C WILLIAM CLARK

AN AQUARIUM FOR SEATTLE, WN.

P378
.C5473

THESIS

C. WILLIAM CLARK

WINTER 1974

department of architecture

montana state university

Subject: An Aquarium for
Seattle, Wn.

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THESIS

Thesis Statement:

To allow human envolvement into an alien environment through architectural form and function.

Thesis Proposal:

At present the city of Seattle, Washington has in its waterfront plan a proposal for what they call an aqua-theatre. As fulfillment of my thesis and partial fulfillment for the degree in Architecture from Montana Sta e University, I would like to use them as my client in designing for them this aqua-theatre (aquarium). This aquarium would display or exhibit a wide variety of aquatic life that would live in harmony with each other forothers to visit and enjoy.

I have also considered combining with this aquarium, research facilities for studying marine life, but I feel I should limit my proposal and design to displaying and maintaining marine life, because of the overall complex function it will take, that of tank systems, etc.

Observing inhabitants from the marine world can become quite compelling. I would like it to be an educational as well as an entertaining experience. It is a known fact that in future years we will be calling more and more on marine life to answer many of our problems. Already the biochemist has been using marine organisms in hope of extracting some useful substance beneficial to man. The behaviorist has been observing marine organisms trying to determine the motivation behind defined behavior patterns. For these reasons and many more I find myself wanting to exploit marine life and since I am putting myself in the positionof designing an aquarium, through this I would to extend my findings to others by letting them relate to aquatic life and experience it through the concept I devise.

I would expect to relate the aquarium to the urban plan of Seattle and to the waterfront redevelopment area. I would expect the aquarium to be a focal point of the waterfront plan.

From this project I would expect to learn the process of design. That of recognizing the problem to be solved, compiling data or the research for the problem, organizing this research, and communicating this material in various forms to my advisor, the architectural committee, and other interested parties.

Thesis advisor: Prof. Francis Woods

Thesis committee: Profs. Jim Gough, Dave Wessel and Ilmar Reinvald

HISTORY

People have been keeping fishes in confinement for a long long time. The Sumerians stocked ponds and pools with food fishes as far back as 2500 B.C. and among the firsts with which China must be credited was the domestication of carp more than two thousand years ago: the Chinese may also be said to have pioneered the home-aquarium hobby, for they were developing fancy goldfish and carp during the Sung dynasty (960-1278) and were the first to keep them indoors in porcelain vessels. (The first goldfish pool was established in Peking.) This was purely for the pleasure of fish-watching, a pleasure that knows no territorial boundaries. As the advertising booklet of the Japanese Fancy Carp Cultivation Association puts it "It is a common joy for adults as well as children to be comforted with these colorful, innocent fancy carp after a day of hard work or study."[1]

Goldfish and carp are freshwater fishes, of course, but marine fishes also have a long history of captivity: the ancient Romans penned them in pools connected with the sea and are known to have kept them as pets. They constructed canals to lead fresh salt water from the seashore to their banquet hall aquariums.

Oddly enough, although zoological parks more or less as we know them today have existed for more than two thousand years, it never seemed to have occured to anyone to put a representative collection of fishes on public exhibition until the middle of the last century. In the spring of 1853 the Zoological Society of London opened a "Fish House" in its garden in Regent's Park. It was nowhere as elaborate as the public aquariums of today, merely a number of standing glass aquariums in a conservatory-like building, but it did show both saltwater and freshwater fishes. The exhibit was enormously successful and set off a craze for keeping fishes in homes all over England.

America, which had borrowed so much from Europe, was slow to sense the charm of looking at fishes. There were temporary fish exhibitions in this country from time to time; The World's Columbian Exposition in 1893 had an extremely popular one, but it was not until December 10, 1896, when the New York Aquarium was opened that the United States had a permanent public aquarium. Now there are about one hundred not all public, in the sense that they are operated by a municipality or a nonprofit organization, but permanent exhibitions nevertheless, and many of them important in

1 Animals and Architecture by David Hancocks

aquatic research. Research is, indeed, almost an inescapeable part of an aquariums operation, for there is so much we need to know about the lives of fishes if we are to keep them successfully.

Aquariums have evolved beyond the meaning of their original context. Their concept of displaying aquatic life and environments for scientific as well as recreational and educational purposes has allowed them to develop in a manner which, zoos, with their menagerie and circus background, have not yet been able to achieve, and it is an aquarium which has made the most significant contribution of all in the architecture for animals.[2]

[2] Animals and Architecture by David Hancocks

SEATTLE

Seattle's physical character is largely determined by its 53 miles of shore line along Lake Washington and the Puget Sound; by the waterways of the Salmon Bay Waterway, Lake Washington Ship Canal and the Duwamish River Waterway; and by the open space of Green Lake, Lake Union and Elliot Bay. Intimately related to the hydrography of Seattle is its topography of hills, valleys and ridges, all resulting from great masses of ice that moved southward during the glacial period.

Seattle is within that region which includes all the urbanized area from Olympia to Everett. This development parallels the waterline of Puget Sound and is essentially a linear series of cities linked together by the chain of water port activities and by the interstate highway system. Most of the cities within this urbanized area are either seaports for international commerce or bedroom communities supporting the larger cities.

Seattle has a high accessibility to leisure time recreational opportunities outside the city. Residents consider this closeness to nature one of the most important attributes of the Pacific Northwest. These activities include active sports(skiing, fishing, camping, hiking, and water sports) as well as numerous varied sites for vacation homes.

While the pattern of land use and development in Seattle is generally disposed to residential uses on the hills, slopes and lake shores, industrial commercial employment areas are located in the valleys, low lands along the rivers and waters located on and connecting the Puget Sound.

Seattle's transportation system is automobile orientated at this point in time, but mass rapid transit planning has advanced to the point of voting on a regional mass transit plan.

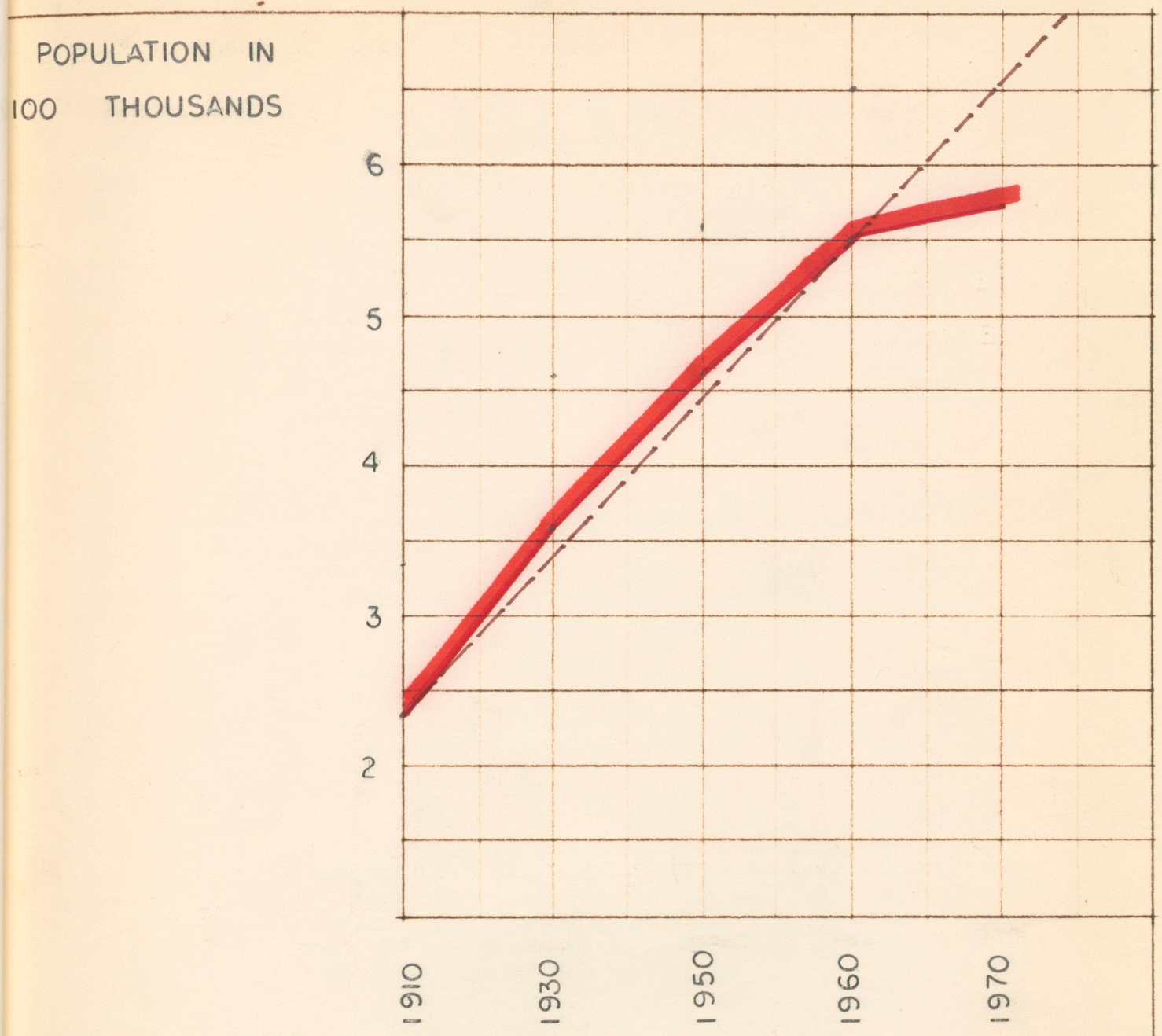
Seattle Central Waterfront is that portion of the harbor area on Elliot Bay most adjacent to the Central Business District. The limits of the area are well defined by the points of street direction change. The south end of the waterfront ties into the historic district of the old Pioneer Square. The Pike Plaza Redevelopment Project lies

at the north end of the Central Waterfront with the retail core lying immediately to the east. The shoreline to the south of the central waterfront is developed as heavy cargo handling and international shipping facilities operated by the Port of Seattle.[3]

Facts about Seattle:

Population	525,000 persons
Population density	90 persons per acre
Total area	91.6 miles square
Elevation	sea level to 513 ft. above sea level
Major Topo features	some 25 hills or ridges Puget Sound, Lake Washington.

[3] SEATTLE CENTRAL WATERFRONT; City of Seattle, 1968-71



DENSITY — 90 PERSONS PER ACRE
TOTAL AREA — 91.6 SQ. MILES

. Population statistics (Seattle)

SITE

SITE

There are several suggested sites available for the Aquarium. Those include Golden Park, Fort Lawton and the waterfront. Golden Park and Fort Lawton are in a remote location with respect to downtown. Of the sites available, the waterfront is the most accessible and is the one for which Forward Thrust funds from two projects could be combined to acheive a nicer Aquarium. Since there is a waterfront park under development presently, it would seem that an Aquarium would provide a great drawing power for people to the park. Bothethe park and the Aquarium are marine oriented, public oriented uses which in this setting can only complement one another. Located together will be a greater convenience for the public and give the public visitors a truly memorable experience.

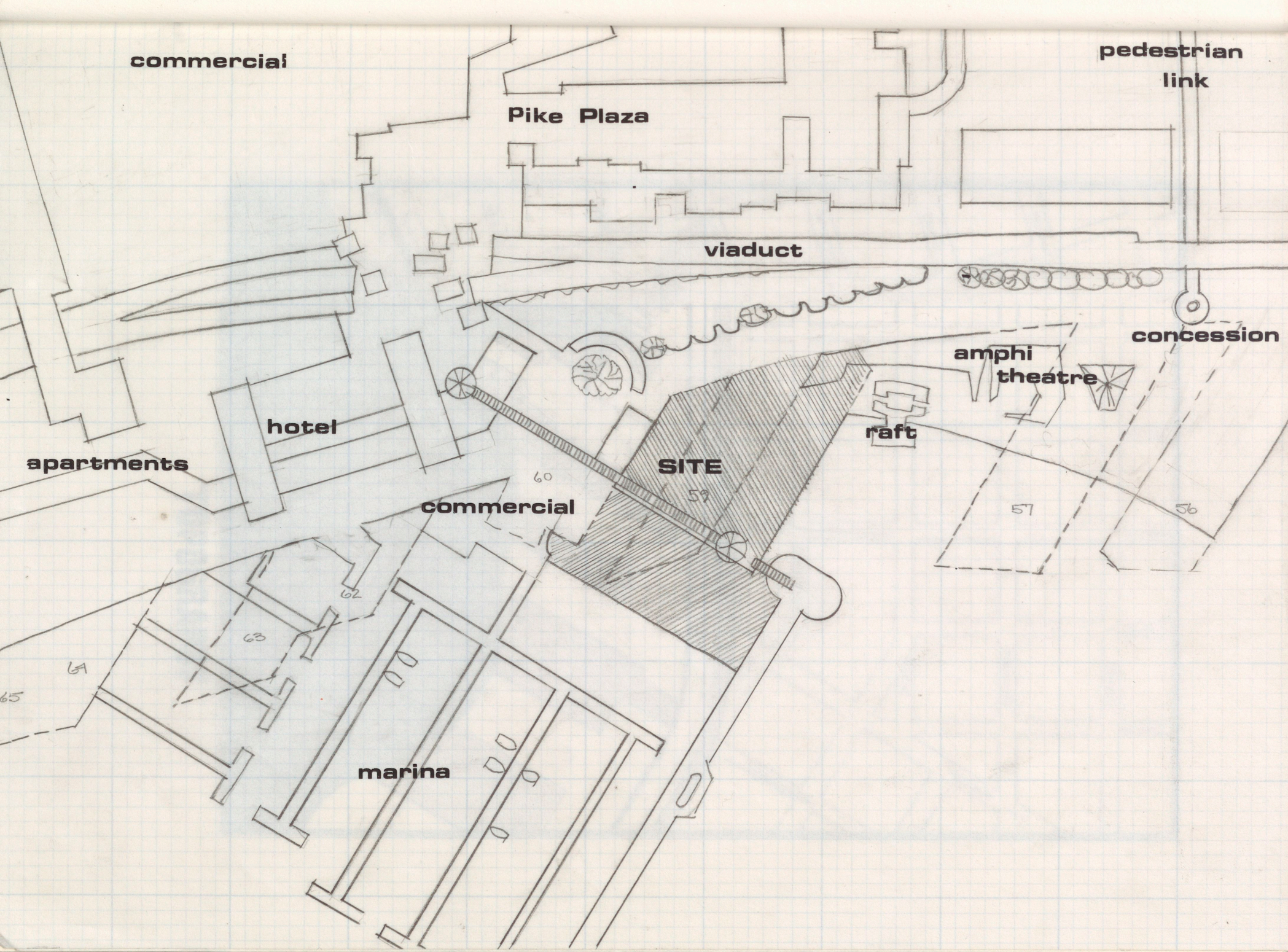
By placing the Aquarium at the north end of the park, it would provide a great attraction and complement the Ferry terminal and Concessions Center at the south end. These would act as end points and insure continous pedestrian movement between them and through the Park.

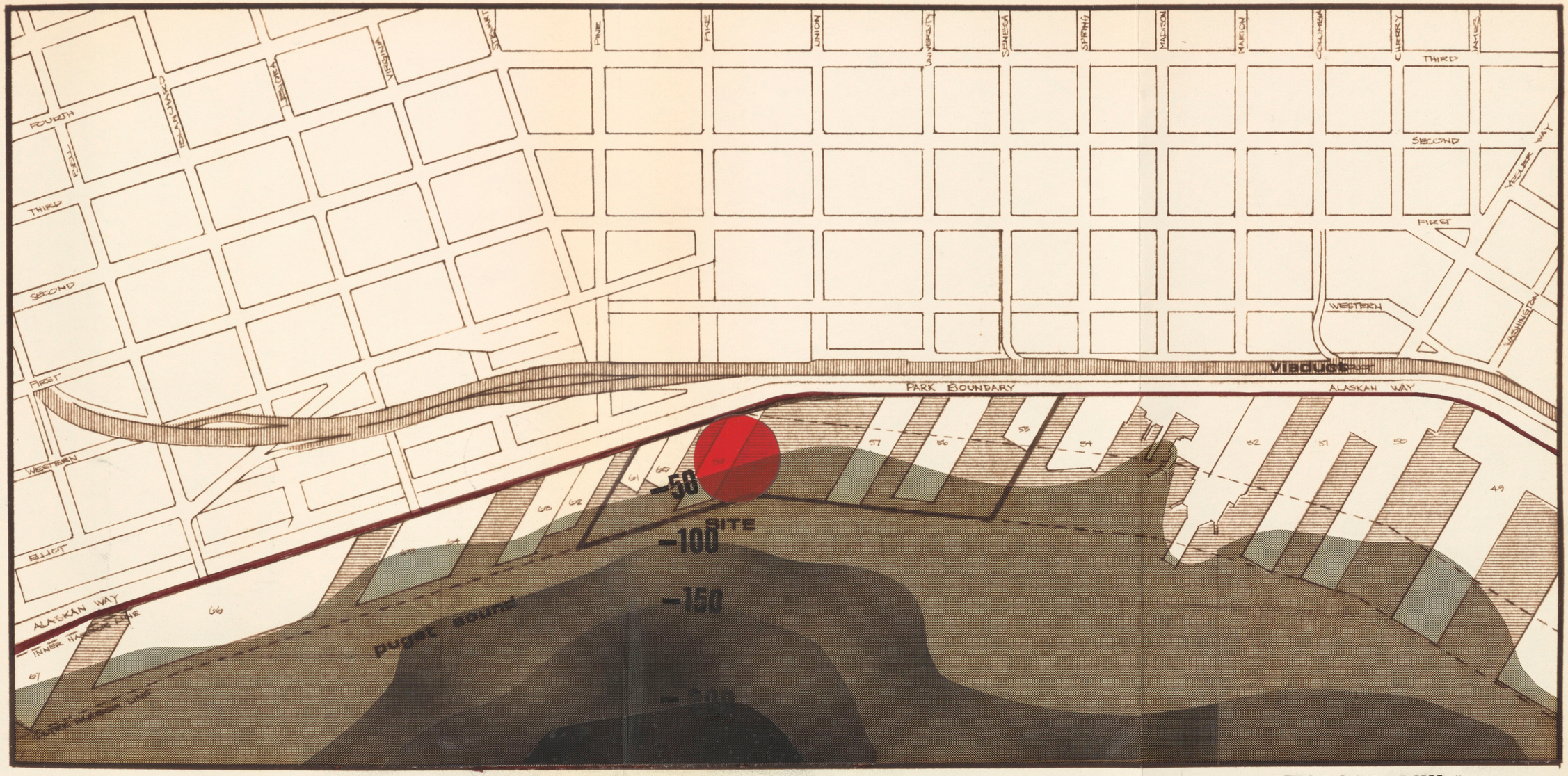
The waterfront site has available to it better public transportation facilities. It is located in the area of the CBD of Seattle which is the hub of the transit system. It is also located near the ferry terminal which provides a link to Bremerton and other places across the Puget Sound.

With respect to parking , when the park and Aquarium are combined, the result will be less total spaces needed than if the two projects were in separate locations. During non-peak hours this parking can provide other profitable uses. There are over 2000 parking spaces in the immediate area and 3000 spaces just outside the area.

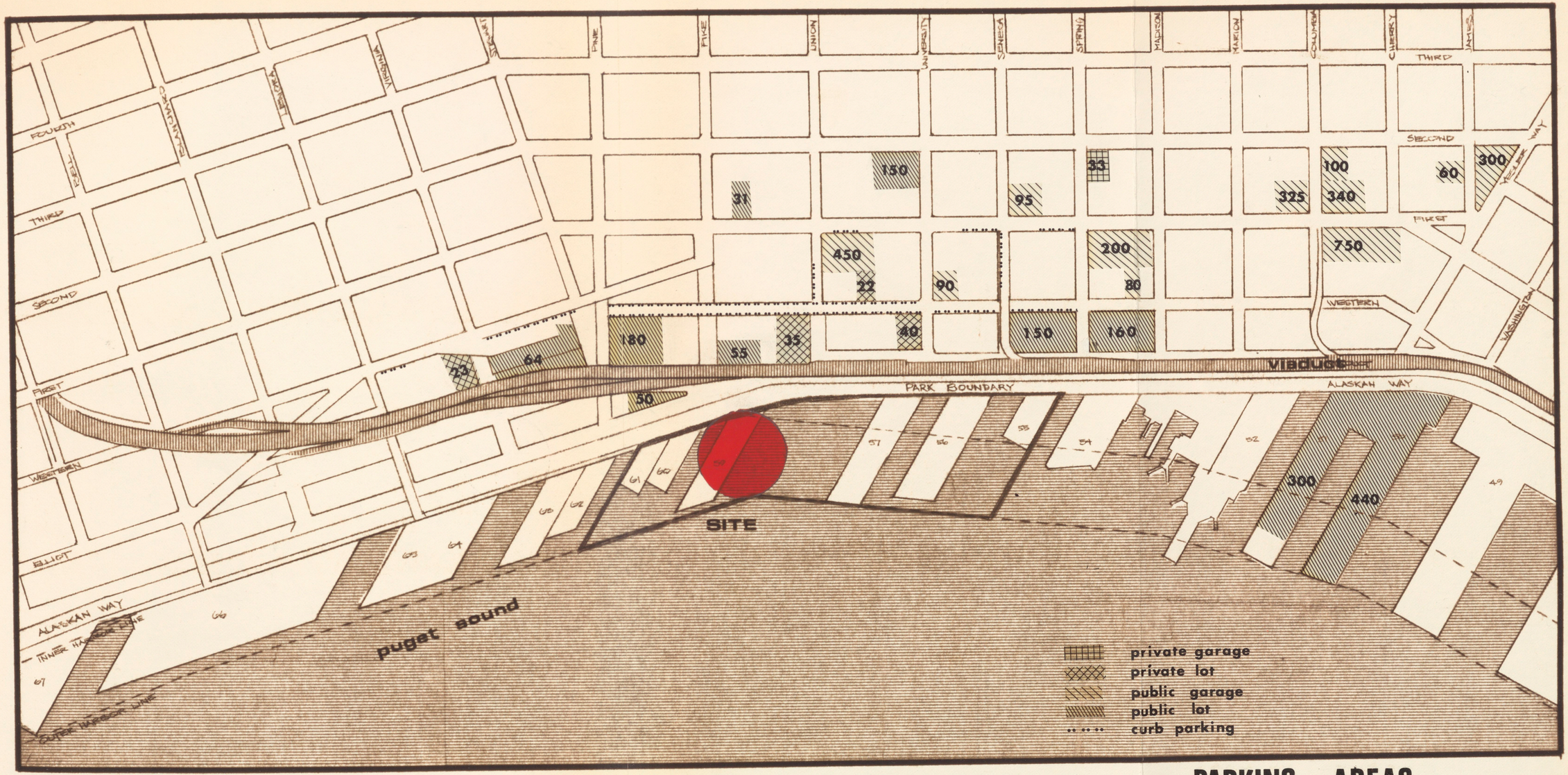
There are some problems with the site. Subsurface conditions require foundations made of pilings of considerable depth. Because of this construction, foundation and over- water structures will be more expensive than with dry land sites. Also the effect of hydrostatic pressure in this area must be taken into consideration. The water table is approximately 4 feet below the surface of Alaskan Way. Waterproofing of below grade construction and the resistance to floatation of depressed structures become problems.

With considerable study it would be found that the dis-advantages strongly outweigh the dis-advantages.

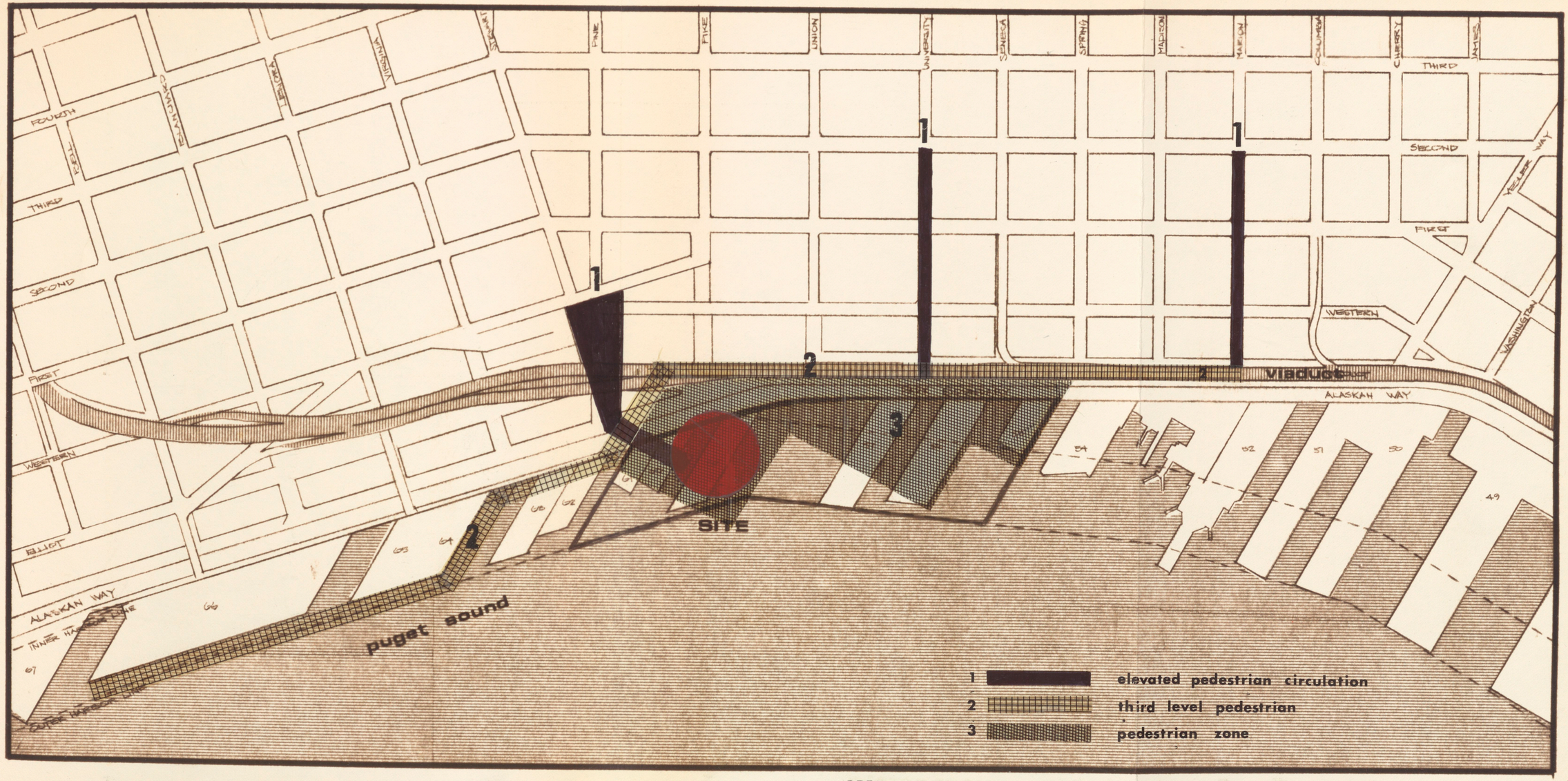

commercial
Pike Plaza
pedestrian
link
viaduct
concession
amphi
theatre
raft
hotel
apartments
SITE
commercial
marina
60
59
57
56
62
63
64
65


FOURTH
THIRD
SECOND
FIRST
VIRGINIA
STEWART
PINE
OLIVE
UNION
UNIVERSITY
SENECA
SPRING
MADISON
MARION
COLUMBIA
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-200
SITE
puget sound

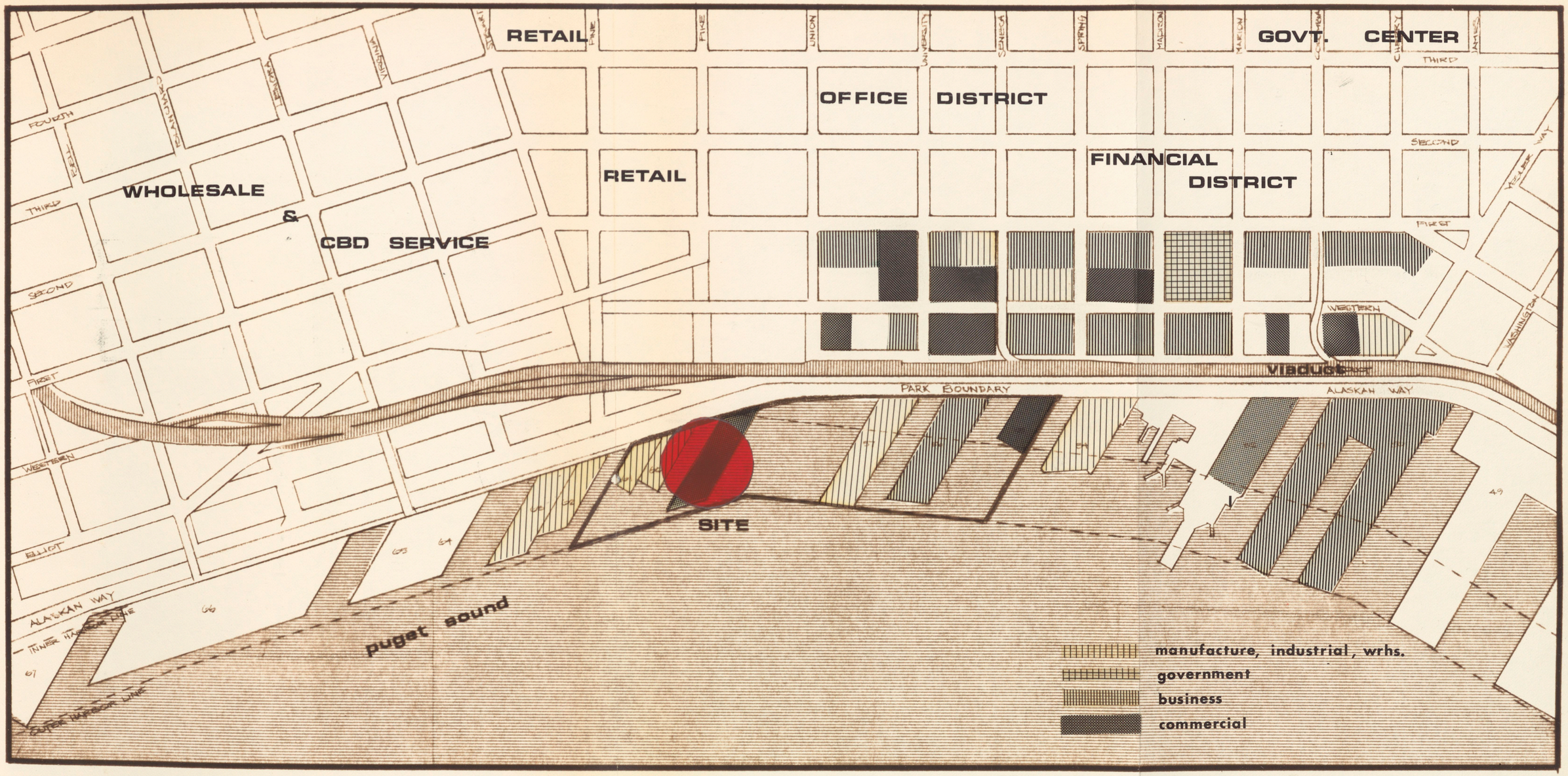
TOPOGRAPHY



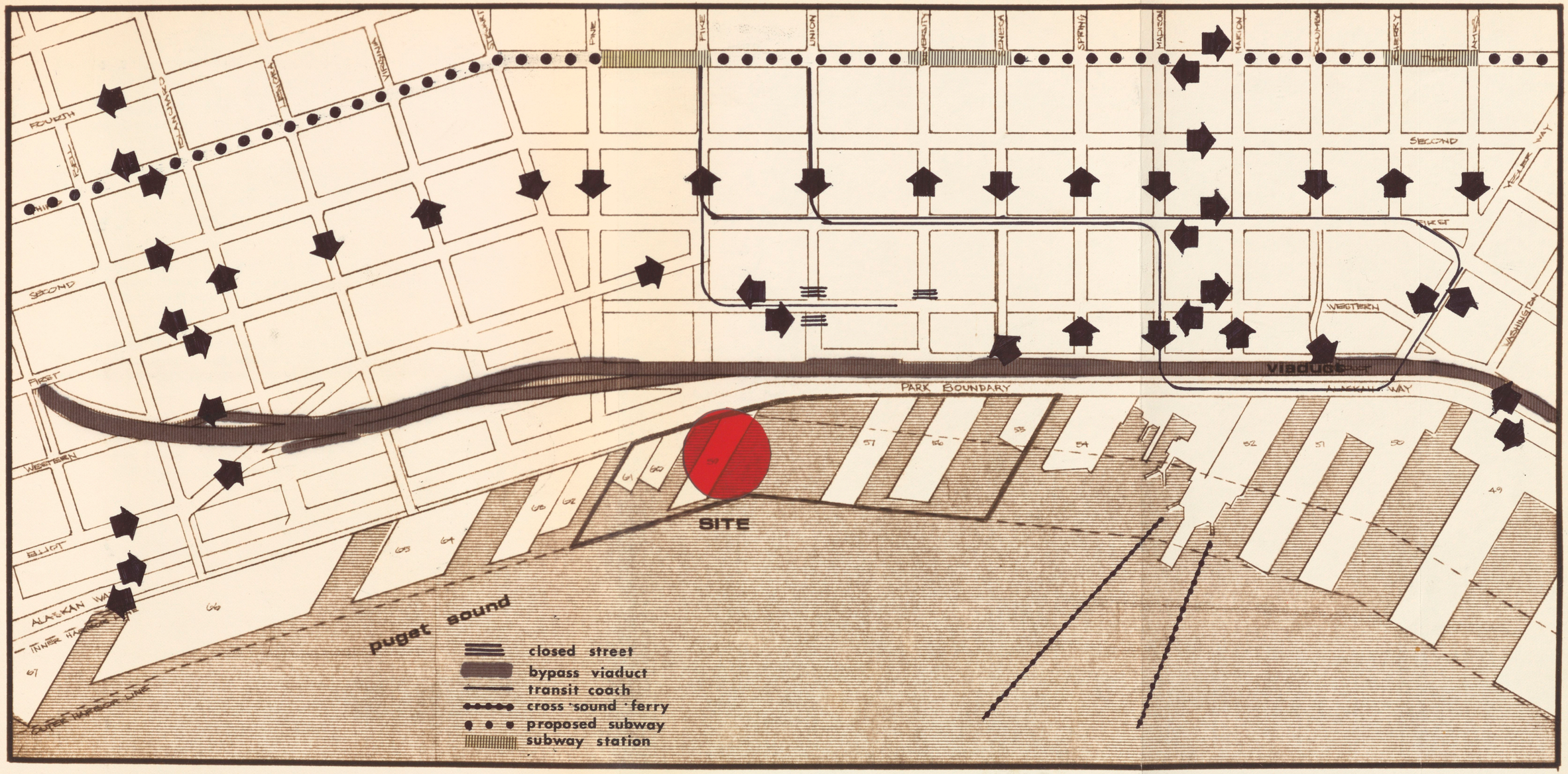
PARKING AREAS



WATERFRONT PEDESTRIAN ORIENTATION



EXISTING LAND USE



MOTOR VEHICLE CIRCULATION

CLIMATE

CLIMATE

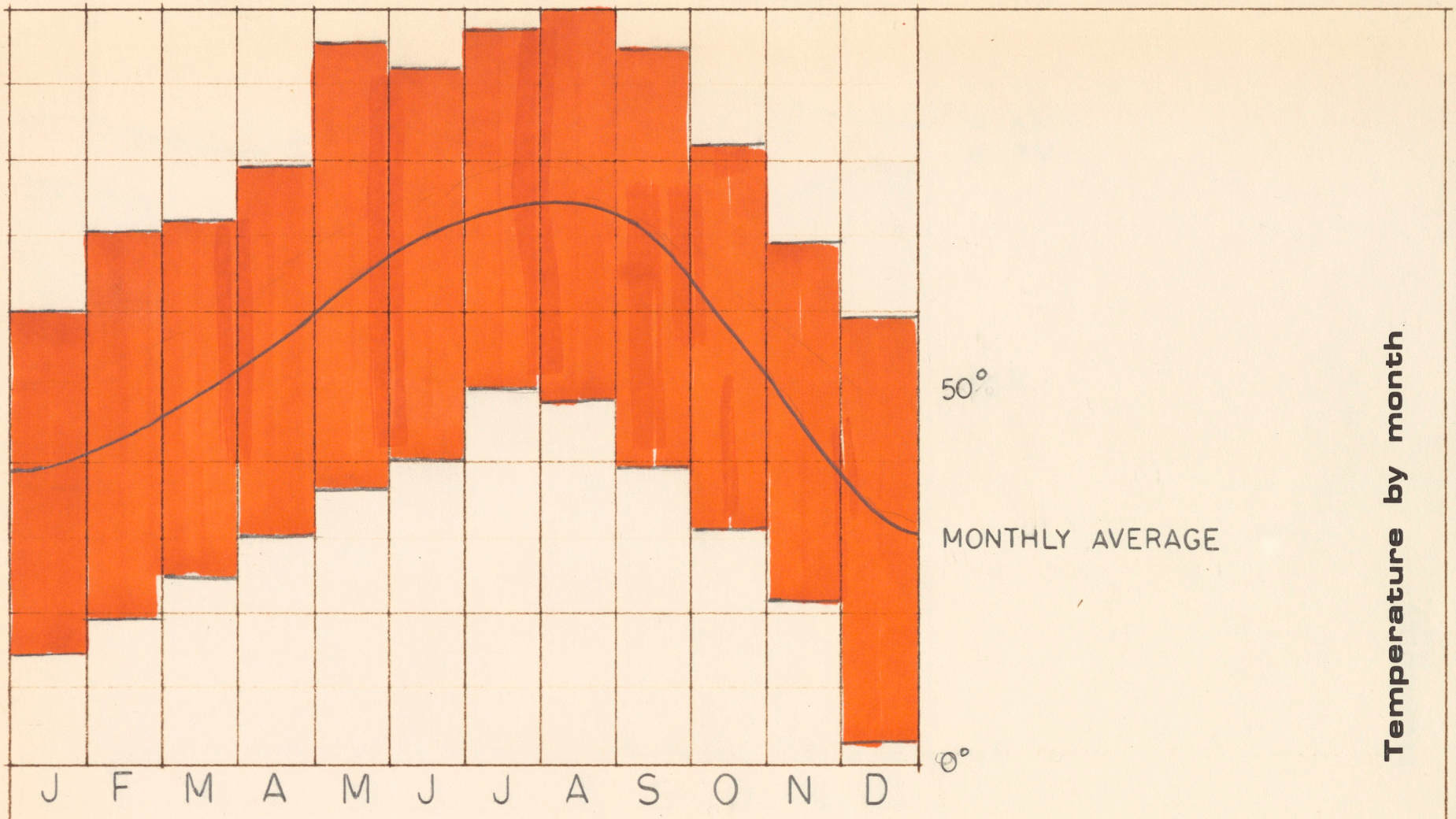
Seattle gets very much moisture. Rainfall occurs primarily 75% of the year, from October through March. This totals 40 inches in an average year as compared to San Francisco with 23 inches per year. The high occurs in January while the low occurs in July.

Snowfall is usually extremely rare and when it does snow it usually melts very rapidly. There have been very heavy snowfalls that have closed down schools, etc. When there is snow it falls from December through March.

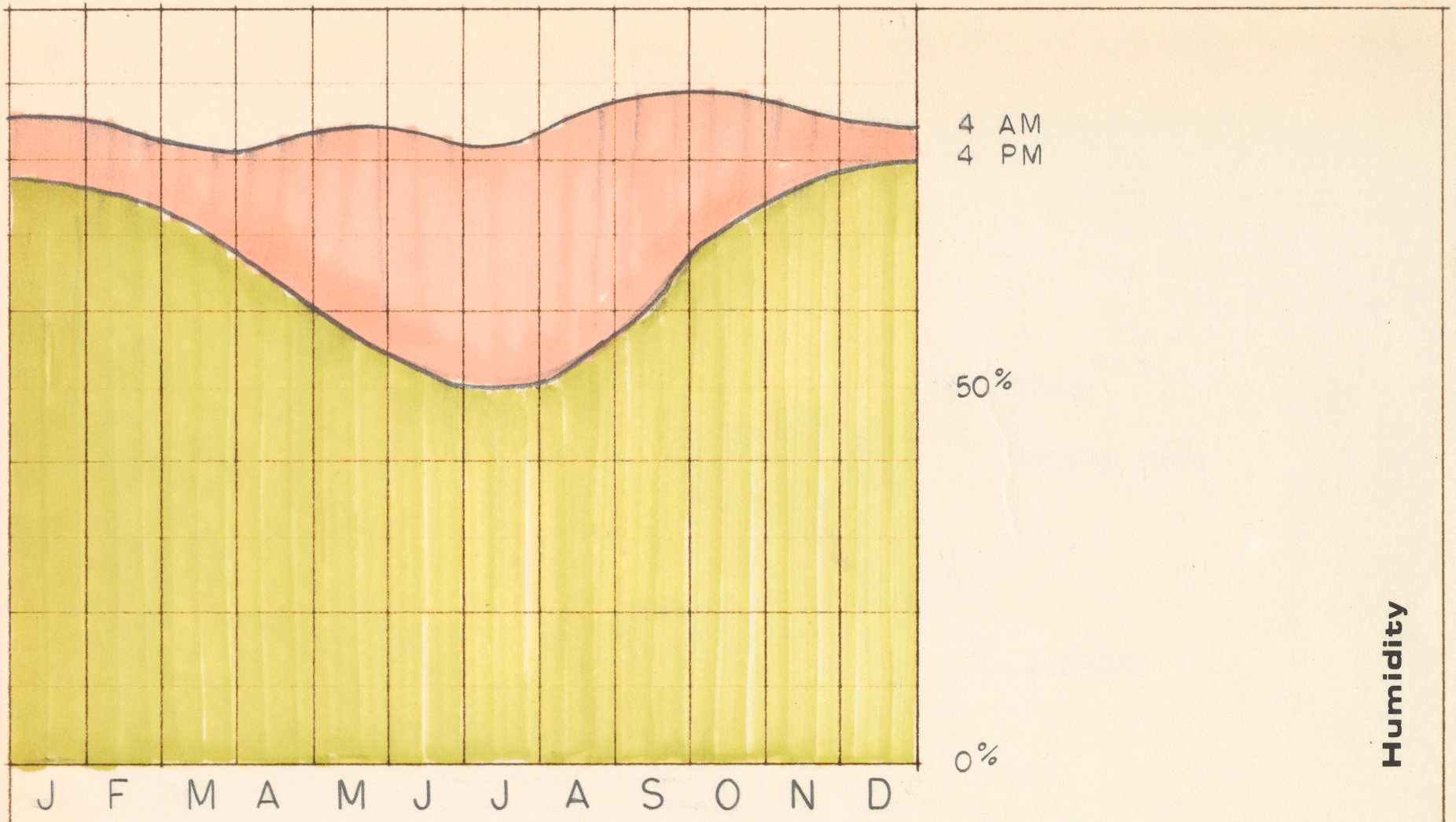
The warmer days of the year occur in July and August. During these months there is an average of 10 clear days for each month. The other months usually see 3 to 5 clear days each.

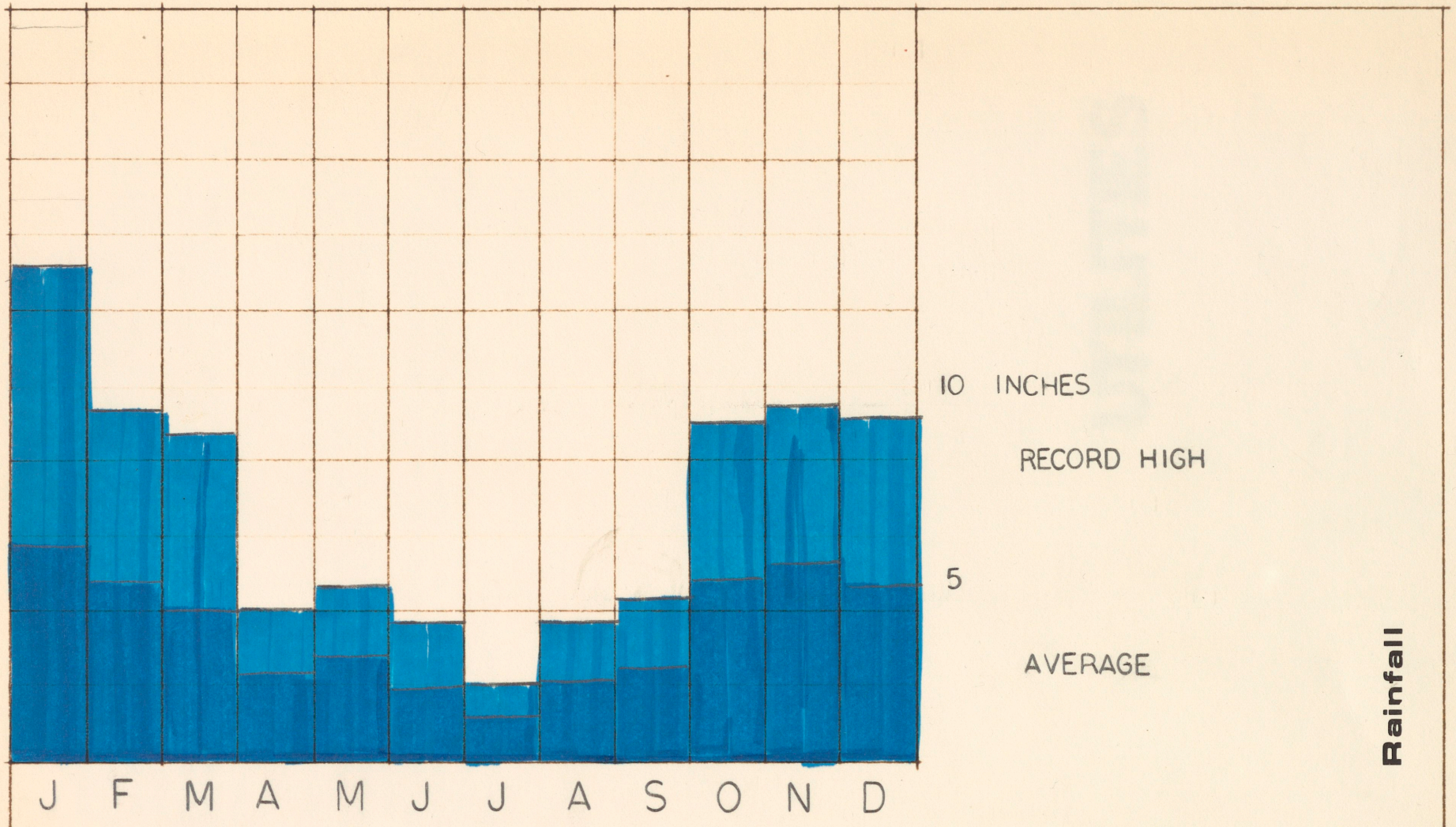
The daytime winter temperature reaches the mid 40's while the daytime summer temperature remains in the mid 70's. The seasonal low temperature ranges in the 30's to the low 50's.

The prevailing wind direction is from the southwest during the winter months, switching to a northwesterly direction during the summer months. Wind is usually light during the night, picking up to speeds of 15 mph during the afternoon.



Temperature by month


4 AM
4 PM
50%
0%
J F M A M J J A S O N D
Humidity



Rainfall

UTILITIES

Utilities

The utilities in this area date back to the origin of Seattle. Many types of utilities, from telegraph to steam can be found under the streets. Many of these facilities are still in use. At present there is a new Metro sewer system under construction. New electric and telephone utility lines are to be placed underground in the near future.

The Aquarium facility should not pose any problems with utilities. All utilities needed for its operation will be present including the availability of sea water for the marine life. This will probably be made available by the drilling of a deep well in the vacinity of the Aquarium. This water will need the necessary filtering and treatment that will have to be provided in the water system of the facility.

SPACES

PUBLIC AREAS

GALLERY DISPLAYS

Contained within the gallery display areas will be displays relating to all the educational objectives. Presented as functions of those objectives, they are:

- how man is related to the sea
- how he ought to look after the seas
- the dangers of some of his present actions.

"Our Environment", a system of display illustrating man and the sea within the context of the total environment; ecology and nature being major topics.

This area is the most active of all display areas, being constantly changed as new research and techniques develop. The display system here needs to be quick-change or flexible.

The media used will be two-dimensional graphics, small models, and dioramas. As this is a self-contained communication unit circulation must be such that it is a defined system within the rest of the displays.

Area: 5000 square feet

Equipment: vertical panels, bases for models and specimens, and an area for back lit and rear projection.

LECTURE FACILITIES:

Used for lectures to school groups and other organized bodies. It will also serve as a briefing area for the Seaquarium. Seating should be for 50 to 100 people. Could be used after normal hours of the Seaquarium.

There should be facilities for multi-media presentations.

Area: 1000 square feet
Projection equipment: 150 square feet

Equipment: Projector and screen

BOOK AND GIFT STORE:

The book and gift store sells books and gifts of an oceanic nature, and sea shell specimens for collectors.

Comfortable browsing combined with staff control is essential in a merchandising situation.

Equipment: Book stacks, tables, display shelving and packaging facilities.

Area: 400 square feet

Relationship: Some form of transportation must be provided for moving supplies from storage to the book and gift store. Located near exit.

BOOKSTORE STORAGE:

The supplies for the bookshop are held in storage and replenished when necessary. This needs to be a space allowing comfortable storage. As the bookstores supplies will be replenished at the rate of depletion this is a very active storage area.

Equipment:	Storage shelves
Area:	200 square feet
Relationships:	Proximous to loading dock and with care of movement to the bookstore.

CONCESSION FACILITIES:

Place where visitors may enjoy a snack when they end their trip through the Seaquarium. The servicing of such an area is generally an unattractive operation so servicing would be done during closed hours.

Equipment:	Coin operated machines
Area:	200 square feet
Relationships:	Adjacent to general public areas and located at the end of display areas near lecture area, gift shop, etc.

It was decided not to incorporate a larger restuarant type facility into the Seaquarium because of the close proximity of concessions in the waterfront park.

DIRECTOR:

The director devotes about 80% of his time to administration, and 20% to research. His office should be located so as to see some of the operation. It needs to retain privacy. With some exception, visitors never visit this office. There must be enough room and accommodations for up to three persons in addition to the director.

Equipment:	One large desk, 3x6 chair, three comfortable room chairs, book storage, small specimen display facilities(dry)
Area:	200 square feet
Relationships:	Direct to conference room, secretary. Indirect to other staff and service facilities.

DIRECTOR'S SECRETARY:

Devotes 100% of her time to administrative work. Serves as control for the conference room and will show visitors around the facility.

This position will be a go between for the Director and visitors.

Equipment:	Desk with chair, two additional chairs, typewriter, reference table filing cabinets.
Area:	120 square feet
Relationships:	Direct to Director's office and conference room

CONFERENCE ROOM:

Contained within the conference room will be library resources pertaining to aquariums and other live display systems. The conference room is used for staff meetings, meetings of the Aquarium Advisory Committee, and meetings with potential donors. Also, the volunteer docents will use this room.

Acoustic privacy as well as facilities for movie and slide presentations are necessary here. When potential donors are met with it would be possible to show what the facility does.

Equipment:	Seating for 10 people with a conference table for participants to place papers, reports, etc. on, also a rear lit projection screen and bookshelving are necessary.
Area:	350 square feet
Relationships:	Direct to the Director's office and his secretary.

CURATORS:

They are in charge of administrating the various activities of the live displays; the collecting of specimens, disease control and study, tank maintenance, and specimen feeding. Among the qualifications for his job is a PhD in Ichthyology or Fish Physiology.

Equipment:	3x5 desk with chair, three aditional chairs.
Area:	130 square feet
Relationships:	Close proximity to the aquarium laboratory.

EMPLOYEE AREAS:

Within the staff areas there needs to be a general lounge, bathroom facilities, and a vending area.

Lounge:

Equipment:	Comfortable seating and book-shelves.
Area:	200 square feet
Relationships:	Private and acoustically and visually isolated from the other staff areas. Proximous to rest-rooms and vending areas.

Restrooms:

Equipment:	Toilets, urinals, sinks, mirrors, and towel dispensors.
Area:	100 square feet
Relationships:	Direct to the lounge, but also accessible from the staff areas.
Vending area:	May be a small area within the lounge area.

AQUARIUM LABORATORY:

A small laboratory equipped for routine analysis of water and examination of dead fish is essential. This lab will need space for equipment to make a chemical analysis of water, parasitological investigations, and bacteriological studies. Routine water analysis is essential.

Equipment:	Benches, racks
Area:	600 square feet
Relationships:	Direct to specimen storing and aquarium curator.

TANK HOLDING AREA:

Not all specimens are on display and these are retained in the specimen holding area. It is here that new specimens are first retained. Sick fish are studied by the assistant curator here, and this is where any surplus fish are kept.

A highly clean atmosphere prevails here. There are hook-ups to the water supply system. Sick fish tanks will be within this area on a small separate system. Included in this area will be space for the assistant curator. This room will be the base for two staff aquarists and part time help.

Equipment:	Number of small tanks and the variety of equipment used by the staff here.
Area:	2000 square feet
Relationships:	Must be adjagent to the aquarium laboratory, and close to display tanks.

WORKSHOP:

Used primarily by the aquarists and collectors, the aquarium shop has facilities for mechanical equipment maintenance for the entire facility. Faulty pump and filtration equipment is repaired here, and traps, are mended and repaired. The shop houses the different kinds of equipment necessary for maintenance, including standard power tools, welding equipment, and powered pipe-fitting tools.

Equipment:	A variety of power tools and often other equipment and the bases and stands necessary. Work benches and storage cabinets are required.
Area:	500 square feet
Relationships:	Proximous to the main mechanical room and the collectors office and specimen holding.

FOOD PREPARATION AREA:

To provide for savings in food-purchasing, a walk-in freezer is necessary, maintaining a temperature within 5 degrees of zero degrees F., so as to preserve all the vitamin and protein constituents of stored food. Vitamin and mineral content may be controlled through the use of an electric blender.

Equipment:	filing cabinets, various grinders, knives, cutting boards, work benches, cabinet storage, walk-in freezer
Area:	300 square feet
Relationships:	Easy access to circulation towards the live displays.

MECHANICAL AREAS:

In general, the area will house the central heating and cooling system for the facility, and will be headquarters for the maintenance department.

Equipment:	The heating and cooling system, facilities for the storage of equipment, and a lounge and locker area for the maintenance department.
Area:	6000 square feet
Relationships:	This area must be closely connected to the shop facilities and the loading area. The final configureation rest entirely upon the installation of the mechanical system.

RECEIVING AREA*LOADING DOCK:

The sorting, directing, and holding of supply arrivals occurs at the receiving area. This area must be free of obstruction, allow ease of movement, and be spacious enough for large arrivals.

Equipment:	Hand trucks, dollies, and wickets
Area:	600 square feet
Relationships:	There must be ease of circulation from here to the various storage areas.

GENERAL STORAGE:

Used by all departments, the general storage area will house a wide variety of items from displayed materials to equipment.

This space will be free from obstruction and will allow for easy movement in and out of the area.

Equipment:	Hand trucks, shelving, some cabinets
Area:	1500 square feet
Relationships:	Proximous to the aquarium dept.

DESIGN & CONCEPTS

THEME:

- emphasis:
  the aquarium will emphasize the aquatic life of Puget Sound and the Adjacent Waters.

- asset:
  the aquarium will be a community asset in many ways, but its primary function will be to interpret and explain the aquatic environment in an entertaining and compelling manner.

- cost:
  available funds are for capital cost and not for maintenance and operation. Therefore, the design must provide both for exonomical operation and high levels of admission revenue.

- design goal:
  this aquarium must put the viewer vicariously into the underwater environment so that he will appreciate this bountiful resource and so that his will to protect the environment is strengthened.

- display:
  it is important that a good portion of the funds be devoted to the creation of display excitement and communications effectiveness.

- dimension:
  added dimension can be given the aquarium by making it an integral part of the Elliot Bay environment.

- parking:
  parking is a problem common to the entire waterfront area. A solution to this problem is beyond the scope of this single project. Therefore, only employee parking, service parking and unloading zones will be provided.

- benefits:
  by becoming better informed about the aquatic life and environment the public will be better able to make rational decisions concerning its use. Such a contribution to informed public participation will constitute the most significant long-term benefits of this aquarium.

•relationships:

as is appropriate to an aquarium, the basic element of display will be living specimens. However, and understanding of the total environment comes from a knowledge of how plants and animals relate to their natural surroundings, to each other and to man. Exhibits will focus on these relationships.

•living conditions:

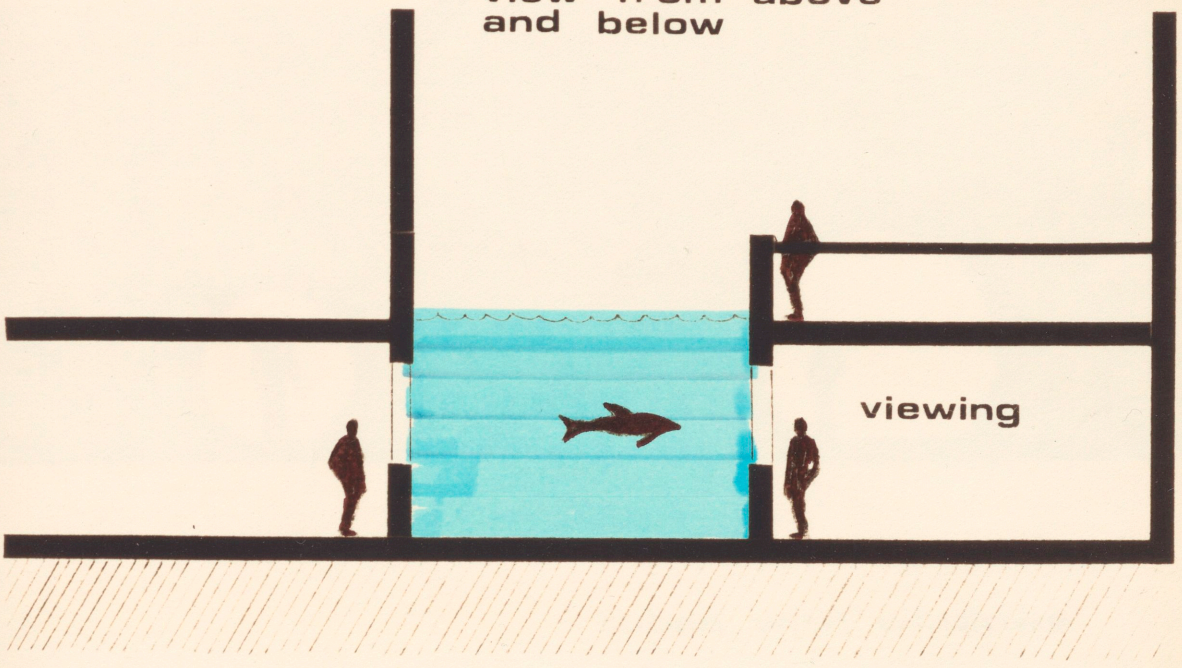
the design will provide for the comfort of the creatures on display. This will require attention to the adequacy of living space, water quality and temperature.

•organization:

Generally, exhibits will be organized on the basis of natural groupings of aquatic plants and animals characteristics of specific habitats. Such groupings, will include live animals with explanatory models, dioramas, superfraphics, film strips, photographs, text, sound, color, and other means.

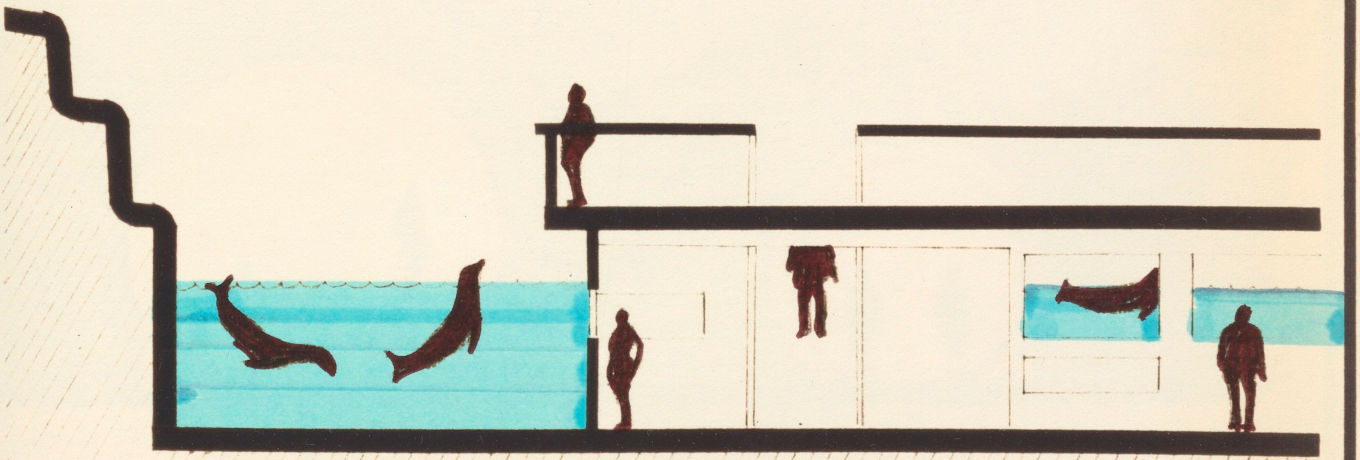
EXHIBIT TYPES

view from above
and below



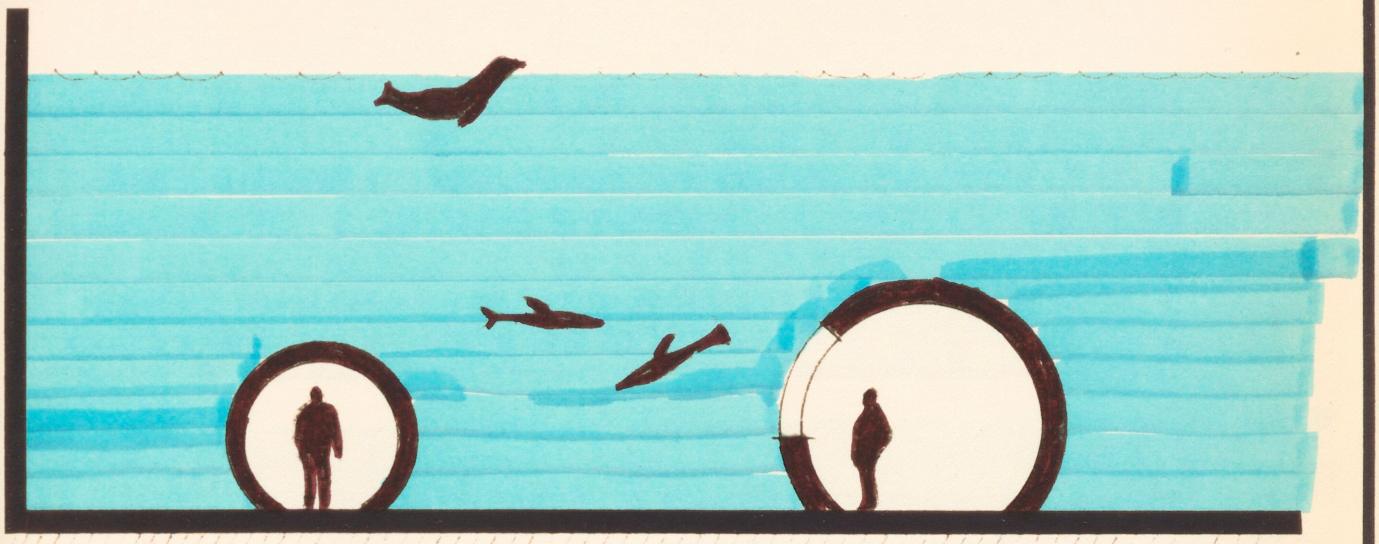
1

inside – outside



2

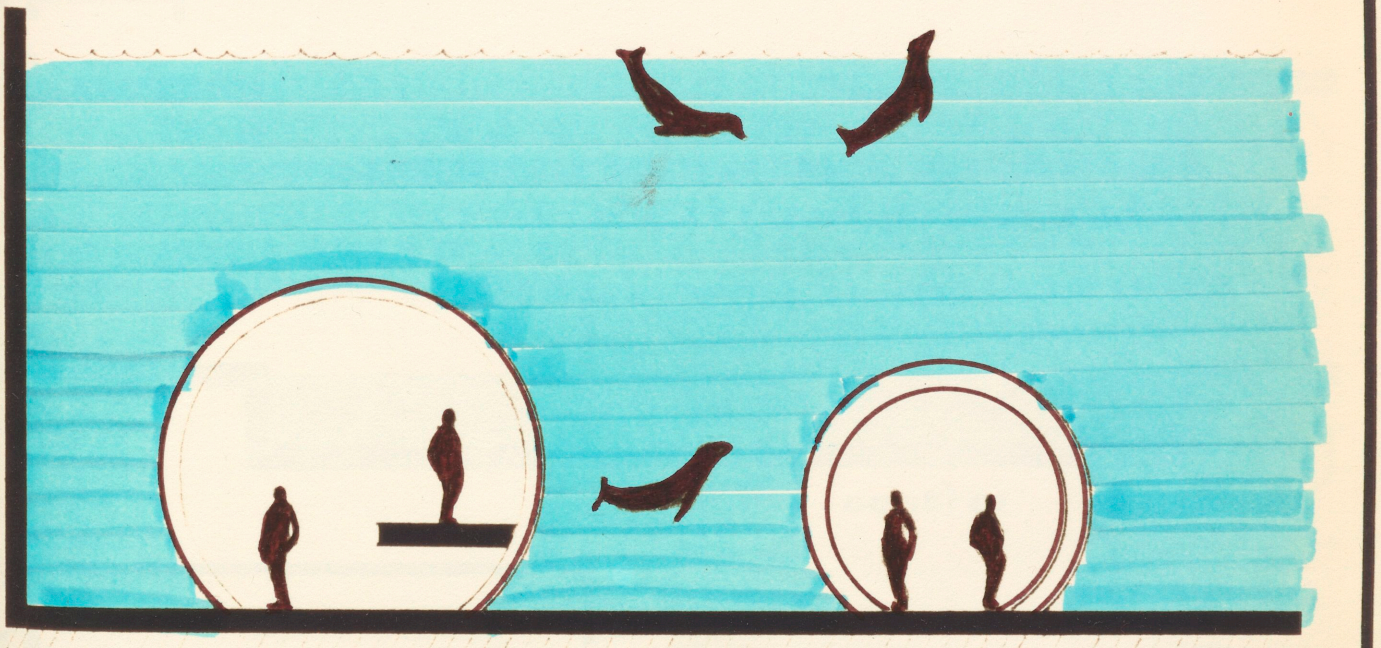
EXHIBIT TYPES



tubes with windows

3

under-water clear tubes



4

EXHIBIT TYPES

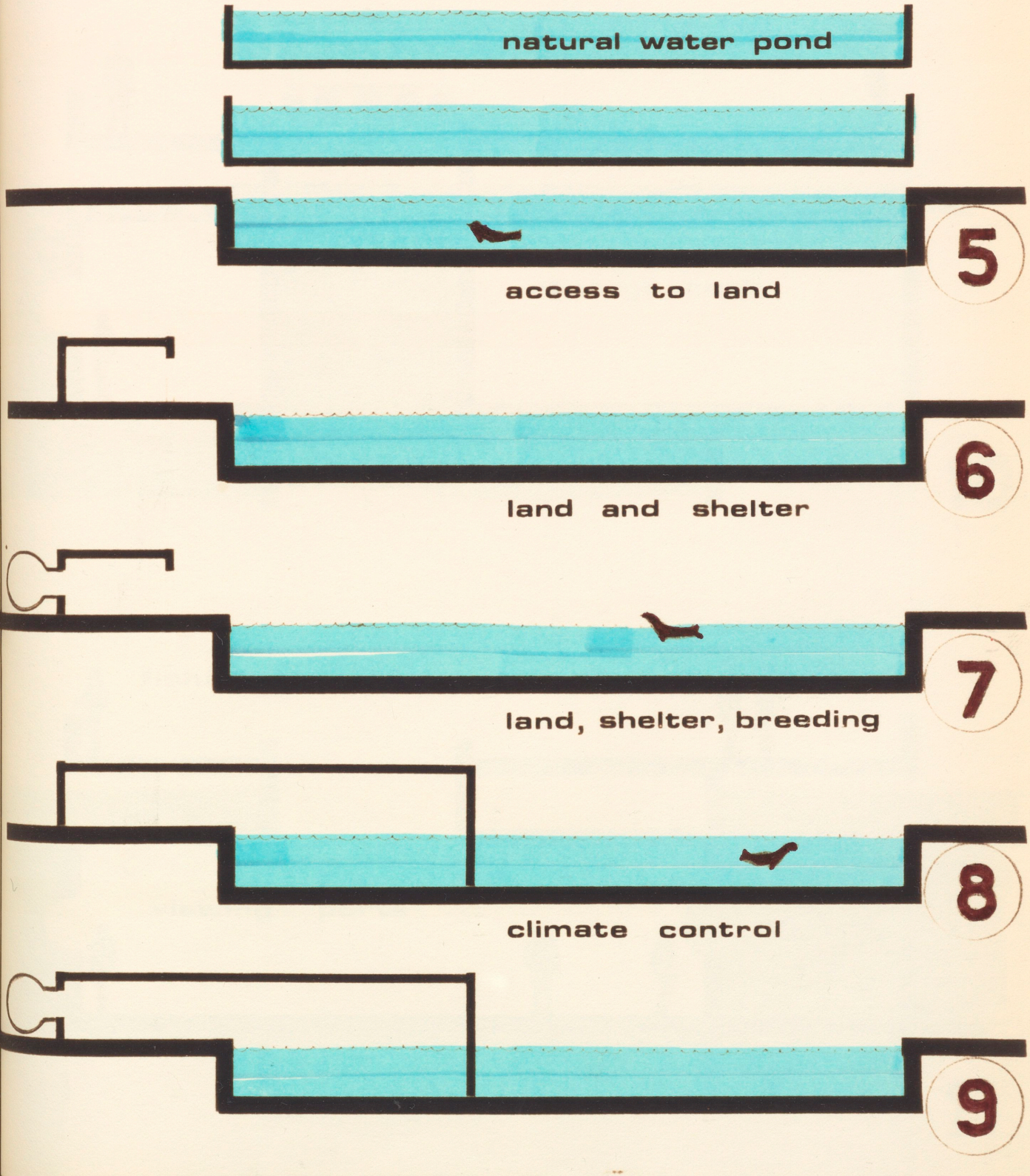
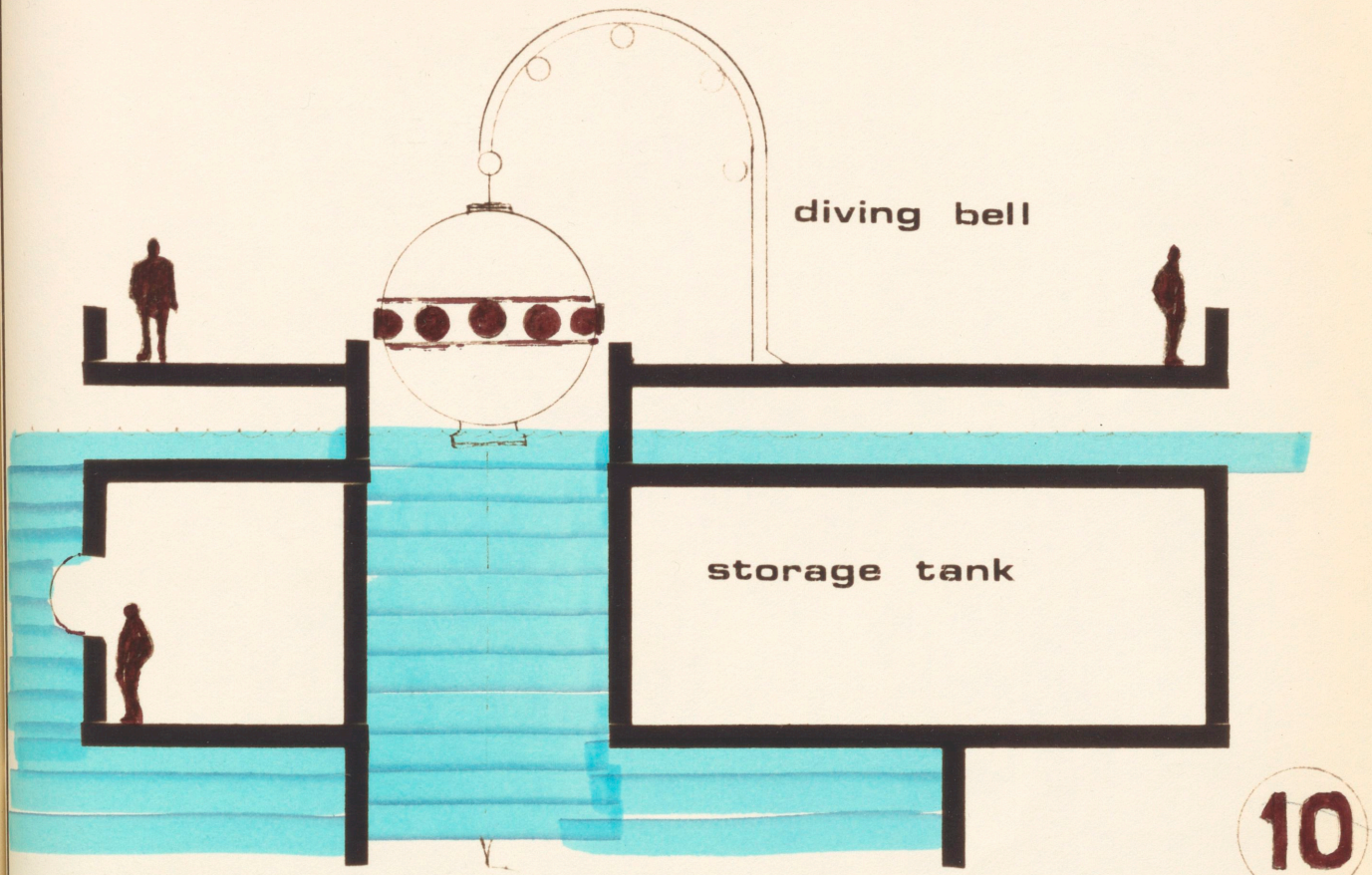
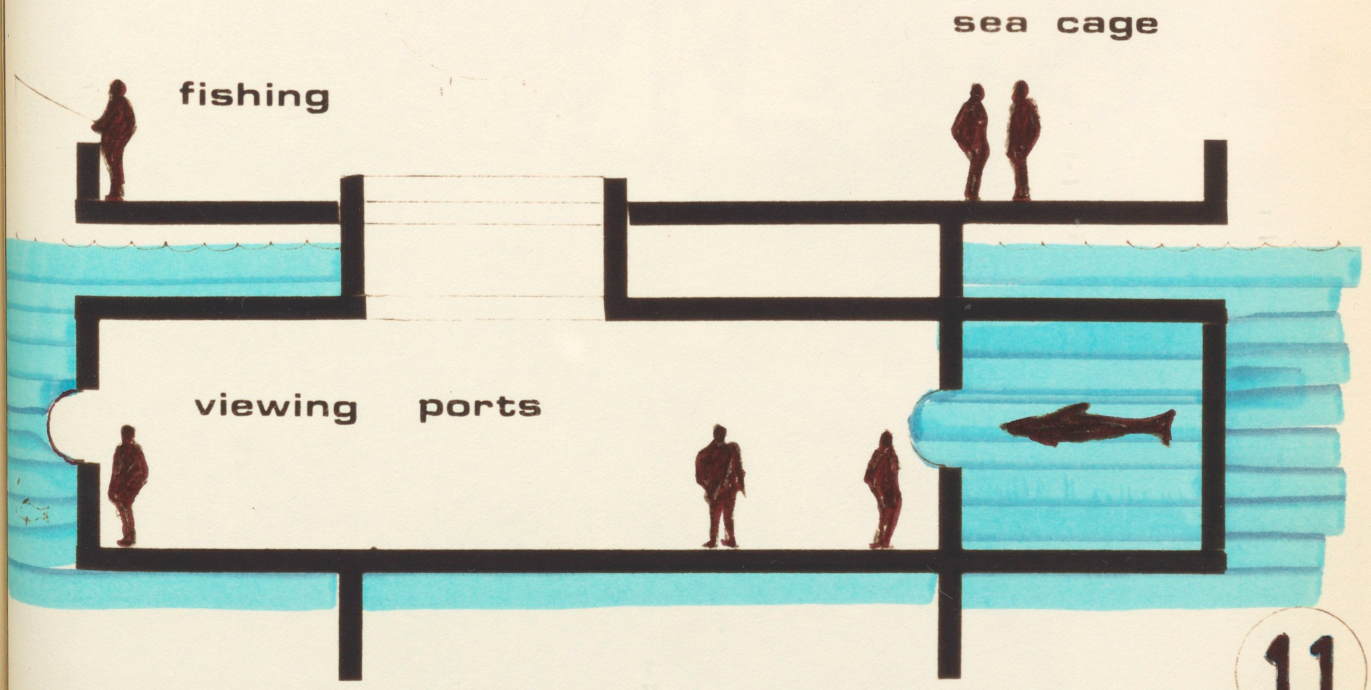


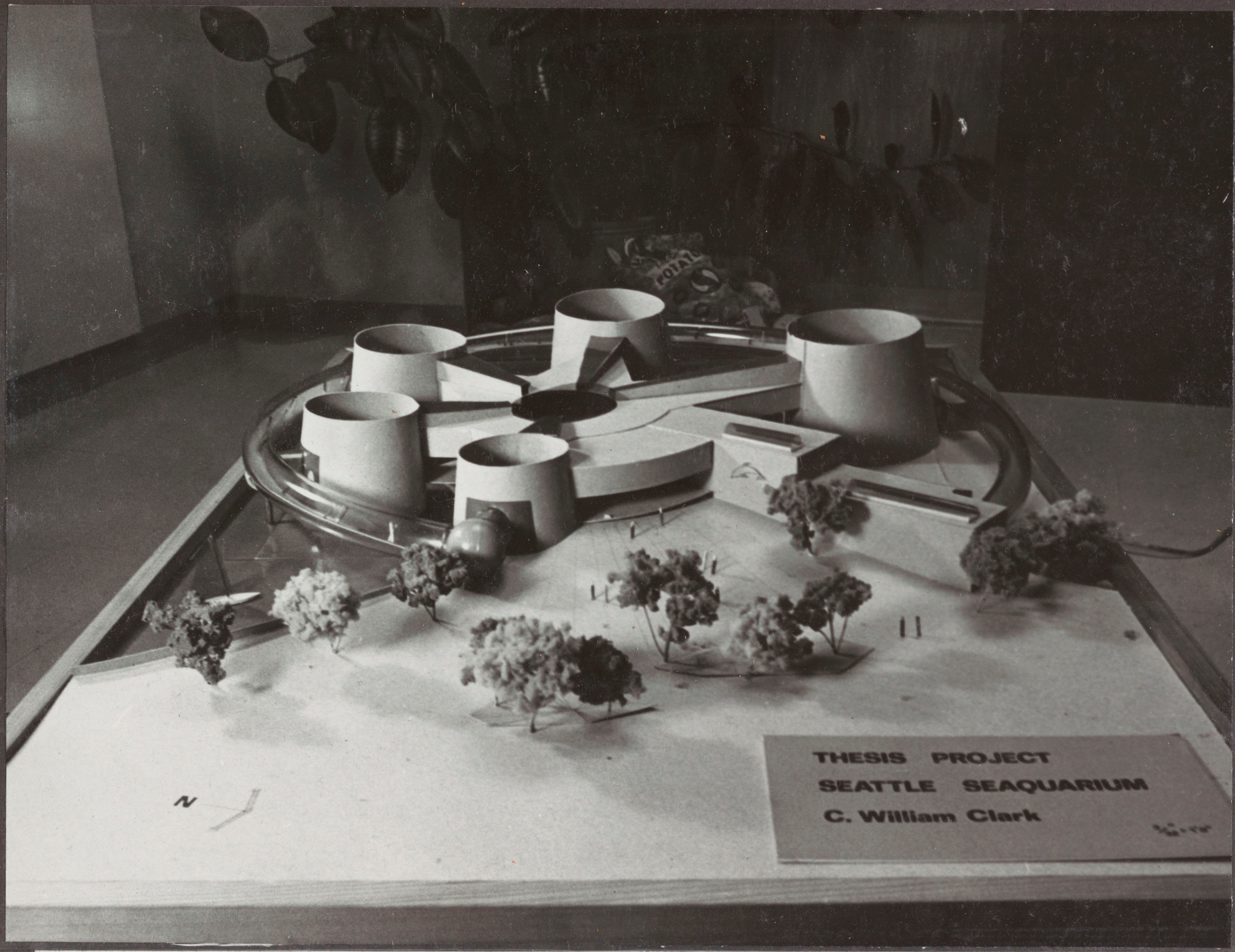
EXHIBIT TYPES

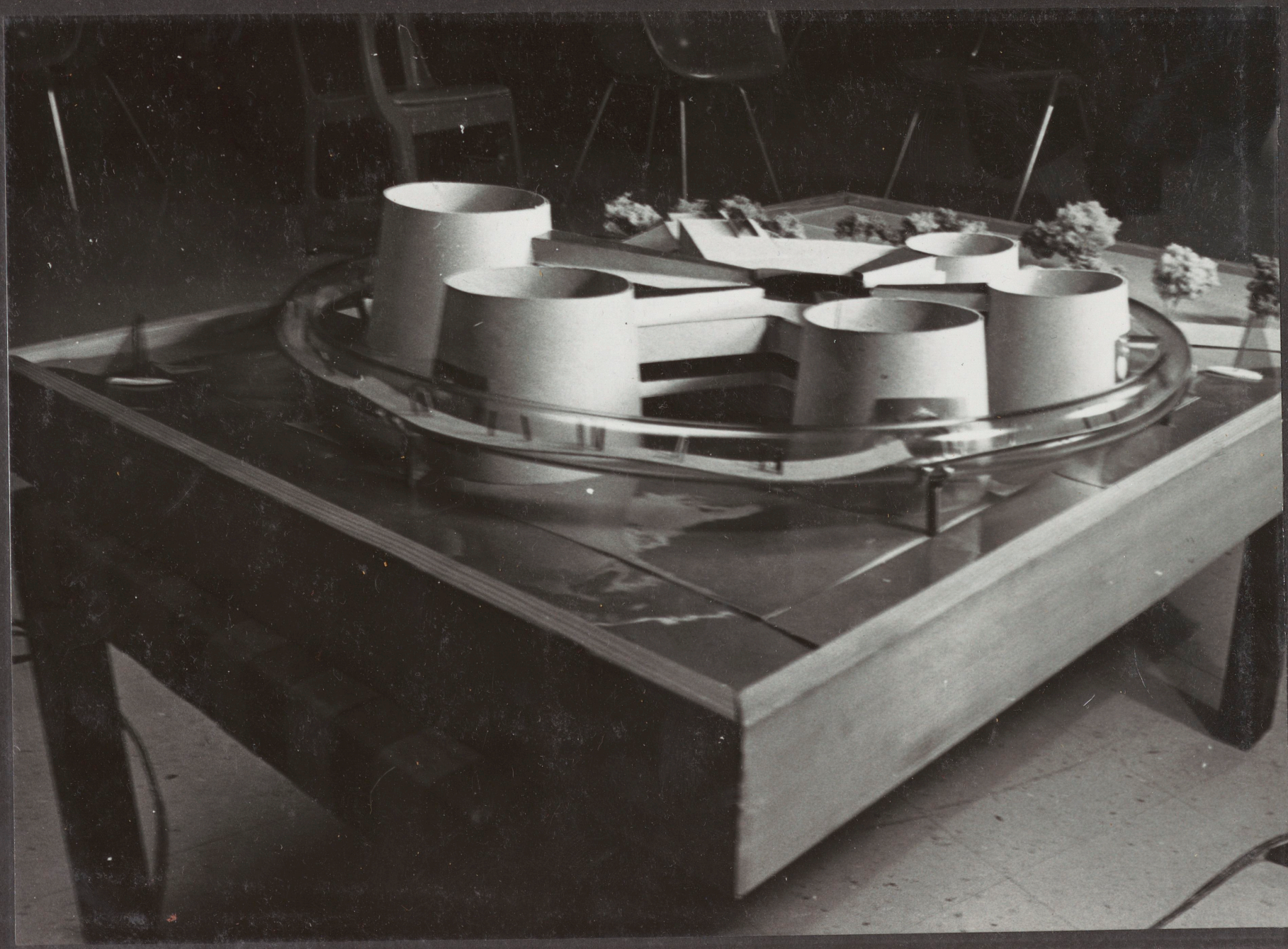


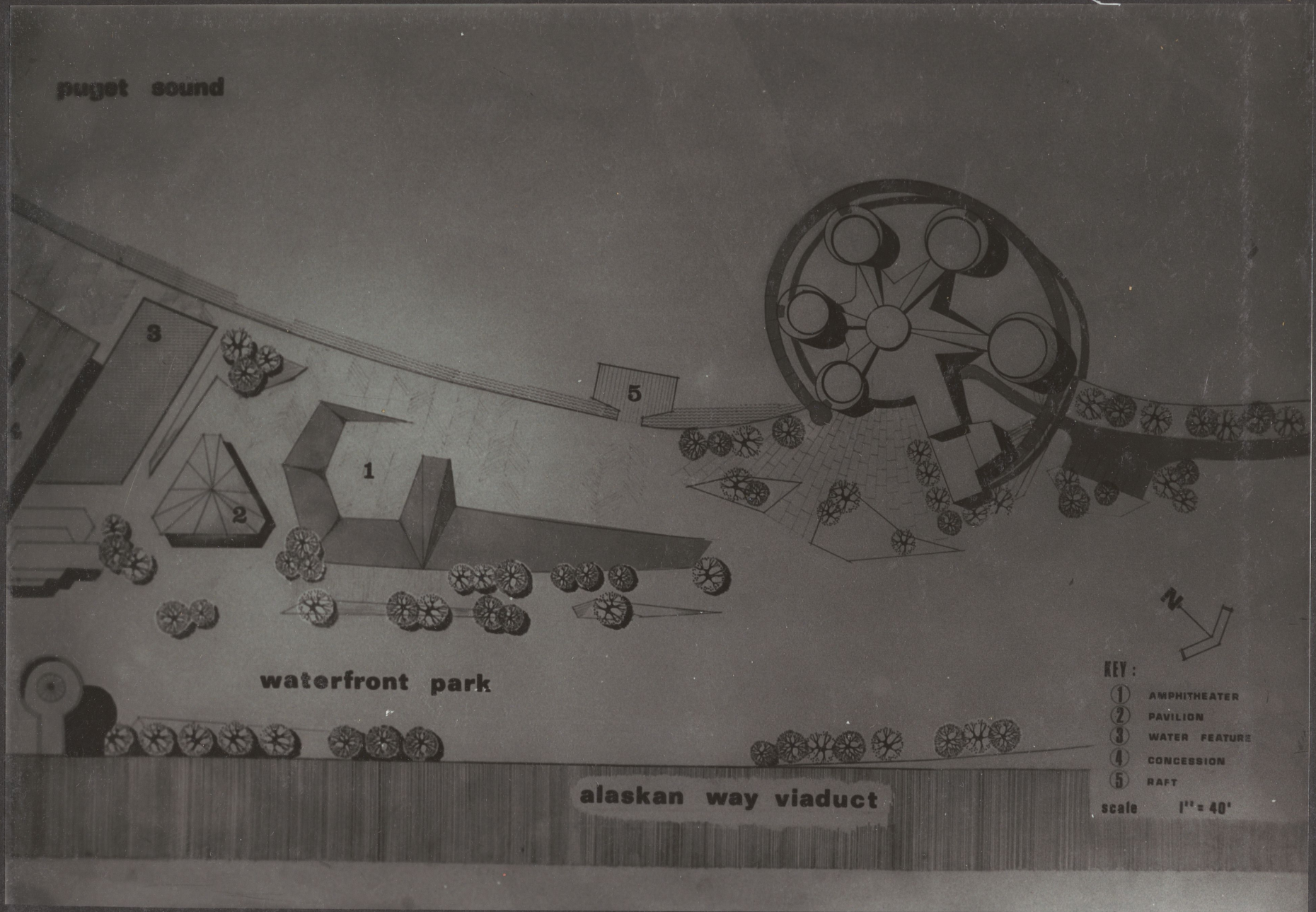
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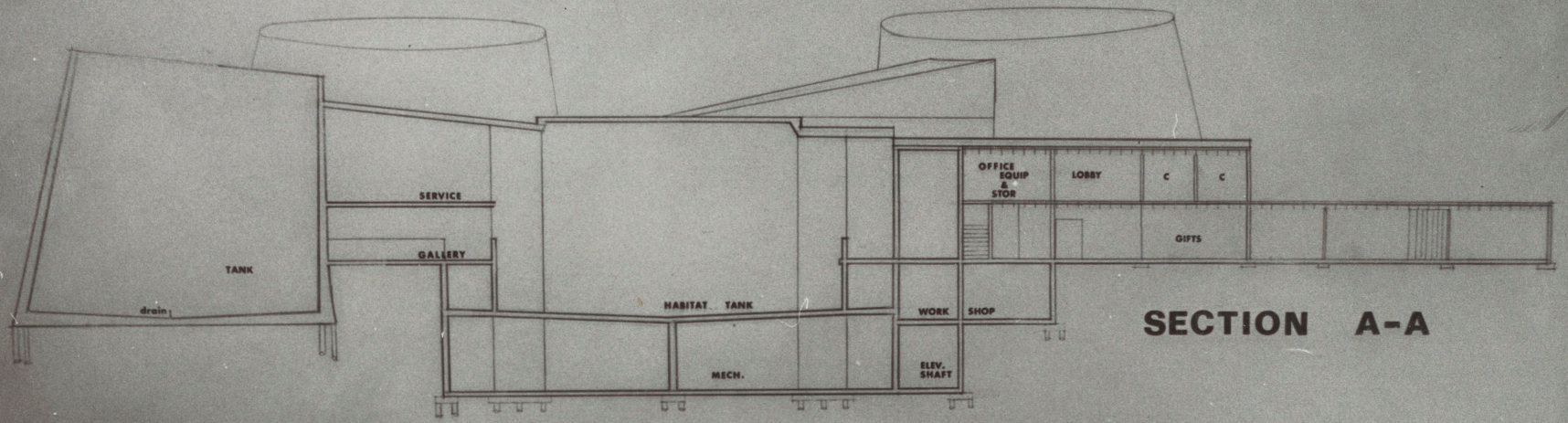


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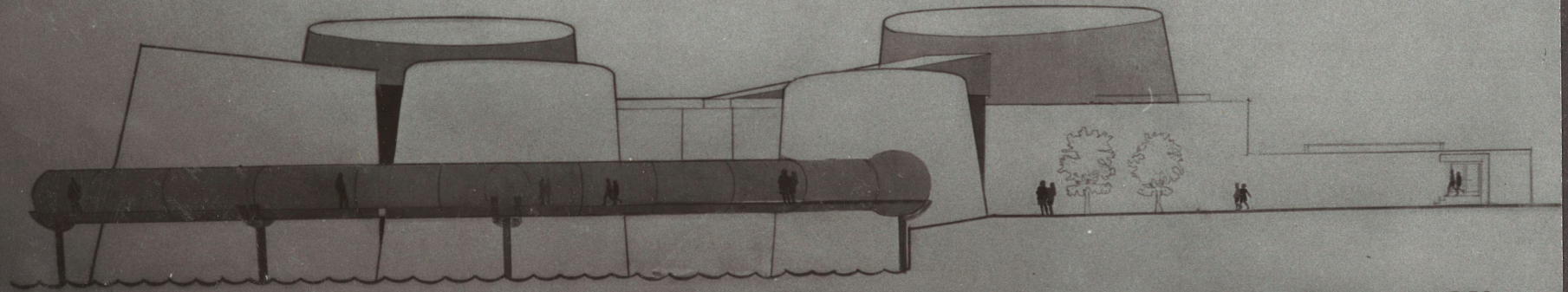

THESIS PROJECT
SEATTLE SEAQUARIUM
C. William Clark




puget sound
3
5
1
2
waterfront park
alaskan way viaduct
N
KEY :
1 AMPHITHEATER
2 PAVILION
3 WATER FEATURE
4 CONCESSION
5 RAFT
scale 1" = 40'

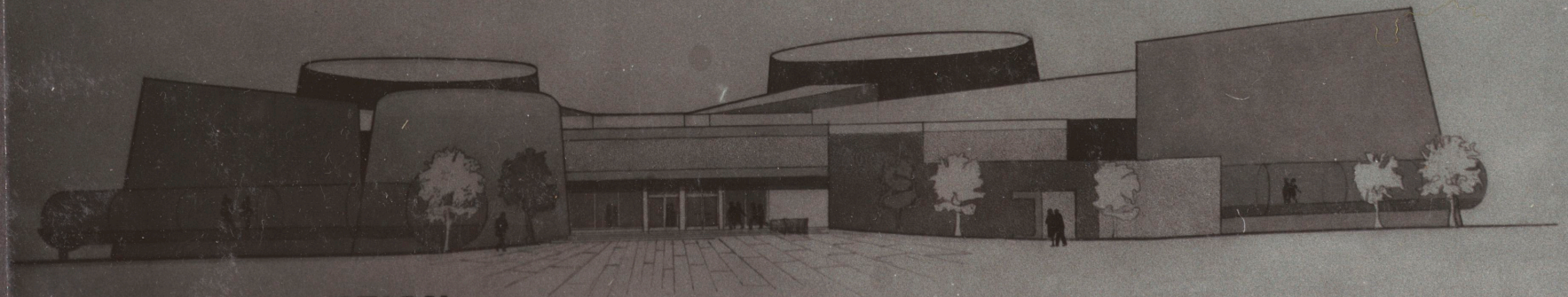


SECTION A-A



SCALE 0 10' 20'

SOUTH ELEVATION



EAST ELEVATION



VIEW TO WEST

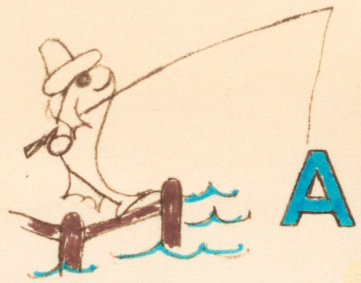


VIEW TO NORTH

GENERAL

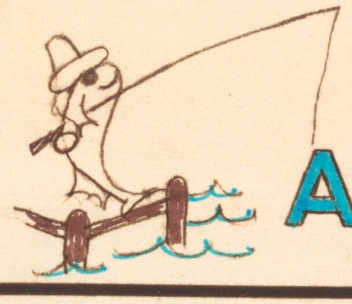
MAJOR AQUARIUMS OF THE U.S.





COMPARATIVE AQUARIUM STUDY

LOCATION & POPULATION	ATTENDANCE					FEE			SPECIES - SPECIMENS	OWNERSHIP - MANAGEMENT				
	2,000,000 - 3,000,000	1,000,000 - 2,000,000	500,000 - 1,000,000	200,000 - 500,000	100,000 - 200,000	ADULT	CHILDREN	PARKING		FEDERAL	COUNTY	MUNICI-PAL	PRIVATE	SOCIETY
COUVER PUBLIC AQUARIUM 8, Stanley Park, Vancouver B.C.				●		.25	1.00		191 - 2023					●
INE WORLD Francisco, Calif.				●								●		
INHART AQUARIUM den Gate Park, San Francisco, Calif.				●		.50	.25		475 - 12000			●	○	
INELAND OF THE PACIFIC os Verdes, Calif.	●												●	
WORLD 0 Shores Rd. San Diego, Calif.			●			1.50						●		
KIKI AQUARIUM 7 Kalakaua Ave., Honolulu, Hawaii				●		.25	free		150 - 2000			●		
N G. SHEDD AQUARIUM 0 So. Lake Shore Dr. Chicago, Ill.		●				.35	1.00		350 - 7500					●
ENGLAND AQUARIUM ong Warf, Boston, Mass.													●	
YORK AQUARIUM ey Island, New York	●											●		
ARAMA 0 So. Broad St. Philadelphia, Pa.				●									●	
AN WORLD 01 S.E. 17th St. Fort Lauderdale, Fla.				●									●	
MI SEAQUARIUM mi, Fla.			●										●	
DALLAS AQUARIMM las, Texas			●									●		
**ARAMA awall at 91st, Galveston, Texas				●									●	



COMPARATIVE AQUARIUM STUDY

LOCATION & POPULATION	ATTENDANCE					FEE			SPECIES - SPECIMENS	OWNERSHIP - MANAGEMENT				
	2,000,000 - 3,000,000	1,000,000 - 2,000,000	500,000 - 1,000,000	200,000 - 500,000	100,000 - 200,000	ADULT	CHILDREN	PARKING		FEDERAL	COUNTY	MUNICI-PAL	PRIVATE	SOCIETY
TIONAL AQUARIUM ot. of Commerce Bldg. Washington, D.C.				●						●				
DERSEA GARDENS 1 Beaview Ave. Seattle, Washington					●									●
GON STATE UNIVERSITY MARINE SCIENCE LABORATORY . Box 157 Newport, Oregon											●			
TTLE PUBLIC AQUARIUM r 56 Seattle, Washington					●								●	
NT DEFIANCE AQUARIUM th 54th and Pearl Tacoma, Washington					●							●		
TPORT AQUARIUM bor Street Westport, Washington													●	
PWRECK AQUARIUM 8 Buhne Drive Eureka, Calif.					●								●	

Function of Aquarium in Education

A more dynamic approach to learning together with greater involvement of children has resulted in educational methods which, while giving a sound knowledge of essentials, also encourages imaginative use of all situations by staff and pupils alike. It is against this exploratory background that the Aquarium visit must be viewed. The first aim of an educational visit to the Aquarium must be to stimulate interest rather than impart information.

To expose children to a situation where all the answers are not known to their questions can be a worthwhile educational aim. It can be a stimulus to the production of a wide variety of projects in the classr oom. Ideally the Aquarium should provide working space for the class so that impressions gained during the visit can be recorded graphically of pictorially before leaving. Art work is a natural outcome of a visit to the Aquarium. Sketching helps to sharpen the powers of observation. The Aquarium should provide educational activities for persons of all ages and academic levels.

Some of the spaces and needs relating to this could be:

1. Multi-use auditorium
2. Classrooms
3. Established educational programs
4. Science and Marine life movies
    a/ these would occur at scheduled times and supplement study at each grade level
5. Public address system
6. Projection screen
7. Portable stage and stacking chairs
8. Chairs and tables adjustable to height

WATER SYSTEM:

The most vital factor in an aquarium is the water supply. The chemical condition in which aquatic life lives is vital to its health. Whatever is contained in the water comes into contact with these animals. As with fish, it is mostly through their gills, and their is little they can do to keep harmful substances from entering into their bloodstreams.

To help alleviate this problem, all parts of the water system must be made of chemically inert materials. The water must always have the proper chemical composition and never contain substances harmful to the exhibits. For the aquarium visitor it must always be clear, so as to clearly see the exhibits.

Because of the close proximity of salt water from the Puget Sound an open system will be used. With this system the water is used and discarded after one use. This method is the least complicated and least troublesome, compared to the closed system where the water is used over again. When water is used only once and discarded, the rate of turnover usually need not be as great as in closed systems, as waste products from the specimens are continually carried away. Some species of fish require a more rapid turnover. A serious disadvantage with a close system is the possiblility of disease organisms from one tank being carried to another tank.

For the majority of exhibits, fresh, filtered seawater may be used without delay if it has not originated from a polluted source and it has reached the proper temperature. Some tanks will be able to use untreated natural seawater, providing it is clear enough. An advantage of this is that it could maintain plankton-feeding animals. [1]

Proper aquarium water depends on the following factors:

- Chemically inert material
- Suitable source of water
- Adequate circulation, aeration, and filtration
- Cleanliness, acheived mostly by avoiding overcrowding and overfeeding

[1] TIME SAVERS STANDARDS for Building Types, Dechiara&Callander.

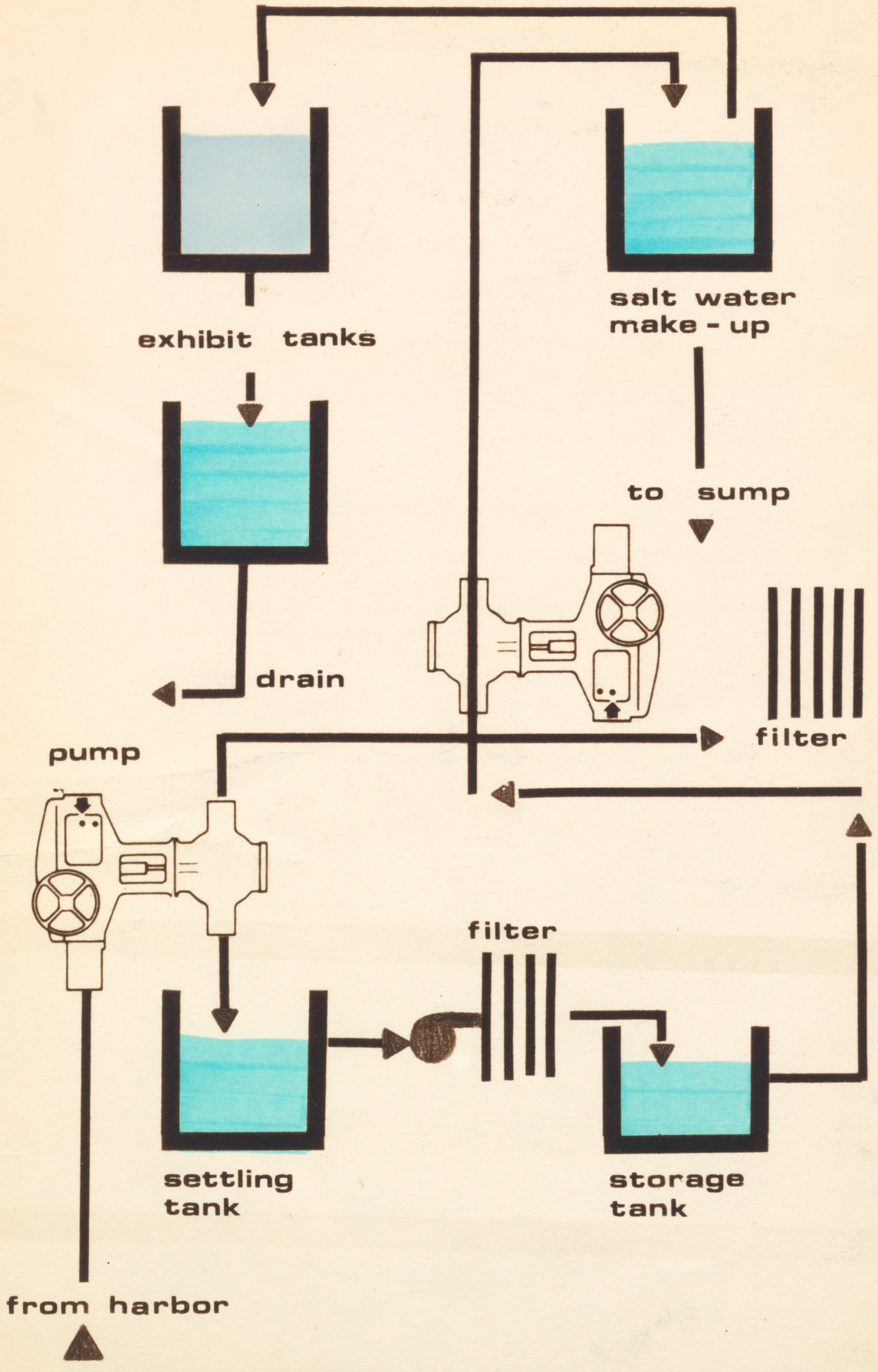
TANKS:

In this design reinforced concrete tanks will be built for the larger display tanks. In the design of these tanks, drainage, cleaning, veiwing, etc. must be considered. All concrete will be coated with an epoxy sealer.

For the smaller holding tanks, a fiberglass tank will be used. Fiberglass is an inert material and an excellent material for this purpose.

All tanks will have a gravel and sand mixed base. This will serve as a filtering material much like that of the small home aquarium. It is with hope that in the large display tanks, an eco-system will take place like that of the actual environment of the sea, eliminating frequent cleaning.

SALT WATER SYSTEM



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