U N I V E R S I T Y   B A Y   P R O J E C T

1972-1976

Report to the Graduate School
and
The Class of 1922

University of Wisconsin

FINAL REPORT

University Bay Advisory Committee
Chairman: Elizabeth McCoy

March 1977

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INTRODUCTION

Although it would be a simple matter to record the activities of the University Bay Advisory Committee, it is not so simple to describe and evaluate its accomplishments, but that is what this report will also attempt to do.

From the beginning the Committee recognized its obligation, and that of the University, to spend well the munificent gift of the Class of 1922; in fact, to spend it in such a way that the results would be a matter of pride to the Class and to the University. At the same time, it was a prime purpose of the Committee to use the money for scientific and ecological gains that would be substantial and on-going even after these particular monies were spent. In several cases, as will be detailed, the Class gift was literally seed money and, in the end, the benefits will be even greater than the Committee now reports.

In all of its planning for funding of the subprojects, the Committee sought out supplemental support from the project investigators or other agencies, both state and federal. In negotiating every Class of 1922 grant the Committee was frugal and once was able to get the services of a graduate student on a fellowship for the mere offer of an exciting problem and material aupport. At times also a faculty member offered to use a University Bay problem for an advanced class project, at little or no cost to the Committee budget. And at other times, by appeal to the proper agencies like the U.S. Geological Survey or the City of Madison, it was possible to get matching money or monitoring services that would otherwise have been very costly to the Committee budget. The same may be said of cooperation within the University to accomplish things that the Committee could not do itself or pay for from its project funds. An example of this latter sort will be described in detail in the interplay of the Committee and the Campus Planning and Construction personnel, both during the construction of the Center for Health Sciences and the development of traffic pattern for the Far West Campus within which the University Bay area lies.

Surely this cooperative approach was justified, because the Committee took care not to lose control. It was the initiating agent, deciding what were the problems and how to attack them. It did not open the fund for grants upon application of investigators at large, who might have worked on their own specialties, rather than on the priorities of the problems of the University Bay area. As research on the several subprojects progressed, the Committee was kept informed through its Coordinator, Richard McCabe. In fact, the investigators often met with the Committee to report results and to discuss further work. Because of the diverse expertise of its members, the Committee was often able to offer specific help or even to foresee the next problem to fund, and thus it went.

We believe the Committee has been a good steward of the fund, and can now report substantial accomplishment. But we also like to believe that this is not the end of the benefits of the University Bay Project. As will be shown, some of the subprojects have recommended certain management practices to be on-going after the Committee's work is finished. Thus in the long run the University will profit still more from the generous gift of the Class of 1922. Lastly, beyond these material benefits to the University Bay area, the University will have a source of pride in its own right. Sound environmental management is an obligation in this day, and the University has here a great opportunity to do the right thing, to be a leader in protection of a large and complex but sensitive ecosystem. After all, the area is a part of the Campus and must continue to be used. Human impact is inevitable. The University's obligation is to so manage that the impact is minimized in ecological damage. And, if this can be done, it will reflect credit to the University for its environmental responsibility and leadership. We of the Committee regard this in itself as a future benefit to the University.

NATURE AND PURPOSE OF THE UNIVERSITY BAY PROJECT

Its Initiation

After it became known that the Class of 1922, for its 50th Jubilee, had in mind some Lake Mendota-oriented project, the concept of the University Bay Project began to develop. A meeting was held at which the matter was discussed by representatives of the Class (Mr. William Kellett and Mr. Donald Slichter), Dean Bock of the Graduate School and several faculty. The broad concepts of the University Bay Project were sketched and, as the Class decision was eventually made, the early steps toward development were taken, even before the Class reunion in May.

In January 1972 the Graduate School arranged for the appointment (full time) of Richard E. McCabe as Coordinator. The Institute for Environmental Studies provided him space and the logistics to facilitate his work. By the time of the Class reunion in May 1972, the plan was ready to describe to the Class. It was well received by all, and, in fact, the Class was praised in the news media for its break with the traditional gift concept and its investment in an environmental legacy for the far future of the Campus and the Madison community alike.

Objectives of the University Bay Project

Although the Project title emphasizes the University Bay, it was realized from the beginning that the University Bay Area was equally vital. The ecology of the Bay and of the Area are interlocked. The Area is part of the Campus and it must be used, increasingly so in the future, since the University is hemmed in on all boundaries by the City of Madison, its contiguous neighbor. For many years the pressure on the Bay Area was not critical but it is now with the new development of buildings and use of that part of the Campus. The new entity of the Area is being recognized in the term "Far West Campus", used more and more commonly in the last ten to fifteen years of University planning. All are agreed that the University Bay Area and the Bay itself are priceless possessions, not to be destroyed. But can they be used, as they inevitably must be, without destruction? That is the problem to which the University Bay Project addressed itself. How to minimize the impact of use; how to preserve the natural beauty and blend it with Campus development; how to manage the Area so as to protect and improve the Bay proper---these are the problems upon which centered the objectives of the Project. The work of the University Bay Project was then mission oriented:

1) to assess the status and identify the problems of the Bay and the Area
2) to solve ecological problems, if possible, and if not, to propose ways to decelerate the

environmental deterioration,

3) to provide scientific and social leadership to the University for its environmental problem and to set an example for the public at large for like problems.

<u>The University Bay Advisory Committee</u>

Promptly after the Class reunion, Dean Bock appointed his Committee as follows:

McCoy, Elizabeth, Chairman
Professor Emeritus, Bacteriology

Ellarson, Robert
Professor, Wildlife Ecology

Lewis, Philip
Professor, Landscape Architecture

Stephenson, David
Assoc. Professor, Geology (water resources)

Burris, Robert
Professor, Biochemistry

Clapp, James
Professor, Civil Engineering (remote sensing)

Polkowski, Lawrence
Professor, Civil Engineering

Chapin, John
Graduate Student, Economics (water management)

Kerrigan, James
Asst. Director, Water Resources Center

McCabe, Richard
Coordinator, Specialist I.E.S. and Graduate School

Bock, Robert M.
Dean, Graduate School, ex officio

Kellett, William
Class of 1922, ex officio

Slichter, Donald
Class of 1922, ex officio

Note the diversity of professional competence within the Committee and the special expertise of some of its members for dealing with problems of the aquatic environment. All members also had personal familiarity with the Bay Area from their own research or from avocational interests.

To aid the Committee, the Coordinator circulated a questionaire among faculty, agencies and groups of individuals likely to be helpful in supplying information, advice, or public opinion. From the answers to the questionaire a list of more than 90 consultants was compiled. With such a reservoir of information and advice the Committee and the Coordinator were able to get much valuable aid.

At the first meetings of the Committee (July 11 and 31), a free-ranging discussion was held. Dean Bock provided background as to the intent of the Class of 1922 and the amount of the gift ($87,000 in hand and in pledges) and explained how the fund was held by the Wisconsin Foundation and how it would be made available through the Graduate School. The main discussion dealt with the mission-oriented purpose of the Project. Two problems basic to others were identified for first priority and the grants to Stephenson (for a Hydrogeologic Study) and to Clapp (for a system of Horizontal Vertical Controls) were authorized.

REPORTS ON FUNDED SUBPROJECTS
1972-1976

A series of subprojects were undertaken as the Committee saw the need to develop new data upon the problems of the Bay and the Area. The following account of the accomplishments of each subproject does not necessarily reflect the order of priority, although, as each was initiated, priority was considered. This account will summarize briefly the work done and the findings of each project. Recommendations or other follow-up will be deferred for discussion later under OVERVIEW OF ACCOMPLISHMENTS.

Hydrogeologic Study

Subproject 133: 8810 David Stephenson, Principal Investigator
Robert Sterrett, Research Assistant

Water in the Bay and the Area is an asset or a liability, depending upon the point of view. For its function as part of Lake Mendota and as a visual and recreational amenity, the Bay water is an asset. But the Bay is notably higher than some of the Area land, such as the Class of 1918 Marsh, and thus it influences the ground-water level and determines its seasonal fluctuation within the land Area. Further, the storm sewer waters from a large area south and west of the Bay Area proper contribute to the water system of the Bay. The ground water of the Area in turn becomes important when it dictates where lie the marshy area and the dry land for Campus use. "Dry" surface is not always indicative of the use that can be made of a particular spot. For example, a building site may be dry in late summer but if subject to flooding at high water, either the building should not be built, or, if built, should have provisions for water-proofing of its basement. A single analysis at the time of planning the building may be seriously deficient and the mistake may be costly.

Only fragmentary records of the ground water levels, discharge and recharge were is existence. And no simultaneous and quantitative study of the Bay water and Area ground water, and the quantitative interchange of the "two", had been done. Thus in the opinion of the Committee, this hydrogeologic subproject was fundamental and was the first to be funded.

It was undertaken by Prof. David Stephenson of the Geology Department and Director of the Water Resources Program. He was aided by graduate student, Robert Sterrett, who did the field work and related research. His findings are presented in his thesis for the Master of Science, Geology and Geophysics (Sterrett, 1975). The thesis contains much data in text, tables, graphs and 9 Appendices. It will be a valuable and permanent source of information for the University Planning and Construction personnel and for ecologists working on the Bay and the Bay Area. There is also a good introductory section on the glacial and post-glacial geology, soils, lake levels and circulation, etc. with literature references to previous publications.

The research plan was to map the Bay by bathymetry and soft sediment isopach data, and by coring the bottom to determine the nature of the stratification and of the soft sedimentary matter at the interface of the bottom and water. Much of the work was done in winter, regardless of weather (and we do mean regardless--- we have a picture of the workers on a day that was -30 F). After the geologic study of the cores, samples were sent for chemical analysis and these data will contribute to eutrophication studies of Lake Mendota in general. The mapping of the sand bar and the delta, which is building at the mouth of Willow Creek, is particularly useful. Secondly, the ground water level in the Area was determined and monitored for seasonal changes. By use of test wells (piezometers) including some in nests (i.e. several in close proximity but at different depths), some data were obtained as to discharge/recharge. Fortunately 1973-1974 were wet years and thus the data on high ground-water status of the Area are particularly useful. From the ground water data and from the chemical analyses of the water, new evidence was presented for areas of discharge and recharge, and thus the dynamics of the Bay/Bay Area water system are better understood. Lastly, ground cores were taken at strategic places in the Area , and these revealed the bed rock and thickness of overlying strata. While these cores are limited in number, they do provide some new information for land use planning in the Area.

Because its glacial history and superficial geology are crucial to understanding the University Bay and its land Area, it is useful at this point to quote from the Sterrett thesis (but without documentation by all of the maps and charts concerned. These can be found in the library thesis or in the copy filed with this report for those most concerned).

Thesis p.19-26

Superficial Geology and Soils

The superficial geology of University Bay is dominated by glacial sediment and landforms. Buckley (1895), Bean (1936), and Cline (1965) all addressed themselves to the superficial geology of Dane County; however, only Buckley's work addressed itself specifically to the Pleistocene geology around Madison. The superficial geology of the area is a result of deposition during the Woodfordian (Cary) Substage of the Wisconsin Glacial Stage about 13,500 years ago.

The farthest advance of the glacier during this time was to a point about eight miles west of the Bay. As the glacier melted and the ice margin receded back to the northeast, it formed the dominant glacial feature of the Bay area. That feature is the Wingra Recessional Moraine. This moraine constitutes the high area which wraps around the lowlands (Figure 9). Based on the surface exposures and auger drilling around the VA Hospital this moraine was determined to be a kame* deposit of fluvial or stream origin in the Bay area. The best surface exposures of this form are near the medical complex construction site.

* AGI Definition: A short, irregular ridge of gravel or sand deposited in contact with glacial ice.

It is of little importance to the planner, however, if only the depositional history of the near surface is known. The planner must know what type of buildings can or cannot be built on the soils found throughout the Bay area.

Soil scientists have classified the soils of the Bay Area into fifteen categories; in soils terminology these categories are called types. These types are seen in Figure 10. The Soil Conservation Service soil survey interpretations for the soils are found in Appendix A.

Instead of all these classes, this study has consolidated all of the soils of the Bay area into four groups. This classification is based upon depositional mechanism and lithology. These four groups are (Figure 11):

Stratified ice contact drift (kame)
Lacustrine deposits
Till
Stream deposited sands and gravels.

The stratified ice contact drift composes the kame morainic deposits which constitute the uplands surrounding the Bay. When the glacier receded to the northeast and east, it experienced a period of stagnation. During this period the stratified moraine was deposited. These sediments directly overlie the bedrock core, and their thicknesses vary from zero to greater than 50 feet. The thinnest deposits are around the Forest Products Laboratory, and the thickest deposits are west of the University's recreation fields. The kame sediments are characterized by interbedded and interfingered coarse sands and gravels. Grain size analysis of selected samples was performed in the Twenhofel Geological Laboratory and the results appear in Appendix B. Thicknesses of unconsolidated sediments were determined from bore holes drilled by Warzyn Engineering Company or by myself.

Because these soils are predominantly silts, sands, and gravels, and because they are distributed on the uplands, they are generally well-drained and well suited to construction foundations. However, construction on hills of this material may result in erosion and slope stability problems, especially where an unsupported earth face is exposed.

After the glacier receded from the Bay area, the water of Lake Mendota extended to the base of the moraine. During this period of occupation, lake marls were deposited in the area which is presently the marsh and playing fields. A bore hole near the northwest corner of the Nielsen Tennis Stadium reveals that these lake marls are about 50 feet thick. The marls are gray colored silty clays of very low permeability. These marls probably represent deep water deposits. Because of their organic content and a high water table, this location is unsuitable for construction.

In addition to the lacustrine marls and silts, other shallow-water deposited sediments are found on the lower fringes of the topographically high areas. These sediments are characterized by sandy silts. Excavation for the new medical center and bore holes on the north side of the marsh provided field evidence for these shallow-water lacustrine deposits. Because of their moderate drainage capacity, shallow slopes and suitability for foundations these soils make acceptable building site locations. It is important to remember though that only their physical properties make them suitable for foundations. Possible problems with the areas in which these sediments are located could be a high ground water table or aesthetic and land ownership characteristics that may prevent or retard substantial development.

Areas to the south of the WARF Building, east of the Forest Products Laboratory, and west of the new heating plant are underlain by glacial till overlying bedrock. This till is approximately nine feet thick, and it is a blend of sand, clay and boulders. There is no stratification or any orderly arrangement of the sediments. No borings were taken to determine the characteristics of these sediments, since excellent cross-sectional exposures were provided in the trenches dug for steam line placement to the new medical center.

The final group of soils in the afore mentioned classification is the stream deposited sands and gravels. Soils of this nature are found on Picnic Point and the area east of Walnut Street. Logs of bore holes, drilled by myself or by Warzyn Engineering, appear in Appendix A.

p. 28-35 Bedrock Geology and Geologic History

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The bedrock geology of the University Bay area consists of Upper Cambrian sandstones and sandy dolomites (Figure 13). Over seven hundred feet of sedimentary units overlie the pre-Cambrian crystalline basement rocks.

To gain a perspective of the relation of these rocks to each other Figure 14 is a geologic cross section of the Lake. The sedimentary rock units inclined to the southwest at a dip of fifteen feet to the mile.

The following are brief explanations of each formation beneath the study area, from crystalline basement rocks to the surface.

The Mount Simon formation, an Upper Cambrian sandstone unconformably* overlies the pre-Cambrian rocks. It is predominantly

* Unconformity -- AGI definition: A surface of erosion or non-deposition, usually the former, that separates younger strata from older rocks. Unconformable means having the relation of unconformity to the underlying rocks; not succeeding the underlying strata in immediate order of age and in parallel position.

a well-cemented medium-grained sandstone that contains very fine to very coarse sand (Cline, 1965). The City of Madison draws its water supplies from this formation.

Above the Mount Simon is the Eau Claire Sandstone which is fine to medium-grained and dolomitic; this means it contains the calcium-magnesium mineral, dolomite. This formation is distinguished from the Mount Simon in that it contains fine-grained clasts and more dolomite.

The next unit ~~of~~ overlying the Eau Claire Formation is the

Galesville Sandstone. It is predominantly a medium to fine-grained sandstone that has an approximate thickness in the Madison area of about 130 feet (Cline, 1965). However, pre-glacial erosion has removed much of this formation. The preceding three formations do not crop out (exposed at the surface) in the University Bay area; however, the Galesville in many areas is directly overlain by glacial till.

Above the Galesville is the Franconia Sandstone. This rock unit forms much of the bedrock surface in the University Bay area. Exposures of this formation can be seen at the edge of the lake in two areas; one point is west of Second Point and the other exposure is along the south shore of Picnic Point. The formation is divided into upper and lower parts on the basis of lithology. The upper parts contain a high percentage of the green clay mineral, glauconite. Cementation of the clasts on the very top few feet of this formation is very poor due to pre-glacial erosion. The exposure of this formation west of Second Point along the lake exemplifies this "green-sand" feature beautifully. The lower part of the formation is a fine-to coarse-grained sandstone which is only locally dolomitic and glauconitic (Cline, 1965).

Pre and Post Glacial History

Before the arrival of the glaciers, the study area topographically resembled the region of southwest Wisconsin, which is typified by V-shaped and steep-walled valleys. Picnic Point was a bedrock ridge between the valleys of the pre-glacial University Bay Creek and the pre-glacial Middleton River (Figure 15). From the top of Picnic Point to the bottom of the pre-glacial University Bay Valley was a drop of almost 250 feet.

During the last stage of the continental glaciation, referred to as the Wisconsin stage, the ice advanced into the Madison area from the northeast. As the glacier moved forward, bedrock material was incorporated into the ice. This advance halted near the present community of Cross Plains. The material incorporated into the glacier was deposited at the front as the glacier melted. The hill which was formed from the material is referred to as the Johnstown terminal moraine.*

* AGI Definition: Drift, deposited chiefly by direct glacial action, and having constructional topography independent of control by the surface on which the drift lies.

As the world-wide temperature increased, the continental glaciers melted and retreated. The retreat of the glaciers was not uniform in time, but rather it was an interrupted series of pauses. Accompanying these halts, unconsolidated material was deposited in ridges from the melting glaciers. These ridges are called recessional moraines. Two recessional moraines directly east of the Johnstown terminal moraine are called the Milton and Wingra recessional moraines (Figure 9).

As the ice moved out of the University Bay, it is believed that melt water was trapped between the retreating ice and the Wingra moraine. This water probably exited from the Bay in a southeast and northeast direction. Sediment deposited by these streams are found on Picnic Point on the north side of the Bay between Walnut Street and Observatory Hill. A physical description of these sediments can be found in the Superficial Geology section.

After the glaciers had retreated completely from the area, the entire landscape was drastically altered from that before the arrival of the glacier. Within the study area, the effects of the glacier are pronounced. The valleys of the pre-glacial streams were filled with 150 to 200 feet of glacial till, and the bedrock ridge of Picnic Point was leveled and covered with a thin layer of glacial deposits. The result of the glacier was that the general topography was changed from deep valleys and sharp edges, which are characteristic of the driftless area west of Madison today, to a rolling topography.

The post glacial drainage was characterized by numerous swamps and lakes. In fact, the Madison lakes themselves were due to the blockage of stream valleys by glacial drift. Originally, Lake Mendota occupied a more extensive area than it does today. University Bay was also larger.

The principal findings of Sterrett may best be quoted from his Discussion and Conlusions as follows:

Thesis p. 84-86

1. Soil thicknesses vary from 1 foot to greater than 150 feet. Figure 41 denotes those areas where bed rock is close to the surface.

2. The shallow ground water flow system shows that most of the Bay recharges the ground-water system. Picnic Point is the only land area which recharges the Bay. Ground water does not discharge into Willow Creek [University Creek]. On the contrary, water levels around the Creek seem to indicate that water moves from the Creek into the ground. [See Figure 1].

3. The water table in the study area varies from 13 to greater than 40 feet below the ground surface. The land occupied by the marsh [Class of 1918 Marsh] and the playing fields is where the water table is closest to the land surface and as a consequence this area should be avoided where construction will involve the emplacement of deep foundations.

4. Bathymetric and soft sediment isopach maps were constructed for the Bay. These maps delineate the location of the sand bar and the delta. However, sedimentation rates for the delta were not obtained.

5. Water samples were collected from various observation wells. Because of sampling techniques conclusions cannot be drawn with regard to the overall quality of the ground water in the Bay study area. The effects of road salting were seen in several wells located near roads.

6. It was calculated that approximately 23,000 gallons per day move from the Bay into the ground. Both horizontal and vertical gradients were calculated for various areas around the Bay Area. It was seen that Madison municipal water-supply pumpage did influence the water table. Around the medical center construction complex it was discovered that shallow aquifer levels varied approximately two feet with municipal pumpage [city well No. 6].

Thesis p. 86-88

Some of these conclusions are repetition of points...in the Discussion; however, there is a need...to repeat....

University Bay field and laboratory investigations lead to the following conclusions.

1. Picnic Point and Eagle Heights are a recharge area. Activity such as the disposal of wastes either in landfills or seepage pits could affect the ground water quality in the rest of the Bay [Area]. These areas are upgradient and polluted ground water can move from them to the marsh or Bay.

2. University Bay serves as a recharge source to most of the Bay lands. Feed lots and/or landfills on any land besides Picnic Point will not impact the water quality of the Bay proper by means of ground water. However, storm sewer drainage can empty into the Bay and this drainage can contribute nutrients to the Bay and Lake Mendota.

3. The 1918 Marsh experiences "flow-through" conditions. Salting the roads north of the marsh will contribute chlorides to the marsh water. However, because of the fact that the marsh soils are fine grained and thus of low permeability, the amount of ground water entering the marsh is very small, about 11 gallons/day.

4. The water table in the marsh area is between five and eight feet below the surface. Because of this fact it is recommended that large structures should not be built in this area. If construction does take place, dewatering pumps will most likely be used.

5. Salting the roads in this area does have an impact on the ground water quality. It was observed that the road salting increases the chloride content of the ground water. Chlorides are not absorbed by soil particles and as a consequence, they do have

the ability to travel through the ground water system.

6. Municipal well pumping does have an effect on ground-water levels. When the city well number 6 is on, the water level in the southeast corner of the study area dropped. Knowledge of this hydraulic connection between the shallow and deep aquifers is valuable in building construction and waste disposal /planning/. In building construction foundation design must take this knowledge into account in order to prevent flooding if the municipal wells are shut off. This knowledge is also useful... when locating disposal sites for refuse. Leachate may enter the ground water and contaminate municipal wells. If hazardous materials are spilled in the area, say by a rail car derailment, it is imperative to retrieve as much of the material as possible so that it does not get into the ground water system and eventually pollute the municipal water wells.

7. The University feedlots do not have an impact on the Bay by means of ground water because the feedlots are down gradient of the Bay. They may have an effect on the Bay due to sheet runoff and eventual discharge to the Bay by either storm sewers or Willow Creek.

It is evident that this Hydrogeologic Study has provided some important new knowledge of the Bay/Bay Area water system, even as the Committee foresaw in giving priority to this subproject.

Horizontal and Vertical Controls

Subproject 133: 8811 James Clapp, Principal Investigator

The Committee found it almost incredible that in all the years of research on the University Bay and the Area, no adequate grid of Horizontal and Vertical Controls had been established. Sampling stations had apparently been verbally described and were almost impossible for a later worker to pinpoint. University building placements were obviously tied to some area controls, but these were unknown to the Committee and probably to investigators in general.

Prof. James Clapp of the Committee called attention to the need for such a control system and the fact that an accurate one could be developed from remote sensing data. The plan was therefore made to proceed in three phases:

Phase I Investigation of all existing controls of record; analysis of their distribution, accuracy and exact location (with site visit, if possible, to examine their condition)

Phase II Discussion of the kind of controls needed for present and future study of the Bay and the Area, followed by planning for an adequate grid of controls, tied to existing controls (Phase I)

Phase III Establishment of such a grid based upon data collected by remote sensing, suitable documentation and placement of monuments.

It was proposed that Phase I and Phase II could be completed during the spring of 1973 and that, if the need was demonstrated, that Phase III could be initiated in the summer of 1973. So the subproject was authorized to begin.

Phase I was completed promptly and is summarized in the Haugen Report, March 1973. It describes 13 markers, some within the Bay Area but most of them elsewhere in Madison. The existing monuments or marks vary as to age and the agency which installed them. For example, the "State" marker of 1934 is on the penthouse of the State Office Building, 1 West Main St.; it is a U.S. Coast and Geodetic Survey control. Several others in Madison, some in the Campus vicinity, were set by the City of Madison Control Survey of 1963 or 1968. A few sites found by Haugen were "Temporary Bench Marks" established by D. Kasper of the Engineering Facilities Management, State of Wisconsin, for reference in locating new buildings in the Bay Area; i.e., Nielsen Tennis Stadium and the W.A.R.F. Building. The only one close enough to the Bay for easy orientation of new investigators is a "low order" site consisting of a mark on the concrete slab under the pump house near the Class of 1918 Marsh. The nearest control of a higher order (second order horizontal and vertical control; established by Alster and Associates, Andrew Dahlen in 1963) is a concrete monument with brass cap under a manhole cover marked Water, and it is quite far from the Bay, in a garden off Herrick Drive.

In April it was found that Prof. E.C. Wagner was seeking a problem for his Engineering Summer Program and would entertain the field work for the Bay Area, provided that some specific and well-defined control points were in place by June 1. The Haugen Report had already shown such controls existing and in good condition, and thus the arrangement between Prof. Wagner and the Committee was approved. This is an example of the University input, at no cost to the Committee budget, to accomplish one of the subprojects.

Phase III was completed with Prof. Clapp serving as the Principal Investigator. Data collecting, office work on the data, and setting of the monuments proceeded as scheduled. The actual markers used are cast aluminum magnetic monuments, set 36" into the soil. The silver colored caps are numbered U BAY 1 to 32 and carry the legend "University Bay Project--Class of 1922." Three old controls located by Haugen, Mad A, Mad B and Mad C, were used as tie-in to the U Bay grid. See the accompanying map, Figure 2. Each of the sites is fully described in the Clapp Report, and the "original notes and computations will be kept on file in the Civil and Environmental Engineering Department" (UW-Madison). Copies of the Haugen and Clapp Reports and of the large scale grid map are also deposited in the Water Resources Center Library.

Needless to say, the Committee considers this subproject one of its valuable and permanent accomplishments.

Monitoring of Willow Creek

Subproject 133: 8812 U.S. Geological Survey cooperating

Willow Creek is an obvious source of pollution to the University Bay. It is not a natural creek but one converted into a channel for discharge of stormwater from a large area of Madison to the south and west of the Bay Area. Since the 1950s and especially after the urbanization of the Hill Farms from University experiment use into the Hilldale area, the runoff has been massive. The sewered area concerned comprises some 6 square miles. The storm sewers deliver the water to about the 2200 block of University Avenue (near the Octopus Car Wash), thence under Campus Drive to an outfall which is the head water of Willow Creek (Figure 3). The Creek has been straightened to facilitate current to efficiently deliver the stormwater to the University Bay. It is well known that the level and flow of the Creek fluctuates dramatically with storm events and snow melt. An obvious delta of sediment is building in the Bay at the mouth of the Creek.

Very early in its discussions of the Bay problems, the Committee recognized Willow Creek to be a serious hazard to the Bay. But there were no good data on the stream flow and no data on the rate of enlargement of the delta (note: this is the delta mentioned earlier and delineated in the Hydrogeologic Study by Sterrett).

The U.S Geological Survey has a Regional Office of its Water Resources Division in Madison; in fact, it is University-related and located at 1815 University Avenue. It was soon ascertained that the USGS was also interested in urban stormwater problems, and would entertain a joint program to monitor Willow Creek. At a cost shared by the Committee and the USGS, a flow-monitoring and water-sampling station was installed. It consists of a small metal house, located below the outfall sewer box. A sampling intake leads from the main stream of the Creek through the building with its automatic sampling equipment and back to the stream. Total stream flow is recorded by a bubble gage monitor set at a point near the concrete weir with a 2 ft. effluent flume (Parshall).

The stage of the Creek is recorded on a punch tape every 5 minutes during both storm events and fair weather. A stage-discharge relationship is derived from the Parshall flume data. The curves were constructed for 4 stage-discharge points with flume data ranging from less than 100 l/sec to 9000 l/sec. Estimated error for flows up to 300 l/sec was 5%; for 300-9000 l/sec it was 30% (Zuells, 1975). The greater error for the high flow occurs because the Creek reaches the top of the flume at 300 l/sec.

Most of the data on the Creek flow (and also data on Total Suspended Solids) were taken by USGS, but they are available from the computer storage bank upon request. For the Committee's use these data were readily available and in addition water samples were provided as needed for analyses by subproject investigators. For example, such samples were the basis of another subproject (<u>Nutrient Contributions of Willow Creek to the Bay</u>) which will be reported in the next section. These samples were taken with an automatic pump-type bottle sampler (USGS-69), which was in place approximately 1 ft. from the Creek bottom and at midstream of the 30 ft. wide creek. The sampler is capable of washing itself through with creek water for 30 sec, and then taking a 600 ml sample automatically every 15 min. during storm events. The samples were collected in 1 liter Nalgene plastic bottles and properly stored until picked up by the subproject investigators. The cooperation of the USGS personnel was excellent.

The monitoring equipment was installed and in use by late 1973 and is still operating. In fact, a plan has been made to transfer the Bay

Committee's support to another agency, so that the USGS monitoring can continue for a much longer record. Such data are much needed, both for the future of the University Bay problems and, more widely, for records of storm-water composition in the Madison area.

Nutrient and Sediment Entering University Bay From Willow Creek

Subproject 133: 8819 David Armstrong, Principal Investigator
John Ahern, Research Assistant
Robert Stanforth, Research Assistant

The Committee was fortunate to find that Prof. David Armstrong of the Water Chemistry Laboratory, Civil Engineering, was interested in studying the nutrient and sediment loading of the waters of Willow Creek. The subproject was divided into two parts:

Part I Impact and Management of Urban Stormwater Runoff (Ahern)

Part II Phosphate Uptake from Flowing Water by *Myriophyllum spicatum* (Stanforth)

Both assistants received their MS degrees with theses based upon this subproject, and their theses are a permanent source of data on the Willow Creek waters and its effect upon the Bay.

PART I Ahern

The Ahern data cover analyses for Total Suspended Solids, Volatile Suspended Solids; Nitrogen in various forms such as Total Kjeldahl, NO_3-N and NH_4-N; Phosphorus as DRP, TDP, ASP and TP; COD, Chlorides, Alkalinity and Specific Conductance.

Base flow of the Creek was found to be 20-60 l/sec. Runoff events were defined as beginning when the flow increased over base , and ending when flow dropped below 100 l/sec. Thirteen such runoff events were sampled and analyzed during the period June 1974 to June 1975. Nine were rains of wide range of intensity; two were snow melts.

The data collected are so extensive that they cannot be summarized here but they are thoroughly discussed in the thesis, often with comments relating them to salting and sanding, leaf sweeping, and other practices that relate to runoff. More important here is to quote generalizations from the Ahern thesis.

Thesis p. 152-154

Environmental Effects of Stormwater Loading

Nutrient loadings from the University Bay watershed can intensify eutrophication in Lake Mendota. Sonzogni (1974) estimated the total P load from all sources to Lake Mendota as 47,000 kg per year. The University Bay watershed constitutes 1.5% of the Lake Mendota watershed, or 2.1% of the total P loading on the lake. Vollenweider (1968) developed empirical estimates of the total P loading sufficient to eutrophy a lake, given its surface area and depth. The estimated loading for Lake Mendota , with its surface area of 1940 hectares and a mean depth of approximately 12 meters, is 10,400 kg total P per year. The University Bay watershed delivers 9.3% of this loading.

The urban runoff from the University Bay watershed is a P-enriched nutrient source. The TN/TP ratio for the year averaged 6.6, while the ratio in the Bay was approximately 8 (Stanforth, 1976). Loucks (1975) has suggested that a P-enriched nutrient sources may favor blue-green algae, which can obtain N by fixation of atmospheric nitrogen gas. Blue green algae are the dominant species during the lake's summer algal blooms.

Chemical Parameters	Dry Weather Loading kg	Surface Runoff Loading kg	Total Annual Loading kg
DRP	50	283	333
TP	50	922	972
NO_3N	1203	1215	2418
TN	1203	5256	6459
Cl	107,000	417,000	524,000

A second detrimental effect of the stormwater is to shorten the life of the Bay through sedimentation of large particulate load. The TSS loading is approximately 350,000 kg per year. At a specific gravity of 2.65, if all the solids settle in the inner Bay area inside the sand bar, as appears to be the case, the Bay

> would fill in at about 4 mm per year. This rate is further increased by the sedimentation of algae and macrophytes. At 4 mm per year for an average depth of one and one-half meters, the inner Bay would fill with sediment in 350 years.

The thesis ends with some cost calculations on the removal of nutrients and sediments, preventive practices for city street maintenance and corrective attempts to remove N and P from the Creek water. The feasibility of a sedimentation basin for the protection of the Bay is discussed. Such a basin was proposed by Nelson, 1975, to be located east of the Creek and north of Campus Drive near the outfall of the storm sewer; the return of water from the basin would enter the Willow Creek downstream. The area is now open and relatively unnoticed. Ahern discusses both sedimentation of the original TSS load and the added precipitate, if P removal were attempted.

PART II Stanforth

The Stanforth data are based upon two lines of work for phosphorus uptake capability of the macrophyte, *Myriophyllum spicatum*, which is dominant in University Bay. At first the tests were in the laboratory under controlled conditions but with *M. spicatum* plants collected fresh from the Bay. Field tests were made later in the Bay proper with attempts to determine uptake of P across the bed of *M. spicatum* naturally growing on the sand bar in the Bay. Here conditions were more "natural" and by a proper timing the tests could be made in fair weather *vs* after storm events, at different times of the year, etc. Many assumptions had to be made as to even flow of storm water (without channeling), biomass of the weed bed, etc. Despite uncertainty, some statements of the results are in order and are taken from the thesis.

Thesis p. 122-123

> Calculations using the best available data indicate that the M. spicatum communities in the inner part of University Bay could remove up to a quarter of the yearly DRP loading from Willow Creek runoff, if runoff were diverted to pass through the macrophyte beds. The assumptions are such that the estimated removal is probably a high estimate rather than a low estimate.
>
> A critical assumption used in considering nutrient removal by macrophytes is that the macrophytes were present in the right place to remove the nutrients, Macrophyte standing crops and distribution vary considerably, both seasonally and yearly. In 1974 University Bay contained luxuriant growth of M. spicatum. In some of the areas of the Bay the growth was thick enough to make canoeing difficult and boating impossible. These same areas were open water in 1975, and the M. spicatum standing crop and distribution was greatly reduced throughout the Bay. Storm water could have passed through the Bay without encountering M. spicatum or other submerged macrophyte beds. Because of the variation in distribution from year to year, the macrophytes are an unreliable sink for storm nutrients. The diversion of the stormwater through macrophyte beds might further alter the distribution pattern of macrophytes.
>
> The calculated amount of P removal by the macrophytes was 9% of the total P loading from Willow Creek. Willow Creek supplies 2% of the estimated total P loading to Lake Mendota (Ahern, 1976). P removal from stormwater by the macrophytes would not be a major factor in reducing the total P loading to Lake Mendota or in controlling the algal bloom making the eutrophication of Lake Mendota so noticeable. Stauffer and Lee (1974) have shown that during the summer thermocline migration is a larger source of P to the epilimnion than is runoff. During a five day period (25-30 July, 1971), the thermocline migration was estimated to bring into the epilimnion two to three orders of magnitude more P than was brought in from Willow Creek during the summer months. Thus, the diversion of Willow Creek stormwater through the macrophyte beds would not significantly reduce the total P loading to Lake Mendota or reduce the P available for algal blooms during the summer.

The reference here to diversion of Willow Creek water pertains to another subproject, which will be discussed next.

The "In Bay" Plan Feasibility

This project was speculative from the beginning and, although a certain investment was made to evaluate its potential, it was never seriously proposed. The report upon it will therefore be brief.

The idea was to establish a "biological filter" within the Bay to absorb nutrients from the eutrophic water and thus remove them from action. It seemd possible to use the weed bed, naturally growing on the sand bar, as the "filter." The water at the bar is shallow and a dense growth of M. spicatum or other suitable macrophyte develops luxuriantly in summer. If the flow of water from the Willow Creek could be diverted to pass through this bed, the nutrients that it carries might be taken up by the plants, and then, if the plants were harvested mechanically, much organic matter could be removed from the ecosystem. The delta building at the Willow Creek entrance to the Bay could perhaps be integrated into the diversion of water, by changing its height or contour or by other means, so as to check the outspread plume of creek water and direct it to the west along the shore of the inner Bay, i.e. keep it south of the sand bar and slow down its flow. The plan was intriguing and it was thought that it might demonstrate a new mechanism for control of eutrophication within a small water system. The Committee therefore authorized an exploratory or feasibility study.

Subproject : 133:8815 James Kerrigan, Principal Investigator
Water Resources Center
Michael Adams, Principal Investigator
Botany
Richard Koegel, Principal Investigator
Water Resources, Mechanical Engineering
Todd Gustafson, Research Assistant

The investigation proceeded slowly and with discretion. There was full realization that, if any physical changes or structures were required within the Bay, that there would have to be permission granted by the proper authorities. Most of the time was devoted to ascertaining facts and entertaining ideas. Todd Gustafson, too, began a study of Typha latifolia (cattail), which might be the plant of choice for the nutrient uptake. Little was known of its growth requirements for artificial propagation or of its total yield potential under conditions that would obtain in the Bay. This study was somewhat independent of the In-Bay Planning and was to be PhD thesis-related for Gustafson but available to the Project. The Stanforth study of P uptake by Myriophyllum spicatum (described earlier) was also made with the In-Bay plan in mind.

To make that story short nothing great was accomplished, and perhaps it is just as well. Also Dr. Kerrigan left the University at about this time and that fact also dampened interest in the In-Bay idea.

Class of 1918 Marsh Management

The Class of 1918 Marsh is the remnant of the originally 180-200 acre wetland, called the University Bay Marsh. Much of the general marsh was tiled and used by the University for muck soil experimental plots in the period of 1910 to the 1940s. As the tiling eventually failed and as the pressure for land in the Far West Campus developed, parts of the marsh were used as land fill and some areas were converted into playing fields for athletes. Through the efforts of student activists in the late 1960s the University was persuaded to save and restore the remaining wetland (McCabe, 1971). The Class of 1918 for its 50th Jubilee provided a fund for the restoration and the area thus became known as the Class of 1918 Marsh. The present wetland covers about 14 acres with a periphery of dry marsh and restored prairie. The Marsh restoration was planned by University ecologists, notably Dr. James Zimmerman of the Arboretum. It has been making interesting recovery but is in need of management and especially of a long term plan of management. Dean Bock therefore requested the Committee to take on the Class of 1918 Marsh as part of its overall responsibility for the University Bay Area. The Committee accepted the challenge and initiated a subproject to deal with it.

Subproject 133: 8816 John Harkin, Principal Investigator
Soil Science
Gordon Chesters, Principal Investigator
Water Resources Center
Patrick McGuire, Research Assistant

The first step was to assemble an ad hoc committee to help in identifying the problems of the Marsh and later to provide counsel for the plan of management. Dr. James Zimmerman, familiar with the earlier work on the Marsh, was invited and so also were Dr. John Magnuson (Limnology Laboratory) and Dr. Robert Ellarson (Wild Life Ecology). Pat McGuire elected to take a double Master of Science degree in Soil Science and Water Resources Management and thus had access to a wide range of other advisers over the two year period of the subproject.

The Marsh complex is comprised of two physical/biological zones: an inner area of standing water in a water-saturated basin and an outer zone of elevated dry marsh and merging prairie plant communities. Figure 4.

Research focused on collection of physical and chemical data with seasonal change. Attention was paid to sediment movement, water level fluctuation and water flow-through, nutrient input and output, and general water quality. Ten sampling stations were located at strategic points within the Marsh area. Testing was done every other month during fall, winter and spring, and monthly during summer. The monitoring began with November 1973 and continued through the summer of 1975.

The water flow system is particularly important. There is a narrow water inlet, perpendicular to Marsh Rd. near the Nielsen Tennis Stadium. This point is directly across from the desiltation pond, built to contain runoff during construction of the Center for Health Sciences. The effluent from this pond drains to the Marsh inlet, as do also the local land runoff and storm drains. In other words, the Marsh is a low point in the terrain and thus in the path of natural flow of water to the lake. However, with the present Willow Drive roadway along the Bay the Marsh is cut off from its natural water way to the Bay and, in fact, the Bay lies upgrade from the Marsh at most times, and this necessitates a pumping station located in a small building near the Marsh outlet at Willow Drive. To measure the water stage and water flow through the Marsh a 5:1 V-notch weir with staff gage and recorder was used at the Marsh outlet. Water level records were calculated with reference to the bench mark at the pump house (see <u>Horizontal and Vertical Controls</u>). However, during the period of study the water level declined until a major portion of the Marsh bed was exposed from mid-July to late September in 1974. In 1973 a similar decline did not occur but only because, according to data of the Wis. Highway Testing Lab., ground water was being pumped to the Marsh from the construction site of the Health Center. The rate of pumping was 250 gal/min from July 3 to 17 and 180 gal/min from July 18 to Nov. 27. Thus the late summer decline was not apparent but ordinarily would occur every year, due mainly to evapotranspiration. If the Marsh level is to be maintained at the wetland level, water management is required. Fortunately, this can be done, since the Marsh is down grade from the Bay and water can be delivered by gravity as needed. This was demonstrated to be feasible during a test period from Oct. 1 to Oct. 15, 1974. A 6 inch subsurface pipe connecting the northeast tip of the Marsh with the Bay was opened and the Marsh was recharged to a standing water depth of approx. 10 inches of water. However, whenever a recharge is done (or at any time when the Marsh water stage is abnormally high from storms), it will be imperative to relate the Marsh water stage with the water level at the Nielsen Stadium. Here there is a culvert which drains the local water to the Marsh and this culvert must not be flooded or reverse water will severely damage the Nielsen Stadium. The Marsh water stage must be kept below the top level of the culvert, which is at 848.2 feet above mean sea level. Pumping water from the Marsh to the Bay may be needed at times of high water, such as the spring snow melt or a very rainy season. This problem is recognized by the University and the pumping system is ready in standby at the pump house on Willow Drive.

The Harkin-Chesters Final Report contains the entire record of Pat McGuire's work on the Marsh, and is the basis for recommendation for Marsh management. To quote from that report:

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> Currently the Class of 1918 Marsh is a healthy marsh. Due to its alkaline feedwaters, its surface dissolved oxygen levels, and a pH generally above 7, iron toxicity has not been a problem within the marsh. In neutral water systems such as the Class of 1918 Marsh, the concentration of water soluble iron rarely exceeds 20 ppm (Pennemperuma, 1972). Draining and liming of the marsh should probably never be required. Nutrient rich water removed to irrigate the adjacent playing fields (cf. section 3.2.2) would be replaced by low-iron alkaline inflow and be effective enough to overcome any incipient iron toxicity.
>
> Multipurpose Management
>
> The Class of 1918 Marsh functions as a multipurpose resource, providing recreational, educational, research and ecological opportunities. Some of the present recreational uses include identification and observation of marsh plant life, waterfowl, and wildlife as well as photography, jogging, bicycling, and winter cross-country skiing. During the winter of 1974 a portion of the marsh was cleared of snow for ice skating. With a minimum of maintenance a portion of the marsh basin near the Marsh parking lot could serve as a safe winter ice skating site on an annual basis. This would be preferable to flooding of lawns on other parts of the Campus.
>
> The Class of 1918 Marsh also serves as a convenient research site for University biology students..... Insect studies, plant succession, water quality studies, waterfowl and wildlife behavior and population dynamics and invertebrate activity are a few of the many research topics available for study within the intricate marsh ecosystem.

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Upland Management

Vegetation. Woody plants must be controlled in the upland community. Cottonwood and aspen invasion around the border of the Marsh could inhibit waterfowl use of the Marsh and compete with the more desirable upland, marsh and prairie vegetation. If the trees become too high, they would interfere with the flight pattern of migratory waterfowl and other birds. It has been suggested that long lasting removal of woody plants may be possible by a July cutting of the plants because they will exhaust root food reserves if cut during this peak growing period (Zimmerman, personal communication). If mechanical removal alone proves ineffective in controlling woody plants, a combination of mechanical removal and spot application of a rapidly degrading herbicide may be necessary. A denser clump of trees on the western side of the Marsh, where it would not interfere with the bird flight patterns, could provide better shelter for wildlife and enhance the opportunities for more diverse wildlife community. They would also provide concealment for birdwatchers.

A preliminary plant community guide and vegetation management plan for the Class of 1918 Marsh has been prepared as a complement to this report by Ms. Nancy Peterik, an Environmental Awareness Center Research Assistant, in a study sponsored by the Brittingham Trust Program of the University Bay Project. The guide describes, locates, and discusses the importance of individual plant species within the Class of 1918 Marsh. The primary purpose of the guide is to help maintenance crews working within or near the Marsh to differentiate between desirable and undesirable vegetation.

Trail. The surface of the trail surrounding the Marsh must accommodate pedestrians, bicycles, and handicapped person traffic (wheelchairs). A stable, hard surface trail is most desirable, but asphalt is aesthetically undesirable in this environment. Alternate materials include... 3/4 inch gravel topped with 3/8 inch screenings; 3/4 inch gravel alone; wood chips. /Suggested by R. Tipple of UW planning and Construction; he also commented upon relative properties./

Annual maintenance (for example, during late May or early June) of the trail to insure a smooth dry surface should include filling of potholes and, as required, installation of drainage pipe in areas where surface drainage is impeded by the trail. A six-inch drain pipe is presently installed under the trail at the south end of the Marsh for the purpose of reducing erosion and providing adequate drainage. Drain pipes are also needed under the trail along the western boundary of the Marsh in some low areas where the trail is a barrier to surface drainage into the marsh, thereby causing ponding after precipitation.

[Then follows a section on the present signs along the trail and some advice as to the kind of signs that might be used. But no decisions were made when the subproject ended.]

p. 19 <u>Summary</u> [of the Harkin-Chesters Report]

Total management of the Class of 1918 Marsh complex involves the proper maintenance of the marsh basin, the adjacent upland plant community, and the area peripheral to the marsh complex.

The marsh basin should be managed to minimize sedimentation, entrap nutrients, provide a diverse habitat for plants and wildlife, and promote multipurpose use. Presently available control features include a desiltation pond, and marsh water level control within a limited range. Possible future action, dependent on funding, includes berm construction across the inflow channel to increase the range of marsh water level control, and grading of channel banks and marsh shoreline to minimize erosion and produce more suitable marsh plant habitat.

Upland plant management includes control or removal of undesirable woody plants, and maintenance of the Marsh trail to provide a stable well drained surface. Interpretive signposts that are easy to read and understand and related to the ecology, natural history and management of the Class of 1918 Marsh should be maintained on the existing pedestals. The adjoining recreational fields should be maintained in a manner that exerts minimal impact on the Marsh complex. Herbicides and fertilizers should be used only when necessary and with care. A buffer zone between the fields and the Marsh trail would be desirable. Year to year decision making on management of the Marsh should be the function of an ad hoc committee composed of interested University staff. Actual maintenance of the Marsh could be implemented by the U.W. Physical Plant personnel [Buildings and Grounds].

<u>Bibliography re University Bay Area</u>

As a service to the investigators on the subprojects and others interested in the University Bay of Lake Mendota, the Coordinator, Richard McCabe, prepared a bibliography, which was published as Working Paper 7 of the Institute for Environmental Studies. The first edition appeared in November 1972 and was soon exhausted. A more complete version with about

200 more citations was issued in March 1974; this too is called Working Paper 7 of the I.E.S. While it probably is still incomplete in its listing of all pertinent research on Lake Mendota Bay, it is very useful because it includes hard-to-find references from University departments, University Archives, theses, and particualrly the Birge-Juday field notes and rare papers that are not easily traced. The volume is well indexed. Copy of the 1974 revision will be placed in the Water Resources Center Library.

Historical Monograph-- "A Niche in Time"

While working on the Bibliography, the Coordinator realized a further way in which he, a trained journalist, could make a contribution. That was to trace through the historical record on the Bay Area, through its creation by glaciation, Indian and white settlement, acquisition by the University and recent impact by University and other public uses. It was hoped that such a summary of natural and cultural history of the Area would be both interesting and useful in planning for its protection and enhancement. The Committee agreed to the proposal and so designated the effort as a subproject in itself.

Subproject 133:8817 Richard McCabe, Principal Investigator
Stephanie Carpenter, Cartographer and Assistant

There was no lack of resource material. Quite the contrary. The investigators became adept at tracing historical records, collecting and reproducing pictures, interviewing all sorts of persons who had personal memories about the Area or suggestions of source materials, etc. Before long the collection was so massive and so interesting to the Coordinator that he anticipated publication and hence chose the title " A Niche in Time." The manuscript was prepared and, in his words, it is a "comprehensive natural and cultural history of the University Bay Area of Lake Mendota from prehistoric time to A.D. 1948." He further states that it is " a chronology, separated into nine chapters. It contains approximately 120,000 words. In addition to the narrative, we have prepared nineteen map illustrations (Stephanie is a cartographer), and collected over 700 historical photographs of the Bay area of which we would like to use about 225 to complement the written documentary."

With McCabe and Carpenter as authors, the monograph was submitted to the University Press in December 1975. In due time the answer from the Press was negative and understandably so. As it was submitted, the manuscript was massive, the pictures very numerous, and, all in all, the monograph would be very expensive to the Press with little chance of wide appeal to readers. If it were to be published, a much reduced and more popular version would be needed, in the opinion of the reviewers for the Press. The position of the Committee is somewhat ambiguous. It had known of the manuscript all along, but had not seen it in its entirety and had not specifically decided that should be done with it. In all fairness, one comment had been made that the Coordinator should look into the possibility of publication, but the timing was poor and the Committee was closing the subproject funding. So the matter of publication was laid aside, but the value of the collection of records is still a worthy result. As the Chairman commented to the Press, "There is a tremendous amount of detailed information which is valuable and which will not be lost... There is a file of the same material on cards, fully indexed." This file and the three large volumes of pictures will certainly be made a part of the Project archives.

The Brittingham Trust Program

After the University Bay Project was well underway and it was evident that there were many more problems than could be attacked with the funding by the Class of 1922 gift, it was suggested to the Committee that the Brittingham Trust might be interested in support of some well-defined part of the work. Upon invitation of Chancellor Young then the Committee chairman proposed Picnic Point as the beneficiary and wrote a description of what was needed to be done for its protection and improvement. The Chancellor then included this proposal among others in his next presentation to the Trustees. Indeed they were interested and provided a $69,000 grant for Picnic Point improvement, broadly defined.

Enjoyment of Picnic Point is precious in the minds of Alumni, present students, University faculty and Madison people at large. Its protection and enhancement by provision of new facilities was next discussed, and it was apparent that professionals in landscape architecture would be needed to analyze the Point, to prepare a model of multiuse that would make the most of its beauty and yet safeguard it from abuse. Professor Philip Lewis of the Committee is such a professional and is also well experienced in the area of public use of an environmentally complex site. He has, in fact, specialized in that concept in his Environmental Awareness Center within the University Landscape Architecture program. Futhermore Prof. Lewis was already working with the Committee in developing a 3-dimensional model of the whole Bay Area (this will be described below). For the work on Picnic Point Dr. Lewis was invited to submit a subproject, which he did, and it was promptly funded.

Subproject 133:9620 Philip Lewis, Principal Investigator
Robert Ellarson, Principal investigator
Rick Kuckkahn, Research Assistant
Namcy Peterik, Research Assistant
Thomas Heggland, Research Assistant
and several others for short times or particular aspects of the work

In a previous subproject (called the <u>Three Dimensional Modeling</u> subproject 133: 8813) Dr. Lewis and his assistant Rick Kuckkahn had built a model of the whole Bay and its Area. It was constructed of 125 sections, each 1 foot square. They were built from sheet plastic, cut and bent to the contours needed. Upon the undulating surface was pasted foam material and on it such features as roads, buildings, trees, etc.; each feature was made to scale and appropriately colored. Each section consisted of the top and two vertical sides, and on the sides were recorded data as to soils and rock strata (depths marked by appropriate lines, groundwater levels and yearly highs, etc.). With only 2 side walls per square the adjacent squares carried on the data, so that there was a contiguous pattern for the user to study. This was easily done because each square could be lifted out . Incidentally this feature of demountable squares, telescoping together for transport or storage, was a new concept for 3-dimensional modeling and it was very successful. The large model was set up in the Environmental Awareness Center and it drew many visitors. It will be kept for future use by research personnel dealing with the Bay Area problems.

For the Brittingham Trust Program Dr. Lewis took a different approach; namely, an analysis of the Area's problems with depiction by photographs, drawings or graphs, which were made into slides and projected onto large screens. The screens were set in a row around a room, i.e. a 360° theater with the viewers seated in the center. Historic pictures could thus be contrasted with present conditions at the same sites; sketches of proposed changes for these sites could simultaneously be shown to viewers and their comments and suggestions recorded. This for the planning about Picnic Point problems worked very well. The Committee had a private showing so did the Arboretum Committee which is the guardian of Picnic Point; appropriate other persons from UW Planning and Construction, from environmental groups, from Shorewood Hills (near neighbors of Picnic Point) were shown the plans as they developed.

Out of all the showings and proposed modifications of the early ideas, Dr. Lewis was able to put together a comprehensive proposal for correction of problems, and for new facilities to allow use of Picnic Point with reasonable controls as to environmental damage. The final draft of his plan is presented in a brochure which is the final report to the Brittingham Trust. It need not be repeated here, because it will be available in the Environmental Awareness Center, the Water Resources Center and probably also the Steenbock Library. Dr. Lewis has also already distributed copies to special persons and planners on the UW Campus, and the Chancellor has supplied copies to the Brittingham Trustees.

The Committee considers this subproject one of its major accomplishments. By its own decision some $37,000 of the Brittingham grant was kept to turn over to the University to implement some of the recommendations for changes and improvements. True, this amount will be insufficient but probably it will stimulate other contributions and so, over time, the University will be able to properly care for Picnic Point and yet to allow multiple use of it.

OTHER ACCOMPLISHMENTS OF THE COMMITTEE

Certain activities of the Committee were not dignified as subprojects because they involved no funding. Some were short-term and of limited importance but some have future potential that should be recorded. And some were just plain interesting, like to one about to be described.

Willow Drive Trees

Between 1892 and 1896, Willow Drive (then called Willow Walk) was constructed as the first activity of a civic organization called the Madison Park and Pleasure Drive Association. For a number of years its leaders, but notably John Olin (then a Professor of Law at the University) solicited funds and promoted the building of Mdison parks and scenic drives. Willow Drive was its first project, built along a natural sand bar across University marsh and generally following the shoreline of the Bay. Willow Drive served as an extension of an existing Lake Mendota Drive, connecting the Eagle Heights area with the University campus. It is reported that the Park and Pleasure Drive group financed its construction by popular subscription of $6888.86. It was John Olin who later supervised the planting of willows along the drive. Willows were a natural for a wetland soil and also were fast-growing and graceful trees. Mr. Olin purchased trees from several nurseries and also raised some in his own nursery in what is now a part of Shorewood Hills.

Records of the kinds of willows in the original planting are lacking but at present there are the white (*Salix alba*), the golden (*S. alba* var. *vitellina*), the crack (*S. fragilis*), the weeping (*S. babylonica*) and the peach-leaf (*S. amygdaloides*). The date of planting of the original trees is not precise but is probably about 1900, for by 1910 an old picture shows sizable trees with full canopy.

There is a story about the golden willow, which, if true, would be noteworthy. In "*Storm Scenes*" published by the Madison Democrat in 1909, there is a picture of a Napoleon willow near a boat house at the north end of North Carroll Street. Also Katherine Stanley Nicholson in her *Historic American Trees* has a picture of a willow and the following statement, "On the shore of Lake Mendota, Madison, Wis. near the foot of North Livingston

Street is a row of handsome willows grown from cuttings that were brought by a sea captain from the grave of Napoleon on St. Helena." From the reference to a row of trees and Mr. Olin's known planting of willows on Willow Drive, there was a possibility that at least some Napoleon willows were obtained by him, but no such evidence could be found. It is probably only coincidence that S. alba var. vitellina is the Napoleon willow and is also represented in the Willow Drive plantings, for it was at one time a popular nursery stock tree.

More important to the Committee's work is the fact that the Willow Drive trees are now old and dying. Yet for sentimental reasons they should be preserved. An obvious solution was to propagate from the present trees to provide at least some of the replacement stock. Dr. John Thomson (Botany) and Nancy Peterik identified the present trees as to species and pointed out which should be the donors of cuttings; Dr. Edward Hasselkus (Horticulture) supervised the cutting and early rooting, and lastly Dr. Katherine Bradley (Arboretum) provided space in the Arboretum Nursery for the trees to grow out to planting size. They are there now, marked as to species and located in rows in the sections J to N of the nursery.

It is not certain that the University will want to use these trees, because at least S. fragilis, the crack willow, is short-lived and tends to shed branches and twigs in a hazardous and unsightly manner. But for sentiment's sake S. alba var vitellina, the Napoleon willow, and others will be available, and they are the descendants of the original willows.

Center For Health Sciences

At an early meeting of the Committee in the summer of 1972, the Chairman was authorized to file the following memorandum with Dean K. Wendt of the U.W. Planning Committee:

> The University Bay Advisory Committee in beginning its work for the preservation and enhancement of the Bay has realized the potential danger to the Bay inherent in the building of the new Medical School complex in its vicinity. We wish to take the initiative to call this to the attention of the planners and to urge that appropriate precautions be taken during the construction and the planning for parking and traffic patterns that will ensue from use of the Center. To aid in such planning for protection of the Bay, the Committee has moved to offer its help to identify the problems and to find means of minimizing the effects.

This note was filed with Dean Wendt on Aug. 7, 1972. He thanked the Committee and informed Mr. James Edsall, Head of Planning and Construction. Mr. Edsall did subsequently offer several opportunities for the Committee to participate in decisions. He also incorporated into the bid requirements these four measures, following the Committee's suggestions:

1. An adequate siltation basin located on the NE portion of the construction site, where by gravity it would receive the major runoff.
2. Stabilization of the stockpiled soils (both top soil and subsoil) by seeding or compaction or both as needed. This was a major concern, since the area excavated and regraded was approximately 75 acres.
3. Use of a longitudinal berm in the desiltation basin to slow the rate of water flow and to extend the water course to obtain better settlement and retention of sediment.
4. Use of a berm around the stockpiled top soil to avoid a major runoff to the Bay.

The desiltation basin is 540 ft. by 132 ft. and is located on Marsh Lane across from the Nielsen Tennis Stadium. It drains by gravity into the Class of 1918 Marsh. It is highly effective, as indicated by a communication from Prof. Gary Bubenzer (Ag. Engineering), who had it tested by a student on a special problem assignment:

> "I would say that the basin is operating as well as can be expected. The side slopes have stabilized and the the water is free of suspended sediment. Our trap efficiency should be well over 95 per cent."

In fact, the Planning and Construction personnel are well satisfied and are now planning to build a pond into the landscaping of the Center For Health Sciences for permanent use. It will, of course, be designed in an attractive shape but also will function to retain runoff, especially that bearing sand and oils from the parking lots. It will be an important protective device to the Bay.

In planning placement of the general storm sewers for the Health Center area, the Planning and Construction personnel sought the opinion of the Committee. From a choice of four proposals, it was decided that the Route B along Marsh Rd. to the east and thence to an outfall in the Bay was best. Although slightly more expensive to install, it would also serve to control the runoff from Parking Lot 60 or its modification. This also is a further protection to the Bay Area.

Consultation between the Planning and Construction personnel and the Committee continued on other matters also, but particularly as to the traffic pattern for the whole Far West Campus: Health Center area. It was carefully planned and finally adopted in April 1976. The effort was to control and facilitate traffic and yet to protect the interests of the Shorewood Hills and the users of the University Bay Area. A part of the traffic pattern is involved in the Committee's proposal for Picnic Point improvement (see the Brittingham Trust Program section). The Committee was concerned also in planning for Willow Drive within the traffic pattern. It is premature to state exactly what will be done, but we are assured that the interests of protection to the Bay and Bay Area will be covered.

OVERVIEW OF ACCOMPLISHMENTS

It is perhaps rash to pick out the prime accomplishments of the University Bay Project, when some are ongoing and some are only in the planning stage. But for the satisfaction of the Committee as it offers this report to the Graduate School and to the Class of 1922, an attempt to summarize is in order.

We know that great good has been done by the mere fact that the Committee has been at work. Faculty colleagues and administrators, as well as students and Madison residents are better informed about the Bay and its problems.

Of the funded subprojects, all but the "In Bay" Plan materialized and we believe that each has made a permanent contribution. We are not apologetic about the "In Bay" outcome because from the first it was known to be only a "feasibility" study. Of the other projects, the future benefits are many, since they provide data to the scientific community; the City of Madison and the U.S. Geological Survey; and the Planning and Construction personnel for future decision making. That these decisions may be vital to the Bay and its protection can be seen from the benefits already provided by the control of runoff from the Health Center. It has been said to the Committee, that, if it had not done anything else, this alone was life-saving to the Bay.

The plan for the management of the Class of 1918 Marsh is specific and easily implemented. Furthermore a residue of the fund from the Class of 1918 is available for at least the initial work; the vegetative study by Nancy Peterik will also facilitate the decision as to what to remove and what to save or replant.

Another intangible benefit is the aid the Project has given to students in the way of financial support and field experiences. Six students were assistants on the subprojects and each received his M.S. degree with his thesis based upon his project work. Eight other students were employed by the Brittingham Trust Program. Civil Engineering classes benefitted from work on the Horizontal and Vertical Control field work. Prof. Gerhard Lee's soils classes mapped the soils of both the Class of 1918 Marsh and the Willow Drive, and lastly a special student, whose name we do not even know, monitored the desiltation basin for Prof. Gary Bubenzer. Surely these experiences in field work on actual problems are a valuable part of their education at the University.

To close this report on a light note: The Committee was given an Orchid Award by the Capital Community Citizens group. It was presented at a luncheon attended by some 300 persons. Mr. Bernhard Mautz of the Class of 1922, the Committee Chairman and the Coordinator were present to receive the orchids. Incidentally the Captical Cummunity Citizens also give Onion Awards for bad environmental performance. There was no question of that for the University Bay Project.

Figure 1 Drainage Pattern in the University Bay Area

DRAINAGE PATTERN

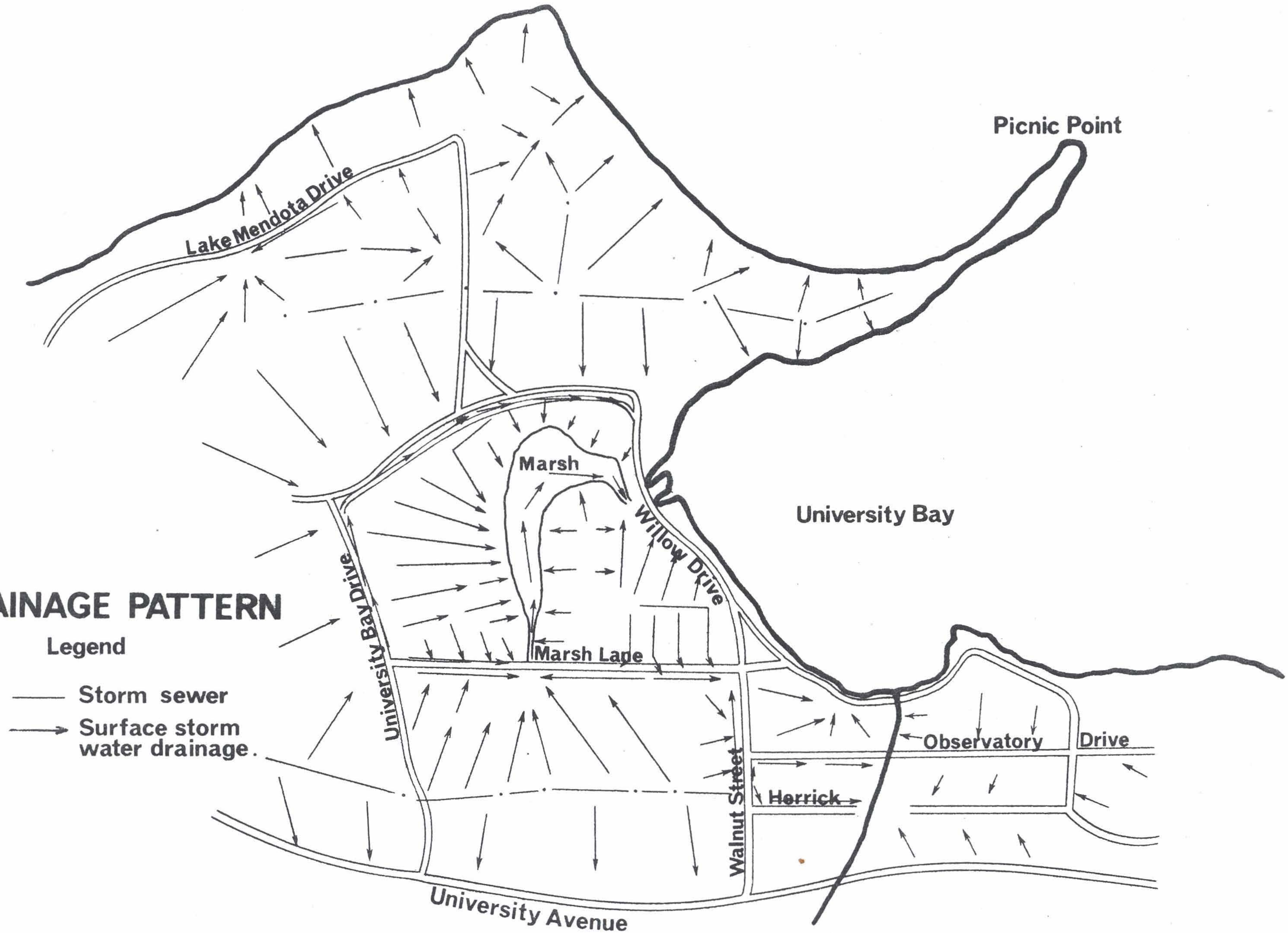


Figure 2 Storm Sewer System Feeding Willow Creek

WILLOW CREEK DRAINAGE AREA

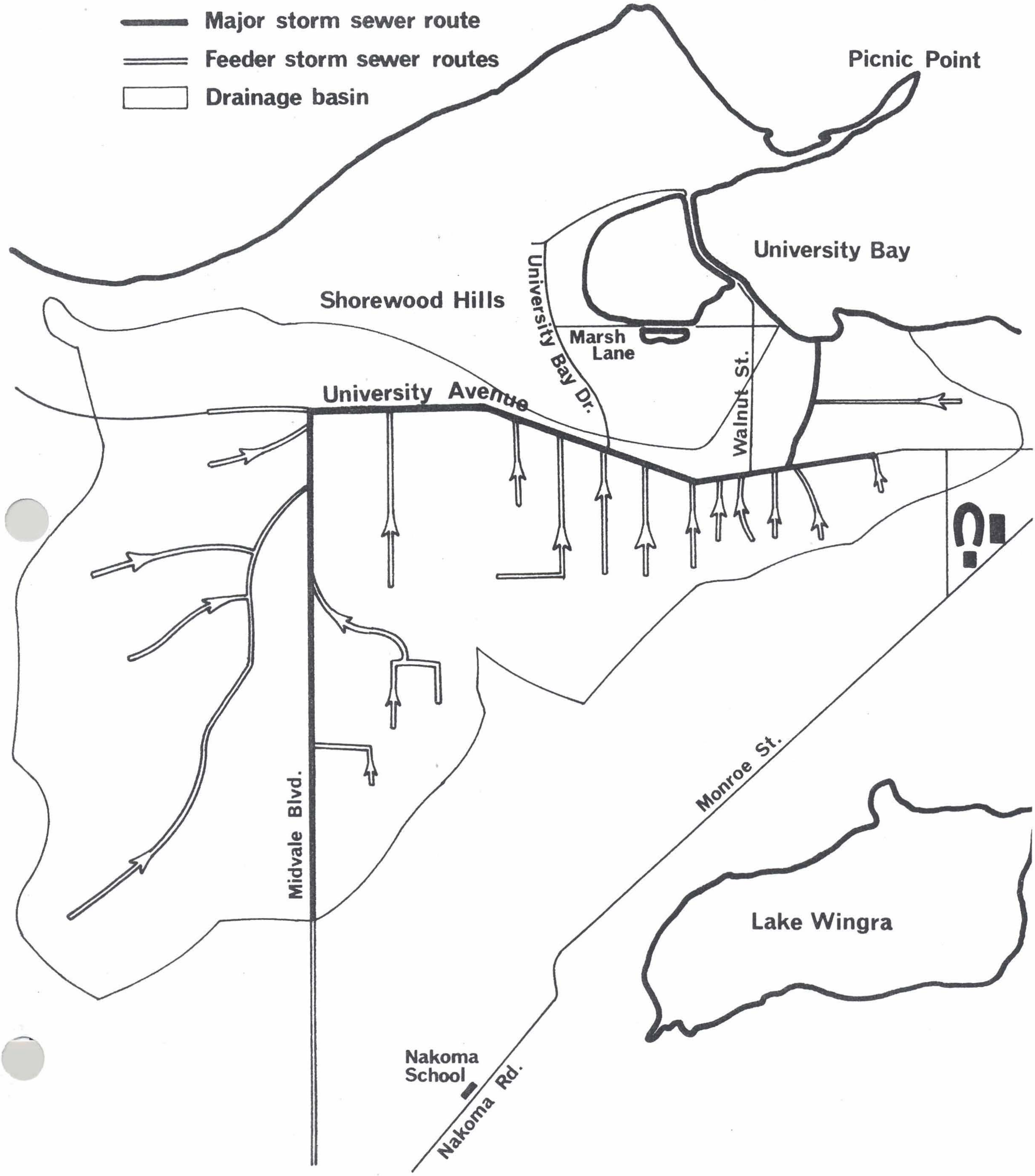
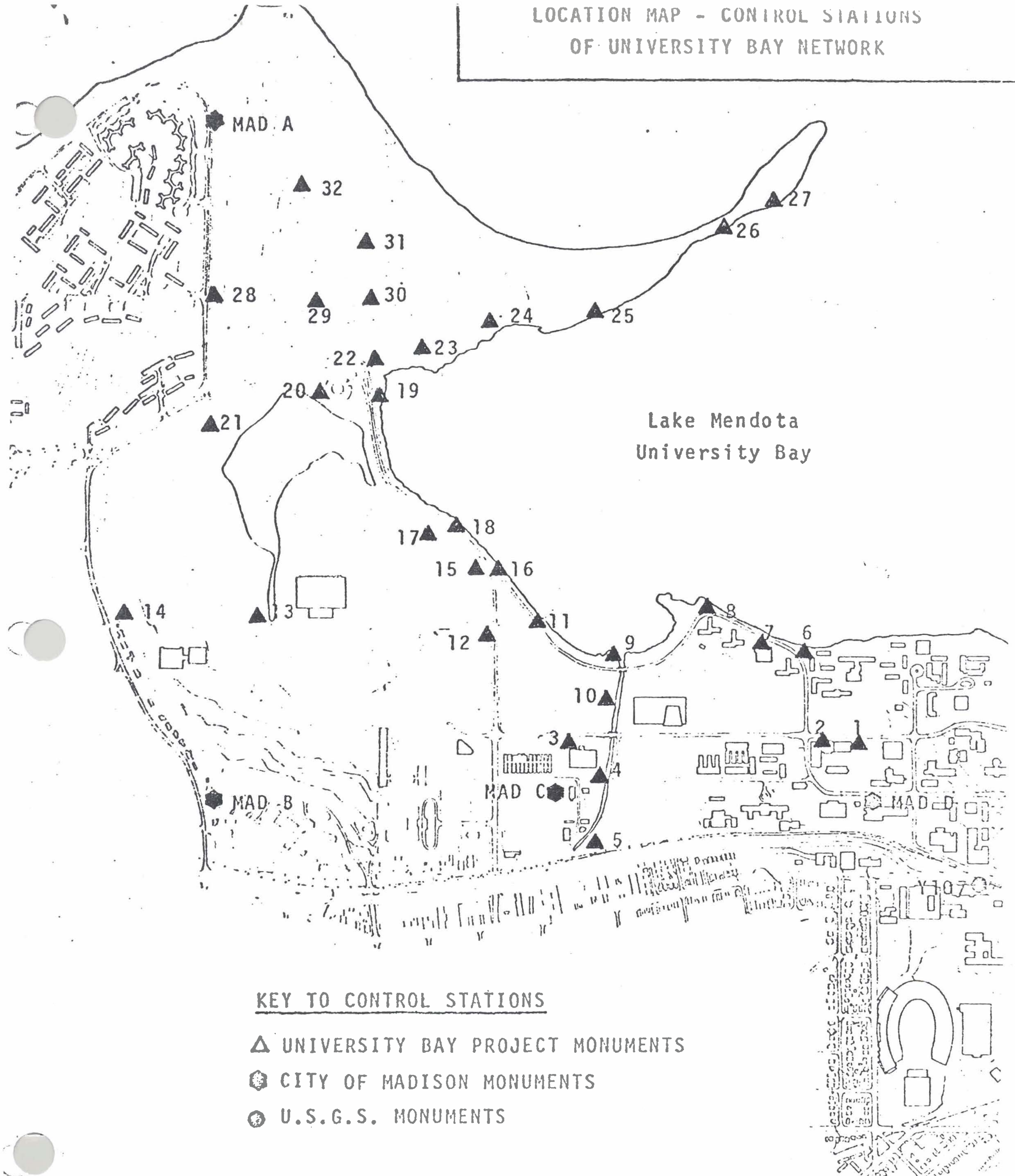


Figure 3 Location of the Horizontal and Vertical Controls: U. Bay 1 - 32

LOCATION MAP - CONTROL STATIONS OF UNIVERSITY BAY NETWORK



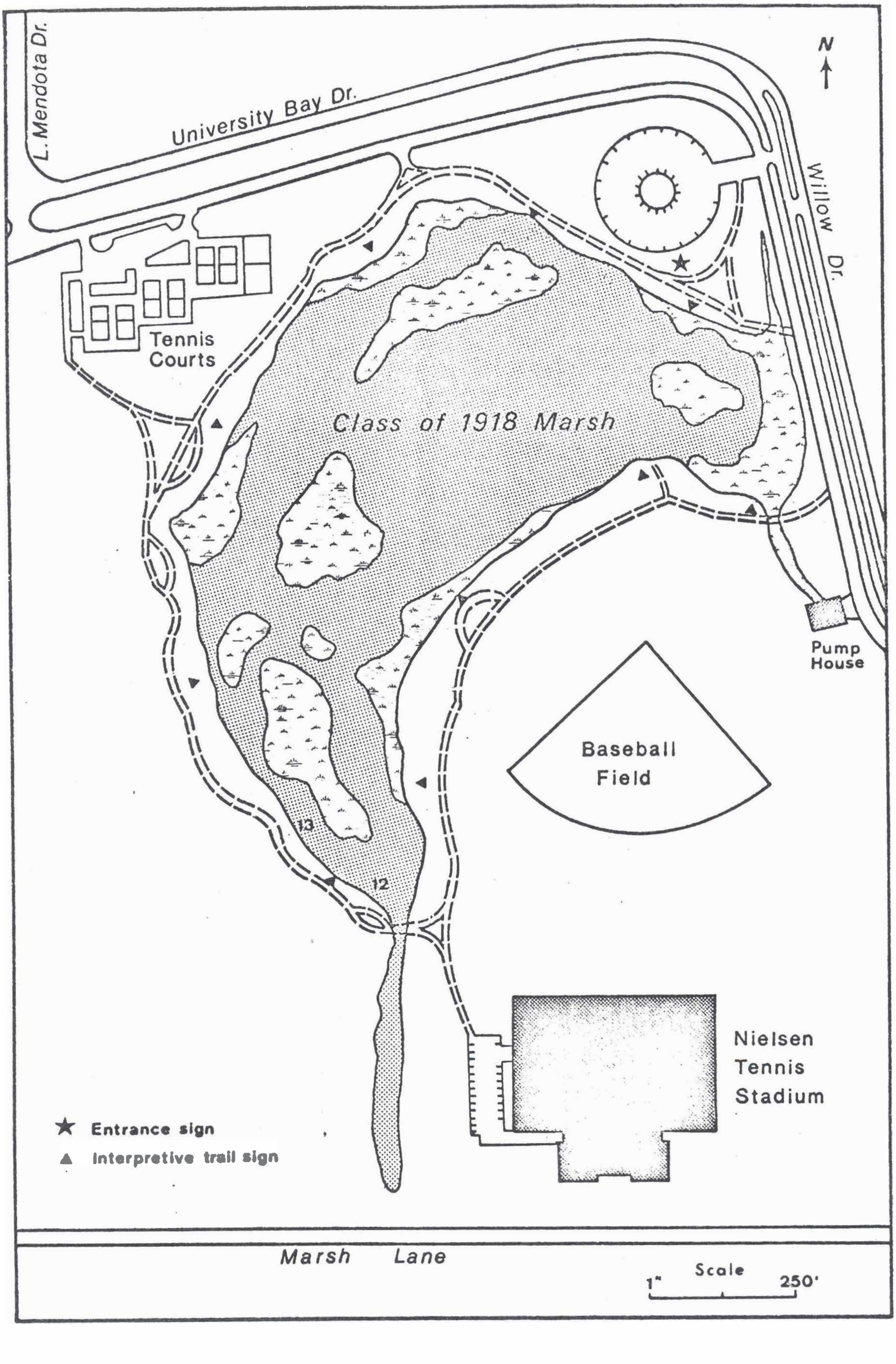
KEY TO CONTROL STATIONS

△ UNIVERSITY BAY PROJECT MONUMENTS

CITY OF MADISON MONUMENTS

U.S.G.S. MONUMENTS

Figure 4 Class of 1918 Marsh


L. Mendota Dr.
University Bay Dr.
N
Willow Dr.
Tennis Courts
Class of 1918 Marsh
Pump House
Baseball Field
13
12
Nielsen Tennis Stadium
Entrance sign
Interpretive trail sign
Marsh Lane
Scale
1"
250'