franklin Park.

> The most significant reasons for this conclusion are: (a) space is available, (b) accessibility to maximum population, (c) new zoo facilities would enhance the Model Cities area, and (d) public argument over selection of another site on poor city land or in a suburban residential area would delay progress for years. [54]

In addition, the Boston Zoological Society evaluated the following location options for a new zoo:

- Locate the Zoo outside the Metropolitan Boston area where it would have ample acreage (100-150 vs. Franklin Park's 50-70) and major highway access, and would be removed from the public image of the "inner city".

- Expand Stone Zoo and abandon the Franklin Park site. Expansion would have to be across the street from the current location.

- Construct a new complete facility at Franklin Park as recommended by the Perry Dean and Stewart proposal, including Long Crouch Woods into the site, bringing the total acreage up to about 100 acres.

- Construct a partial exhibit at Franklin Park, staying roughly within current bounds, and consider Stone Zoo as a complimentary exhibit. This could be achieved by placing certain continental exhibits at Franklin Park (Africa, Asia and the Poles) and the remaining at Stone Zoo (North and South American and Australia.)

The BZS decided on a modified version of the last alternative for a number of reasons, as outlined in a letter included as Appendix C . The conclusion of that letter is as follows:

> The Society's decison to recommend the project at Franklin Park Zoo in its current size, scheme and location is consistent with most successful zoos in the country today. With the exception of commercial "animal park" type exhibits, most of the great zoos are located in or contiguous to the heavy population centers. Success is spelled in many ways for zoos, but certainly one of the most important is the number of people it serves and the ease with which they can attend.

Several of the benefits associated with a different zoo location would be experienced at the Franklin Park Zoo site. These include:

- The 16.25 acre "Sausage" would be unchanged.
- Current land use would remain the same within the Zoo site.
- Local residents would still have a free neighborhood park for their enjoyment.
- There would not be changes made to the Zoo portion of the Olmsted Park System, which is listed in the National Register of Historic Places.

Other benefits will be realized wherever the new Zoo is located. These include:

- There would be a major zoological facility in the New England region as a recreational and educational resource.
- The animals would be kept in modern, spacious exhibits.
- There would be an economic benefit to the Zoo area from the sale of goods and services to Zoo visitors, as well as from increased jobs in construction and operation.
- Parking accommodations would be easier to provide because of the availability of more land.
- The new Zoo design would be less constrained, in that a larger site with more useful topography, vegetation, and soils could possibly be located.

(b) Negative Impacts

The construction of a zoo at a location other than at the proposed site would have several adverse impacts on the Franklin Park area. These include:

- A zoo has been in Franklin Park since 1912. The historical significance of this fact is very important, and should not be ignored.
- The school children and local residents of the low-income project area would not have inexpensive and convenient access to a major educational and cultural facility.
- A major investment would not be made in a section of the City where development is badly needed. The economic loss to local businesses, as well as the loss of possible construction and operations jobs would be very significant.
- The new Zoo facility would probably reduce the attendance at whatever exhibits remain at Franklin Park. If the attendance drops, it is possible that funds for manpower and maintenance would either drop or remain the same, which would lead to continued deterioration of park facilities. This would also mean a possible drop in Franklin Park usage, which is already too low. In fact, in order to fully utilize Franklin Park, some other high density usage would have to be proposed for the area which in all likelihood would have many of the same environmental impacts as the proposed project.
- The Franklin Park area would continue to be avoided by the general public because of the fear of crime.

In addition to the cost just described, many of the adverse environmental impacts associated with a zoo at Franklin Park would shift to the new location. The difference would be one of magnitude. Possible considerations are:

- Wherever the site is chosen, there would be an increase in both local and regional air pollution levels due to private transportation

zoo access. If the air is relatively clean at the new site, this impact could be significant.

- Depending on the existing traffic mix (i.e., the amount of truck traffic) near the new site, increased traffic from zoo visitors could increase noise levels.
- There would be some increase in traffic congestion wherever a major facility like a zoo is located.
- Wherever the zoo is located, there would be an increased demand for utility services, (electricity, gas, water, and sewage treatment).
- The existing land use of the new site would change to one that would very likely sharply increase the density of usage.
- There may be a loss of trees and vegetation, depending on the amount of open space at the chosen site.
- Construction operations would increase the dust levels, disturb traffic, and possibly increase noise levels.
- It is very likely that any site chosen outside the City of Boston would attract fewer visitors than projected for an in-city location. This loss of visitors would increase as the site locations is moved further away from Boston. This is an economic loss as well as an educational and recreational loss for the whole region.

3. Modify the Project

(a) No Parking Garage

This alternative provides that no major parking garage or local street and surface lot parking would be made available to Zoo visitors in an effort to discourage private transportation trips into the Zoo. This would necessitate a significant expansion of the existing public transit service to the area as well as a complete public information program to promote the use of mass transit.

The major objection to this alternative arises from the fact that in zoos throughout the country, roughly 90 percent of the access is by private transportation, even when good transit connections are available. Families and groups simply prefer the convenience of travelling directly to the Zoo in a car to the possibility of numerous connections on a transit system. Aside from being less expensive under average circumstances, a car keeps everyone together, is often more comfortable than public transit, and allows families to carry picnic lunches and other bulky items without problems.

This 90 percent modal split could change if the thinking of the general public changes, but this kind of alteration of basic orientations takes time to develop. It is expected that the first result of the lack of private vehicle access to the Zoo would be a significant reduction in attendance, which would upset the economic feasibility of the project. It is also clear that many groups would try to drive to the Zoo anyway, hoping to find parking within walking distance. This would have obvious adverse effects on local traffic congestion and residential parking availability. (Fenway Park is an example of an attraction with an excellent subway connection, yet the streets are lined with parked vehicles everywhere within at least a one-half mile radius during baseball games).

It is also imporant to re-emphasize that the project site is located in an area of Boston avoided by most people because of a fear of crime. This fear would tend to further reduce attendance if the only access is through public transit.

In summary, the combination of increased local traffic and parking impacts, the time required for rapid transit expansions, plus the expected reduction in attendance all serve to make this an unsatisfactory alternative.

(b) <u>Alternative Locations for Parking</u>

This alternative examines five basic parking options:

Option I: Utilize existing parking in the Zoo vicinity.

Option II: Build an adjacent garage, with overflow handled by local streets and parking lots.

Option III: Build an adjacent garage but supplement this with a satellite lot linked to the Zoo by some other means of transporation.

Option IV: Build no adjacent garage, and rely on a satellite lot plus existing parking near the Zoo grounds.

Option V: Build no adjacent garage and rely solely on a satellite lot. This is the recommended parking solution.

(1) Option I

With this alternative, no additional off street parking would be provided for Zoo visitors.

As discussed in Section IV A (2d) there are approximately 970 available parking spaces near the existing Zoo, in addition to 490 more spaces that are restricted at this time. The construction of the new Zoo will result in the loss of 160 spaces from the gravel lot in the Sausage, as well as 100 spaces along Glen Lane. This would leave 710 available parking spaces for both Zoo visitors and local residents, which would provide sufficient parking only 200 days out of the year, assuming that all spaces are used by Zoo visitors.

If the existing White Stadium parking lot is made available, (300 spaces), along with Pierpont Road (190 spaces), and parking is allowed on both sides of Circuit Drive from Pierpont Road to Glen Lane (260 spaces), the available total comes to 1538 spaces. This would satisfy all weekday demand, and weekend demand except for the months of May, June, July, and August, again assuming no usage of the spaces by local residents.

In summary, this option does not present a viable alternative. Without even considering other land use demand, sufficient spaces could not be provided for weekend attendance during spring and summer months.

- Pierpont Road

A three-story structure for 1200 cars could be built along Pierpont Road, but once again, the location within the Park is a significant problem.

- Boch Rambler Site

This site would present a viable alternative if at least 600 or 700 spaces could be provided. It has good access possibilites, and is located directly across from the Zoo entrance. However, part of this location is already planned as a Family Life Center by the Boston Model City Agency. Funds have been allocated, preliminary designs are in progress, and suggestions for changes in these plans have met with strong opposition.

- Peabody Circle

A small garage could be built at Peabody Circle, but this alternative would surely lead to opposition because of its prominence directly in front of the Zoo entrance, in addition to other environmental considerations.

In order to provide supplemental parking for any of these options, various changes are necessary to the existing parking spaces in the Zoo area. For example, during the summer peak periods, parallel parking could be permitted along both sides of Circuit Drive, and the White Stadium and Pierpont Road area could be opened for regulated parking using the existing capacities. These changes also present problems that cannot be disregarded, such as congestion, safety, and aesthetic considerations along Circuit Drive if two lanes are used for parking.

In summary, it can be said that the adverse impacts associated with parking garage location and the adverse impacts resulting from the provision of supplemental parking combine to eliminate this option from serious consideration.

(2) Option II

With this option, a parking garage would be built near the Zoo, with overflow cars using the existing on and off-street spaces.

There are a number of possible locations for a nearby parking garage, although many of these possibilities are not very probable. It is felt that any parking structure within Franklin Park would meet with significant opposition because of the use of park land. Constructing a garage site along Seaver Street is also a poor alternative due to the residential land use and traffic service capabilities of the roadway.

The following garage locations near the Zoo were evaluated: the Refectory; White Stadium; Pierpont Road; the Boch Rambler Site; and Peabody Circle. These locations are shown in Figure 34.

- The Refectory

A 1200 car garage could be built at the Refectory site, as proposed in the Feasibility Report. This garage would have access from three different street elevations because of its unique location. In terms of access, proximity to the Zoo entrance, and projected needs, this is a very good location. However, in terms of aesthetics, historical significance, existing land use, and other environmental considerations, a parking garage at this location would have many adverse effects. Considerable opposition has been voiced against this alternative.

- White Stadium

If land could be made available, a parking structure adjacent to White Stadium would be a good alternative. Recently this area was closed to the general public because of problems associated with drug traffic, but a paved lot presently exists with space for 300 vehicles. Although this location has several advantages, it is felt that it would generate the same opposition as the Refectory site because of the location within the Park.

METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

PARKING ALTERNATIVES

Scale: 1" = 550'

FIGURE 34

CLM / SYSTEMS, INC.
CAMBRIDGE, MASSACHUSETTS

CLM

Source: Alan M. Voorhees & Assoc.

(3) Option III

The previous section discussed possible site locations for an adjacent garage. With this alternative, the adjacent garage would be supplemented by a remote satellite lot connected to the Zoo by some other means of transportation. This concept was dropped in favor of Option V because of the site location problems previously discussed, as well as the complications arising from having two widely separated parking areas. For example, traffic congestion problems could be expected near the Zoo when the adjacent lot fills up and visitors have to be directed to the satellite lot.

(4) Option IV

With this alternative, there would be adjacent garage, but there would be a satellite garage supplemented by existing parking near the Zoo grounds. This alternative was dropped in favor of total satellite parking because of the expected impact on local traffic congestion and parking availability due to the number of visitors who would drive around searching for free parking places near the Zoo.

(5) Option V

As discussed previously, this alternative has been selected after many meetings and considerable joint effort between the project staff, the BRA, the Mayor's Office, Boston Model Cities, the Executive Office of Transportation and Construction, and the Boston Parks Department. The impacts associated with this location and the transportation link to the Zoo ground have been incorporated into the various sections of this report.

It should be noted that several alternative modes of transportation to the Zoo were evaluated before the selection of the double decker bus system. One major consideration in this selection process was that except for the various bus systems, all other alternatives require large initial expenditures for guideways and rail-beds. Since there is always uncertainty in any attendance forecasts,

any alternative that allows for future modifications to either increase or decrease capacity once actualdemand is known can be considered quite desirable at this point in the planning process. When the Zoo attendance has stabilized, it is conceivable that the shuttle buses could be sold and a monorail system constructed with more assurance of success than if it is built now. The shuttle bus system can thus be either a permanent or a temporary solution.

The following alternative transportation modes were evaluated to shuttle visitors between the satellite parking lot and the Zoo:

- Double Decker Bus

This alternative is the most economical, as it could be operated at a fare of only $.10 per person. The buses could travel along existing roadways, so there would be no additional construction requirements. In addition, the vehicles would be attractive from a novelty standpoint and would provide scenic views of the Park, especially from the upper deck. Disadvantages include noise, air pollution, potential for highway accidents, and susceptibility to traffic congestion and adverse weather.

- Standard Bus

These vehicles have many of the advantages and disadvantages of the double decker buses, although they do lack the novelty and are 30 percent more expensive to operate.

- Minibus

This alternative appears to be the worst option financially, as it could cost from three to five times more than the recommended system. This difference is largely due to lack of capacity and the subsequent need for more vehicles. Other advantages and disadvantages are the same as those discussed previously.

- Light Rail

This alternative is not attractive financially without a minimum 25 cent fare, and even then it could lose money if children are given reduced rates. These vehicles could be stored at the Forest Hills MBTA yards and might eventually link to the proposed Green Line - "replacement service" proposed by the BTPR when the Orange Line elevated is removed. The advantages from this system include no direct air pollution, fairly good safety, a rail-bed with a low profile, good schedule adherence and a separate right-of-way (which avoids congestion problems). Disadvantages include high noise levels, delays from at-grade roadway crossings, possible safety hazards to both pedestrians and automobiles due to lack of grade separation, moderate potential for problems caused by weather, and unsightly electric poles and wires.

- Minirail

This alternative is also not attractive without at least a 25 cent fare due to the large capital expense of a double-tracked or looped guideway, plus the cost of the number of trains required for adequate capacity. Advantages include lack of noise, no direct air pollution, modern design, use of an elevated guideway not subject to traffic congestion or accident hazards, good schedule adherence, good safety record, and significant attraction due to novelty and scenic views. Disadvantages include cost and general aesthetics due to the elevated guideway within Franklin Park.

- Monorail

This alternative is a strong third choice after double decker and standard buses, and appears financially feasible except under a $. 10 fare. Advantages include the lack of direct air pollution, noise, safety hazards, congestion problems and weather problems, in addition to very good schedule adherence and great attraction due to novelty and scenic views. Disadvantages include cost and general

aesthetic considerations due to the elevated guideway through Franklin Park. It should be noted that because of a monorail's high capacity, it is feasible to operate a shuttle using a single train over a single beamway. This reduces capital and operating expenses over the minirail while improving aesthetics.

(c) Build a Smaller Zoo at Franklin Park

This alternative considers a reduction in the magnitude of the Zoo expansion. This would involve either a renovation of existing buildings, or the construction of new facilites on a smaller scale, still utilizing the funds allocated by the State Legislature.

Renovation of the existing buildings at the Franklin Park Zoo is only partially feasible. The Children's Zoo could be renovated, but the Elephant House and Lion House would not be worth repairing because of their age and old-fashioned design. The Range Area is adequate, but does leave much to be desired in terms of animal mobility and exhibit concepts.

The environmental impacts associated with this alternative are the same as those for the proposed project, except for the alteration of the Greeting. It is assumed that a reduction in the size of the Zoo program would allow the designers to locate their exhibits so as to leave the Greeting as an unchanged axis, if that was desired. All other impacts change only in magnitude, assuming that a reduction in the number and types of exhibits will also bring about a reduction in annual attendance. The exact nature of the change in the Zoo program would depend on which environmental problem (or problems) associated with the proposed project needed to be eliminated or scaled down.

If this alternative were adopted it would continue the piecemeal development of the Zoo which has created many problems over the years. A significant reduction in the Zoo program would thus be highly undesirable from this standpoint. A minor change in the proposed project would only slightly alter the general environmental impacts as discussed, and therefore, these impacts will not be re-stated.

(d) Alter the Site Plan

This alternative utilizes the same basic resources as the proposed project, but orients them differently on the site. There are, of course, many possible building and exhibit orientations, but only the most plausible will be discussed.

During the development of the proposed project, eleven different site plans were studied in detail by the project team, in addition to many minor variations of each plan. The first considered one huge 6.5 acre pavilion which covered all indoor exhibits under one roof. Although this concept was feasible, it was rejected because of aesthetic as well as engineering considerations.

The other design alternatives dealt with four separate exhibit pavilions, each with its outdoor exhibit area extending outward from the building perimeter, with some type of service connector running underground between the buildings. The important factors that went into the evaluation of each alternative included the following, (in no particular order):

- General aesthetic layout (i.e., architecturally, how would it look?).
- How would Zoo visitors circulate from building to building, from exhibit to exhibit?
- How easily could animals be shifted from their holding facilities to either outdoor or indoor exhibits?
- How did the service facilities interconnect, and how efficient were they?
- How much earth and rock required removal? How many trees would be destroyed? How could the topography be best utilized for exhibit purposes?

- How did the plan relate to the historic setting within Franklin Park?

- To what extent would the Greeting be changed?

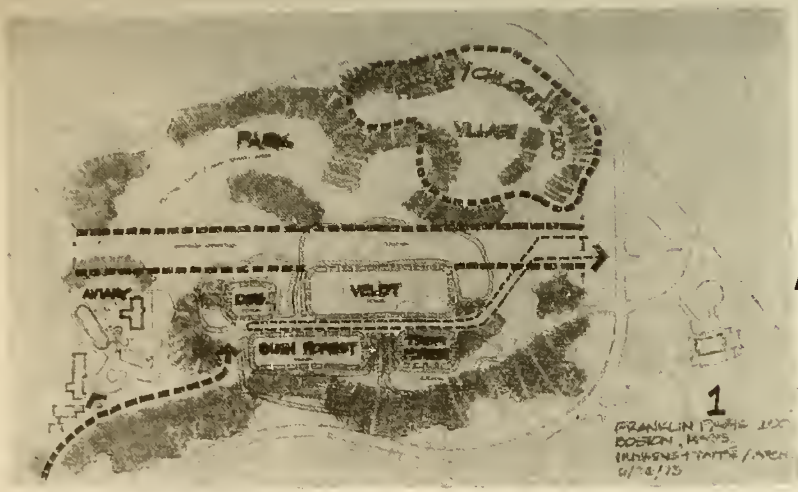
- How well is the body of the Zoo isolated from the outside urban area?

Figure 35 shows four of these design alternatives. It should be noted that the buildings are shown only as "bubbles." Their exact shape and orientation were not fixed at this stage of the design. These four designs were selected because they best represent the major variations that were examined. Other alternatives were very similar in concept to at least one of these four.

Figure 35A shows the four separate buildings grouped closely together to the west of the Greeting, with their outdoor exhibit areas extending outward. (The Veldt and part of the Desert outdoor exhibit areas lie across the Greeting). In addition, the Children's Zoo is relocated to the present Range Area. Although this design would be convenient from service and public circulation viewpoints, it was rejected because it was too cramped (i.e., too much was being done in too small a space). In addition, it was felt that one large cluster of buildings would make the site unbalanced and unattractive.

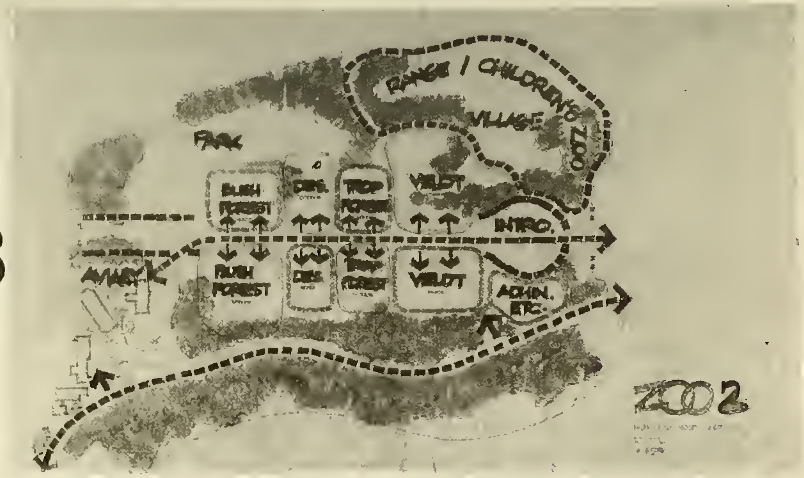
Figure 35B shows the next alternative, which placed the exhibit buildings alternately along the Greeting, with the outdoor areas extending across this Zoo axis. This provided very convenient linear service axis and public circulation, much as in the previous design, but the exhibit buildings would have been too visible and would have extended too far into the Greeting.

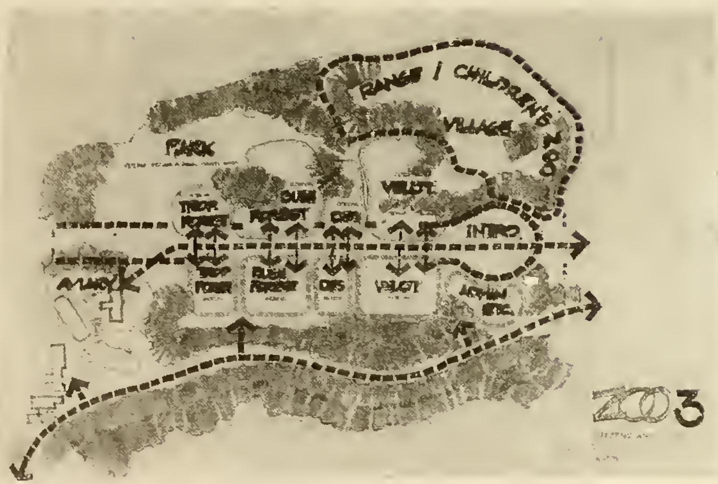
Figure 35C shows how these buildings were pushed back from the Greeting, and all placed together on one side. This was more difficult in terms of service access, (although still feasible), but once again, the site had too much structure on one side and became unbalanced.



A

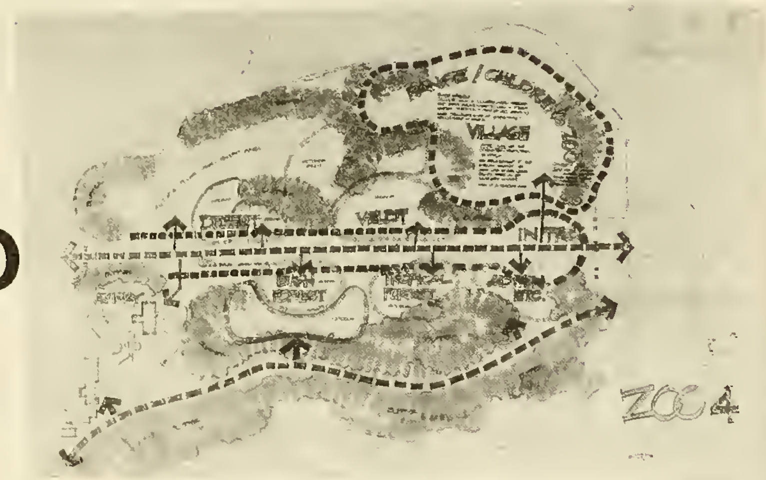
B





C

D



METROPOLITAN DISTRICT COMMISSION

HUYGENS AND TAPPÉ, ARCHITECTS AND PLANNERS

SITE PLAN ALTERNATIVES

FIGURE 35

CLM / SYSTEMS, INC.
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CLM

In addition, public circulation became a problem, since the visitors would have proceeded down the exhibits, only to come to a dead-end several thousand feet from the Zoo exit. This design also did not allow adequate outdoor exhibit area without major alterations to the vegetation and topography.

Figure 35D shows how the buildings were once again put on alternate sides of the Greeting, only this time they were spaced further apart, with the outdoor exhibit areas extending away from the Greeting. This design encroached less on the Greeting than the others, but the buildings were difficult to orient and the terrain was bad for certain exhibits. For example, the Veldt outdoor area would have been on a hillside, whereas a flat terrain was desirable.

The other design alternatives were variations on these four main concepts. The proposed project is actually a modification of the fourth, as can be seen by comparing Figure 2 with Figure 35D.

One point that became clear during this design process was that there was no way to avoid some alteration of the Greeting. It was simply too long and too wide to avoid completely. (It covers roughly one-seventh of the existing site). It became necessary to design the Zoo so that outdoor exhibit areas would be on portions of the Greeting. In a sense, instead of a long vista populated by humans, the designs were providing a panoramic view of many animals. With the natural drop in elevation of the Greeting (10 feet) and using planting as screening it became possible to let visitors cross this mall without being seen by those entering the Zoo. The final project design represents a refinement of these concepts.

It can thus be said that the proposed project design represents the best of many different site plans, and that it best meets the major design criteria that were discussed previously.

(e) Change the Type of Exhibit

This alternative would replace the African continent theme of the proposed project with one representing animals and vegetation from climates more compatible with that of New England. This Zoo

would still be located in Franklin Park, and all funding aspects would remain the same.

(1) Positive Impacts

One benefit of this alternative would be the possible reduction in size and complexity of the indoor exhibits (and thus the structures), since many of the animals would be from northern climates and could be displayed outdoors during cold weather. If the theme were to be truly North American, there would still be a need for indoor exhibit areas for the less hardy animals. In addition, there would be a definite necessity to heat the visitor circulation areas as well as the animal holding areas if the Zoo were to operate 365 days each year and the animals are to remain healthy. A realistic estimate of the cost and energy savings from this type of exhibit change cannot be made at this time, as these factors are heavily dependent on the exact zoological program that is selected.

Another benefit of this alternative would be that the Zoo animals and exhibits would be more in keeping with the character of Franklin Park than are African exhibits. Although the proposed project will utilize as much as existing terrain and vegetation as possible in the outdoor exhibit layouts, it is clear that the site would be a much more natural setting for North American animals, for example, than it would be for African desert or tropical forest species.

One other factor that might be considered a benefit from this alternative is that the attendance would drop because of lack of many of the most popular animal exhibits (a large majority of which come from Africa) in addition to the elimination of many indoor exhibits, (which allow visitors to attend during bad weather). With reduced attendance, there would be an associated drop in problems concerning parking, air pollution, traffic congestion, and so forth.

Other benefits include:

- The Greeting could be left unchanged because the reduced sizes of the structures needed

for indoor exhibits would permit more latitude for open space planning.

- Animals and vegetation would be less sensitive to the loss of heat during a power failure.

In general this alternative could mean slightly lower construction and operating costs, reduced attendance, lower energy needs, a more natural setting, and more open space possibilities.

(2) Negative Impacts

One major drawback of this alternative has already been discussed as if it were a benefit, and that is the fact that a change in exhibit themes will result in a reduction in attendance because of the lack of the very popular African exhibits (the elephant, lion, giraffe, monkey, gorilla, and so forth). In addition, the proposed Zoo expects to draw a significant number of people during the winter months and during bad weather because of the presence of the indoor exhibits. Although it is true that any major expansion of the existing Zoo will increase the present attendance levels significantly, it is also very likely that an African exhibit would draw more visitors than any other theme.

This loss of attendance would mean reduced trip generation and therefore less of the vehicle generated problems (air pollution, congestion, etc) but it would also mean an economic loss to the surrounding community as well as the whole New England region.

More intangible would be the educational or recreational loss if the New England region continues to have access to only part of the "complete zoological experience". With year-round exhibits of African animals at Franklin park and animals from northern climates at the Stone Zoo (as is presently planned) the region will have significant zoological potential.

The history of the Franklin Park Zoo has been one of piecemeal development. If a reduced zoological program is chosen for the proposed expansion, this history will be continued. This would mean that at some future date (at another site), a Zoo with African exhibits would have to be designed and built (at significantly increased costs), if the region is ever to have access to a complete zoological program.

VII MEASURES TAKEN TO MINIMIZE ENVIRONMENTAL IMPACT

A feeling for the extent to which the project has been modified in order to minimize environmental impacts can be seen by comparing the proposed project with the September, 1972 Feasibility Study. Changes have been made since that time which were not environmental in nature, but a great many other modifications were undertaken that do minimize the adverse environmental impact of the expanded Zoo.

As discussed previously, numerous meetings were held with concerned governmental agencies, citizen groups, and individuals in an effort to discover and then remedy any items of concern. Because of this consideration of environmental problems early in the planning process, it was possible to make significant modifications before the project entered the final schematic design stage. Many different site layouts were examined before the recommended scheme was selected.

The following is a summary of various changes to the project that have reduced environmental impacts:

- Pavilions were located in existing open areas, thus minimizing the destruction of trees and shrubs.
- Existing trees and terrain were utilized where possible for both the exhibits and the general landscaping.
- The pavilion floors were depressed below grade in order to facilitate berming, to conserve energy, to balance cut and fill volumes, and to reduce the vertical height of the buildings as perceived by the Zoo visitor from the outside.
- Plantings are planned at selected locations on the pavilion perimeters to block reflected sunlight and divert cold winds from the surface.
- No buildings have been planned for the "Sausage" area. Exhibits in that area will be viewed from elevated walkways which will wind through the trees without altering the natural canopy.
- The "Sausage" area will be screened from Circuit Drive traffic by selective plantings where necessary.

- Several areas on the "Sausage" will be open to the public free of charge for picnics and relaxation.

- An attempt has been made to balance cut and fill operations so that trucking of fill will be kept to a minimum.

- Although the Greeting area has been modified, the length of the visual axis is still relatively intact. Buildings have been pushed as far as possible from the edge of the Greeting, with the open space being utilized to provide a striking panorama of animals as the visitor enters the Zoo.

- The existing Children's Zoo and Range Area have been incorporated into the design of the expanded facility.

- All service and delivery vehicles will enter the Zoo at the existing service area. Distribution within the Zoo will be accomplished by Zoo vehicles. This will minimize community traffic and noise impacts from these vehicles.

- Manure from unrestricted animals will not be incinerated, thus reducing the air pollution potential of the project.

- Storm water from the pavilion roofs will be detained in troughs around each building. These detention areas, in conjunction with the system of ponds and water moats are designed to avoid flooding during heavy storms. The feasibility of using this collected runoff water for interior irrigation is currently being investigated.

- Every effort will be made to keep existing healthy vegetation alive by limiting excavation to the drip line of large trees where possible, by protecting the vegetation from the animals, and by ongoing maintenance to keep problems like soil compaction around the tree roots under control.

- Experts in the field of indoor plants have been consulted to insure maximum survival of the interior and exterior vegetation, which is being selected based on specific limitations posed by the design and general climatic locations of the project.

- The Zoo will obtain its water connection from a main in Blue Hill Avenue, thus avoiding 4000 feet of excavation and piping to the nearest available source near Morton Street. This represents a significant reduction in traffic, noise, and general aesthetic impacts.

- The existing Zoo will remain open during construction operations, so public access will remain unchanged.

- The parking solution now utilizes a previously planned commuter parking facility instead of a garage built solely for Zoo visitors. This solution avoids the use of park land and other controversial locations.

- The location of the shuttle bus service at the Forest Hills Station may encourage more rapid transit usage among Zoo visitors.

- Many different parking locations and people mover systems were evaluated before selecting the recommended system. This evaluation process involved the joint efforts of many different agencies.

- Every effort has been made to minimize energy consumption. Thus there is one central heating and cooling facility, heat recovery systems are part of the pavilion exhaust cycles, vents have been strategically placed to recirculate interior warm air, berms and plantings are used for heat retention and wind reflection, hardy vegetation species are being selected that do not require tropical temperatures, and only the people walkways are to be cooled during the summer months.

- An emergency power generating system will be provided to protect the animals and plants during extensive power failures.

- The large columns and statues located on opposite ends of the Greeting have been incorporated into the the project design.

VIII WRITTEN COMMENTS AND COMMUNITY REACTIONS

As prescribed in State environmental control regulations, copies of this draft environmental impact report have been submitted for review to the following Massachusetts agencies:

- Executive Office of Environmental Affairs
- Attorney General
- Metropolitan Area Planning Council
- State Clearinghouse

Present procedures in the Commonwealth are for the State Clearinghouse to forward copies of the draft report to other agencies not mentioned above who may have an interest in the project.

FOOTNOTES

1. The Code of Federal Regulations in Title 9 - Animals and Animal Products, Section 92.4 (2) establishes standards for approval of zoological parks receiving and maintaining certain imported animals. Standards include provision of satisfactory pens, cages, or enclosures, provision for the disposal of manure and other wastes, availability of vetinary services, and inspection by an authorized representative of the U. S. Department of Agriculture.

2. Alan M. Voorhees & Associates, Technical Memo No. 3, Job 390, August 31, 1973.

3. These traffic volumes were assigned using 11-hour City of Boston counts as a data base. Mechanical recorder counts taken on Blue Hill Avenue and Circuit Drive by Alan M. Voorhees & Associates during several weeks in July and August were used to develop a calibration factor to expand the 11-hour counts to 24-hour figures. These counts were then adjusaed to a 1973 base year figure by applying a 1.6 percent annual rate of growth. These results agree well with data from the 1972 Areawide TOPICS Plan prepared for the Massachusetts Department of Public Works and the Federal Highway Administration.

4. Highway Research Board, Special Report 87, Highway Capacity Manual, National Academy of Sciences, National Research Council, Publication 1328, 1965.

5. Alan M. Voorhees and Associates, Technical Memo No. 2, Job 390, August 22, 1973.

6. Telephone conversation with Mr. Williams, MBTA Manager of Systems Planning, August 10, 1973.

7. The equipment utilized was an ECOLYZER, manufactured by Energetics Science, Inc., New York, which measures Carbon Monoxide on a continuous basis using an electrochemical process. This instrument was connected to a strip-chart recorder to provide a hard copy of the measurements.

8. This model was the HIWAY model developed for the EPA. Since the model can only handle one road segment at a time, concentrations at the receptor locations were obtained by superimposing separate runs for each roadway.

9. In order to obtain an eight-hour average from the computer model, it was necessary to use the average hourly traffic flow taken from the busiest eight hours of the day. This turned out to be from 1:00 p.m. to 9:00 p.m.

10. Areawide TOPICS Plan, West Roxbury-Roslindale-Hyde Park (Boston) Massachusetts, Tippetts-Abbett-McCarthy-Stratton, October, 1972, p.5.

11. Environmental Protection Agency, <u>Compilation of Air Pollutant Emission Factors</u>, (Second Edition), April, 1973, p. 2. 1-4.

12. Conversation with John O'Neil, Maintenance Supervisor of the Franklin Park Zoo, August 29, 1973.

13. National Register of Historic Places, Inventory-Nomination form, 1971.

14. Metropolitan Area Planning Commission, <u>Olmsted Park Inventory Report</u> "Historical Overview", January, 1973, p. 20.

15. Frederick Law Olmsted, "Notes on Franklin Park and Related Matters" 1884 quoted in Metropolitan Area Planning Commission, <u>Olmsted Park Inventory Report</u> p. 20-24.

16. The Franklin Park Advisory Committee stated:

> ...the budget allocation of the Park Department was $7,249,204.00 in 1970, and although Franklin Park represents 20% of the Park property, less than 1% of this budget can be identified as having been utilized for Franklin Park.

Franklin Park Advisory Committee, "A Study and Report on the Establishment of Management Plans for the Operation of Franklin Park", 1972, p. 4.

17. Franklin Park Advisory Committee, "Study and Report", p.

18. Perry, Dean, Hepburn & Stewart, "Franklin Park Zoo, Development Plan - Summary", for the Metropolitan District Commission, November 21, 1967,

19. Conversation with John Nagle, General Foreman for Franklin Park Maintenance Division, Boston Parks and Recreation Department, August 23, 1973.

20. Conversation with City of Boston Water Department for zoo account 12 21 150 100, August 29, 1973.

21. Conversation with Mr. Holehouse, Superintendent of the M. D. C. Deer Island Sewage Treatment Plant, August 22, 1973.

22. Telephone conversation with Charles Dineen, Civil Engineer in charge of the Landfill and Incinerator, City of Boston, September 10, 1973.

23. Telephone conversation on September 12, 1973 with the office of Charles Ferguson, Department of Rates and Operations, Boston Gas Company.

24. Conversation with City of Boston Water Department for Zoo account 1221150100, August 29, 1973.

25. Conversation with Boston Edison Company, September 5, 1973.

26. "City of Boston Preliminary Report of the Board of Commissioners of the Department of Parks with Plans and Estimates for a Zoological Garden at Franklin Park and an Aquarium at Manne Park", 1910, In "Brief History of Development: Franklin Park Zoo", compiled by Moriece and Gary, August, 1973.

27. Shurcliff and Shurcliff, "Franklin Park Zoo: A Plan for the Future" prepared for City of Boston Park Department, April, 1954, p. 6.

28. Shurcliff and Shurcliff, "Franklin Park Zoo", 1954, p. 20.

29. Shurcliff and Shurcliff, "Franklin Park Zoo", 1954, p. 20.

30. Interim Report of the Special Commission on Franklin Park Zoo and Other Metropolitan District Commission Zoological Facilities, The Commonwealth of Massachusetts, House No. 5400.

31. Boston Zoological Society, "Report of the First Year's Operation of Zoological Parks", September, 1971, p. 3.

32. Conversation with Boston Zoological Society, July, 1973.

33. De Leuw, Cather Associates, "Report on Traffic, Parking and Circulation, National Zoological Park", Washington, D.C., June, 1972.

34. Conversation with Alan M. Voorhees and Associates, November 21, 1973.

35. Environmental Protection Agency <u>Report to the President and Congress on Noise</u>, February, 1972, p. 2-59.

36. Letter from Robert J. Tis, Public Relations Department, Boston Edison Company, September 26, 1973. Also subsequent conversation with Mr. Leo Flemming, November 26, 1973. Conversation with Boston Gas Company, Paul Crossen, October, 1973.

37. Conversation with the foreman of the Roxbury Headworks, MDC Sewerage Division, August, 1973.

38. Boston Transportation Planning Review, Southwest Draft Environmental Impact Statement, Preliminary Location Report, Program Package Evaluation Report, September, 1972, p. 1-50.

39. Conversation with MDC Water Division, November 20, 1973.

40. These figures were derived from information on operations supplied by the New York Zoological Society for the Bronx Zoological Park, and by the Zoological Society of Philadelphia for the Philadelphia Zoological Garden.

41. Metropolitan Area Planning Council, "Criminal Activity and Vandalism" Olmsted Park Inventory Report, January, 1973, p. 15.

42. Special Commission on Franklin Park Zoo and Other Metropolitan District Commission Facilities, "Interim Report", May 23, 1969, p. 21.

43. Telephone conversation with Margaret Condrick, Chamber of Commerce, September 12, 1973.

44. Telephone conversation with Bill Najan, Executive Office of Transportation and Construction, August 10, 1973.

45. MDC Budget, Fiscal Year 1973, Preliminary Totals (obtained from BZS).

46. Boston Zoological Society, Statement of Income and Expenses for the Year Ended June 30, 1973.

47. Telephone conversation with Dr.. Dolensek, Veterinarian for the New York Zoological Park, October 18, 1973.

48. U.S. Department of Transportation, Airports and Their Environment, A Guide to Environmental Planning, DOT P5600. I, September, 1972, p. 332.

49. It should be noted that the newly constructed Aviary will be open to the public in early 1974. BZS officials feel that attendance will increase significantly at the existing Zoo as a result of this new exhibit, although no accurate estimates have been developed.

50. Conversation with Boston Zoological Society, July, 1973.

51. Linger, Paul N. editor. Zoos and Aquariums in the Americas, 1972, published by the American Association of Zoological Parks and Aquariums.

52. "Interim Report of the Special Commission on Franklin Park Zoo and Other Metropolitan District Commission Zoological Facilities", May 13, 1969, House No. 5400, p. 20-21.

53. Franklin Park Zoo Development Plan, Perry Dean Hepburn and Stewart, November 21, 1967.

54. "Interim Report of the Special Commission on the Franklin Park Zoo and Other Metropolitan District Commission Zoological Facilities", May 23, 1969, House No. 5400, p. 33.

APPENDIX A

ANIMAL SPECIES LIST

FRANKLIN PARK ZOO - SCHEMATIC DESIGN

ANIMAL SPECIES, NUMBERS & EXHIBIT AREAS (INCLUDING MOATS) 19 November 1973

	Number Min	Number Max	Indoor Exhibit Area	Outdoor Exhibit Area
VELDT REGION				
Veldt Exhibit			78,600 s.f.	156,000 s.f.
White Bearded Gnu (Wildebeast)	6	12		
Masai Giraffe	4			
Grant's Zebra	6	12		
Thompson's Gazelle	6	18		
Masai Ostrich	4	-		
Birds (Sunbirds, Starlings, Cattle Egrets)	varies			
Leopard Tortoise	varies			
Lion	4	10	7,500	19,700
Hyena - Vultures	varies		5,600	10,750
Dioramas				
Diurnal Small Mammal (Dik-Dik, Suni, Oribi, Rock Hyrax, Patas)	varies		1,500	
Nocturnal Small Mammal (Spring Haas, Aardvaark, Bat-eared Fox, Owls)	varies		1,500	
Canine Small Mammal (Jackal, Mongoose)	varies		1,500	
Crepescular (Goliath Heron)	varies		300	
Reptilian (Monitors, Safari Ants, Dung Beetle, Scorpion)	varies		120	
			96,620 s.f.	186,450 s.f.

	Number Min	Number Max	Indoor Exhibit Area	Outdoor Exhibit Area
ESERT REGION				
esert Exhibit			20,000 s.f.	62,000 s.f.
Dama Gazelle	4	8		
Addax	4	8		
Scimitor-horned Oryx	4	8		
Camel	varies			
aboon - Mountain Sheep	varies		3,000	8,700
heetah	2	-	3,000	6,200
ioramas				
Diurnal Small Mammal Fennec, Aardwolf, Hedgehogs, Caracal, Elephant Shrews, Jerboas)	varies		1,500	-
eptiles (Geckos, Skinks, Tortoises, Lizards, Snakes)	varies		120	-
			27,620 s.f.	76,900 s.f.
JSH FOREST REGION				
frican Elephant	3	4	22,000	42,700
ack Rhino	2	5	10,000	31,100
uiker	3	6	3,000	11,600
esser Kudu	3	6	7,500	15,500
efassa Waterbuck	3	6	7,500	15,500
ver Hippo	3	5	5,000	13,700
eopard (spotted & black)	2	-	3,000	-
olobus Monkey	6	10	1,500	2,500
ioramas				
Diurnal Small Mammal (Klipspringers, DeBrazza Monkey, Ratel, Turacos, Parrots, Bl-Bell Pangolin Vervet)	varies		1,500	

	Number Min	Number Max	Indoor Exhibit Area	Outdoor Exhibit Area
Nocturnal Small Mammal (Bush Babies, Tree Hyrax, Crested Porcupine, White Bellied Pangolin, Genet, Birds, Bush Tailed Procupine)	varies		1,500	-
Reptiles (Lizards, Fish Geckos, Chamelions, Skinks, Agamids, Monitors, Python)	varies		300	-
			62,800 s.f.	132,600 s.f.
TROPICAL FOREST REGION				
Yellow-backed Duiker	3	6	3,400	11,000
Bongo	2	4	3,500	6,000
Pigmy Hippo	3	5	5,000	9,000
Congo Buffalo	3	5	5,000	9,700
Lowland Gorilla - Talapoins	4	10	7,300	12,600
Mandrill			2,000	-
Dioramas				
Diurnal Small Mammals (Picathartes, Giant Blue Plaintain Eater, Congo Peacock, White Headed Guinea Fowl, Zebra Duiker, Diana, Potto)	varies		1,500	-
Nocturnal Small Mammal (Potto (arboreal), Giant Pouched Rat, Fruit Bat, Royal Antelope, Water Chevatain, Otters)	varies		1,500	-
Reptiles (Monitors, Chamelions, Snakes)	varies		120	-
Crocodiles (Crocodiles, Tree Frogs, Fish)	varies		300	-
			29,620	48,300
			216,660 s.f.	444,250 s.f.

APPENDIX B

MEASURED HOURLY CARBON MONOXIDE AVERAGES

MEASURED HOURLY CARBON MONOXIDE DATA

(At the Endicott School)

DATE: DAY: WEATHER:	August 14, 1973 Tuesday Clear			August 15, 1973 Wednesday Light Rain			August 16, 1973 Thursday Cloudy and Cool		
Hours	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm
12- 1 A.M.	11	N	NA	7	E	2.0	11	NE	2.1
1- 2 A.M.	12	N	NA	8	E	1.0	11	NE	1.8
2- 3 A.M.	9	N	NA	9	E	0.8	10	NE	1.8
3- 4 A.M.	9	N	NA	10	ESE	1.0	9	NNE	1.8
4- 5 A.M.	9	NNE	NA	11	ESE	1.0	8	ENE	1.8
5- 6 A.M.	8	NE	NA	11	ESE	2.0	9	NE	2.0
6- 7 A.M.	5	NE	NA	13	E	3.2	8	ENE	2.4
7- 8 A.M.	5	ENE	NA	14	E	3.0	8	NE	6.0
8- 9 A.M.	7	ENE	NA	14	E	3.0	6	NNE	4.0
9-10 A.M.	12	ENE	NA	15	E	2.0	5	NNE	3.8
10-11 A.M.	11	ENE	NA	15	E	2.0	4	NNE	4.0
11-12 Noon	11	ENE	2.8	15	E	NA	5	NNE	NA
12- 1 P.M.	10	ENE	2.8	20	E	2.0	4	NNE	3.2
1- 2 P.M.	12	ENE	2.8	20	E	2.2	2	E	3.0
2- 3 P.M.	13	E	3.0	17	E	3.5	2	SE	2.8
3- 4 P.M.	15	E	2.2	17	E	2.5	2	SE	2.4
4- 5 P.M.	10	E	2.2	17	E	2.1	2	SSE	2.3
5- 6 P.M.	10	ESE	2.2	17	E	2.4	0	SSW	2.5
6- 7 P.M.	12	ESE	3.0	15	ENE	2.4	2	S	2.0
7- 8 P.M.	10	SE	3.2	14	ENE	2.1	6	SSE	2.4
8- 9 P.M.	8	SE	2.2	13	ENE	2.2	9	S	3.0
9-10 P.M.	10	SE	2.2	12	ENE	2.1	10	SSW	3.3
10-11 P.M.	7	SE	3.0	13	NE	2.0	12	SSW	6.0
11-12 P.M.	6	ESE	2.3	14	ENE	2.1	12	WSW	4.0

*At Blue Hills Weather Station

MEASURED HOURLY CARBON MONOXIDE DATA
(At the Endicott School)

DATE: DAY: WEATHER:	August 17, 1973 Friday Clear and Sunny			August 18, 1973 Saturday Clear			August 19, 1973 Sunday Partly Cloudy		
Hours	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)
12- 1 A.M.	12	W	4.0	12	W	NA	10	S	NA
1- 2 A.M.	12	W	2.0	12	W	NA	9	S	NA
2- 3 A.M.	11	W	2.5	11	W	NA	7	SSE	NA
3- 4 A.M.	11	W	2.0	9	W	NA	4	ESE	NA
4- 5 A.M.	10	W	1.8	9	W	NA	8	E	NA
5- 6 A.M.	7	W	2.1	6	W	NA	8	E	NA
6- 7 A.M.	6	W	4.2	3	WSW	NA	7	E	NA
7- 8 A.M.	4	NW	6.0	4	SSW	NA	7	E	NA
8- 9 A.M.	3	WNW	5.0	4	S	NA	8	E	NA
9-10 A.M.	2	W	4.0	3	S	NA	11	ENE	NA
10-11 A.M.	3	SE	5.0	4	S	NA	14	ENE	NA
11-12 Noon	6	ENE	NA	5	SSE	NA	15	ENE	NA
12- 1 P.M.	4	ENE	NA	6	ESE	NA	13	ENE	NA
1- 2 P.M.	6	E	NA	7	S	NA	13	ENE	NA
2- 3 P.M.	7	ESE	NA	11	S	NA	10	ENE	NA
3- 4 P.M.	8	SSE	NA	12	SSW	NA	9	ENE	NA
4- 5 P.M.	10	S	NA	13	SSW	NA	8	E	NA
5- 6 P.M.	10	S	NA	11	SSW	NA	11	E	NA
6- 7 P.M.	9	S	NA	11	S	NA	10	E	NA
7- 8 P.M.	10	SSW	NA	10	S	NA	11	E	NA
8- 9 P.M.	10	SW	NA	8	S	NA	12	E	NA
9-10 P.M.	9	SW	NA	10	S	NA	11	ENE	NA
10-11 P.M.	12	SW	NA	10	S	NA	10	ENE	NA
11-12 P.M.	12	W	NA	11	S	NA	9	NNE	NA

*At Blue Hills Weather Station

MEASURED HOURLY CARBON MONOXIDE DATA

(At the Endicott School)

DATE:	August 20, 1973			August 21, 1973			August 22, 1973		
DAY:	Monday			Tuesday			Wednesday		
WEATHER:	Clear and Sunny			Clear and Sunny			Cool and Cloudy		
Hours	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm
12- 1 A.M.	9	NNE	NA	2	S	1.0	14	S	1.0
1- 2 A.M.	10	N	NA	1	SSW	2.0	13	S	0.4
2- 3 A.M.	9	N	NA	3	WSW	3.0	13	SSE	0 4
3- 4 A.M.	10	N	NA	3	W	2.6	13	SSE	0 2
4- 5 A.M.	8	N	NA	3	W	2.2	12	SSE	0 2
5- 6 A.M.	3	N	NA	6	E	2.2	12	SSE	0.6
6- 7 A.M.	5	N	NA	3	ESE	7.5	9	SE	0.8
7- 8 A.M.	6	NNW	NA	4	ESE	10.3	9	SE	2.8
8- 9 A.M.	6	NE	NA	5	ENE	6.8	12	ESE	3.6
9-10 A.M.	10	ENE	NA	8	ESE	4.0	13	ESE	3.8
0-11 A.M.	9	ENE	NA	8	ESE	3.0	10	E	4.0
1-12 Noon	10	ENE	NA	9	ESE	NA	10	E	NA
2- 1 P.M.	11	ENE	3.0	8	ESE	4.1	8	E	2.6
1- 2 P.M.	10	ENE	3.6	9	ESE	2.0	8	E	2.4
2- 3 P.M.	10	ENE	3.6	10	ESE	2.8	9	ESE	2.5
3- 4 P.M.	6	ENE	4.0	8	SE	3.8	8	ENE	3.6
4- 5 P.M.	8	ENE	3.5	9	SSE	2.0	9	ENE	3.0
5- 6 P.M.	10	ENE	3.0	12	SSE	1.8	10	NE	2.8
6- 7 P.M.	9	ENE	2.6	11	SSE	1.4	11	NNE	2.0
7- 8 P.M.	8	ESE	2.8	12	S	2.6	12	N	3.0
8- 9 P.M.	6	ESE	3.0	12	SSE	1.8	9	NNE	6.0
9-10 P.M.	6	E	2.8	13	SSE	2.0	10	N	6.0
0-11 P.M.	4	ESE	2.0	13	SSE	2.0	9	N	5.0
1-12 P.M.	5	S	2.0	16	S	1.8	9	N	5.4

At Blue Hills Weather Station

MEASURED HOURLY CARBON MONOXIDE DATA

(At the Endicott School)

DATE: / DAY: / WEATHER:	August 23, 1973 Thursday Clear and Sunny			August 24, 1973 Friday			August 25, 1973 Saturday Slear and Sunny		
Hours	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm
12- 1 A.M.	11	N	5.0	13	W	3.2	9	WSE	6.4
1- 2 A.M.	15	N	3.6	12	WNW	2.6	8	W	5.0
2- 3 A.M.	15	N	2.4	11	NW	2.4	5	NNW	4.1
3- 4 A.M.	15	N	1.8	12	NNW	2.0	3	NNW	2.1
4- 5 A.M.	13	N	1.0	11	NNW	1.6	3	NE	3.2
5- 6 A.M.	12	N	1.4	10	N	1.8	5	NE	3.8
6- 7 A.M.	9	NNW	4.0	9	N	3.6	2	E	4.[illegible]
7- 8 A.M.	8	NNW	5.0	8	N	6.0	3	SSE	4.3
8- 9 A.M.	6	NNW	4.4	8	N	8.0	5	SW	4.1
9-10 A.M.	4	WNW	4.0	5	N	5.0	9	W	4.1
10-11 A.M.	5	WSW	3.2	5	NNW	3.8	11	WSW	4.0
11-12 Noon	7	W	3.0	7	NW	3.8	11	WSW	4.0
12- 1 P.M.	8	NNW	2.8	6	NW	3.1	12	W	3.8
1- 2 P.M.	7	WNW	3.0	9	NNW	4.0	14	SW	3.[illegible]
2- 3 P.M.	8	WSW	3.0	6	NNW	4.1	16	SW	3.8
3- 4 P.M.	9	WSW	5.0	6	NW	4.0	16	SSW	3.2
4- 5 P.M.	8	W	5.0	6	S	4.8	17	SSW	3.6
5- 6 P.M.	11	WSW	4.4	9	S	5.5	16	SW	4.[illegible]
6- 7 P.M.	11	SW	5.1	12	S	4.1	15	SW	4.2
7- 8 P.M.	14	WSW	10.0	10	S	2.4	15	SW	5.2
8- 9 P.M.	14	W	8.0	9	SSW	4.6	15	SW	5.[illegible]
9-10 P.M.	14	W	5.8	8	SW	7.0	15	SW	4.2
10-11 P.M.	11	W	4.0	7	WSW	6.2	14	WSW	4.0
11-12 P.M.	12	WSW	3.4	9	WSW	8.0	16	WSW	4.0

*At Blue Hills Weather Station

MEASURED HOURLY CARBON MONOXIDE DATA

(At the Endicott School)

DATE: / DAY: / WEATHER:	August 26, 1973 / Sunday / Clear and Sunny			August 27, 1973 / Monday / Hot, Humid, Overcast			August 28, 1973 / Tuesday / Clear, Hot, Humid		
Hours	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm
12- 1 A.M.	16	W	4.0	10	WNW	6.0	13	WSW	5.0
1- 2 A.M.	14	WSW	3.2	7	S	4.8	14	WSW	3.0
2- 3 A.M.	13	W	2.8	11	S	3.8	14	W	2.3
3- 4 A.M.	14	W	2.2	14	SSW	3.0	14	WNW	2.0
4- 5 A.M.	12	W	2.2	11	WSW	2.6	15	WNW	1.8
5- 6 A.M.	11	W	2.0	10	WSW	3.0	12	W	1.8
6- 7 A.M.	9	W	2.2	7	SW	6.0	12	W	5.1
7- 8 A.M.	9	W	2.2	6	WSW	9.2	12	W	9.6
8- 9 A.M.	8	WNW	2.2	6	W	6.2	13	W	5.6
9-10 A.M.	9	WNW	2.2	4	WSW	5.2	14	W	3.6
0-11 A.M.	10	NW	2.5	6	WSW	4.5	15	W	3.0
1-12 Noon	11	NNW	3.0	9	WSW	NA	14	WNW	NA
2- 1 P.M.	7	NW	2.6	9	WSW	5.0	14	WNW	5.8
1- 2 P.M.	10	WNW	2.4	10	WSW	5.5	20	WNW	5.8
2- 3 P.M.	10	WNW	3.0	8	WSW	6.0	19	WNW	5.5
3- 4 P.M.	9	WNW	3.6	9	WSW	3.8	17	WNW	5.1
4- 5 P.M.	8	WNW	3.0	13	WNW	3.4	14	NNW	5.2
5- 6 P.M.	7	W	4.1	11	WSW	5.4	13	N	6.5
6- 7 P.M.	9	WNW	3.0	12	WSW	10.0	16	N	7.8
7- 8 P.M.	9	NNW	3.5	11	WSW	12.0	16	N	8.0
8- 9 P.M.	5	WNW	3.0	12	WSW	9.8	16	N	7.0
9-10 P.M.	4	WNW	11.1	12	WSW	6.5	14	N	6.1
0-11 P.M.	4	WNW	12.0	13	W	6.0	13	NNW	5.0
1-12 P.M.	5	WNW	7.5	13	W	5.8	13	NNW	6.0

At Blue Hills Weather Station

MEASURED HOURLY CARBON MONOXIDE DATA

(At the Endicott School)

DATE:	August 29, 1973			August 30, 1973			August 31, 1973		
DAY:	Wednesday			Thursday			Friday		
WEATHER:	Clear, Hot, Humid			Clear, Hot, Humid			Clear, Hot, Humid		
Hours	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm
12- 1 A.M.	15	NNW	5.1	13	WNW	5.0	14	NNW	NA
1- 2 A.M.	14	NW	3.2	15	WNW	4.8	13	NNW	NA
2- 3 A.M.	15	NW	2.4	16	WNW	4.0	15	NNW	NA
3- 4 A.M.	14	NNW	2.4	16	NW	3.6	14	NNW	NA
4- 5 A.M.	14	NNW	2.1	15	WNW	2.2	14	N	NA
5- 6 A.M.	13	NNW	2.0	14	NW	2.1	12	N	NA
6- 7 A.M.	11	NNW	3.9	12	NW	4.5	11	N	NA
7- 8 A.M.	10	NNW	6.0	10	NW	7.5	11	NNW	NA
8- 9 A.M.	11	NNW	7.0	12	NW	6.0	6	NNW	NA
9-10 A.M.	9	NW	4.9	12	NW	5.2	4	NNW	NA
10-11 A.M.	9	NW	4.5	12	NW	5.0	3	NW	NA
11-12 Noon	10	NW	4.8	14	NNW	NA	5	NW	8.0
12- 1 P.M.	11	WNW	4.5	12	NNW	6.0	6	NW	7.1
1- 2 P.M.	11	WNW	4.4	11	NW	NA	8	WNW	7.5
2- 3 P.M.	10	WNW	5.0	11	NW	NA	5	WNW	7.5
3- 4 P.M.	9	W	4.8	8	WNW	NA	4	WSW	6.0
4- 5 P.M.	9	W	6.0	8	W	NA	7	SSW	7.5
5- 6 P.M.	9	SW	8.0	13	WNW	NA	19	NNW	8.0
6- 7 P.M.	10	SSW	7.9	13	NNE	NA	13	NNW	8.5
7- 8 P.M.	12	SW	13.2	6	WNW	NA	8	ESE	6.2
8- 9 P.M.	13	W	12.5	12	W	NA	10	W	8.0
9-10 P.M.	16	W	8.0	16	W	NA	13	W	7.0
10-11 P.M.	15	W	7.6	15	WNW	NA	14	W	9.6
11-12 P.M.	NA		7.0	1.6	NW	NA	12	NNW	9.6

*At Blue Hills Weather Station

MEASURED HOURLY CARBON MONOXIDE DATA
(At the Endicott School)

DATE:	September 1, 1973			September 2, 1973			September 3, 1973		
DAY:	Saturday			Sunday			Monday (Labor Day)		
WEATHER:	Clear, Hot, Humid			Clear, Hot, Humid			Clear, Hot, Humid		
Hours	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm
2- 1 A.M.	16	N	7.6	5	SSE	13.1	13	WSW	5.8
1- 2 A.M.	13	N	7.0	5	S	15.0	12	W	4.0
2- 3 A.M.	10	NNW	6.1	4	S	4.2	12	W	2.6
3- 4 A.M.	8	WSW	5.0	4	ESE	2.1	10	W	1.1
4- 5 A.M.	7	SW	5.1	10	E	2.1	10	W	0.6
5- 6 A.M.	9	WSW	4.0	11	E	0.8	9	W	0.4
6- 7 A.M.	8	WSW	5.8	7	E	0.6	7	WNW	0.4
7- 8 A.M.	6	WSW	6.0	6	ENE	0.6	4	WNW	1.0
8- 9 A.M.	5	W	6.1	5	ENE	0.8	4	WNW	1.1
9-10 A.M.	5	WNW	6.2	5	ENE	2.2	3	NW	1.2
0-11 A.M.	4	NW	6.4	4	ESE	4.0	5	NW	2.8
1-12 Noon	5	WNW	8.0	6	ESE	3.1	7	WNW	2.6
2- 1 P.M.	4	NNW	9.1	4	ESE	3.0	7	WNW	2.0
1- 2 P.M.	6	NNW	10.0	5	ESE	3.0	8	WNW	2.2
2- 3 P.M.	4	NNW	6.8	7	ESE	2.8	5	E	2.6
3- 4 P.M.	4	NNW	6.2	8	SSE	3.0	3	SW	3.4
4- 5 P.M.	5	E	7.0	9	S	1.8	6	SSE	4.0
5- 6 P.M.	7	E	6.3	9	SSW	1.4	9	S	6.6
6- 7 P.M.	8	ESE	6.4	12	SSW	2.6	9	SSW	6.0
7- 8 P.M.	7	SE	7.2	11	SSW	4.0	9	WSW	10.2
8- 9 P.M.	9	SE	9.6	12	SSW	11.0	8	W	10.0
9-10 P.M.	10	SSE	7.5	13	WSW	6.0	9	W	8.0
0-11 P.M.	8	SSE	9.5	12	WSW	5.4	6	WSW	8.1
1-12 P.M.	8	SSE	13.0	13	WSW	5.8	6	WNW	7.8

*At Blue Hills Weather Station

MEASURED HOURLY CARBON MONOXIDE DATA
(At the Endicott School)

DATE:	September 4, 1973								
DAY:	Tuesday								
WEATHER:	Hot, Humid, Clear								
Hours	Wind Speed (mph)*	Wind Dir. *	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm)	Wind Speed (mph)*	Wind Dir.*	CO (ppm
12- 1 A.M.	6	WNW	6.4						
1- 2 A.M.	7	WNW	3.1						
2- 3 A.M.	7	NW	3.0						
3- 4 A.M.	7	NNW	2.4						
4- 5 A.M.	7	NNW	1.2						
5- 6 A.M.	4	NNW	2.0						
6- 7 A.M.	3	W	8.2						
7- 8 A.M.	6	W	11.4						
8- 9 A.M.	5	W	NA						
9-10 A.M.	7	WNW	NA						
10-11 A.M.	8	NW	NA						
11-12 Noon									
12- 1 P.M.									
1- 2 P.M.									
2- 3 P.M.									
3- 4 P.M.									
4- 5 P.M.									
5- 6 P.M.									
6- 7 P.M.									
7- 8 P.M.									
8- 9 P.M.									
9-10 P.M.									
10-11 P.M.									
11-12 P.M.									

*At Blue Hills Weather Station

APPENDIX C

CORRESPONDENCE RELATING TO THE FRANKLIN PARK ZOO EXPANSION

The Commonwealth of Massachusetts
Metropolitan District Commission
20 Somerset Street, Boston 02108

John W. Sears
Commissioner

November 20, 1973

Commissioner Anthony Forgione
Boston Park Commission
City Hall
Boston, Massachusetts

Dear Commissioner Forgione:

On October 31, 1973 representatives of the Boston Zoological Society and the firm of Huygens and Tappe Inc. appeared before the Commission with their final presentation of the schematic design phase of the new Zoo exhibit at Franklin Park. The plan calls for four new pavilions housing enclosed exhibits with adjacent outdoor exhibit areas.

As part of the joint effort of the MDC and the City of Boston to minimize the scale and impact of the new exhibit on the park particular attention has been given to fitting the exhibits into the site and to parking. The parking demands are planned to be accommodated at Forest Hills through joint use of a new fringe parking garage to be built by the State Department of Public Works. Access from the garage to the Zoo will be handled by a "people-mover." Six alternatives are being explored at present through an analysis of relative capital and operating expenses.

In order to successfully fit the exhibits into the park site some use has been proposed for the land lying between Glen Lane and Circuit Drive. The proposed uses involve a small network of pedestrian bridges and outdoor animal exhibits in the central portion of the area with the two ends kept as natural buffers.

This possibility was first discussed with the Boston Park Commission in May and the final schematic design was presented to you on November 15, 1973. During that period every effort was made to coordinate the Zoo planning with overall objectives for Franklin Park, and it is the Commission's understanding that the present plans are mutually agreeable.

After acceptance of the schematic design on October 31, 1973 the Commission voted to authorize a formal request of the City of Boston for use, on a 99 year basis to be used for zoological garden purposes, of the land between Glen Lane and Circuit Drive known as the "Sausage." This request is consistent with Mayor White's letter of October 31, 1973.

I hereby formally request such action by the Boston Park Commission. The staff of the MDC will be available at your convenience to assist in working out the use agreement.

I also wish to convey my personal appreciation for the efforts of your staff in coordinating City and MDC concerns and in helping us to develop the best new zoo exhibit possible. Your continuing support is essential to the success of a rejuvenated Zoo and the Commission hopes that the Zoo will in turn contribute to your efforts towards increased public enjoyment of the entire Park.

Sincerely yours,

John W Sears

JOHN W. SEARS

JBOB/S
cc: Mayor White

The Commonwealth of Massachusetts
Metropolitan District Commission
20 Somerset Street, Boston 02108

John W. Sears
Commissioner

November 20, 1973

The Honorable Kevin H. White
Mayor of Boston
City Hall
Boston, Massachusetts

Dear Mayor White:

On October 31, 1973 representatives of the Boston Zoological Society and the firm of Huygens and Tappe Inc. appeared before the Metropolitan District Commission and made a final presentation of the schematic phase of the new exhibit at Franklin Park Zoo. The Commission was very much satisfied with the schematic plan of four pavilions, with the scale of the development and with the attention given to the natural quality of the park. The Commission also supports use of a fringe parking garage at Forest Hills as the most satisfactory solution to parking needs. Subsequent to the presentation and after thorough consideration the Commission voted "...to advise the City of Boston of the Commission's interest in the parking alternative which provides for use of present on-site parking for daily low-volume demands, and major use of a new fringe parking garage at Forest Hills.....and also to request of the Massachusetts Department of Public Works and the City of Boston, information concerning the possible timing of garage construction in Forest Hills and the conditions for multiple use of such a facility." Given the extensive park and ride commuter use in the area at present and the fact that high visitor peaks at the Zoo occur at non-commuter times, a complementary arrangement would seem most desirable. I appreciate your generous offer of support in exploring such an arrangement and am pleased that the City views this facility as a necessary and high priority transportation project. The Commission would like to be kept informed of the City's progress in requesting the garage and the reactions of Secretary Altshuler and Commissioner Campbell to the proposal.

A further vote taken by the Commission authorizes me to formally request that the City of Boston give care and control, on a 99 year basis, to the Metropolitan District Commission over that portion of Franklin Park lying between Glen Lane and Circuit Drive for Zoological exhibit purposes, consistent with

the uses set forth in the schematic design. To that end I am submitting such a formal request to the Boston Park Commission, Anthony Forgione, Commissioner, as suggested in your letter of October 31, 1973.

The Commission appreciates the continuing support of your administration in the new Zoo project and you may be assured of our continued interest in coordinating this effort with the best interests of the City and community.

Very truly yours,

John W. Sears

JOHN W. SEARS

JBOB/S

The Commonwealth of Massachusetts
Metropolitan District Commission
20 Somerset Street, Boston 02108

John W. Sears
Commissioner

November 20, 1973

Commissioner Bruce Campbell
Department of Public Works
100 Nashua Street
Boston, Massachusetts

Dear Commissioner Campbell:

Attached is a copy of a letter to Secretary Altshuler describing the Commission's interest in making use of a commuter garage facility proposed for Forest Hills. I believe it is particularly important to coordinate our interests with the City of Boston's stated interest in a commuter facility in this area, and with local business activities and neighborhood concerns.

I look forward to an early meeting between our staff and consultants and Secretary Altshuler's office and your staff to determine your interest in and possible scheduling of construction.

Sincerely yours,

JOHN W. SEARS

JBOB/S
Encl.

The Commonwealth of Massachusetts
Metropolitan District Commission
20 Somerset Street, Boston 02108

John W. Sears
Commissioner

November 20, 1973

Alan A. Altshuler, Secretary
Department of Transportation
18 Tremont Street
Boston, Massachusetts

Dear Secretary Altshuler:

It is the Commission's understanding that the State through the Department of Public Works is developing a system of fringe parking areas to reduce commuter traffic into the City of Boston. Further, it appears from discussions with the City that the Forest Hills area is potentially a high priority site for the construction of a garage as part of the fringe parking program and the development of the Southwest Corridor.

The MDC is now in the design development phase, preparing plans for a major new Zoo exhibit in Franklin Park. This will include 6½ acres of covered year-round exhibits and extensive outdoor animal areas. The Commission's portion of the capital costs has been funded and the Boston Zoological Society, which operates the facility, has embarked on a major fund raising effort for the remainder of the funds. The opening of the new exhibits is planned for 1976.

An important concern is for parking. Because of the low level of public transit to the site and because Zoo visits are primarily family recreation trips, it is estimated that 90% of the visitors will come to the Zoo by private automobile. It is important to minimize the impact of these trips on the community and on the Park.

The MDC has been working closely with the City of Boston to develop a minimal impact solution. The most desirable would be to make use of the suggested commuter garage on off-peak periods (which turn out to be the high Zoo visitor peaks; weekends, holidays, etc.). The Commission voted on October 31, 1973 to authorize me to explore with you and Commissioner Campbell the possible timing of garage construction in Forest Hills and the conditions for multiple use of such a facility. It is my understanding that the City of

Boston has also expressed to you its interest in improving the commuter parking in this area through the construction of a garage.

I would look forward to a meeting between the Commission staff and Zoo consultants and representatives of your office to work out the particulars of such a proposal and to determine its feasibility and timing.

Sincerely yours,

John W. Sears

JOHN W. SEARS

JBOB/S
cc: Commissioner Campbell

THE NEW ENGLAND OLMSTED SESQUICENTENNIAL COMMITTEE
ONE CENTER PLAZA
BOSTON, MASSACHUSETTS 02108

July 30, 1973

RECEIVED

C.L.M. Systems
292 Main Street
Cambridge, Massachusetts

Gentlemen:

You have asked me as Director of The New England Olmsted Sesquicentennial Committee whether or not the Committee was in a position to comment on the proposed new zoo for Franklin Park. The Committee was organized to celebrate the 150th anniversary year of Frederick Olmsted (1972), to encourage restoration of the so-called Emerald Necklace and to put together an "Olmsted extension" so as to create a Charles-to-Charles park corridor. In this connection the Committee sponsored a festival in the summer of 1972 and created an exhibit which is on permanent display in the Skywalk of the Prudential Tower, Boston, Massachusetts. Another copy of the exhibit has been on display at Boston City Hall, Brookline Town Hall, the Museum of Transportation and other places.

The Committee has been inactive since the completion of the exhibit early this year and I, as Director, am certainly not authorized to make any comments on behalf of the Committee. Indeed, in the formation of the Committee, many individuals were assured that the Committee's activities would be limited to the promotion of the goals stated above and that no particular positions would be taken. Therefore, I think it is completely proper for you to assume that The New England Olmsted Sesquicentennial Committee will have no comments to make, either pro or con.

This is not to say that individual members of the Committee may not have strong feelings about the project. For your convenience I am enclosing a

C.L.M. Systems
July 30, 1973
Page Two

mailing list of the Committee members as of the first of the year. The residences of several of the members may have changed since the first of the year, particularly those holding elective office. The occupations of the members are also noted in an accompanying list. I am sorry that I cannot survey the members for you since the Committee does not have a budget or funds of any kind.

Sincerely yours,

Francis X. Meaney bjb

Francis X. Meaney, Director
The New England Olmsted
Sesquicentennial Committee

FXM:bjb
Enclosures
Dictated but not read.

HARVARD UNIVERSITY

DEPARTMENT OF LANDSCAPE ARCHITECTURE / GRADUATE SCHOOL OF DESIGN / CAMBRIDGE, MASSACHUSETTS 01238

GUND HALL / PHONE 617 495-2573

September 4, 1973

CLM/Systems, Inc.
292 Main Street
Cambridge, Massachusetts 02142

Sirs:

This is in response to Mr. Anderson's request following the meeting of August 24 to hear from the architects, Huygens and Tappé, and their consulting landscape architect, Benjamin Gary, a presentation of their schematic plans for a new Franklin Park Zoo.

Until such time as precise plans for the Zoo are available, any definitive judgment on the proposal can hardly be made. In the meanwhile, however, I am glad to offer the personal opinion that the plans are very clearly on the right track. You will recall my indicating a few points of design, as shown on the model, that will require careful attention. But on the whole I believe the proposed arrangement of spaces and buildings of the Zoo is actually more in keeping with the overall character of Franklin Park than the Greeting has been in its various forms, despite its embryonic presence in the original plan of Olmsted. Moreover, the area proposed for modification appears to have been kept rigorously to the east of the Circuit Drive, and thus intrudes upon the central main space of the park no more than the earlier provisions have done.

For a brief critical account of the history of Franklin Park I take the liberty of referring you to pages 295-299 in my book, "Design on the Land: the Development of Landscape Architecture" (Cambridge, Harvard University Press, 1971).

If I can be of any further help in this commendable effort, do feel free to call upon me.

Yours sincerely,

Norman Newton

Norman T. Newton
Professor Emeritus

NTN:t

SHEPLEY BULFINCH RICHARDSON AND ABBOTT

SUBJECT: MEETING OF MDC DESIGN REVIEW COMMITTEE October 23, 1973

September 25, 1973, at 462 Boylston Street

Review Notes on Schematic Design of Zoo in Franklin Park,
Huygens and Tappe, Inc., Architects.

PRESENT: Mrs. Brook, Mr. Harkness, and Mr. Coolidge

PLANNING AND TRANSPORTATION

Although DRC was not exposed to feasibility study in which another site was considered, it may be justifiably assumed that Franklin Park is a valid Zoo site because of its location, open space available and also because of precedence. The Zoo could be a boost to the area if community participation and local pride develop.

The present transportation system is, of course, inadequate. There should be an underground rapid transit connection to the MBTA system. Zoo planning presents opportunity to improve transportation and traffic patterns in entire area.

It seems everyone is aware of the lack of parking facilities. Surface parking (600 to 1,200 cars, presently projected) is not a design solution. The neighborhood, every ecologist and fresh-air enthusiast will be justifiably on the warpath if open land is taken for surface parking purposes. Ideally an underground facility would be the best parking solution. If money is not now available, then this facility should be projected with a realistic funding proposal.

DESIGN

The present solution of four separate pavilions is a significant improvement over the single large structure originally proposed. The design approach is valid, i.e., setting the pavilions into a molded landscape, creating interior and exterior spaces environmentally suitable for African animals and their exhibition. The designers have made a commendable effort to retain existing major plant materials and to tie the new scheme in with existing topography and structures scheduled to remain. Respecting the Greeting Axis helps to organize the total scheme which could tend toward a romantically arbitrary organization. Retention of the period gates and sculpture at Greeting entrances is a commendable preservation gesture.

The experience of passing through subterranean, tent-covered and open spaces, as indicated, could be extremely effective. Care should be taken that visitors do not become bewildered and disoriented.

Some method of creating a "hub" type circulation, as opposed to a circumferential "rim" type circulation, should be explored. As the circulation now stands, a person in the northern most pavilion must pass through at least two other pavilions in order to return to the reception and administration area. Also a Zoo visitor should be allowed to escape the enforced "educational routing".

DESIGN (continued)

North access to site, though politically expedient, confuses circulation and will be expensive to keep manned.

The pavilions themselves, in the words of the Architect, are supposed to be "nonbuildings". Despite carefully planned site lines and the use of berms and foliage, the buildings are going to be impossible to hide, and extremely dominant as one moves around the Zoo site. The prospect of acres of soot-stained, white plastic covering supported by minimal exposed structural elements could be very bleak. It is assumed that as the designers delve further into the problem, they will explore expression of the structure, light and shadow patterns, night effects, etc., to add interest to the exterior of the pavilions.

The administration and reception area was not sufficiently developed to comment on.

It was noted that, other than a new Children's Zoo and a building for Arctic animals, no significant expansion is planned.

TECHNICAL

The Zoo is an experimental structure. Architects and Engineers should be allowed sufficient funds for "mock-ups" and required consultant reports.

From Mr. Hornbeck's experience with plant materials, both the quantity and quality of light penetrating the plastic will severely inhibit plant growth.

Water seepage is bound to be a problem in underground structures in this area. Provisions must be made to keep water out as well as possible and also to drain water away that manages to penetrate. Finishes should probably not be attached directly to retaining walls.

It would be tragic to fund only the construction of the Zoo and not provide adequate funds for operation and maintenance, and prevention of inevitable vandalism.

DJC/pjh

BOSTON ZOOLOGICAL SOCIETY
Franklin Park
Dorchester, Mass. 02121
(617) 442-2002
President
...ert E. Mainer
Executive Director
... ell Sylva

Mr. Don Anderson
CLM Systems, Inc.
292 Main Street
Cambridge, Mass. 02142

August 31, 1973

Dear Mr. Anderson:

Before recommending a location for a new zoo in Boston, the Boston Zoological Society studied prior recommendations (Shurcliff, Perry Dean & Stewart), studied our own set of alternatives, and finally reviewed suggestions from outside. Several aspects of location were taken into consideration and a good deal of thought was given to the fact that one zoo was already located at Stoneham.

Several options seemed available:

1. Locate the zoo outside the Metropolitan Boston area where it would have ample acreage (100-150 vs. Franklin Park's 50-70) and major highway access, and would be removed from the public image of the "inner city".

2. Expand Stone Zoo and abandon the Franklin Park site. Although the expansion would have to be across the street from the current location, M.D.C. land was available.

3. Construct a new complete facility at Franklin Park as recommended by the Perry, Dean and Stewart proposal, including Long Crouch Woods into the site, bringing the total acreage up to about 100 acres.

4. Construct a partial exhibit at Franklin Park, staying roughly within current bounds, and consider Stone Zoo as a complementary exhibit. This could be achieved by placing certain continental exhibits at Franklin Park (Africa, Asia and the Poles) and the remaining at Stone Zoo (North and South America and Australia).

Each option was reviewed and the pros and cons were studied. Briefly the decision reached was based on the following:

1. <u>New location outside Boston</u>

We did not consider inside Boston because adequate land was just unobtainable. Several sites along 128 and 495 might well be obtained with adequate acreage. Cost of land purchase, however, limited us to consideration of sites that could be obtained, or were presently owned by the M.D.C. and could be supplied free, or nearly free of cost. When one reviews the properties owned by the M.D.C. in the appropriate areas it is questionable that such sites should be used for intensive public recreation. For the main part these sites are heavily wooded and were obtained basically as conservation areas.

One major benefit from such a location would be easy provision for parking in terms of space, but it is doubtful that it could be accomplished without major destruction of trees and natural land scape. In balance, virtually no area which was obtainable within reasonable cost could be serviced by mass transportation.

Location of a facility south-west of 128 would have an additional advantage of drawing from Providence and Worcester, but would substantially reduce the chance for inner-city people without cars to reach the facility from any of the major population centers.

Finally, this option would have meant the withdrawal of the one major public attraction from Franklin Park, which might well remove most regional interest from the park proper. The Society feels that the whole park can be brought back into high public usage only when legitimate use of the area is substantially increased. At present the major potential for development of this interest seems to be the zoological gardens.

2. <u>Expand Stone Zoo</u>

Most of the points in (1) above apply to this option, with Stone Zoo, in its present location north of Boston, even less suited than a location to the west. Furthermore the expansion would involve some complications with people moving across a busy highway.

Nonetheless the Society looked carefully at the possibility. One major problem is that the existing zoo, relatively new, does not take well to major expansion. Designed as a mini-zoo it would require a great deal of modification of existing exhibits to bring it up to acceptable standards. In a sense, the fact that Franklin Park Zoo had no structures of recent vintage that required saving, made it a ~~more~~ less difficult planning program.

Stone Zoo does have the advantage of more varied topography and certain areas adjacent to it could be attractive animal exhibits. However the introduction of tropical animal shelters into that area would call for massive loss of trees for the provision of heated shelters. The area would be much more suitable to the display of northern climate animals requiring a minimum of support facilities.

3. Construct a complete zoo at Franklin Park

This would require the taking of Long Crouch Woods to gain the generally accepted acreage of 100-125 acres. By law this area would have to be fenced and a review of the geography of Franklin Park would show that this effectively would cut off the neighboring community along Seaver Street from the park proper. Long Crouch itself seems more appropriate for developed park and picnic use, being directly across the street from the housing on and behind Seaver Street. The heavily used playground now located there tends to support this.

Furthermore, to build a total zoo at Franklin Park would be to duplicate and make Stone Zoo redundant. While one might not have designed two zoo sites starting from scratch, one cannot ignore the situation as it exists. We doubt that the limiting of either zoo to specific geographic areas will greatly reduce the zoo's recreational and educational impact and in fact allows for complementary exhibits which might well be of a more appropriate scale to normal zoo visiting patterns.

4. Construct a limited exhibit at Franklin Park

The Society settled on this program as the best usage of all the zoo components. The African exhibit at Franklin Park will solve the access problems of the suburban location, provide a broad enough zoo experience to encourage attendence and service the largest school system in the area within Boston's city limits. It is accessible from the out-skirts and of a size and scale that programming a visit is a managable task. Larger zoos often have troubles because their size prohibits a full visit in a single day on other than a "rush-through" basis. We believe all the exhibits in the zoo, as designed, can be programmed for a coherent 3-4 hour visit, allowing us to produce the maximum educational experience in a structured and logical manner.

Finally one cannot fail to recognize that the surrounding area has few if any facilities of wide spread regional interest. It would seem that the psychology of a large popular experience within the community will have several favorable spin offs in the areas of business, recreation and education in an area sorely needing them.

The Society's decision to recommend the project at Franklin Park Zoo in its current size, scheme and location is consistent with most successful zoos in the country today. With the exception of commercial "animal park" type exhibits, most of the great zoos are located in or contingent to the heavy population centers. Success is spelled in many ways for zoos, but certainly one of the most important is the number of poeple it serves and the ease with which they can attend.

Sincerely,

S. Russell Sylva
Executive Director

SRS:mk