PENCIL POINTS
PROGRESSIVE ARCHITECTURE

June 1945

6

TO THE AMERICAN PEOPLE:

Your sons, husbands and brothers who are standing today upon the battlefronts are fighting for more than victory in war. They are fighting for a new world of freedom and peace.

We, upon whom has been placed the responsibility of leading the American forces, appeal to you with all possible earnestness to invest in War Bonds to the fullest extent of your capacity.

Give us not only the needed implements of war, but the assurance and backing of a united people so necessary to hasten the victory and speed the return of your fighting men.

HERE'S ONE *for America's Future*

There's scarcely any need for Jenkins to remind you of the dramatically big war job America's heavy construction industry is doing on every battle front. It's headline stuff in almost every communique. The statistics are a war secret but the fact is that equipment and parts, alone, cost 800 million dollars, six times the 1935 output.

But the construction industry's big project – the job that may make its war job seem just a warmer-upper, is the task of making elbow room for the greatest industrial expansion ever known.

It's been Jenkins' privilege to be in on the planning. And this job isn't just "in the air", much of it is "down to earth".

1. There's already a $16,000,000,000 backlog of identified and recorded postwar construction projects. And more to come.

2. $6,000,000,000 of it was in or past the planning stage by the start of '45.

3. Plans now ready will take $459,000,000. Finances, sites and legal arrangements are completed . . . ready for bids.

4. $248,000,000 of completed plans are being cleared and financed . . . and $164,000,000 in cold cash is just waiting for final plans.

5. All this is going to make a lot of jobs . . . at least 3,027,000 by careful estimate . . . one million "at the site" and two million others furnishing materials, supplies, service, equipment.

This, mind you, is heavy engineering stuff, the kind of construction in which Jenkins has always had a vital part. That's how Jenkins knows our construction industry will build for America as heroically as it has helped America to fight. Jenkins Valves have made a conspicuously honorable record in this most basic of all American industries . . . a record which has proved once more how much *"It Pays to Standardize on Jenkins."*

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal; London, England.

LOOK FOR THE DIAMOND MARK

Jenkins Bros

JENKINS VALVES

SINCE 1864

For every industrial, engineering, marine, plumbing-heating service . . . in Bronze Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

Sold Through Reliable Industrial Distributors Everywhere.

Architecture Faces Its H-Hour

The sudden, even if long-expected end of the shooting in Europe has left us in a sort of demi-peace, whose nature is not yet clear to most of us, although we vaguely sense that it is not going to be easy to live through. We may even risk national schizophrenia as we seek to maintain a bitter all-out war against a tough enemy in the Orient and simultaneously try to restore a peaceful economy on the home front and in the western world. But while the statesmen of our own and other countries struggle with the staggering job of social and economic reconstruction, the architectural profession has its own responsibility to the future. How ready it is as it approaches the take-off for the greatest building campaign of history, and how well it will do its share of establishing a worthy pattern for the better world ahead, remain to be seen. We hope for the best.

Though it may be a year or more before a real volume of building gets under way, architectural drafting boards have already been delivered of many plans for new buildings. Not nearly enough yet to satisfy the impending need, but enough perhaps to indicate what the quality of our future is going to be. No one, of course, has any over-all view of what these plans will add up to. That would require an all-seeing eye, which is beyond our human capacity. But what little we have seen is not reassuring. We are afraid that too many future buildings may be no more than throwbacks to the type of design that was acceptable back in the 20's when eclecticism held full sway.

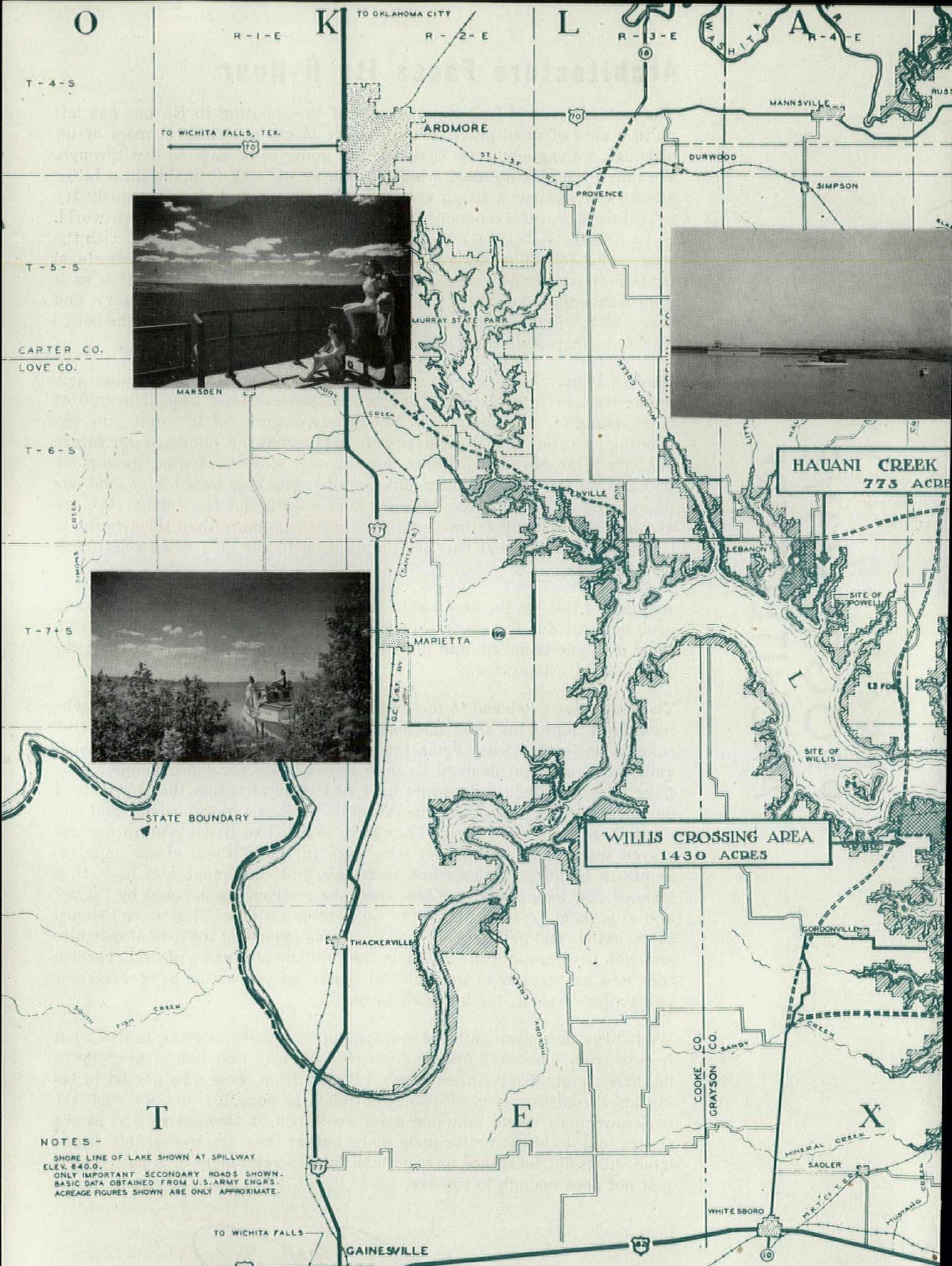
As against this, on the credit side, there are plenty of alert architects and designers within the profession who have long ago ceased talking into their own ear trumpets and have turned them instead to catch what the outer world was saying.

These men have listened to the teachers and doctors and businessmen who have been improving their methods of running schools and hospitals and commercial enterprises. From these they have learned of changed needs and techniques that demand entirely new architectural provisions. They have listened to housewives and have had their attention thereby focused on the matter of making the operation of the home more orderly and efficient than it ever has been. They have listened to the inventors and research workers and engineers who have informed them about improvements in building methods and materials and equipment and have thus learned how to set buildings free from the restrictions imposed by "style" and give them greater capacity to serve their owners. They have listened to the artists and philosophers who have been exploring the field of esthetics and who have brought them back to the fundamental bases of design which they now use in place of the old rigid "rules" of proportion to produce new harmonies of color, texture, and form.

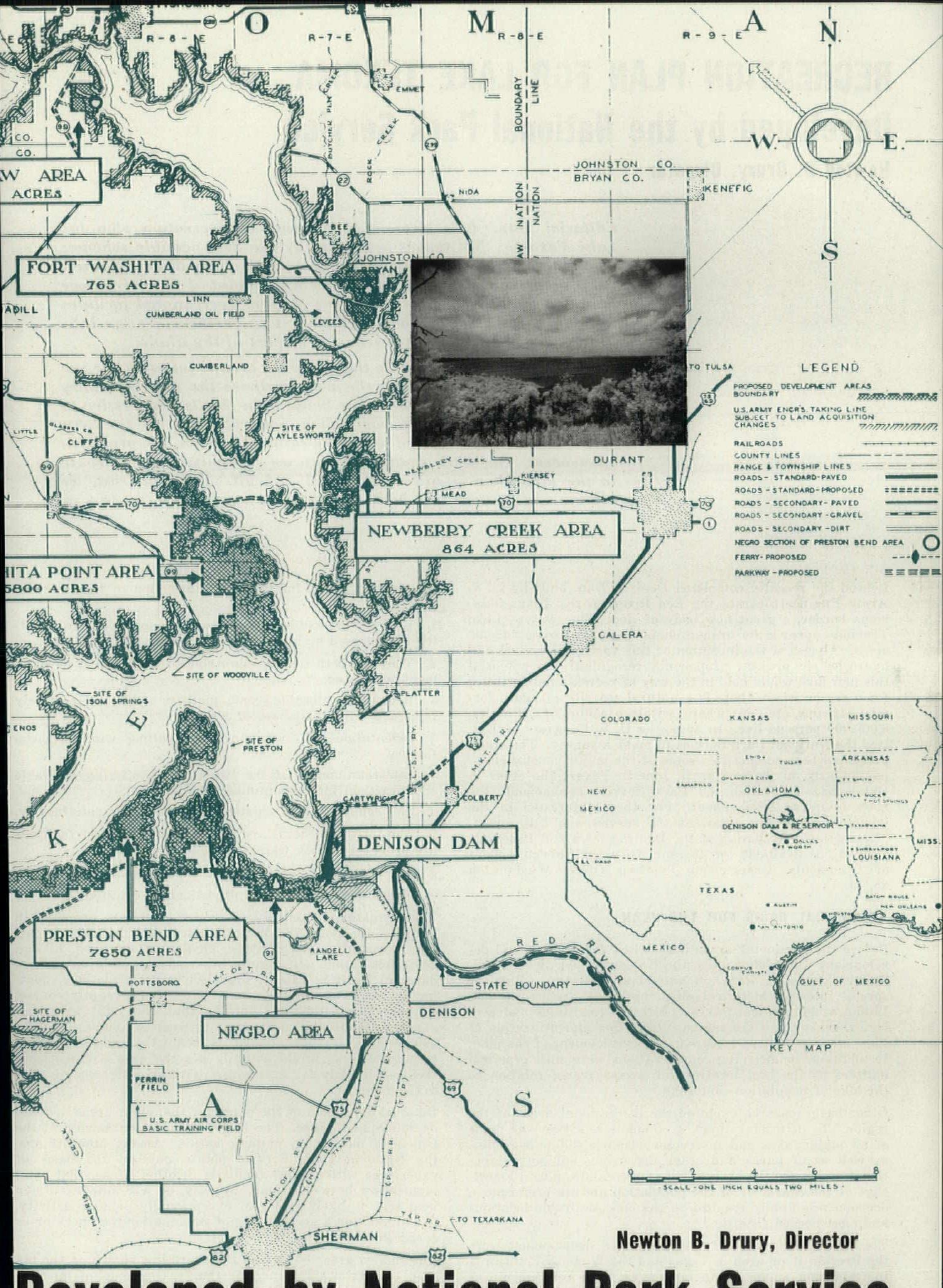
We believe that when building starts again the public is going to like what it gets from these well-prepared progressive men and that it is going to be increasingly disappointed in what it gets from those who persist in being anachronistic. It is probably too much to hope for, but we wish the backward ones would take one more good look at themselves and at the future and decide to revise their plans before they are irrevocably translated into solid substance to remain as forlorn reminders of a past that is just not good enough to survive.

Kenneth Reid

PENCIL POINTS
PROGRESSIVE
ARCHITECTURE



Recreation Plan for Lake Texoma



Newton B. Drury, Director

Developed by National Park Service

RECREATION PLAN FOR LAKE TEXOMA
Developed by the National Park Service

Newton B. Drury, Director

***Editorial Note:** It is pleasant to present this recreation plan for Lake Texoma. Not that it is necessarily the best possible scheme; or that the individual structures are phenomenally brilliant. Rather, because it is a broad plan; it starts from the point of view of proper land use, and its objective is to bring outdoor recreational facilities to 6,000,000 persons who need them. It is, furthermore, an integrated plan; each element is schemed as part of the whole.*

With one exception. We note that a special area is set aside for use by Negroes. To that extent, the plan furthers the discriminatory concepts of racism. On the other hand, even this is progressive to a degree; for not long ago, such a plan, particularly in the southern states, would have offered the dark-skinned citizen no provision whatsoever. So, while noting the fact, we recognize that the route to the millenium is still devious and difficult. Here, at least, we are moving forward, not back.

Behind the recently completed Denison Dam built by U. S. Army Engineers across the Red River on the Texas-Oklahoma border, a great new body of clear, blue water—Lake Texoma—sprawls its dragon shape back over some 145,000 acres. Almost at the inception of this vast flood-control and hydroelectric project, proponents recognized the potential this new lake would hold in the way of recreational facilities for a region where there is a natural scarcity of lakes, forests, streams, etc., but where, within a radius of 200 miles, 6,000,000 persons live. In 1941, the U. S. Congress authorized the National Park Service to make a survey. The study presented here summarizes some of the major conclusions—particularly on the two areas (one in Texas; the other in Oklahoma) for which the Park Service recommends the most intensive development. For those interested in the inclusive scope and detail of the survey, the full report, "Recreational Resources of the Denison Dam and Reservoir Project," is available for 45 cents from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

ANALYTICAL BASIS FOR THE PLAN

Before the particular areas best suited for recreational development were determined, the National Park Service collected exhaustive data on attendant matters—points of special interest, historical sites, areas of prehistoric and Indian archaeological interest, forestry conditions and geological make-up of the region. Protection and utilization of these were important factors in the development of the plan. In addition, conditioning considerations were such practical matters as the best location for access roads, relation to the lake of population centers, etc.

Other basic research explored the recreational needs of the region. To determine these, a complete analysis was made of all major lakes and reservoirs within a 200-mile radius, as well as of parks and other non-urban outdoor recreational areas. On the basis of all of these data, plus a knowledge of the character of the population and its preferences, decision was finally reached on the most desirable locations and most needed facilities.

The two areas selected for concentrated development were the Preston Bend area in Texas and the Washita Point area in Oklahoma (maps on facing page). The relationship of these areas to each other and to Denison Dam is shown on the large map on the opening pages of this study.

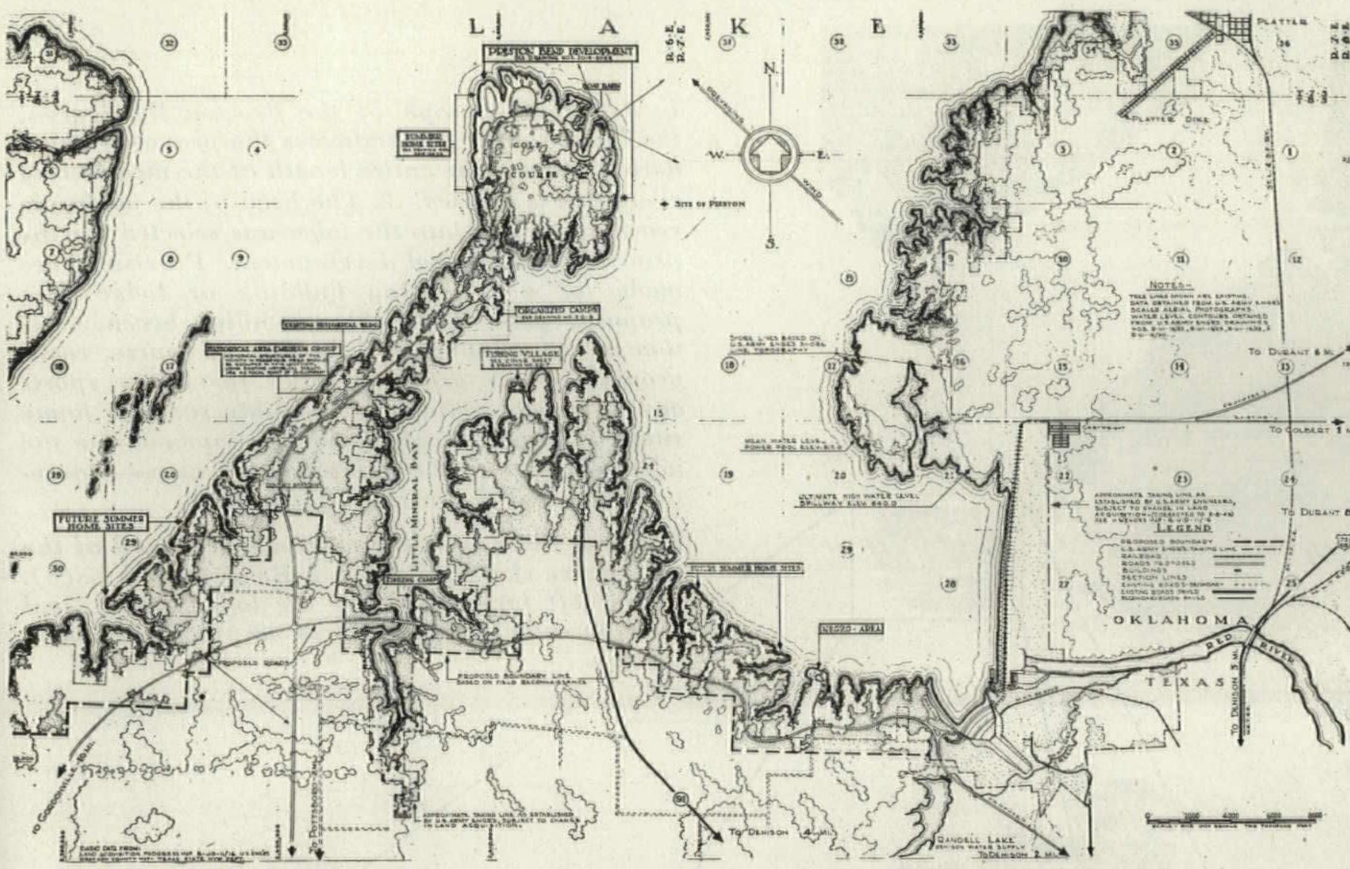
Nine chief factors influenced the selection of these particular sites:

1. Both are accessible from centers of population over existing or proposed highways or other means of transportation.
2. They are both readily adaptable to the types of development envisioned.
3. Both have agreeable scenic qualities and are immediately related to large expanses of water.
4. Orientation with relation to prevailing wind is satisfactory.
5. Interrelationship of the two is good, offering desirable and practical intercommunication.
6. Soil conditions and existing vegetation are satisfactory.
7. The interstate boundary separates them; good facilities are provided in both Oklahoma and Texas.
8. The water depth adjacent to the sites is desirably various.
9. There is a minimum of objectionable features.

The recreational facilities for which plans are proposed in both Preston Bend and Washita Point include fishing, boating, swimming, duck hunting, picnicking, camping, hiking, horseback riding, golf, tennis, other sports; children's areas, dancing, vacation cabins, overnight accommodations, floating cabins, lodge, summer-home sites, and a regatta course. Conservative estimates indicate that the total area can expect an annual attendance of between 600,000 and 1,000,000 persons. By "attendance" is meant the number of visits by persons who would actually use the area's recreational facilities, if only for a pleasure drive or a sightseeing visit to the dam.

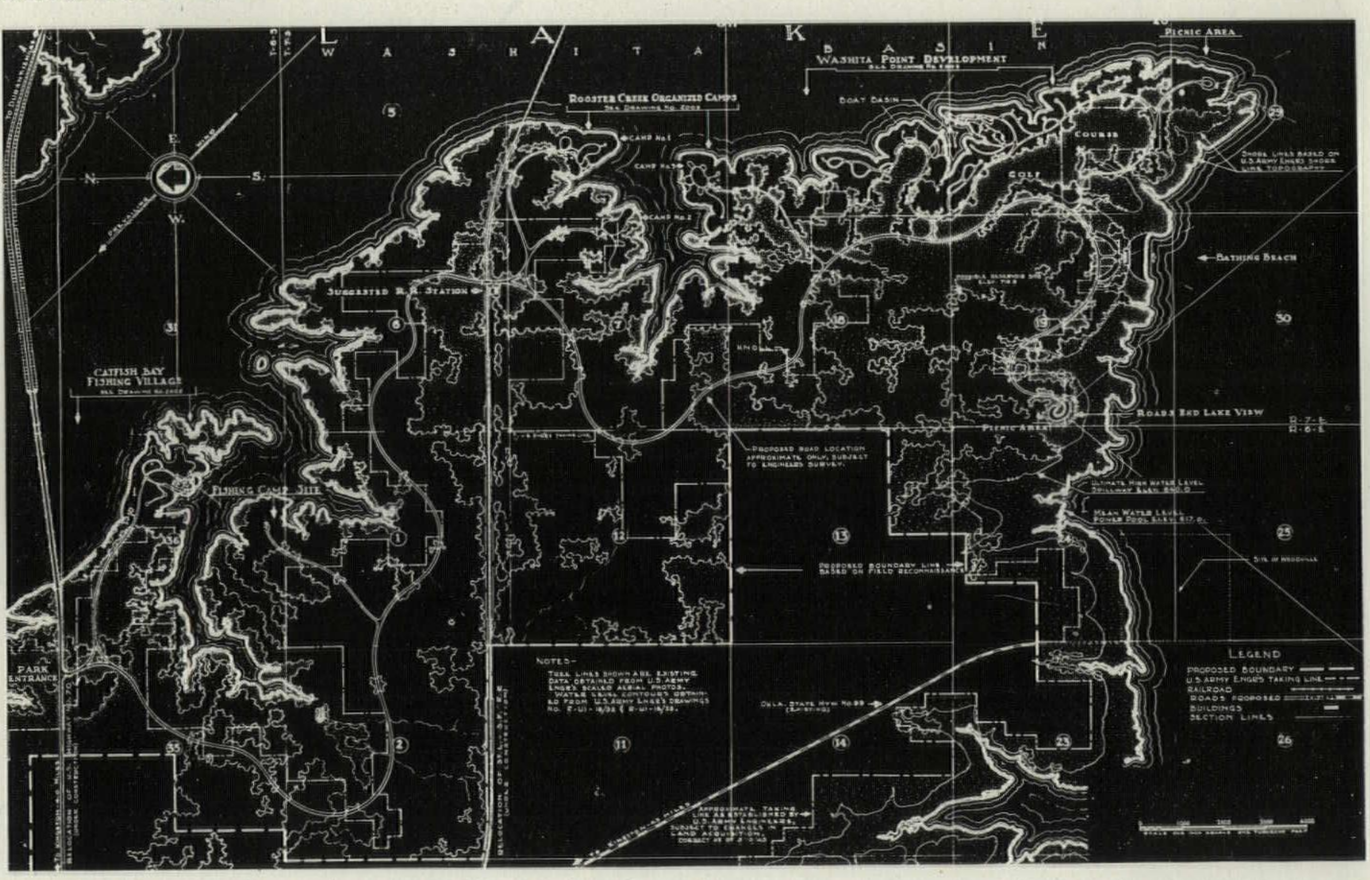
Detailed discussion of the plans for the major areas appears on subsequent pages. The factor of interrelationship of the two is of more than passing notice. Among other things, the National Park Service points out, on the basis of experience with similar facilities in other areas, that communication between them, by way of a 5-mile excursion boat trip, is likely to be an exceptionally popular activity, not to mention a good source of revenue for the operator or concessioner.

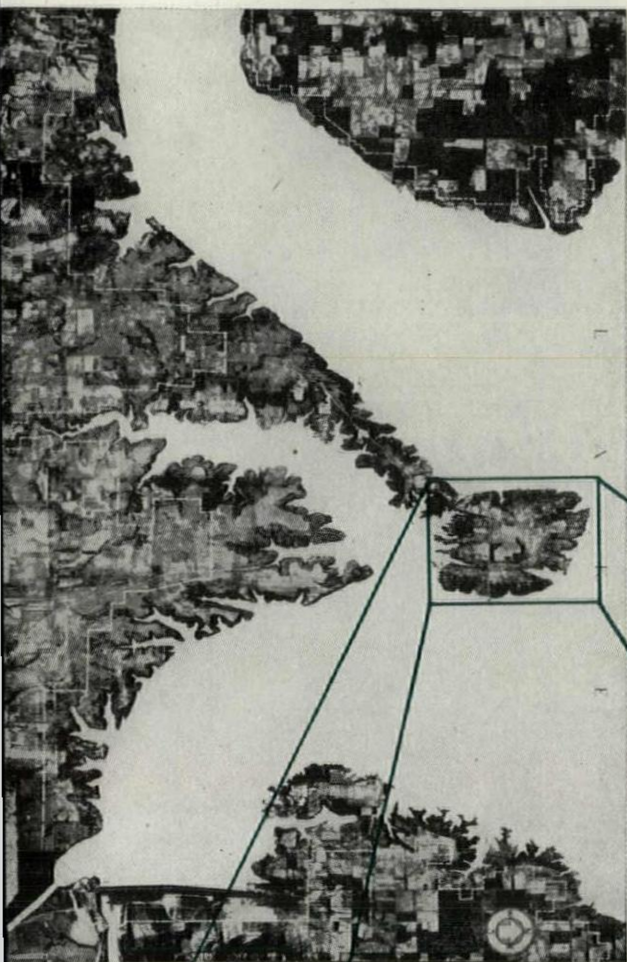
The shaded areas bordering the shore line shown on the big map (Pages 59—60) indicate the "taking line" of land acquired by the Army Engineers; this fringe of Federally owned land will total about 39,000 acres.



WASHITA POINT AREA, OKLAHOMA

PRESTON BEND AREA, TEXAS



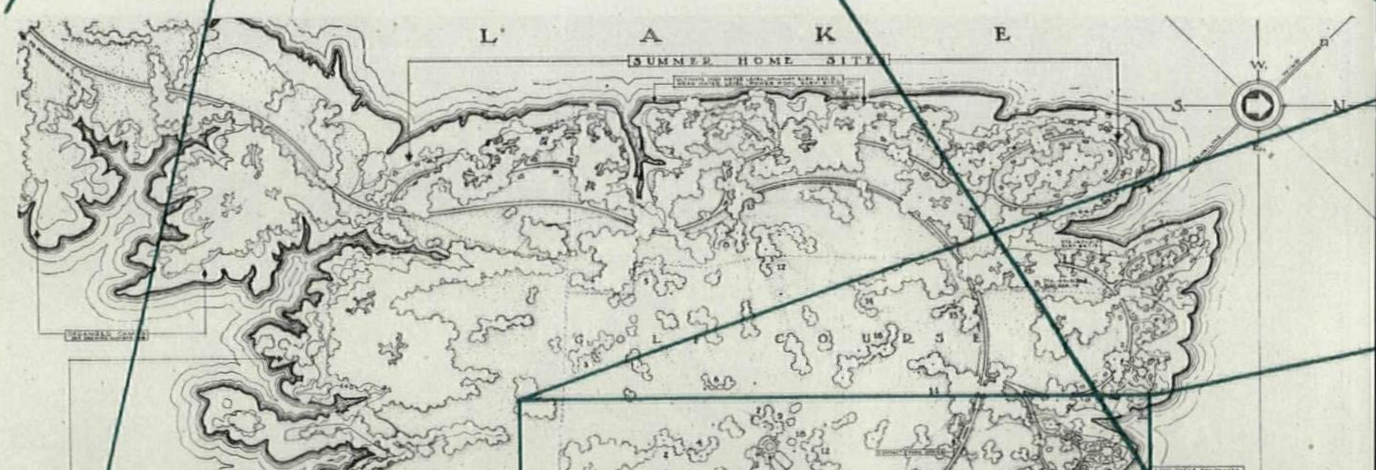


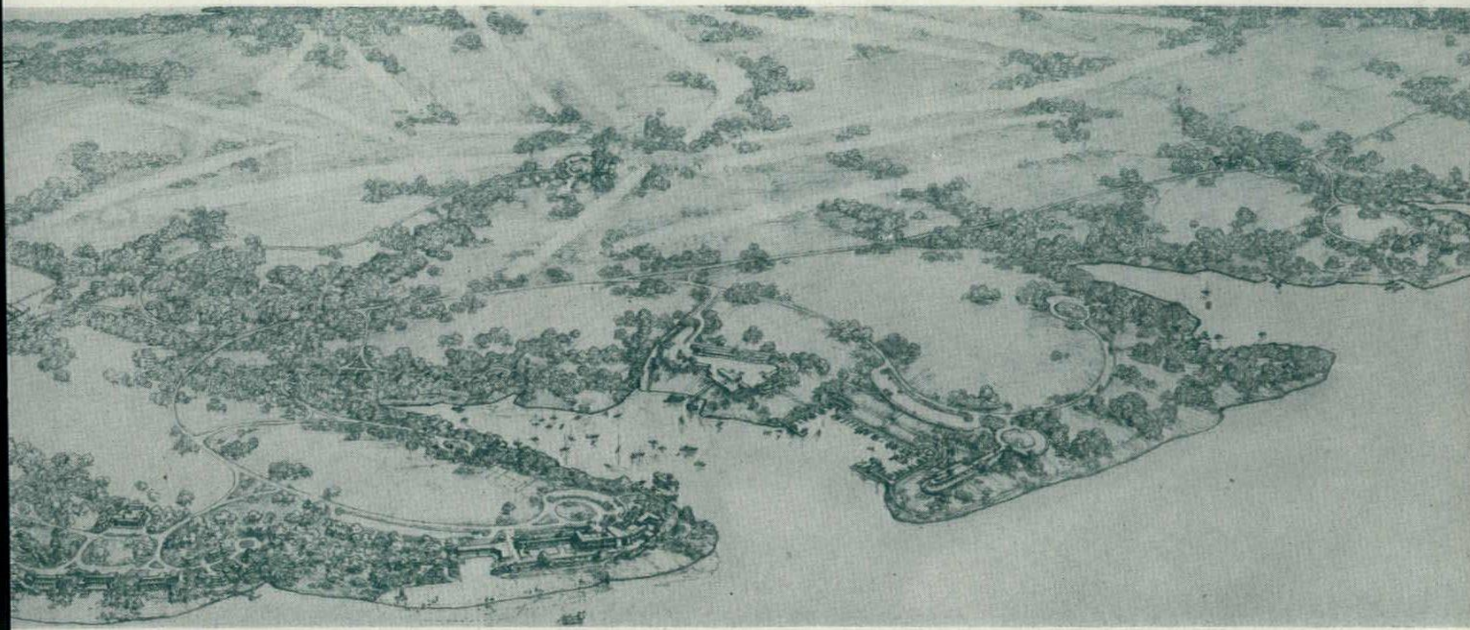
1.

1. Aerial photograph of the Preston Bend area; the broken white line indicates the proposed boundaries. Almost the entire length of the meandering shore line is wooded. 2. The head of the peninsula reaching far out into the lake, was selected for the principal recreational development. Provisions are made for a concession building or lodge (see proposed plan, Page 64), a bathing beach, vacation cabins, boating facilities, a golf course, camp grounds, picnic areas, facilities for minor sports and horseback riding and possibly summer home sites. 3. Detail of proposed development for the northeast part of the Preston Bend area—concentrated around the principal boat basin.

The boat basin is in the central foreground of the perspective sketch of Preston Bend (across page). In the left foreground are the lodge, beach, and vacation cabins; a golf course occupies the central portion.

2.





PRESTON BEND AREA, TEXAS

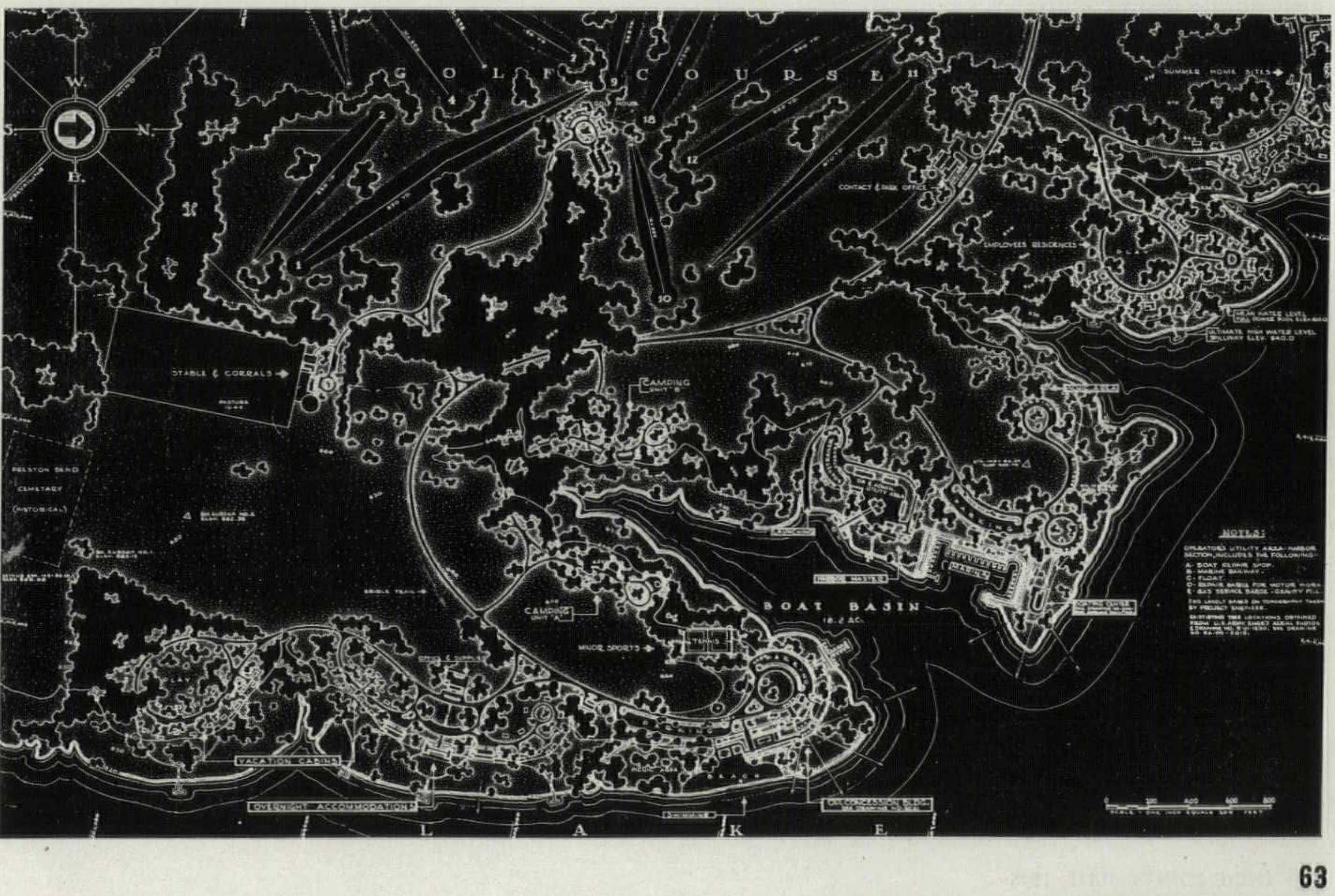
An area of about 1,000 acres at the head of the peninsula is the primary site recommended for recreational facilities on the Texas shore. In addition to having the necessary elements for interesting development and an advantageous relationship to large expanses of water, the land approach is well adapted for administrative control and can readily be joined with a short, new approach road by existing State Highway 91.

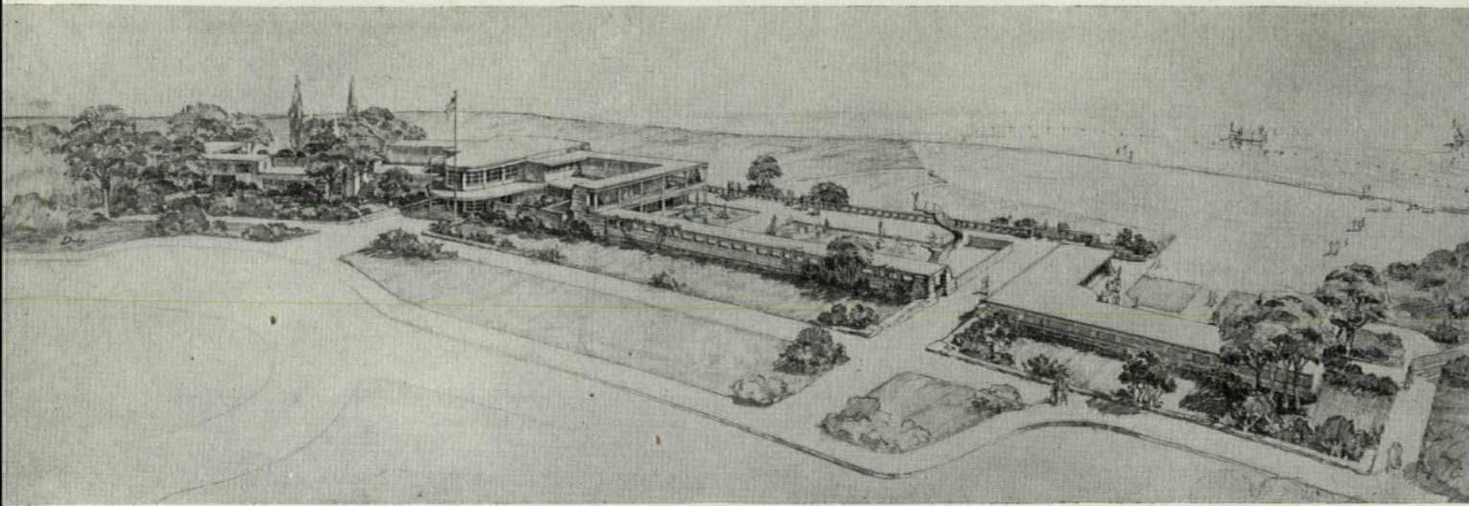
The land in general slopes gently from the center of the peninsula in all directions toward the shore line; the 23-acre site for the boat basin is ideal with relation to protection from the prevailing breeze.

There is a multiplicity of protected coves around the peninsula which not only provide boat anchorages but offer pleasing variety of contour and outlook. A good proportion of the shoreland is wooded, and about 60 percent of the land either has been or is now under cultivation.

Little Mineral Bay, just east of the peninsula, provides almost unlimited open-water mooring for boats and an excellent site (on the east shore, near the mouth) for full development of fishing facilities. Proposed buildings for the latter, shown on Page 65, are arranged in a group known as Grandpappy Fishing Village.

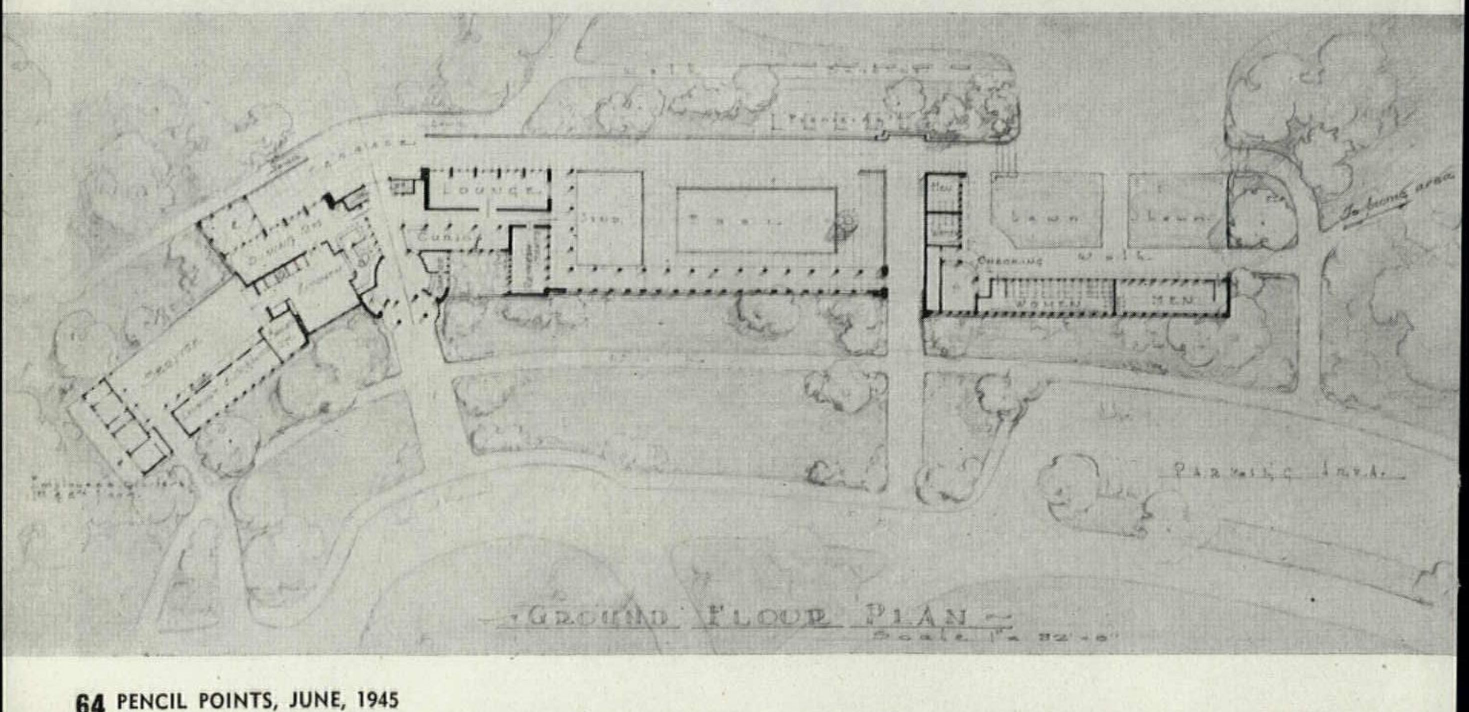
3.





LODGE FOR PRESTON BEND

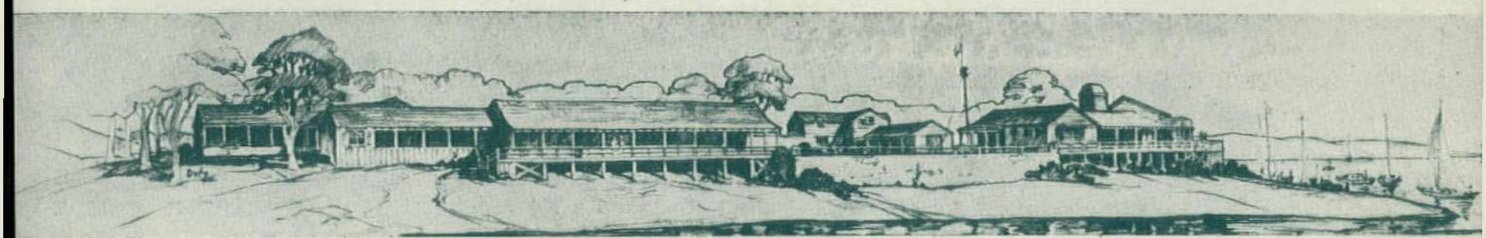
Located on the east point flanking the boat basin, the Lodge or concession building is centrally placed with respect to other public-use facilities. In addition to a restaurant, public lounge rooms, space for sale of refreshments and souvenirs, a recreation room is planned on the second floor for dancing and educational lectures. Rest rooms, employe quarters, and a public information booth are also included. The building faces northeast overlooking the broadest expanse of the lake. At one side is an ideal location for a beach, and the plan indicates a bathhouse to serve both the beach and a swimming pool. The latter is suggested for use in swimming tournaments and races as well as for those who prefer quiet, restricted water. Like the other plans drawn up by the National Park Service, this one is simply a proposed scheme, indicating general use of space and the approximate desired character.

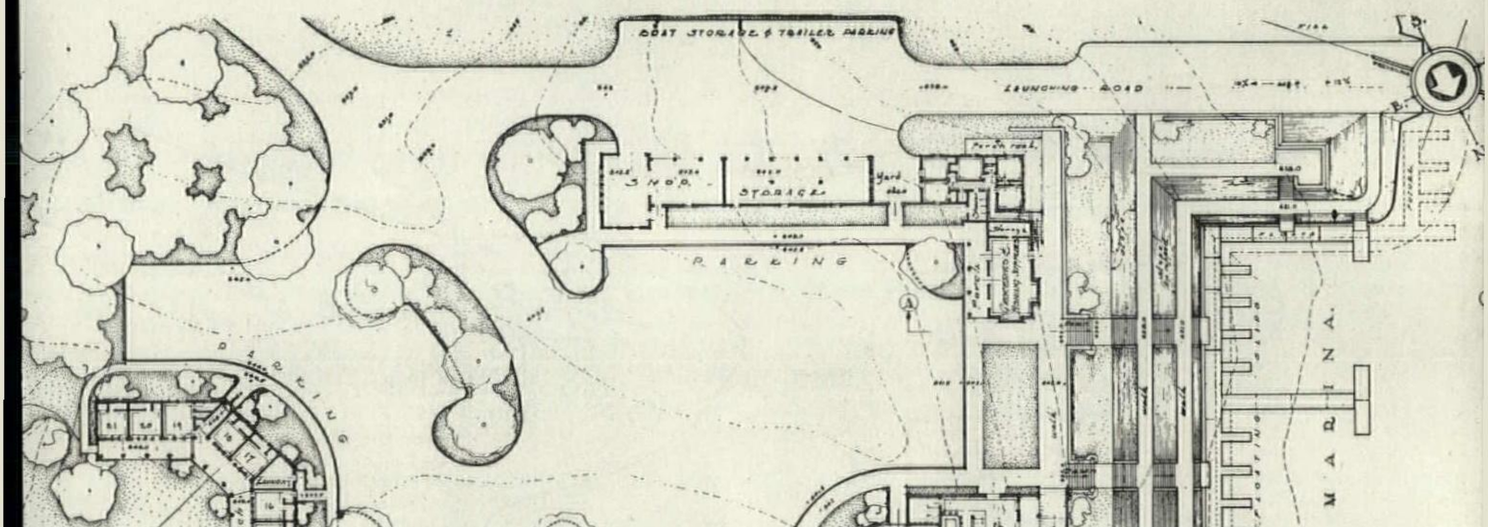


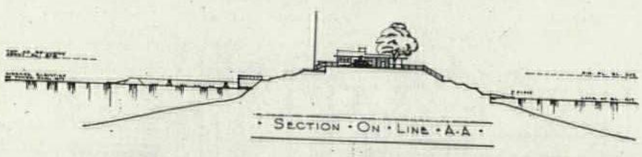
Fishing is expected to be one of the principal attractions at Lake Texoma. Most of the fish caught in the Red and Washita Rivers in the vicinity of the reservoir location are buffalo, drum, carp, and several varieties of catfish and perch. Large-mouth bass and crappie are also caught locally.

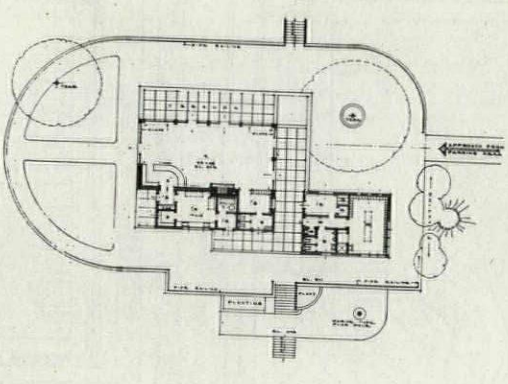
The lake waters should support large numbers of certain warm-water fishes, particularly crappie, white bass, black bass, carp, and catfish. A regular stocking program is under consideration; already the experiment of stocking large-mouth black bass has proven highly satisfactory.

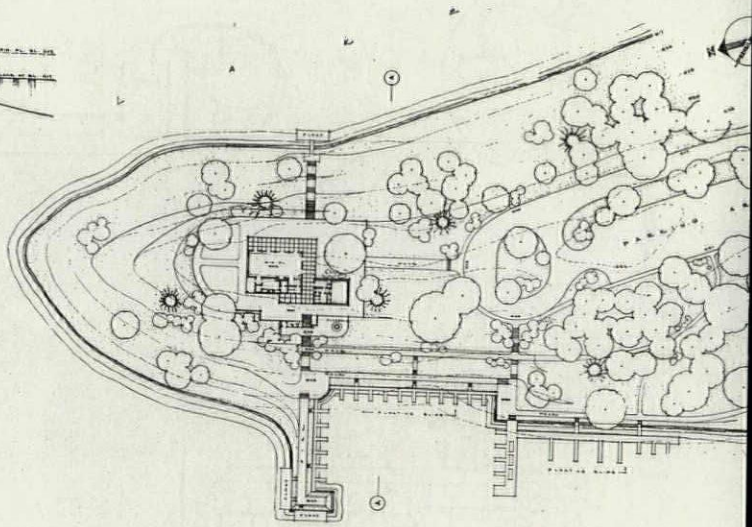
Grandpappy Fishing Village, on little Mineral Bay, is planned to provide full facilities for fisherman-vacationists. Reached either by a 3-mile boat trip from the Preston Bend peninsula or (with completion of a proposed 1½-mile spur road) by car from State Highway 91, the community consists of a concession building (eating, refreshments, lounge room, booking office, dancing space, and screened dining and lounge veranda) located centrally with respect to views and lake activities; a lodge with moderate-price sleeping accommodations for 50 guests, and space for sale of supplies and storage and repair of fishing boats. These are all closely grouped for convenience. A "marina" provides floating slip anchorage for approximately 45 craft.



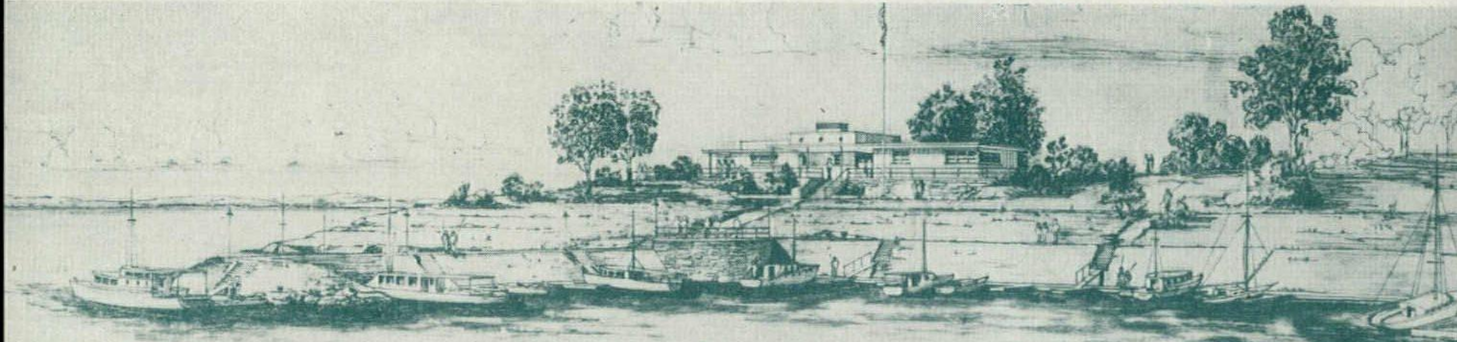






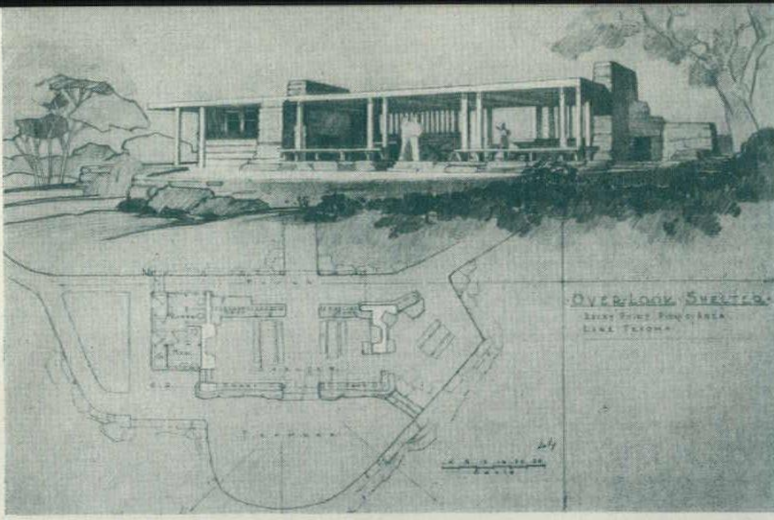


COMMUNITY BOAT CLUB AND DOCKS



WASHITA POINT AREA, OKLAHOMA

Facilities proposed for the area of concentrated development on the Oklahoma side of the lake are similar to those for the Preston Bend area. The principal concentration is centered around the boat basin. In the perspective sketch of the area on the facing page, sites for the community boat club and for summer homes are indicated at the left of the entrance to the boat harbor; in the background is the head of the Preston Bend Peninsula. At the right of the boat harbor is the central lodge or concession building, with vacation cabins and hotel-type accommodations confined to the long narrow point at extreme right of the sketch.



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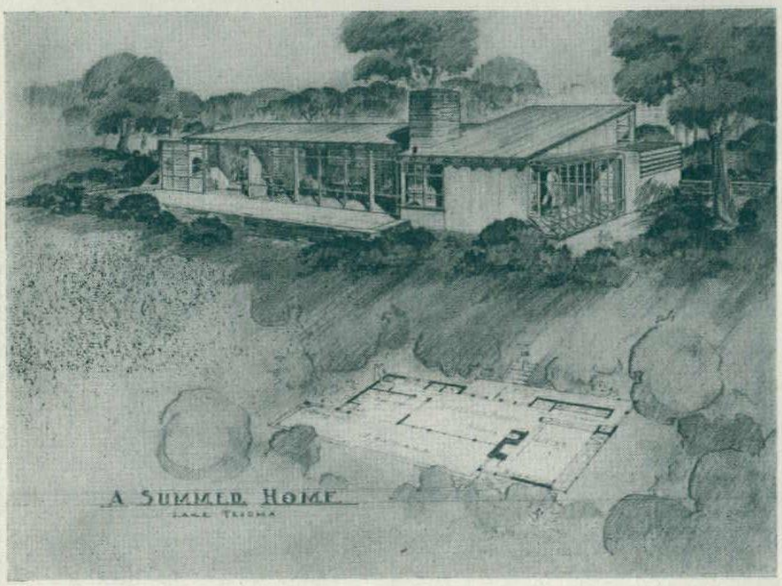
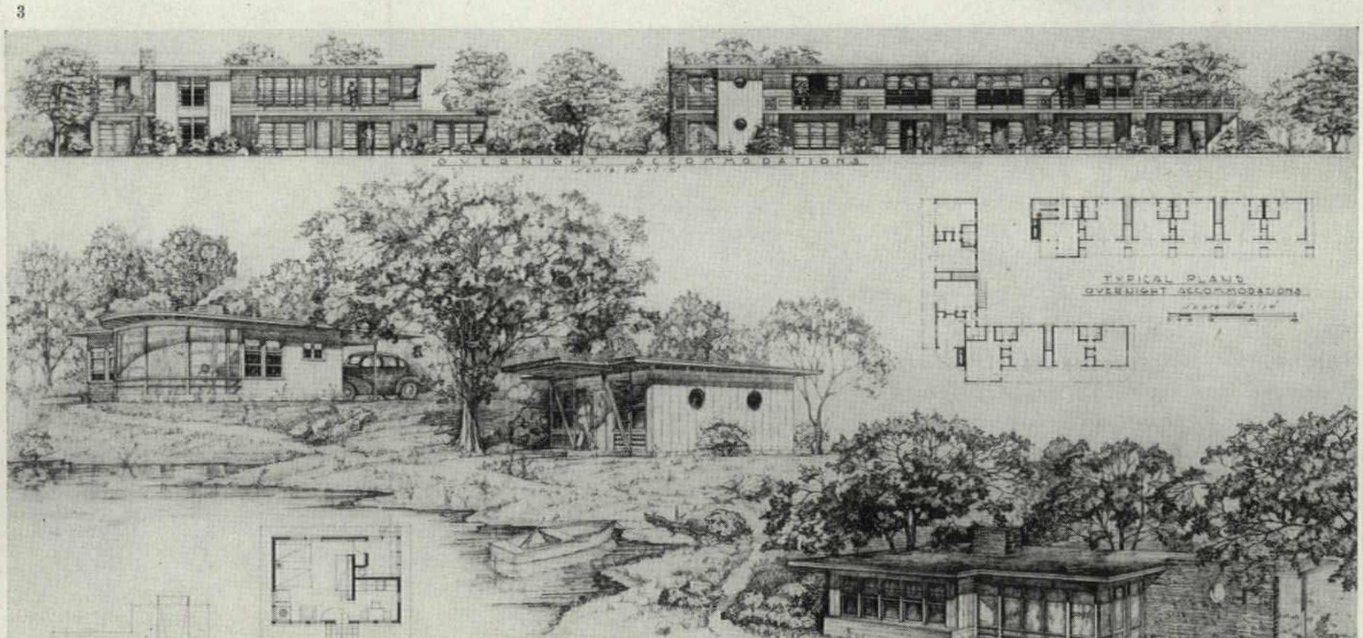
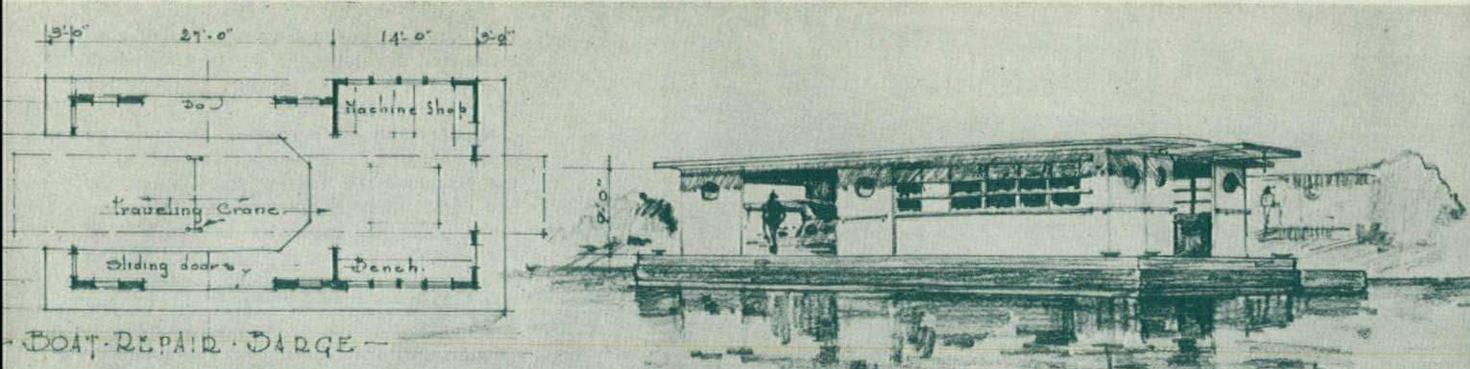


2

1. Typical overlook shelter. 2. A summer home. 3. Overnight typical camps.

3





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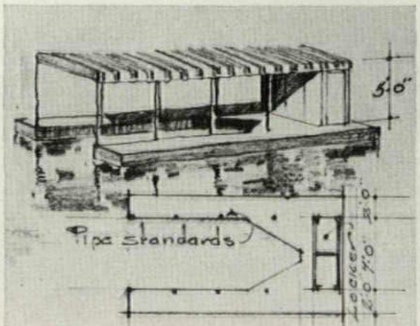

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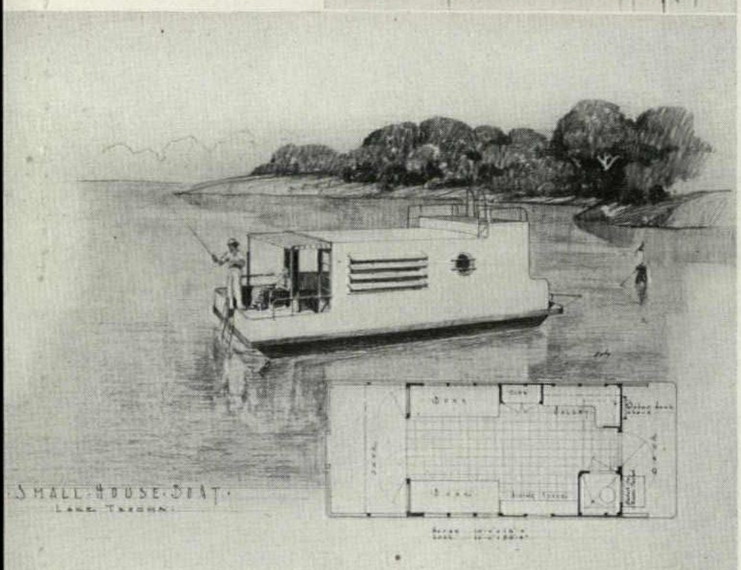

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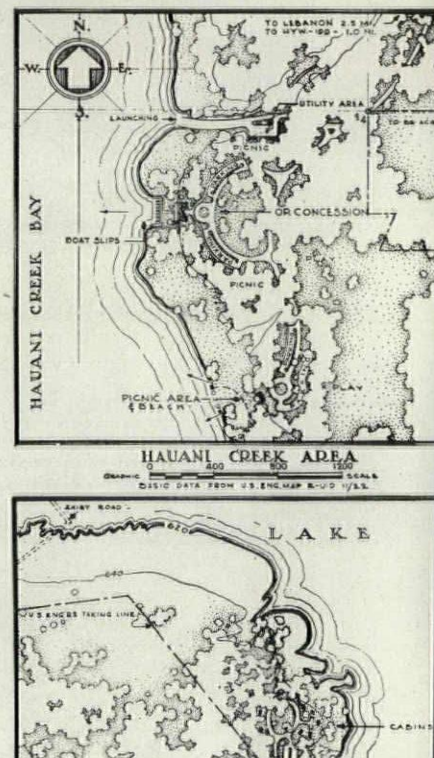
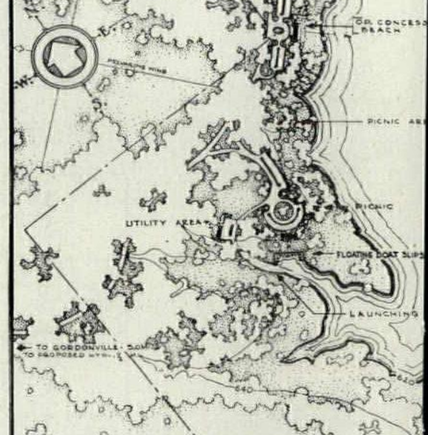
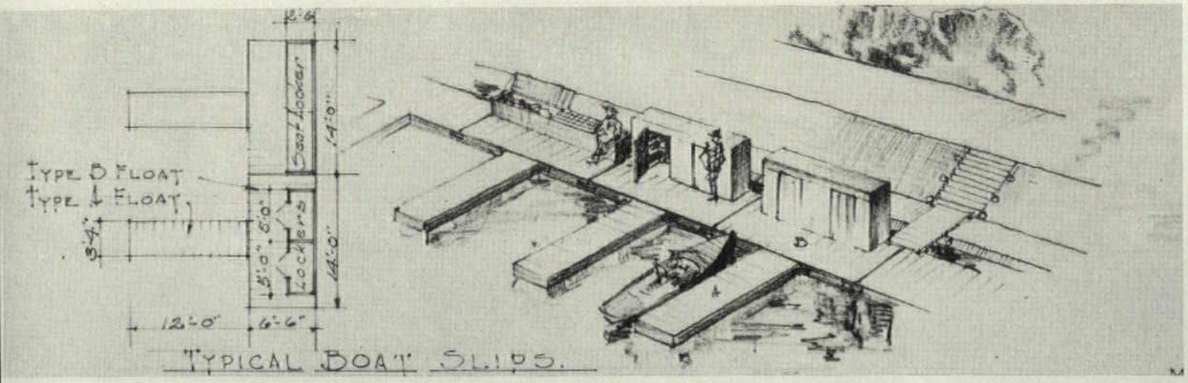




Among the more unusual structures proposed for vacationers throughout the Lake Texoma development are various shore line accommodations to serve boating activities or floating facilities for use on the lake. A few of these are shown on these two pages.

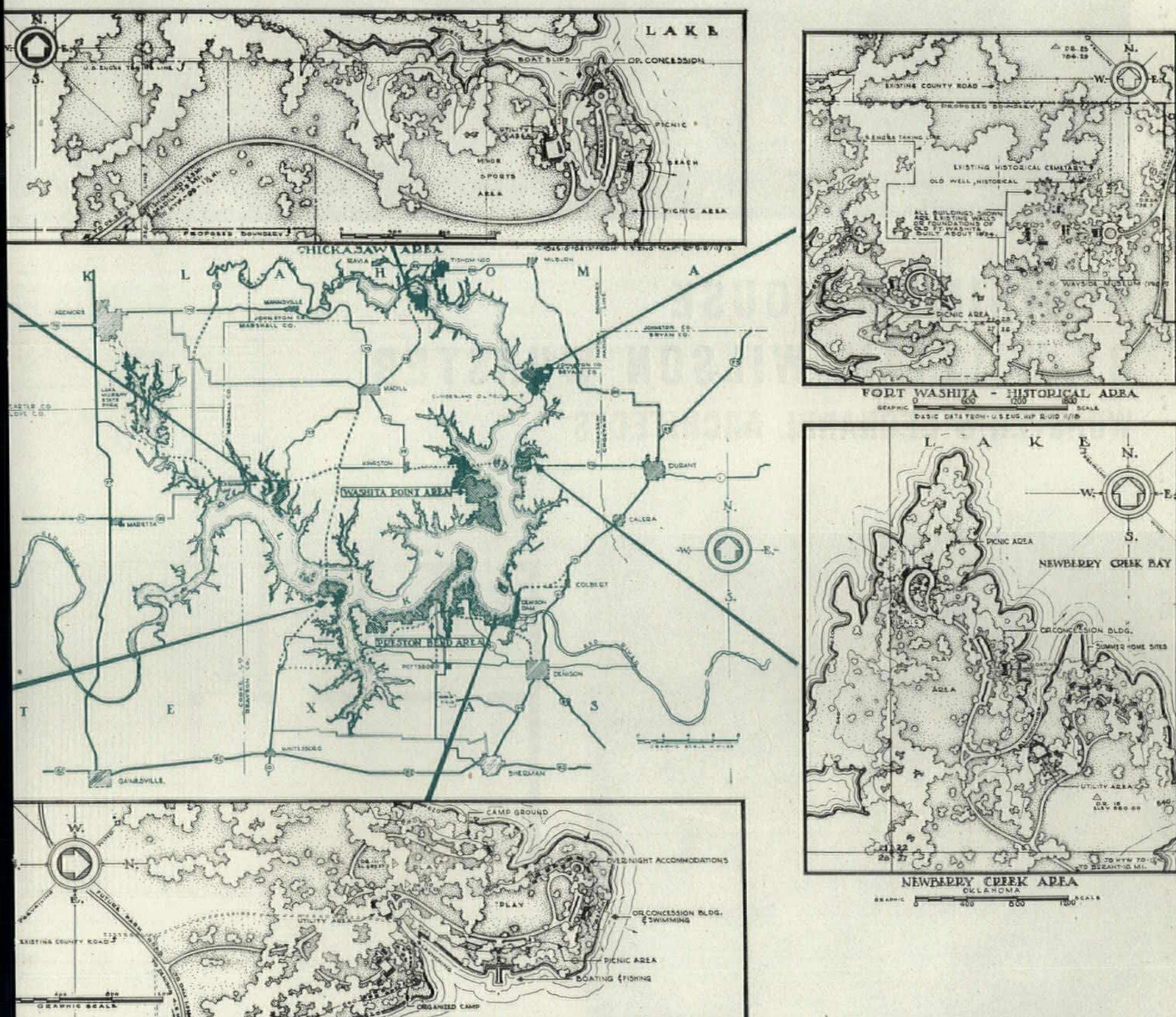
1. Boat repair barge. 2. Minimum private boat shelter. 3. Floating cabin. 4. Typical boat slips.



4.

OTHER PLANNED AREAS

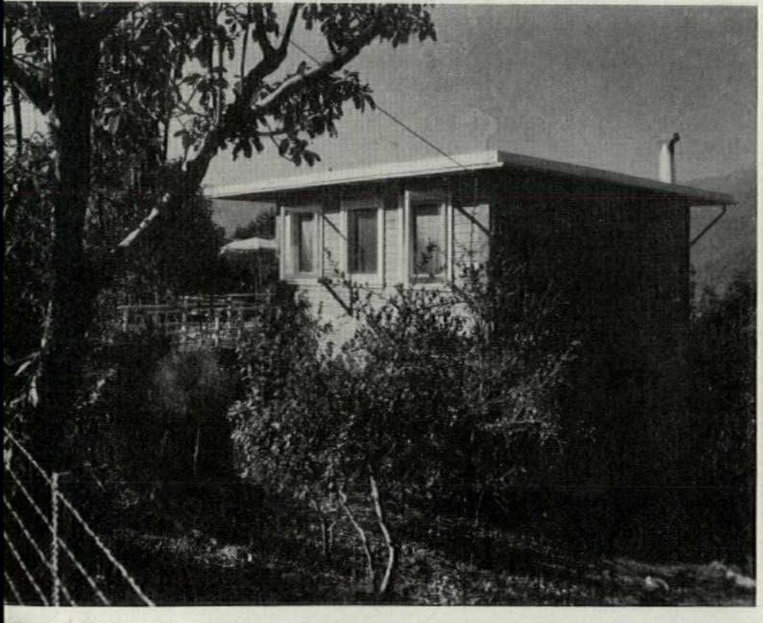
While Preston Bend and Washita Point are the main development areas, the National Park Service has also worked out secondary developments for various other locations. The combined map (below) shows the location of these and the recommended plans.

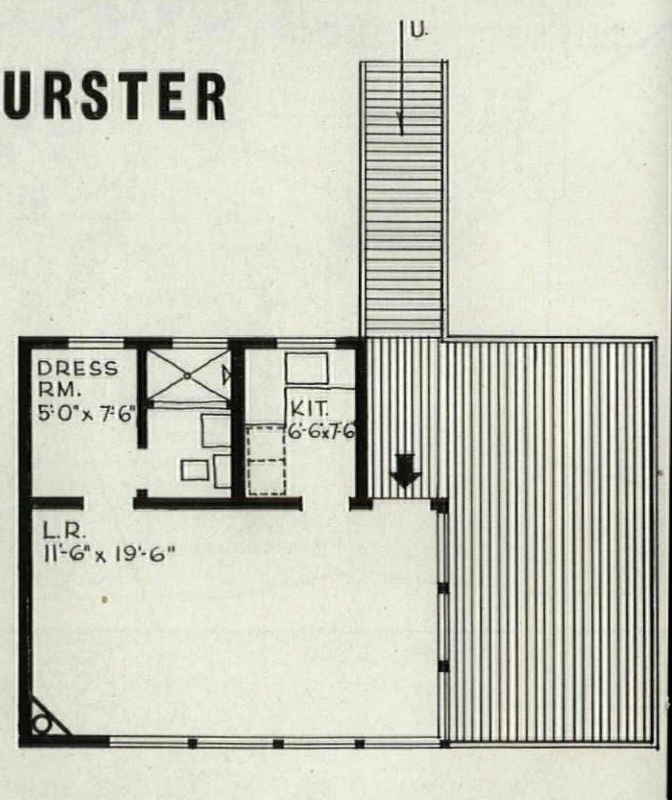


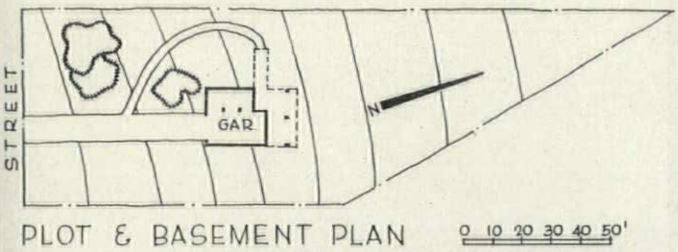
Roger Sturtevant

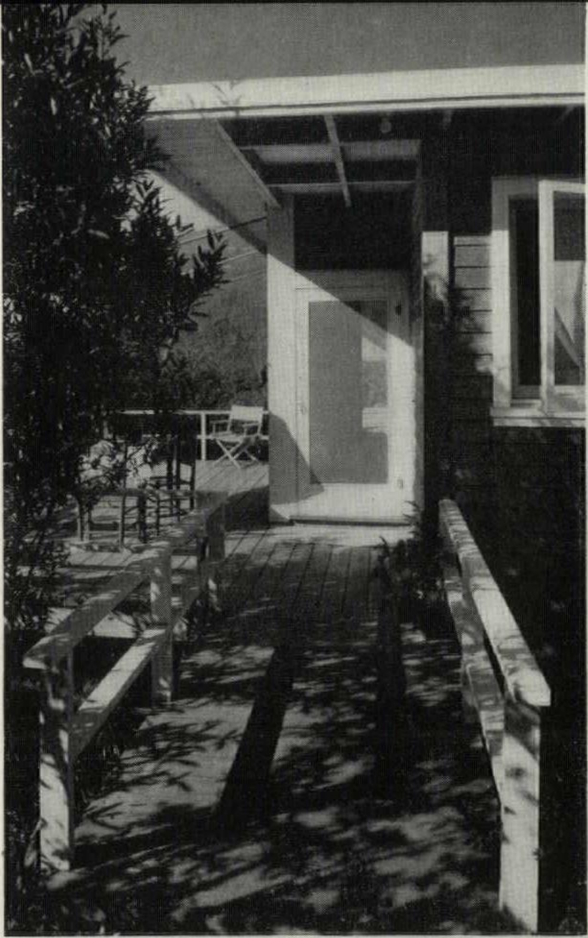
A MINIMUM HOUSE BY WILLIAM WILSON WURSTER

WURSTER & BERNARDI, ARCHITECTS





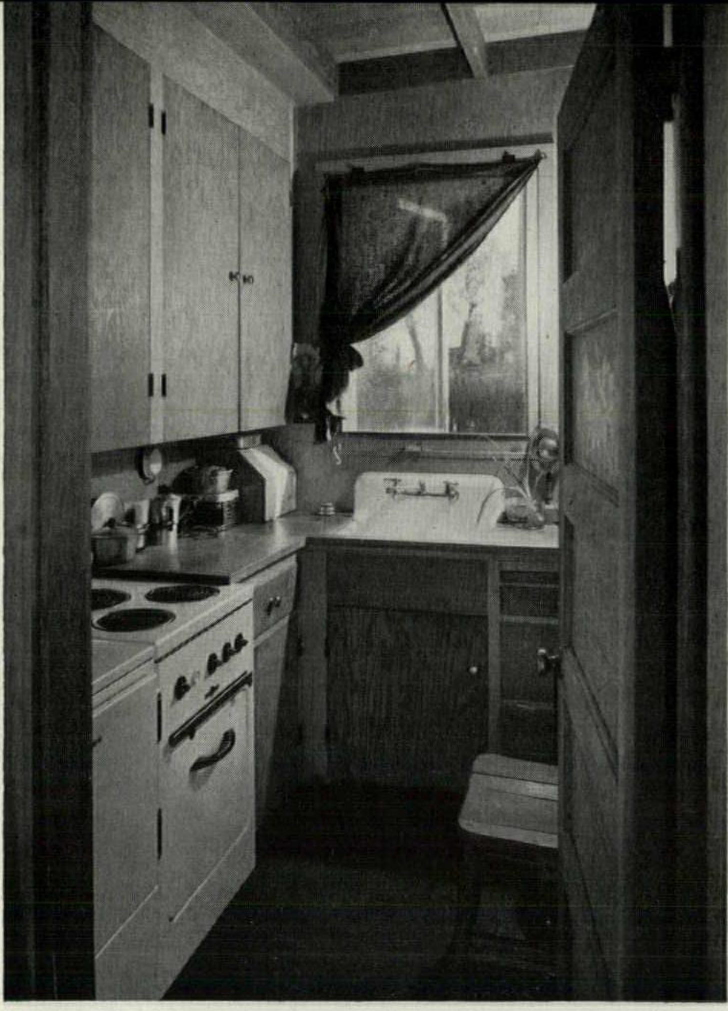




"Freedom from care" might be called the major criterion in the design of recreational structures. While the cottage shown here was in fact built for year-round occupancy by an older person, it might well be a vacation house, and we include it in this issue for its success in eliminating non-essentials and providing full living facilities for less than $2,600, including architect's fee.

Square in plan (with the exception of the entrance corner), the enclosing walls are standard frame construction, finished outside with redwood siding; inside, with fir plywood. The land slope allowed a low-cost, full-height basement which, because of the location of the access road, was usable as the garage. In addition, there is ample storage space and a place for the water heater.

This "meat and potatoes" house is an excellent instance of Mr. Wurster's long-held contention that no job is too small if it gives the designer an opportunity to develop a real idea. Thus, the advantages of good contemporary design reach yet wider application and usefulness.

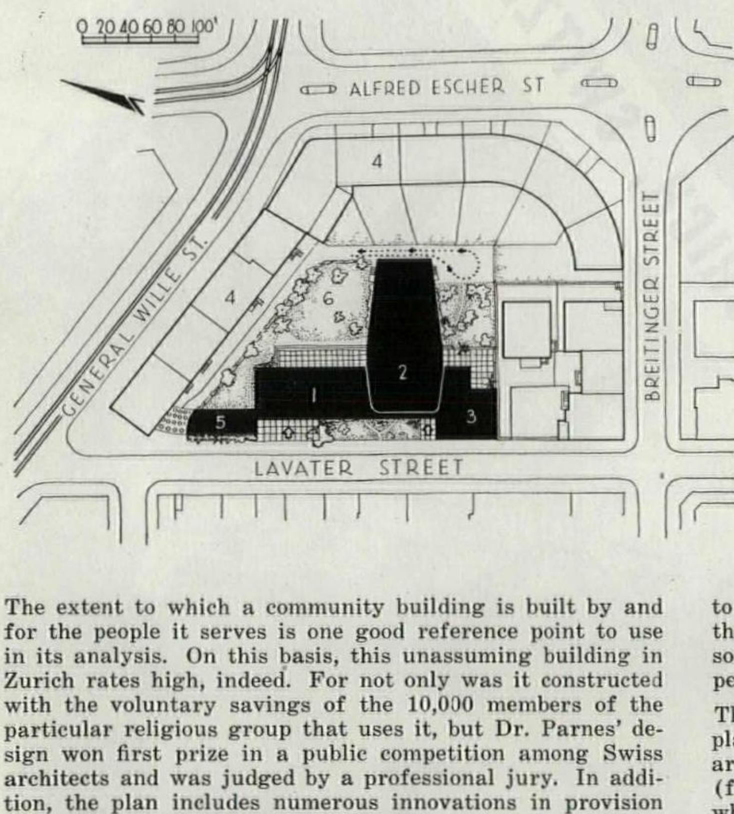


The kitchen, only 6'-6" by 7'-6" is arranged in an efficient L-shape. Cupboards have ¾" plywood doors. Counter and drain board are of sugar pine.

A Franklin stove heats the living room; walls are plain fir plywood sheets from floor to ceiling; flooring is T and G fir, finished with one coat of oil.

COMMUNITY BUILDING, ZURICH, SWITZERLAND

LOUIS PARNES, A.I.A., ARCHITECT



1. School and Administration. 2. Assembly Hall-Auditorium. 3. Club Rooms, etc. 4. Apartment Houses (Dr. Louis Parnes, Architect). 5. Janitor's Apartment. 6. Garden.

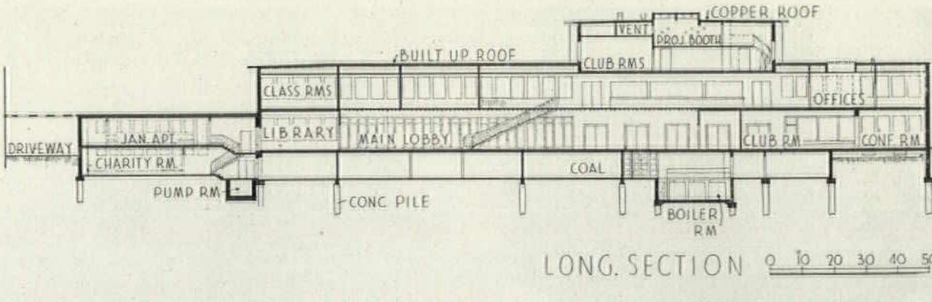
COMMUNITY BUILDING ZURICH, SWITZERLAND

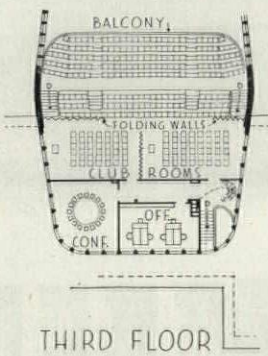
LOUIS PARNES, A.I.A., ARCHITECT

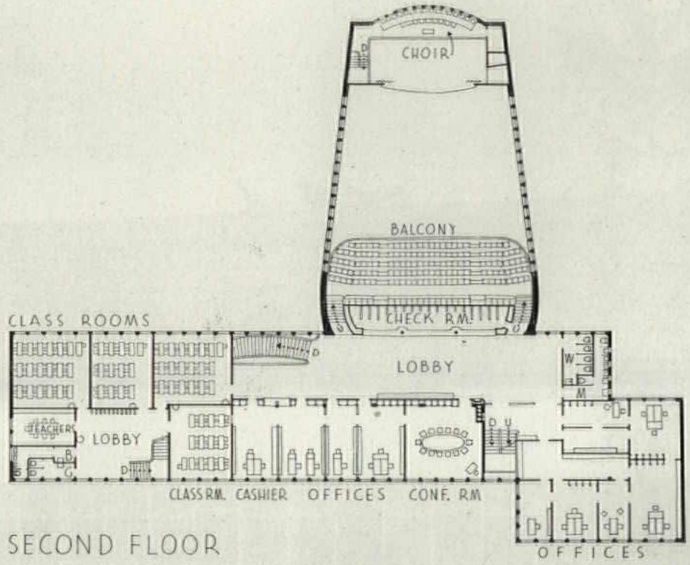
The extent to which a community building is built by and for the people it serves is one good reference point to use in its analysis. On this basis, this unassuming building in Zurich rates high, indeed. For not only was it constructed with the voluntary savings of the 10,000 members of the particular religious group that uses it, but Dr. Parnes' design won first prize in a public competition among Swiss architects and was judged by a professional jury. In addition, the plan includes numerous innovations in provision for use-flexibility, and the structure exploits some of the potentials of reinforced concrete in new and exciting ways.

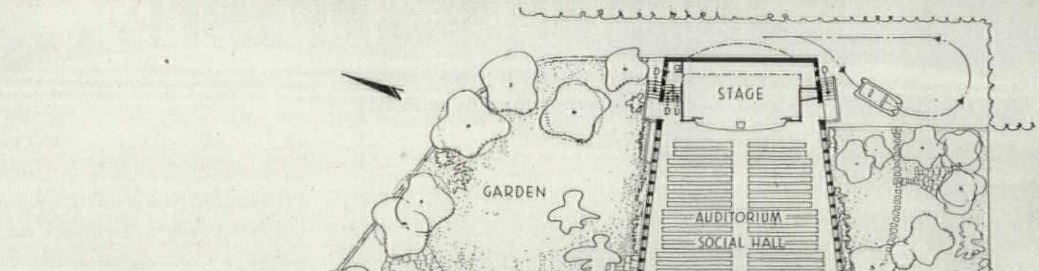
The building's purpose is to serve all the cultural, communal, and devotional needs of the community—library, school, clubs, theater, charity and social welfare, banqueting, dancing, religious service, etc. An important plan requirement was that the various public rooms should be so arranged that they could readily be rented to other groups to produce income for the support of the building. Hence, the separate functions, though interrelated, are organized so that any one—or any combination—may be used independently; each sub-area has an outside entrance.

The architect had the entire city block to design; a basic plan factor was the division of the property into two main areas—one for the community building; the other for sale (for the construction of apartment buildings), income from which would help finance the community structure. The two main-street frontages, with their high land value, were assigned for the apartment development; the largest, but cheapest, portion (facing a secondary street) was reserved for the community building. On this land, local ordinances restricted the building height, but the location had the distinct advantage of being well screened from both of the main streets with their noise and traffic. Actually, the lower building height worked out to provide the apartment houses









with excellent light and air conditions, and allowed the architect to develop a horizontal traffic scheme within it that effects a functional connection between room groups without cross traffic.

The Community Building is made up of two main wings—the one on the street front for offices, school facilities, club rooms, and janitor's quarters; the higher block, containing the assembly hall, arranged at right angles toward the rear to make the most advantageous use of the interior garden area. The structural, hence visual, joining of the low building with the taller apartment houses alongside was skillfully handled by means of intermediate elements—the perforated canopy over the driveway and the low mass of the janitor's apartment, which, increasing in weight and emphasis, lead up to the main community structure as the dominant element.

Heavy-traffic rooms are all on the first floor; each main group has its own outside entrance; kitchen, strategically placed to serve club rooms, assembly hall, or both. Angular relation of lobby and auditorium facilitates uninterrupted one-way traffic from entrance to check room to assembly hall; prevents drafts from the entrance into the hall. During intermissions, large lobby accommodates entire audience who can enjoy garden outlook through window wall.

Long walls of second floor have continuous window bands with slender concrete piers 5 feet on centers to allow flexible room sizes and arrangements; windows of all rooms extend from wall to wall and to the ceiling, eliminating glare. Floors, walls, and ceilings of classrooms are surfaced with materials that assist acoustical control.

Flexible walls permit two of third-floor club rooms to be thrown together or to become added space in the auditorium balcony.

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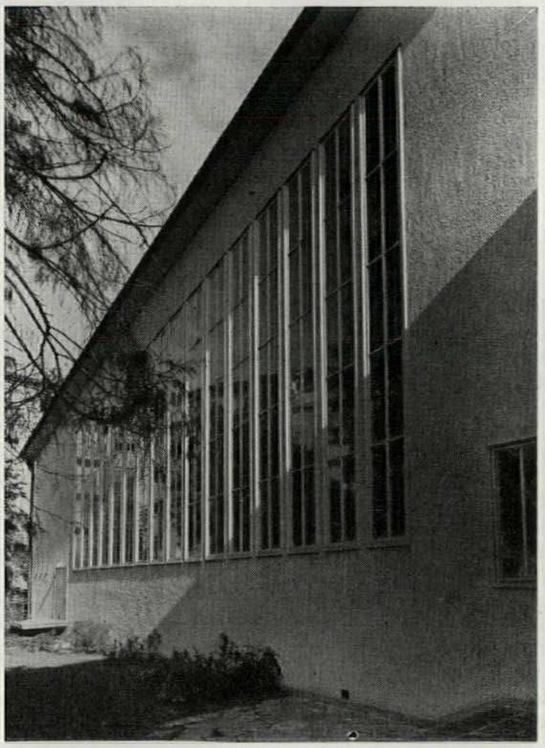

STRUCTURE

Three chief factors led to the adoption of a monolithic, reinforced concrete scheme: 1. desire for large window openings; 2. wish to keep structural elements as small as technically possible; 3. construction and maintenance economy. Exterior walls are but 4 inches thick; piers between standard windows have a section of but 5" x 8", and the vertical divisions between the 38-foot-high auditorium windows are splayed sections, 4 inches on the inner face, 9 on the outer (see detail, Page 79).

Exterior walls are insulated with one-inch asphalt impregnated cork, applied to interior wall surfaces and plastered, except on the auditorium piers, where the insulation comes on the exterior. All window sash are of wood. Exterior wall finish is a special hard white stucco.

In the auditorium construction (described on pages following), many refinements and innovations in the precise use of reinforced concrete are included. In the main lobby, the free-standing curved stairway is a further instance. Since it is located against a wall of windows, the need was for the lightest possible construction. To accomplish this, principles of bridge construction were applied, and the lower portion of the stair is a section cantilevered from the floor slab. The remaining portion, spanning between the cantilever and the second-floor slab, is a simple, normal slab of but 7 inches in depth.

***1.** Garden front; integration of outdoor and indoor space was considered an important design factor. **2.** Auditorium wall. **3.** Ground-floor club room. **4.** Conference room. **5.** Library entrance; book storage, left; reading room, beyond. **6.** Check room counter in main lobby. **7.** One of the classrooms, equipped with movable stools and tables. **8.** General view of lobby; entrance to auditorium at right. **9.** Detail of "bridge constructed," free-standing stairway in lobby.*

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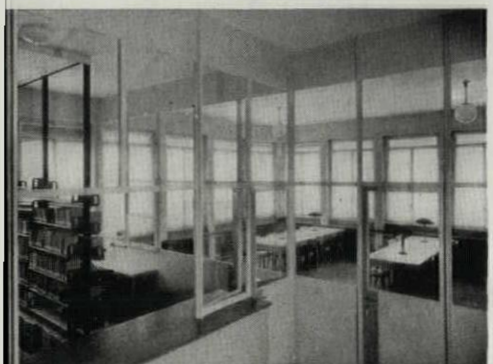

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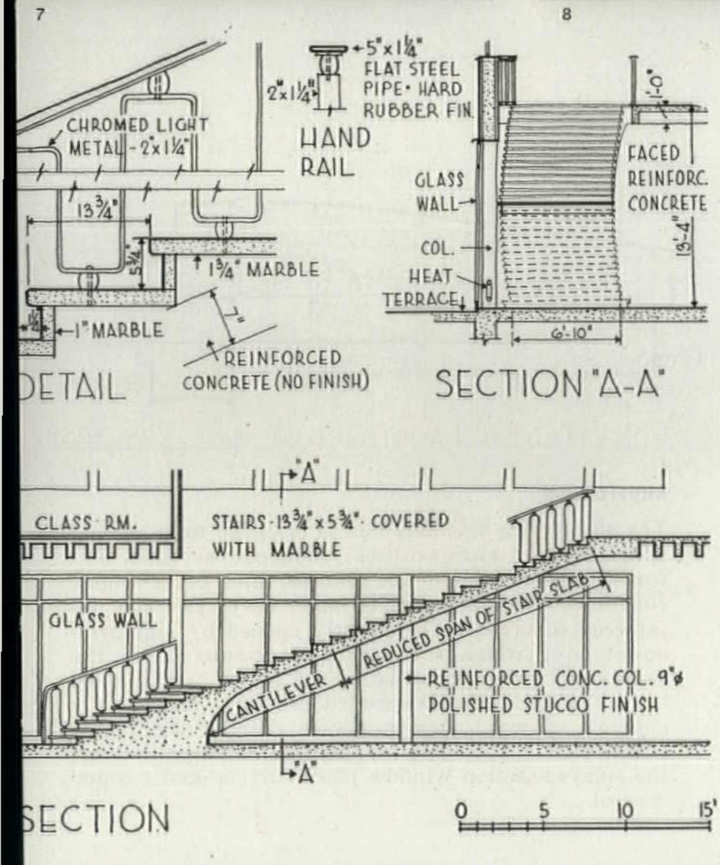

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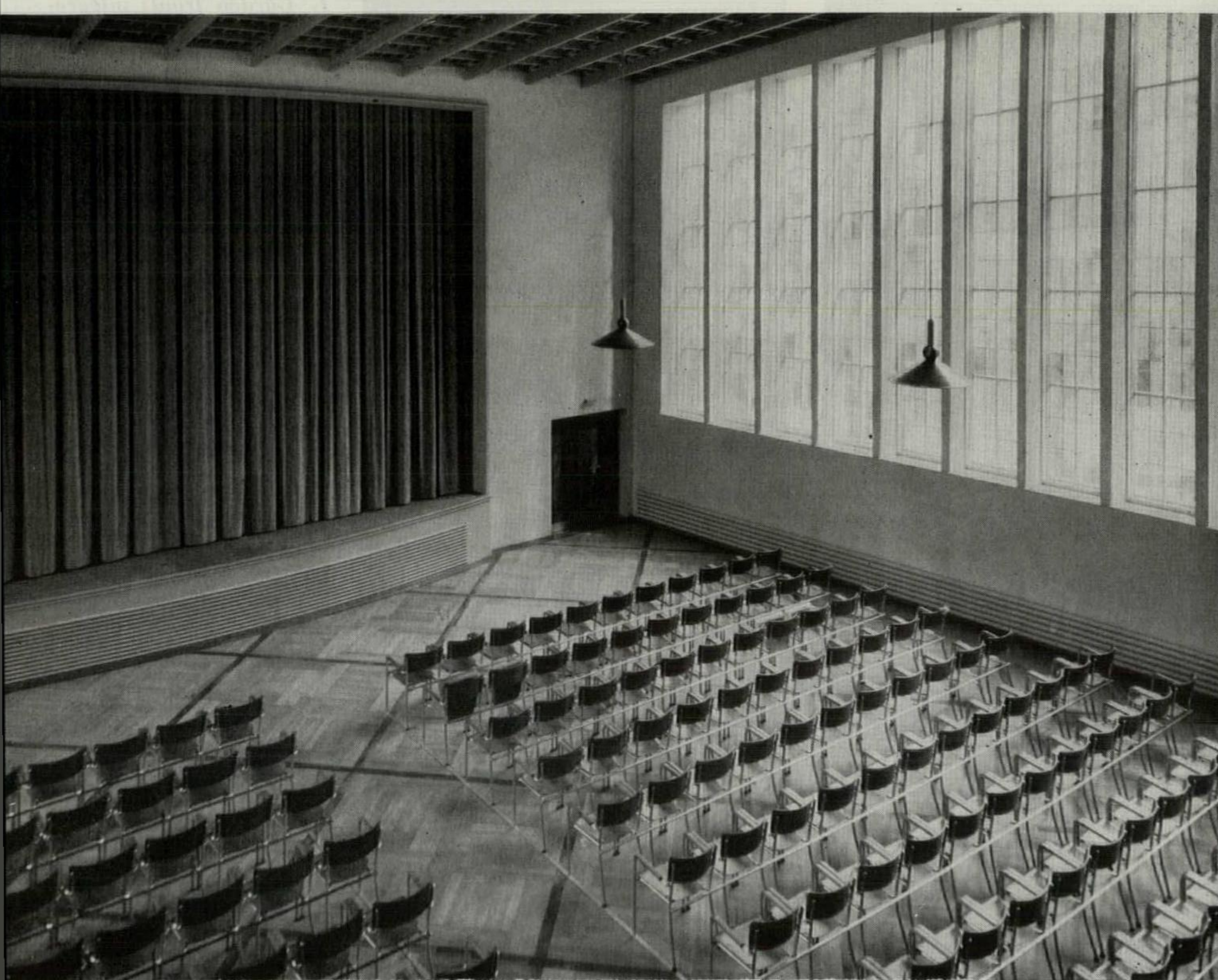
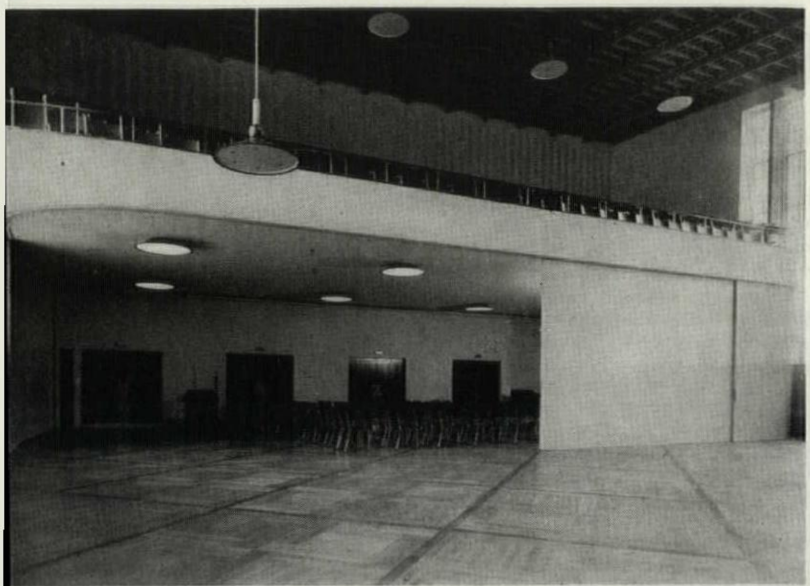


LONG. SECT. THRU AUDITORIUM

AUDITORIUM

The auditorium-assembly hall is designed to be readily adaptable for various uses: religious services, lectures, concerts, banquets, dances, and other public functions. The structure is made up of two side reinforced concrete walls (mostly opened by high windows) over which seven concrete beams carry the sloped roof slab. Acoustically, the funnel-section room is controlled by the suspended ceiling made up of a network of wood members (see detail), the trapezoidal plan shape, and the parabolic curved ceiling; the splayed-section window piers further assist sound control.



Seating is of movable armchairs with light chrome metal frames and birch plywood seats and backs.

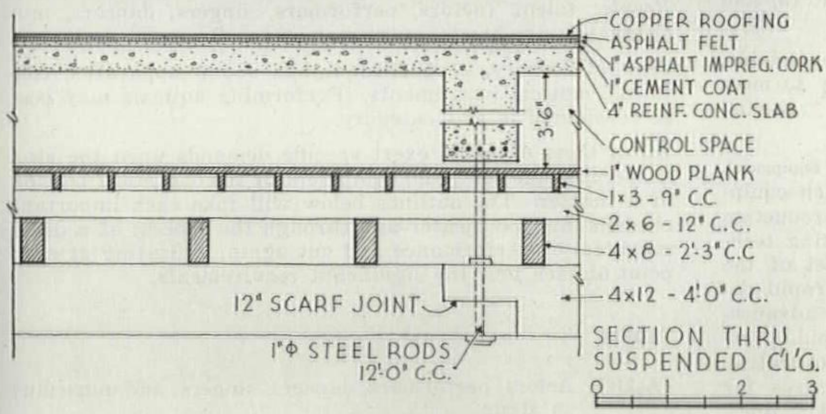
A metal pipe at the back holds the chairs in straight rows; the legs of end chairs fit into screwed-down metal floor strips to keep space between rows constant. For religious services, etc., small bookrests are readily attached to the backs of chairs (see balcony seating photograph, at left). The seats are readily stacked, for storage beneath the stage.

Wall panels on tracks pull around to form a separate small auditorium of the under-balcony area.

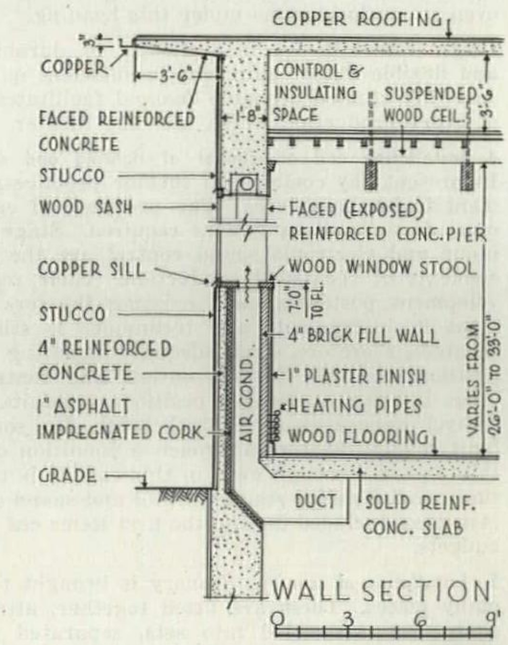
Lights may be raised or lowered, depending on the particular effect desired; low, for banquets and religious ceremonies; high, for general assemblies, dances, etc.

A dual heating system controls the auditorium; hot-water pipes along the window sill walls insure the room from going below a safe minimum temperature; when the room is to be used for a gathering, this is supplemented by a conditioned-air system which quickly brings room temperature to the desired level; in summer (through the same ducts within the sill walls, with grille openings on the top of sill walls), cold air is supplied.

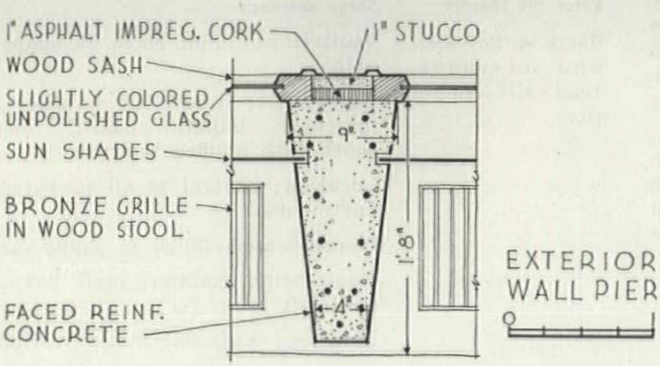
Because of the high window surfaces of the auditorium, the lower portion of the balcony had to be cantilevered; an additional structural factor was the need for windows beneath the balcony, to bring light to this area when the movable panels are pulled around. The main support of the balcony is a 6'-6"-deep reinforced concrete beam, carried on the thin room walls and stiffened by the concrete shell of the balcony.



SECTION THRU SUSPENDED CL'G.



WALL SECTION



EXTERIOR WALL PIER

ASSEMBLY HALL DETAILS

The Performance in the Theater

by Edward Cole and Harold Burris-Meyer

Edward C. Cole, Assistant Professor and Technical Director, Department of Drama, Yale University School of Fine Arts, and Lt. Comdr. Harold Burris-Meyer, USN, on leave from his post as Professor of English, Department of Humanities, Stevens Institute of Technology, are well known for their contributions to good housing for the American theater. This article is a condensed chapter from a book on theater design which they have in preparation.

An architect, intelligently to plan a theater, must know the uses for which the building is to be planned. The process of preparing a theatrical production culminates in an operation called "taking-in the show" which means assembling all the elements of the show within the theater and making them ready for the performance. An involved sequence of operations must be analyzed and the elements examined to determine how they best may be accommodated "backstage" in the working portions of the theater building. This article proposes to state first the sequence of operations and then to consider how each of the elements of the show fits into the sequence, in order to derive the architectural requirements of each operation and element. Outline form is used as being more concise and more indicative than prose.

OPERATIONS INVOLVED IN TAKING-IN THE SHOW

1. **Architectural alteration of the theater.** Necessitated by
   a. archaism of the theater.
   b. productional requirements: production very large; theater too small, more often the case; production designs require it, as for Jumbo, The Eternal Road, The Great Waltz.

The theater planner must anticipate a variety of demands and provide a theater which is large enough to meet reasonable maxima.

2. **Adjustment of permanent equipment.** The varying demands of theatrical productions require that all equipment of the stage including even the stage floor and the act curtain (fire curtain excepted by law) be either movable or removable.

3. **Installation of new equipment.** Special flying equipment, cycloramas, tormentors, light bridges, stage elevators, and even stage floors come under this heading.

Original installation in a theater of durable, dependable, and flexible stage equipment in sufficient quantity to meet carefully studied probable demand facilitates the "take-in" of every production which uses the theater.

4. **Installation and adjustment of lighting and sound equipment.** In present day commercial theater practice no such equipment is in the theater. The producer of each production must furnish all equipment required. Stage lighting technique and electronic sound control are the newest of the elements of theatrical production. Their recent rapid development postdates most existing theaters and advancement in instruments and techniques is still rapid. Few theaters, therefore, have adequate mounting and operating positions, branch circuits, outlets and control boards for stage lighting or speaker positions, conduits, "mike" lines, control apparatus or control booth for sound. Recently built college theaters approach a condition of adequacy in this regard although even in this case it is to be suspected that provisions for stage lighting and sound control are the last items included in, and the first items cut from, building budgets.

5. **Installation of scenery.** Scenery is brought to the stage in many pieces. These are fitted together, attached to stage equipment, assembled into sets, separated and stored in planned positions on the stage. The handling of scenery is routined and rehearsed by stage hands before the performance.

6. **Properties fitted to sets.** Properties are all objects which ornament the scenery and stand in the acting area: furniture, draperies, art objects, pictures, rugs, shrubs, flowers, etc., as well as all objects which are manipulated by the actors. Props are brought to the stage in trunks and crates, are unpacked, fitted to each set of scenery, and placed in planned storage positions. The handling of props is routined and rehearsed by property men.

7. **Rehearsal of lighting, sound, and scenic effects by stage manager and stage hands.**

8. **Rehearsal of parts of the production in which actors are closely involved with lights, sound, or mechanical parts.**

9. **Costumes received, unpacked, inspected, fitted, altered, repaired, pressed, distributed to dressing rooms.**

10. **Dress parade.** Actors wear costumes in sets and under lights. Move about to test costumes under performance conditions.

11. **Dress rehearsals.** Actors wear make-up and costumes and rehearse entire production. All conditions are as much like a performance as they can be.

12. **Performances.**

13. **Take-out.** When a show moves from one theater to another or from one town to another time is of the essence. Therefore, the plan and equipment of the theater must be conducive to speed and efficiency.

PRODUCTION ELEMENTS

The elements of a theatrical production may be divided categorically into living and dead, or people and things.

People: talent (actors, performers, singers, dancers, musicians); stage hands; stage managers; directors; designers.

Things: scenery, properties, lights, sound apparatus, costumes, musical instruments. Performing animals may best be considered in this category.

All of these elements exert specific demands upon the size, shape, arrangement, and equipment of the backstage portion of a theater. The outlines below will take each important element into the theater and through the process of a dress rehearsal or performance and out again, indicating at each point of each tour the significant requirements.

PEOPLE

TALENT: Actors, performers, dancers, singers, and musicians on stage

Enter the theater	Stage entrance
Check in, get mail and messages, read calls and notices.	**Vestibule:** minimum 50 sq. ft. shape variable. Equipment: time clock or other in-out indicator, bulletin board, telephone booth with muffled bell. Location: central to all backstage departments. **Doorman's booth:** 30 sq. ft. shape variable. Equipment: counter, mail box, small desk, key rack. Location: adjacent stage vestibule to

control all traffic to backstage part of building.

Dress for performance: take off street clothes, put on make-up, put on costume, inspection of costume.

Dressing room: minimum 50 sq. ft. per person. (See table.) School, college, community: group dressing rooms.

Professional: stars, individuals, choruses.

Opera: principal singers, choruses, ballets, supernumeraries.

Equipment: clothes and costume hangers, 2 linear feet of rod per person, 2 linear feet of show rack per person, no doors on cabinets, curtains if anything, make-up table 30" wide per person, 18" deep, mirror 18" wide per person, well diffused light, no shadows, 10 f.c. on face before mirror, one wall outlet per two persons, full length mirrors: one in each star's dressing room, one per eight persons in each chorus room, one in corridor on way to stage. Call system, phone outlet, monitor loudspeaker. One lavatory in each small dressing room, one per four people in large dressing rooms.

Location: near stage but not necessarily adjoining stage. (See Green room and Stage anteroom below.)

Make-up room: minimum 100 sq. ft. Desirable in schools, colleges, and community theaters where actors are unskilled at make-up.

Equipment: make-up tables or benches, chairs on two sides. 10 f.c. general light on faces.

Location: adjoining dressing rooms.

Toilets: use concentrated into short periods of time before show, and during intermissions. Peak load inevitable. Minimum one per six persons.

Wait for call to stage

Green room: minimum 300 sq. ft. Stage manager checks cast, assembles choruses. Directors talk to cast. Actors' social room.

Equipment: lounge furniture, tables, smoking accessories, card table set, full length mirror. Call system outlet. Telephone outlet.

Location: near stage, same level.

Stage anteroom: alternate to Green room. Minimum 150 sq. ft.

Equipment: chairs or benches.

Location: adjoining stage near proscenium.

Same use as Green room but stripped of lounge aspects. Strictly business. May be merely an enlarged passage between dressing rooms and stage.

Go to stage

Passage: minimum width 5 ft. Short and direct, *no stairs,* use ramps to change level.

Enter set and perform

Leave set

(The next four actions are alternates)

(1) Wait for next entrance

Waiting space on stage: minimum 50 sq. ft., chairs.

or

Stage anteroom.

Actors are responsible for re-entrances. Must stay where they can hear show. Monitor loud-speaker desirable in Green room or Stage anteroom.

(2) Quick change of costume and-or make-up before next entrance

Quick change dressing room: minimum 50 sq. ft. per actor. Space for dresser to help actor.

Equipment: same as other dressing rooms.

Location: immediately adjoining stage.

(3) Slow change of costume and-or make-up

Regular dressing room (see above).

(4) Wait for curtain calls

Green room or Stage anteroom.

Remove costume, clean up, and dress for street

Showers: one adjoining each star's dressing room, one for six actors otherwise. Peak load immediately following per-

PERSONNEL REQUIREMENTS FOR MAIN TYPES OF THEATRICAL ENTERTAINMENT

TYPE OF SHOW	ACTORS PRINCIPALS	ACTORS EXTRAS	PLAN DRESSING ROOMS PRINCIPALS	PLAN DRESSING ROOMS EXTRAS	STAGE HANDS	MUSICIANS	STAGE MANAGERS	DIRECTORS	DESIGNERS
PAGEANT	10 TO 50	100 TO 2000	40	500	50	100	4 TO 10	3	3
GRAND OPERA	4 TO 10	20 TO 100	10	100	50	80	2 TO 4	3	3
PRESENTATION	4 TO 10	20 TO 100	10	50	30	30 TO 200	2 TO 4	3	3
VAUDEVILLE OR REVUE	4 TO 10	20 TO 50	10	50	20	10 TO 30	2	0 TO 3	0 TO 3
OPERETTA OR MUSICAL COMEDY	4 TO 10	20 TO 50	10	50	30	10 TO 30	2 TO 4	3	3
PLAYS ("LEGIT")	2 TO 20	0 TO 50	20	30	3 TO 30	0 TO 20	1 TO 4	1	3
MOTION PICTURE PALACE	NONE EXCEPT WHEN, AS, AND IF ONE OF THE ABOVE TYPES OF SHOW MOVES IN				2	0 TO 50	0	0	0
MOTION PICTURE NEIGHBORHOOD	NONE EXCEPT WHEN, AS, AND IF ONE OF THE ABOVE TYPES OF SHOW MOVES IN				0	0	0	0	0

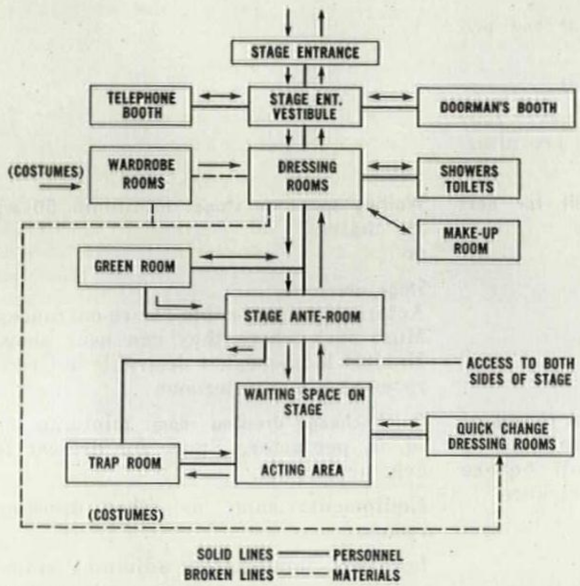
	formance; body make-up may necessitate baths by entire company.
Confer with stage manager or director	
Entertain friends after show	Green room: kitchenette adjoining.
Check out and leave theater	Vestibule and stage entrance (above).

MUSICIANS

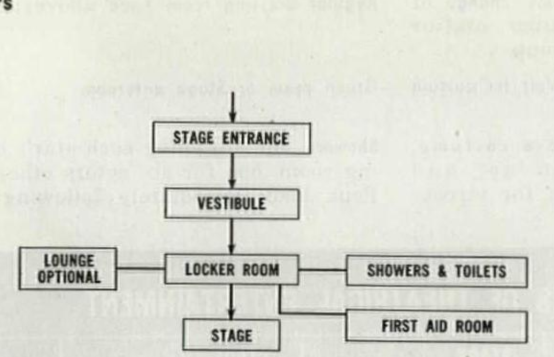
Musicians who perform on stage follow substantially the same route as other talent. The following applies to musicians who play in the pit.

Enter theater, check in, get mail messages, calls.	Stage entrance, Vestibule, Doorman's booth, as above.
Prepare for performance: remove wraps, tune instruments, get out music, practice.	Musicians' room: minimum 300 sq. ft. Equipment: lockers or clothes racks, chairs, music cabinets, telephone and call system outlets. Location: basement level near pit and stage. Large instruments usually kept in pit. Visiting orchestra's instruments, stands, and music trunks may be received through prop loading door (see properties below), and large cases stored on stage.
Go to pit	Passage: direct. Large doors to allow carrying instruments. Orchestra pit: 10 sq. ft. per musician plus 50 sq. ft. for grand piano and 25 sq. ft. for tympani. Width from stage figured on a permanent basis. Depth should keep musicians below audience sight line to stage but not lower. Conductor must see stage. Singers and orchestra must see conductor. Podium. Elevating orchestra pit floor 1) features orchestra as part of performance, 2) adds floor for chairs if brought to auditorium level, 3) makes forestage when desired. Portable steps or platforms may be set over orchestra pit.
Leave pit and leave theater	

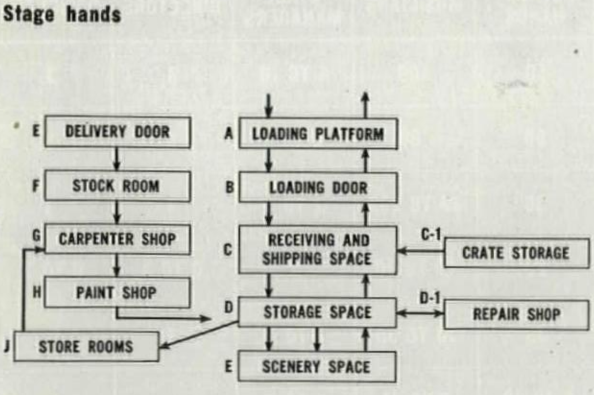
Flow charts for various production elements



Actors



Stage hands



Scenery

Sequence A B C D E for commercial theater (combination system), road theater.

Sequence E F G H D E for self-contained theater (school, college, community, repertory): omit D-1 in this sequence. J (scenery storage) completes the cycle for scenery which is salvaged and stored.

STAGE HANDS

Enter theater, check in	Stage entrance and vestibule.
Change from street clothes to work clothes	Locker room: according to number of men. Equipment: individual lockers, chairs, benches. Call system outlet. Phone outlet. Location: may be in basement, near stage, serves as stage hands' lounge.
Go to stage	Passage: direct to either side of stage.
Work the show	Passages: easy access from stage to fly galleries, gridiron, light bridges, trap room, and auditorium ceiling. Clear passage across stage at back.
Wait between scene shifts	Locker room may serve as stage hands' lounge. Equipment: lounge furniture, card table set, smoking facilities, if allowed, adjoining toilets. There is little provision for comfort of stage hands in existing theaters. Traditionally they play pinochle in the trap room between shifts.
Clean up and dress for street	Locker room *Showers*: one to every four men. Peak load after performance inevitable. Stage work is dirty work.
Treatment of accidents	First aid room: minimum 50 sq. ft. Equipment: surgical table, stools, chair, first aid cabinet, sink, hot water. Seldom proper provision for first aid

	backstage. Stage work is hazardous on occasion.
	For co-educational organizations (amateur, school, college) dual locker rooms, showers, toilets, for crews. Common lounge.

STAGE MANAGERS

Enter theater, check in	Use stage hands' locker-room.
Manage the show	Stage manager's desk: on stage near proscenium on working side.
	Equipment: nerve center of backstage signal systems: calls, phones, monitors, moving stage controls, etc.
Care of scripts, cue sheets, etc.	Office: minimum 50 sq. ft. Necessary only in permanent theater organization: repertory or stock.

DIRECTORS AND DESIGNERS

No specific routine, but they need backstage offices in permanent organization. Conference room near all offices is desirable. Empty dressing rooms may serve as pro tem offices.

THINGS

SCENERY

Brought to theater	Loading door: 8′ wide, 12′ high. at side or rear of stage.
	Loading platform: height above grade equal height of average van floor. Width to accommodate two vans. Avoid change of level inside. Use ramps outside to adjust to grade. Roof over.
Stored pending set-up	Receiving space: minimum 200 sq. ft. 20 ft. high.
	Equipment: pipe frames at right angles optional for stacking scenery, otherwise clear wall and floor space.
	Receiving space is lacking or scanty in existing theaters. Result: when delivered scenery is stacked on stage, necessitating much rehandling during set-up. Scenery left outside theater, sometimes damaged by weather.
Set-up	Stage equipment for flying, rolling, sinking scenery.
Rehearsed and operated during show	Note: the considerations determining the size, shape, arrangement, and equipment of the stage are too various and detailed to be treated in this article. *Scenery for the Theatre* by the same authors (Little, Brown and Co., 1938) contains the most thorough American treatment of this subject.
Repaired	Repair shop: minimum 100 sq. ft.
	Equipment: work bench, tools for working wood, tin, iron (cold), sewing, painting, electrical work. This shop will also serve property and electrical departments. This is in no sense to be considered a shop for the production of scenery, properties, or electrical equipment; it is merely the necessary repair shop in the event that scenery, properties, and lights are produced elsewhere.
Dismantled	Receiving space.
Shipped out	Loading door.

PROPERTIES

Brought to theater	Loading door: 6′ wide, 8′ high separate from scenery door. Adjacent on loading platform.
Unpacked	Receiving space: 100 sq. ft. minimum.
	Property crates stored in this space when empty.
Fitted to sets of scenery	
Stored on stage	Floor space, racks, shelves (see note regarding scenery above).
Operated during show	
Repaired	
Struck and shipped out	

LIGHTING EQUIPMENT

Brought to theater	Loading door (may use property loading door).
Unpacked	Receiving space: minimum 100 sq. ft. additional to space for properties. Crates are stored here when empty. May be in alley or on loading platform.
Installed	Lighting equipment may be placed in any position on the stage floor, in the space at the sides of the stage, above the stage, in slots or ports in the auditorium ceiling or on the fronts of balconies or boxes. (See McCandless: "A Method of Lighting the Stage," Theatre Arts, 1941, for plans showing usual lighting positions.)
	Portable switchboards are set in areas up to 200 sq. ft. on the working side. Power supply through company switches up to 200 KVA for large productions.
Operated	
Dismantled and shipped out	

SOUND APPARATUS

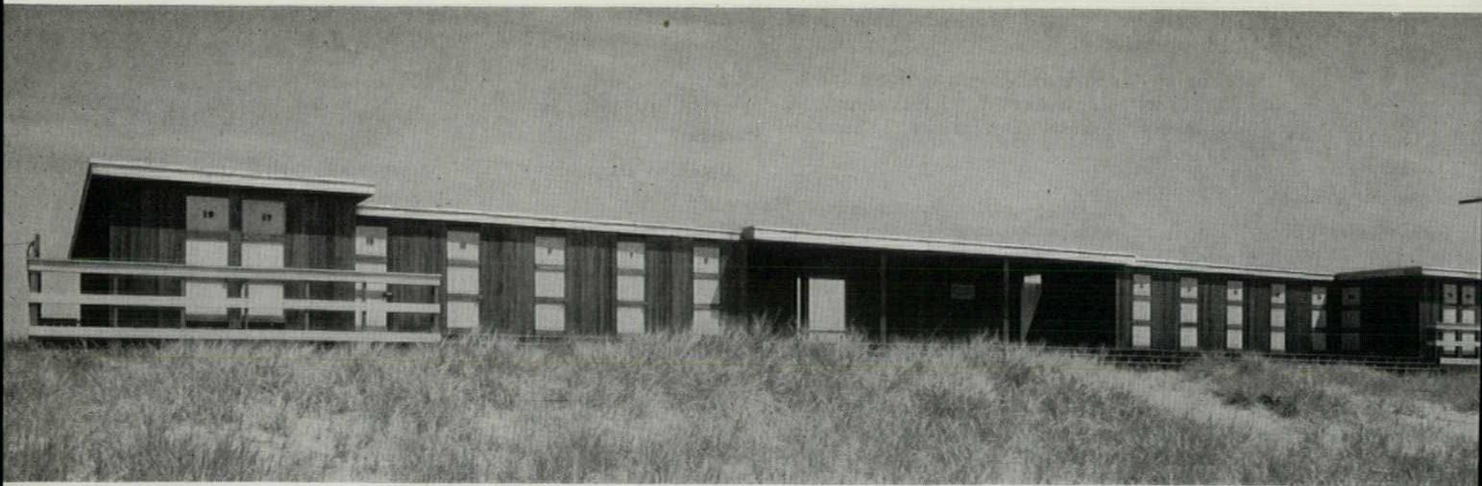
With less bulk by 75% essentially the same as lighting equipment.

COSTUMES

Brought to theater	Loading door: property door above.
Taken for Inspection	via Passage: 5 ft. clear width, no stairs, ramps where needed.
	or Lift: minimum 6 ft. by 8 ft.
	to Wardrobe room: minimum 120 sq. ft.
	Equipment: costume hangers 12 linear feet, ironing board and iron, electric ironer, outlets, sewing machine, and table.
Hung in dressing rooms	castered garment trucks a la 34th Street.
to actors' persons to stage and return	Passages: 6′ clear width for widest costumes, no protuberances on which costumes may catch.
Cleaning, pressing, repairs to trunks and shipped out.	*Wardrobe room.*

ANIMALS

A common requirement in theaters planned for vaudeville was the animal room. The Hippodrome in New York contained provisions for housing a menagerie. An occasional performing animal or troupe must be accommodated today. Hence a completely equipped theater must have an animal room, adjacent to the stage but separated from it by masonry walls, with separate outside door, ventilation, drainage, and water.

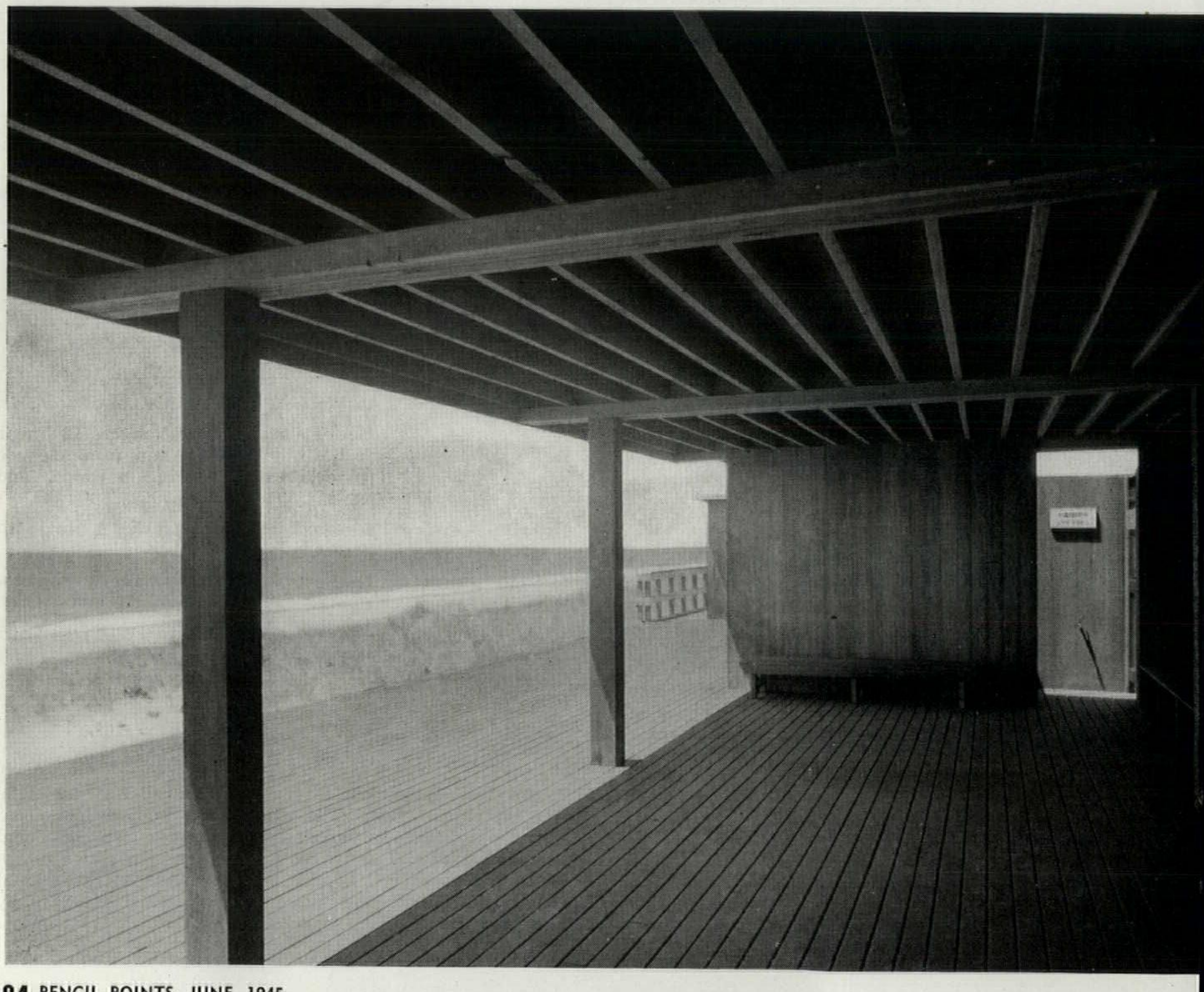


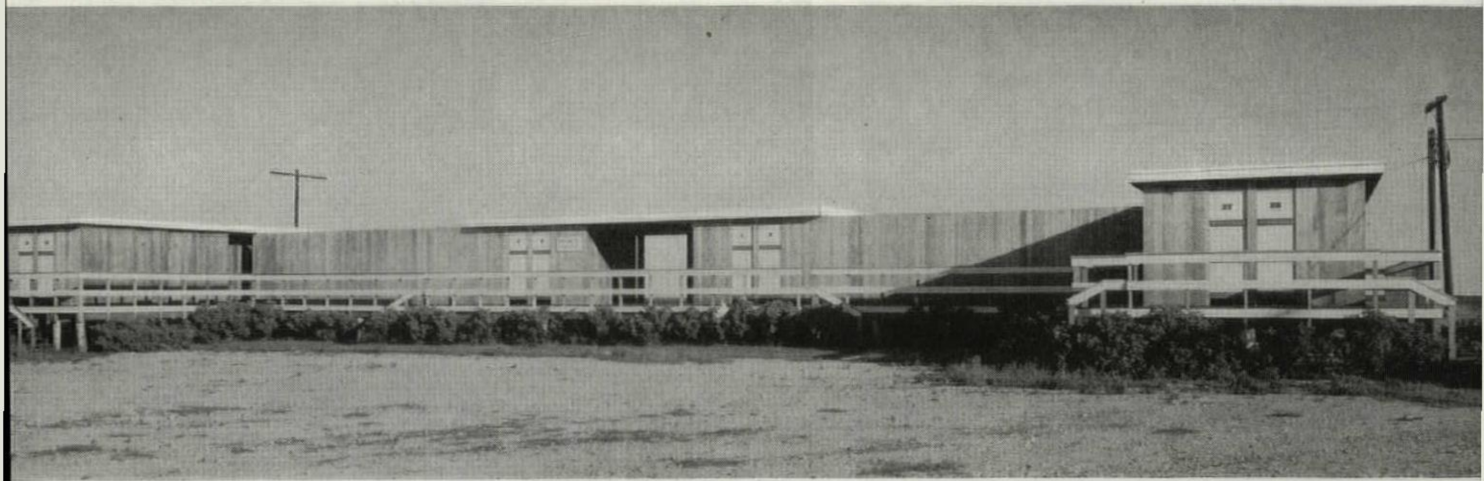
1

COMMUNITY BEACH HOUSE IN RHODE ISLAND

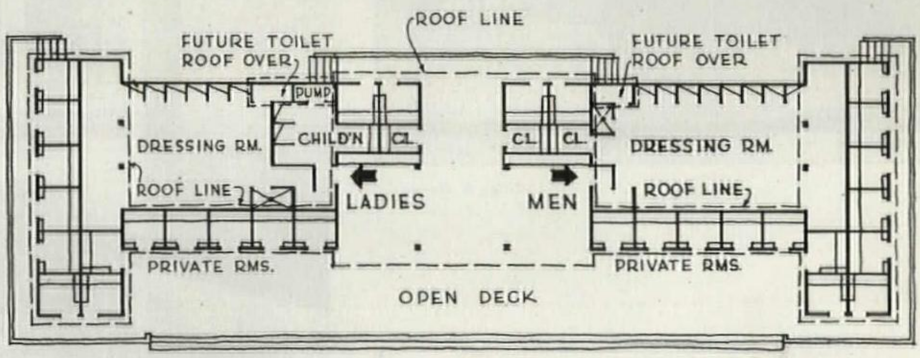
R. K. DuMOULIN, ARCHITECT

2





P. A. Dearborn



FLOOR PLAN

In the design of the Willow Dell Beach House, the architect added little in the way of flourishes to the basic requirements of such a building. Yet, through spacing and proportioning and the sensitive use of structure as a design medium, he produced a building that is well planned for its purpose, proud in its use of simple materials, congenial with its beach site, and unaffected and sure in character.

Above a foundation of posts, a decklike floor was applied to girder and joist framing. Enclosure walls and partitions are entirely constructed of four types of prefabricated panels plus one standard door made of redwood boarding (variously braced) applied to 2" x 3" frame members. These panels are joined to the floor construction with bolts through sill members; adjoining panels are connected by horizontal bolting. Roofed areas—over the private dressing rooms, entrance passage, and porch—are of frame with tar and gravel surfacing.

4

1. Beach front; private dressing rooms at either side of central porch. 2. Beach view from sheltered porch. 3. Approach front. 4. Looking down into one of the public dressing areas; note panel construction of walls and partitions.

1 *Millar & Harris*

2

3

LONDON CLUB

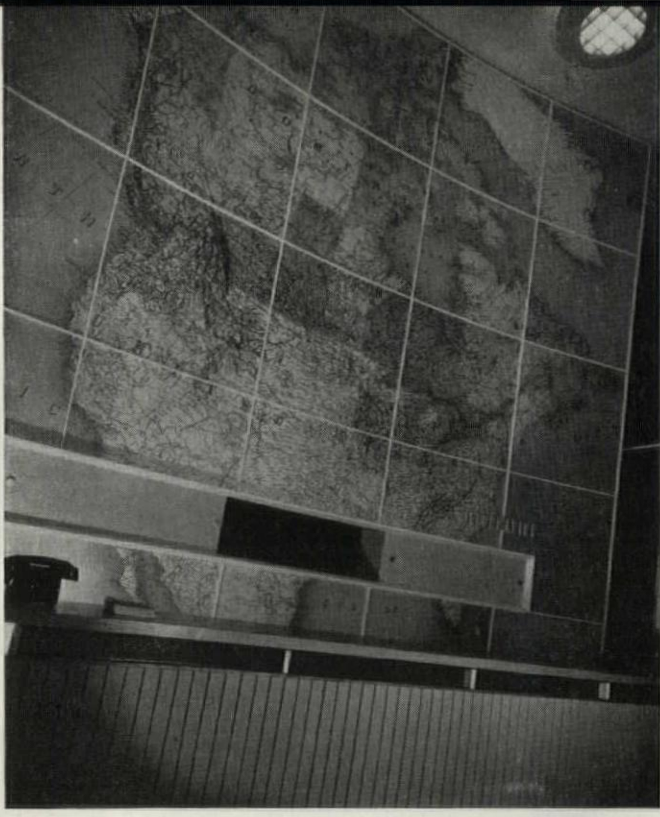
PROJECT ARCHITECTS: REID & PAISLEY

GROUND FLOOR ROOMS

This colorful series of rooms, sponsored by the Government of Ontario, was contrived within available ground-floor space in a war-damaged London business building. Unable to make substantial structural alterations, the architects also had to use ingenuity in working out detail with the barest handful of materials.

Jamb linings, soffits, counter fronts, light fixtures, etc., are of plaster board; plaster itself serves for decoration—the sculptured coats of arms, textured wall surfaces, and the like.

Within the building, imaginative use of color produced cheerful interiors. The overly high rooms were brought into more informal proportions by extending ceiling colors down onto the walls. The check room lobby between the information-entrance rooms and the cafeteria and snack bar at the rear is developed in neutral wall tones and a deep blue ceiling; by contrast, bright colors are used in the cafeteria, and the snack bar, decorated with a lively mural, has a ceiling painted terra cotta. On upper floors, there are writing rooms and a separate women's club.



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1. Proportions of the large commercial windows are altered with inset panels. 2. The sawtooth plaster upper wall is red; coat of arms, white. 3. Glazed screen between cafeteria and check room. 4. Ceiling-height map mural behind the information desk. 5. View to snack bar; mural by Tom Gentleman. 6. The terra cotta color of the ceiling continues in a cove down onto the wall.

...FOR MEMBERS OF CANADA'S ARMED FORCES

MISHA BLACK, DESIGNER, BRONEK KATZ AND KENNETH BAYES, ASSOCIATED ARCHITECTS

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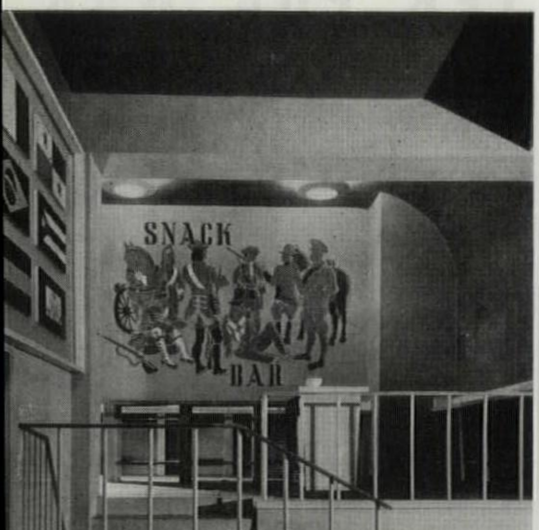


Roger Sturtevant

BERNARDI, WICKENDEN,

LANGHORST & FUNK,

ASSOCIATED ARCHITECTS

STRUCTURAL ENGINEER: A. V. SAPH, JR.

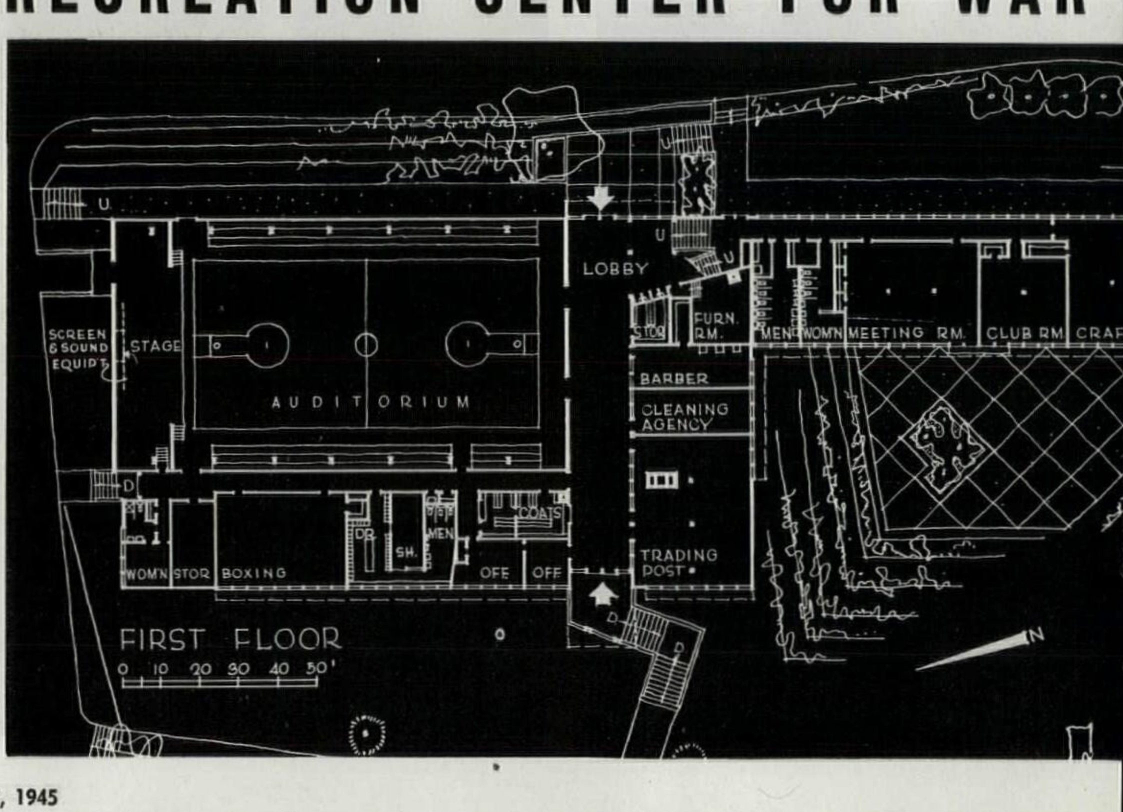
MECHANICAL ENGINEER: JAMES GAYNER

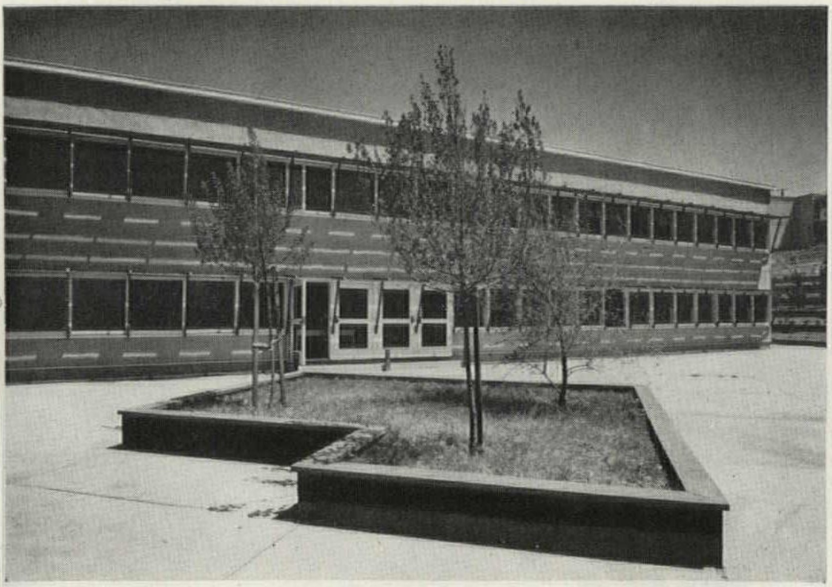
ELECTRICAL ENGINEER: LYLE E. PATTON

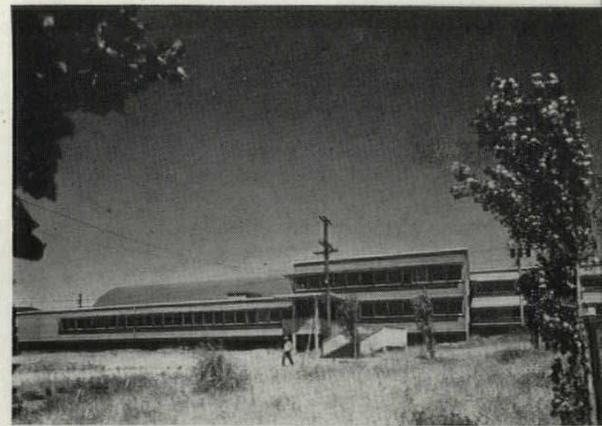
LANDSCAPE ARCHITECT: GARRETT ECKBO

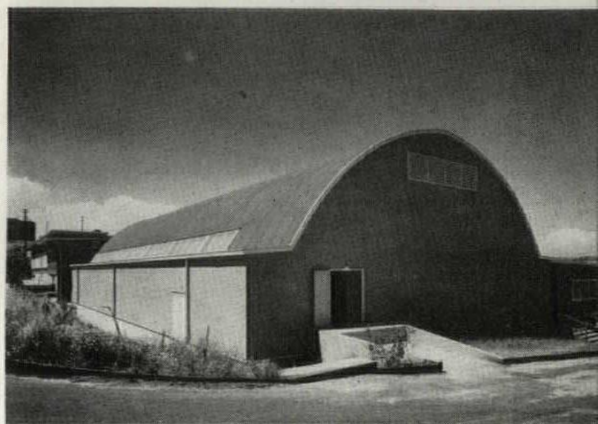
RECREATION CENTER FOR WAR

The wing at right, raised a half flight to avoid excessive excavation, is devoted to quieter cultural and recreational activities. In the gym-auditorium wing are the center's offices, a boxing room, and dressing rooms.



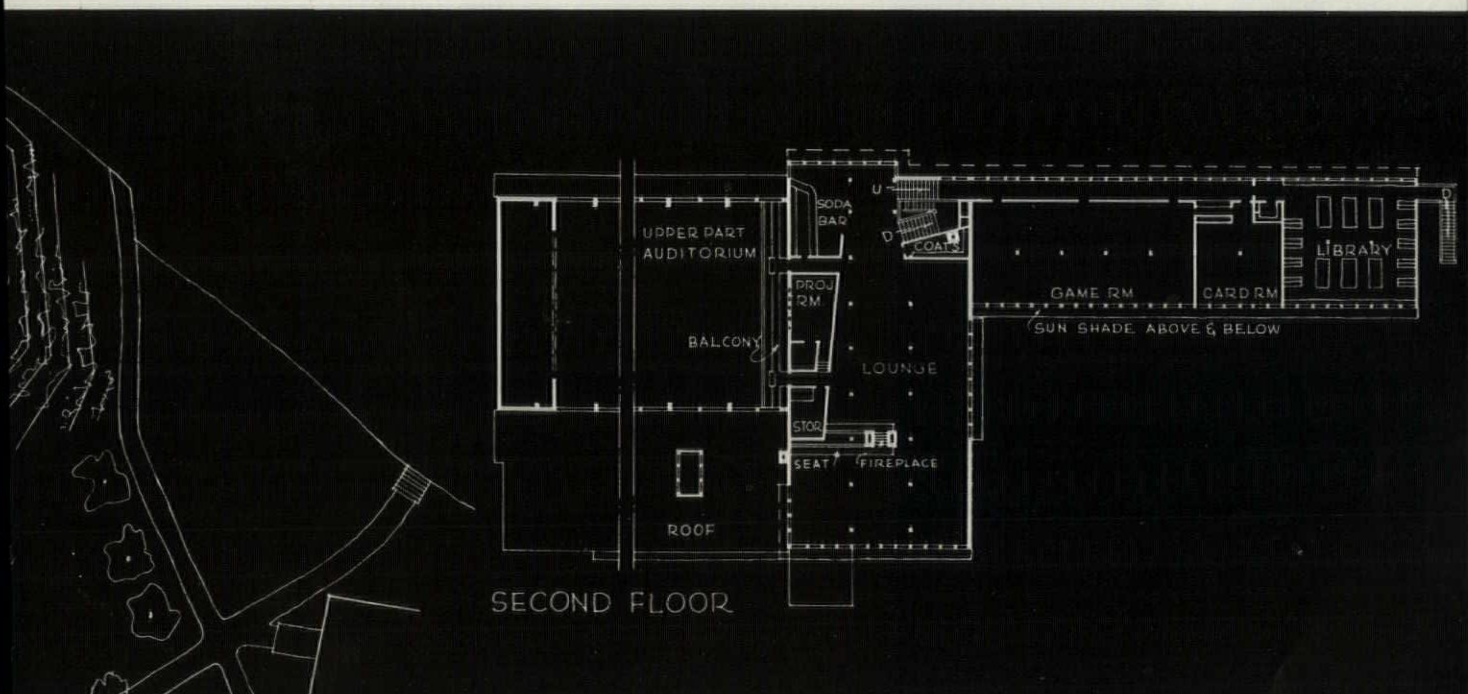


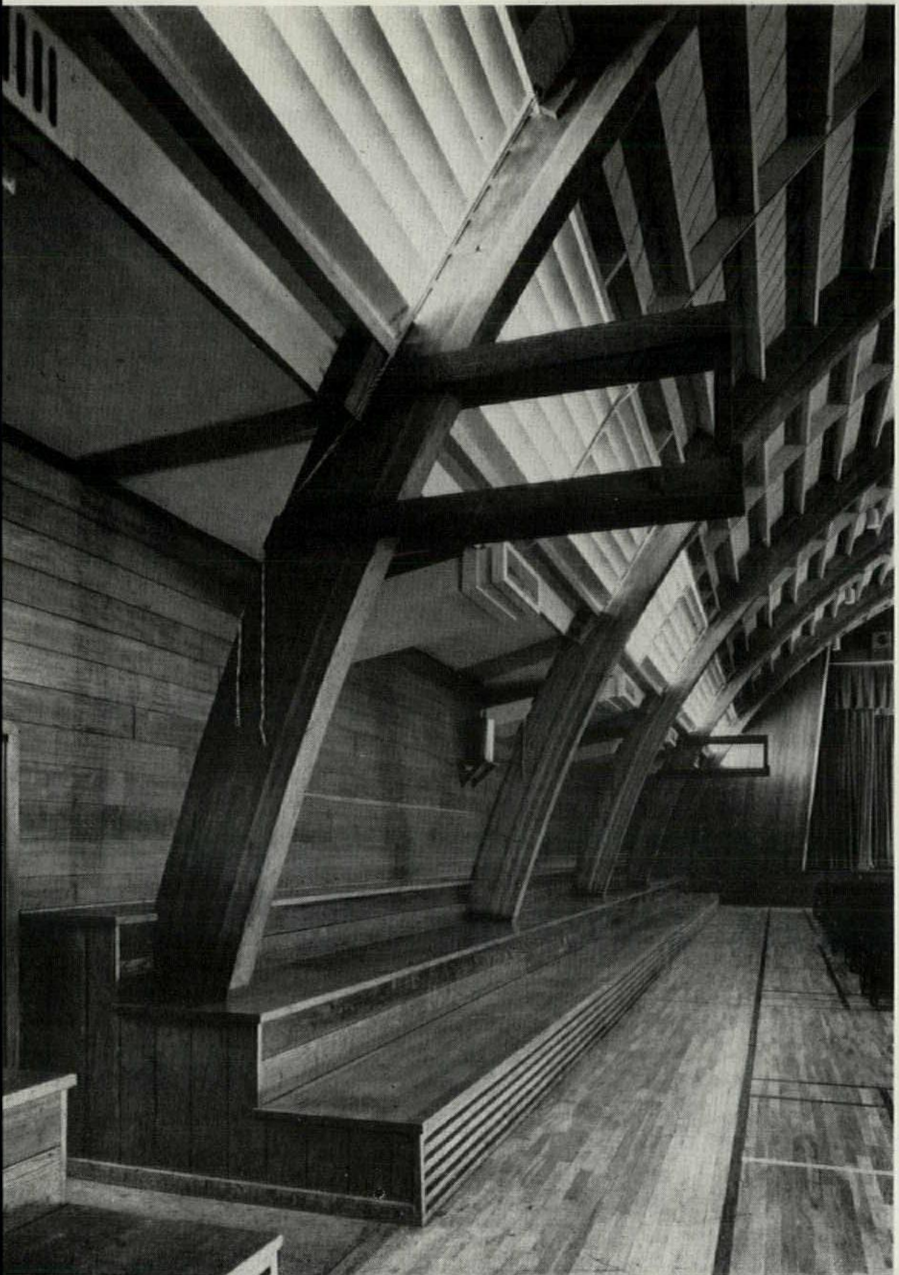




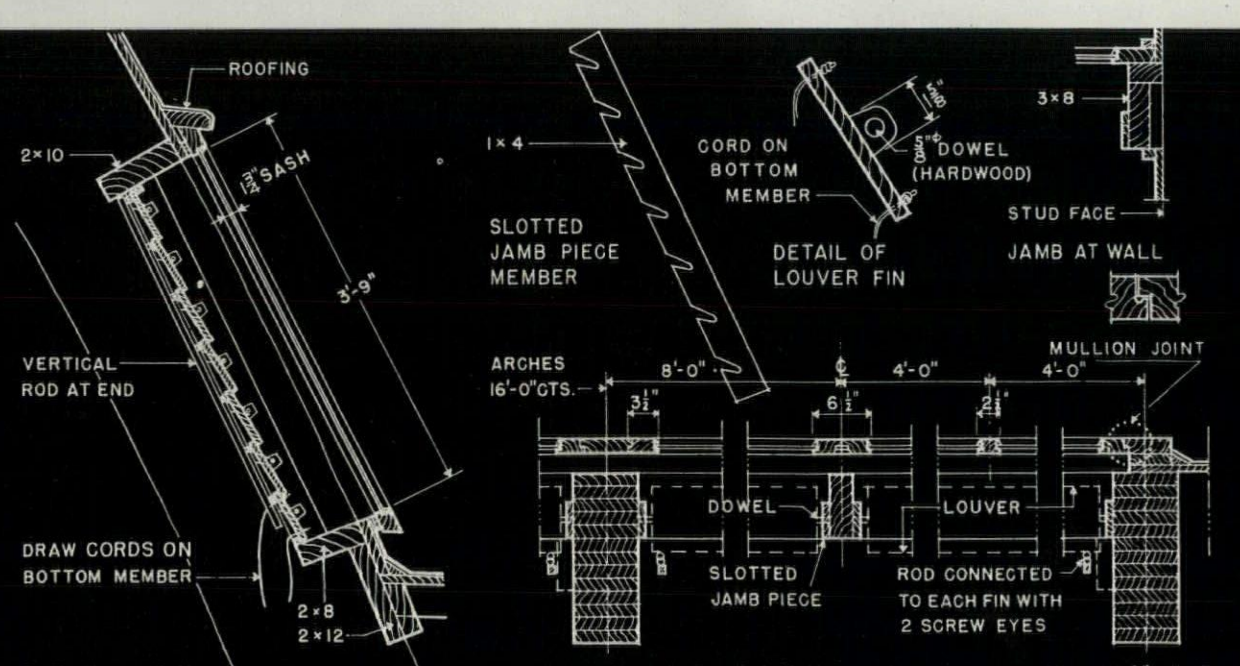
Originally begun in the engineering department of FSA (under direction of Vernon Demars who later was Consultant on the job), this temporary building for the Housing Authority of the City of Vallejo provides badly needed recreational facilities for some 3,000 men who work at Mare Island. When the project was transferred to FPHA, much of the original work had to be scrapped to meet FPHA requirements. In addition, the far-from-ideal hillside site was selected simply because it was the only available, central piece of land that would accommodate the structure. In spite of these conditions, the architects managed to produce a forthright, convenient building with an extraordinarily diversified series of facilities.

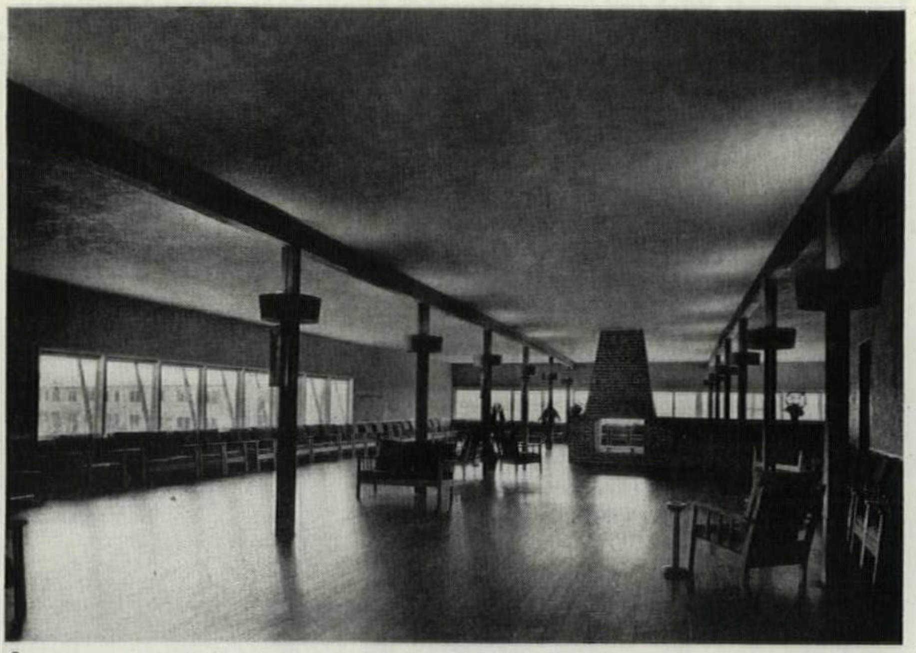
VORKERS, VALLEJO, CALIFORNIA





1. The gym-auditorium wing. Horizontal window strip and louvers extend the length of the gymnasium, framed with laminated wood arches. 2. The multi-use lounge occupies the greater part of the second floor of the central unit. 3. General view of auditorium-gymnasium. 4. The staircase is divided into half flights to join the four levels of the building. 5. Reading-room library. 6. Table games. 7. Arts and Crafts. 8. Boxing Room.





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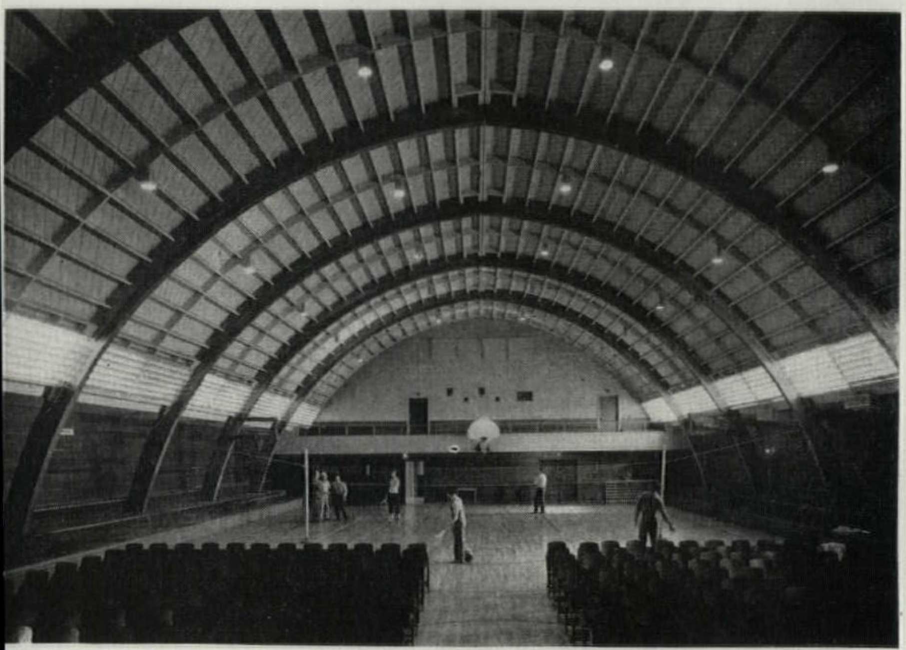

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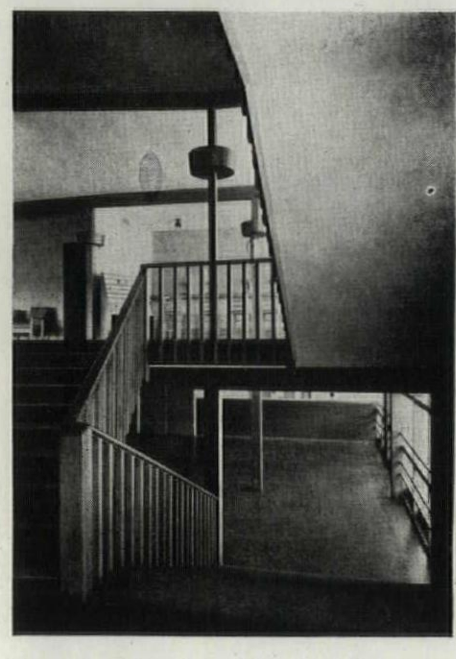

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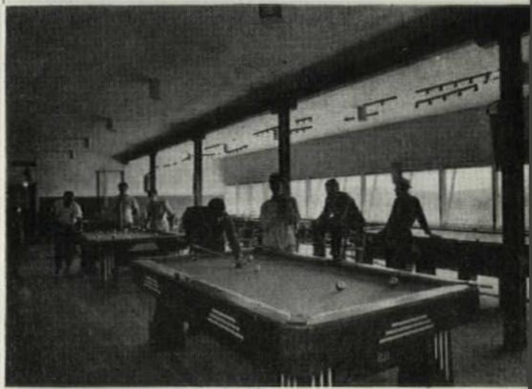

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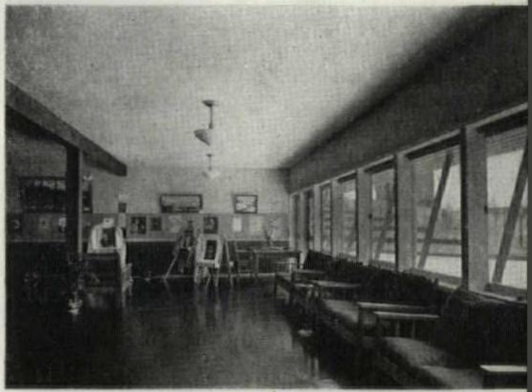

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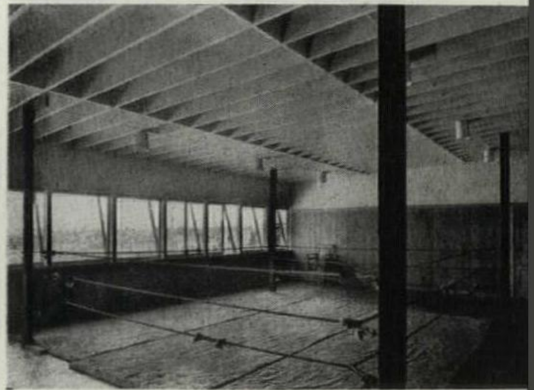

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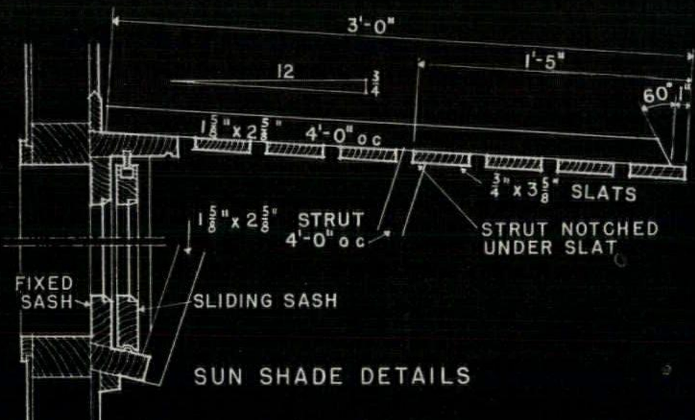
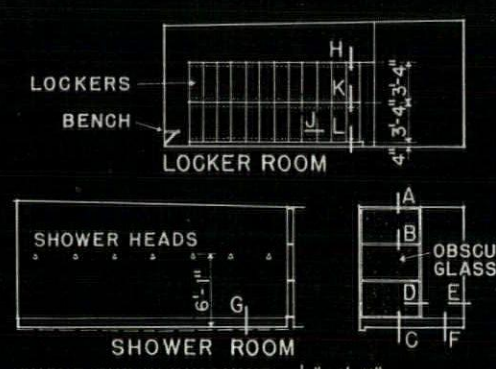
The whole building is of frame built to FPHA standard specifications. The projecting sun shade above windows toward the west (see detail, Page 92) avoids use of interior shades except in the late afternoon.

Window Shade and Lockers

. . Bernardi, Wickenden, Langhorst & Funk, Associated Architects



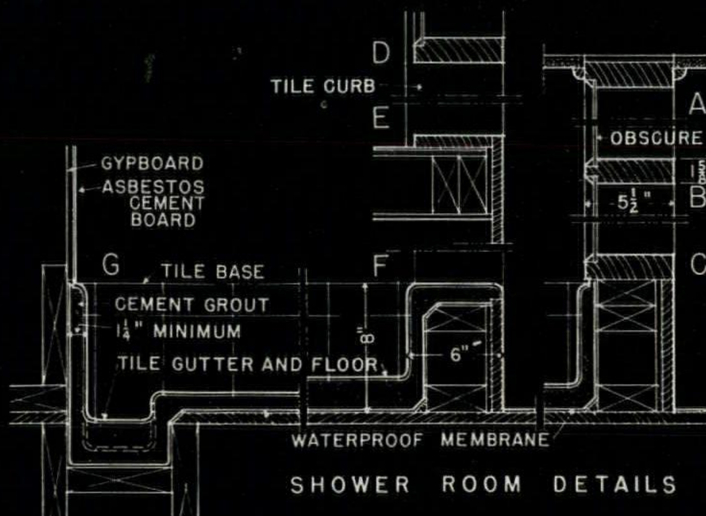
SUN SHADE DETAILS



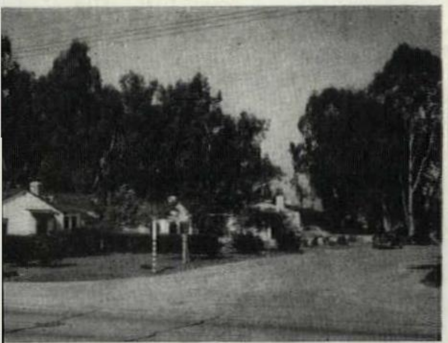
SCALE FOR ELEVATIONS $\frac{1}{16}$" = 1'-0"

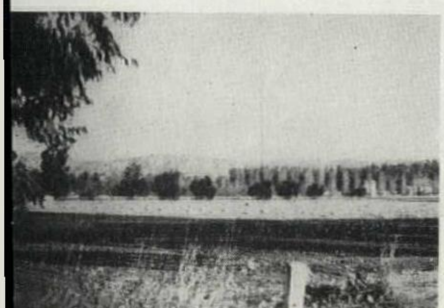
SCALE FOR ALL DETAILS 1" = 1'-0"

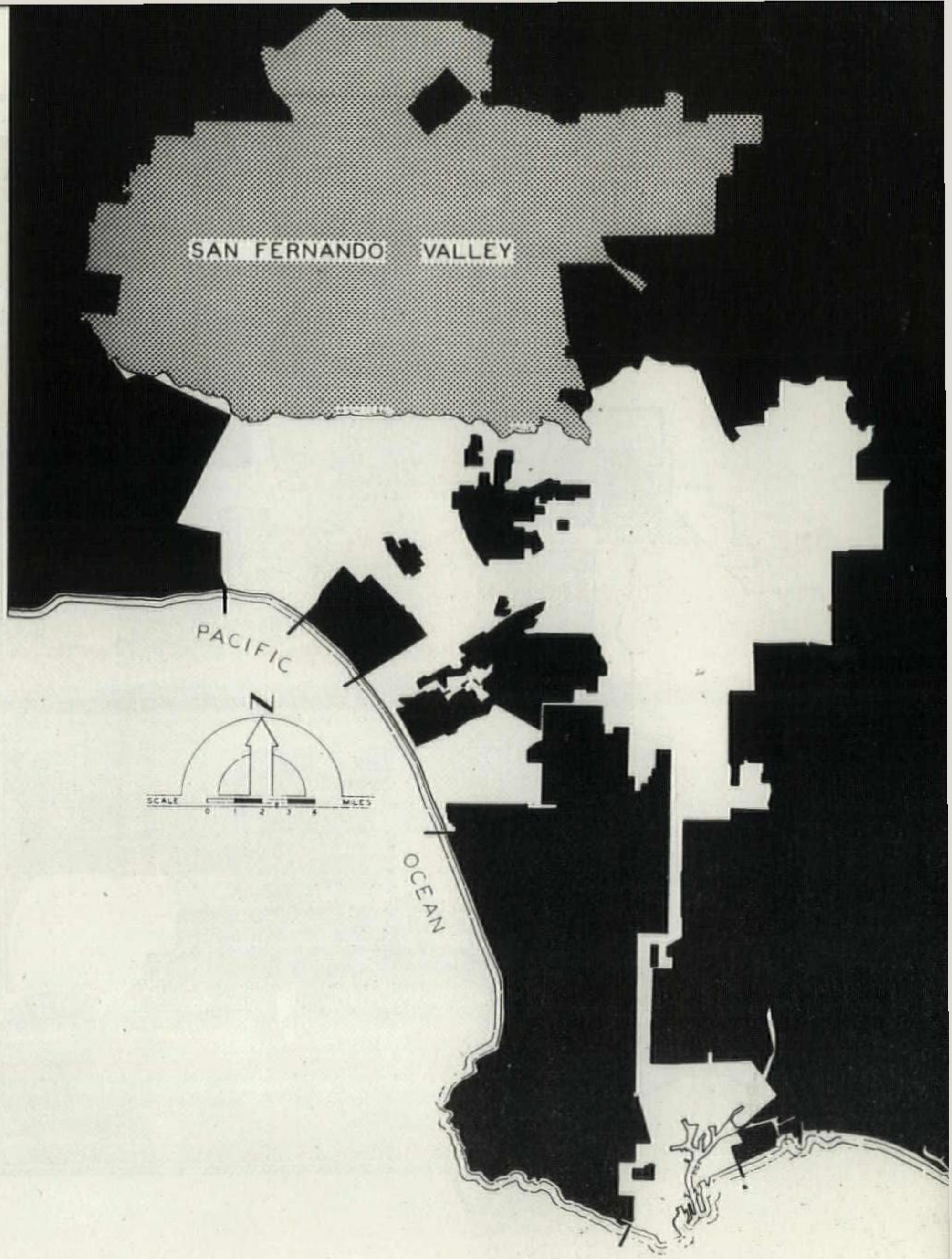
LOCKER DETAILS



SHOWER ROOM DETAILS







Photographs of typical residential, commercial, and agricultural areas as they have already developed within the valley. Map shows relationship of valley to entire City of Los Angeles.

The Plan for the San Fernando Valley

Developed by the Los Angeles Planning Commission

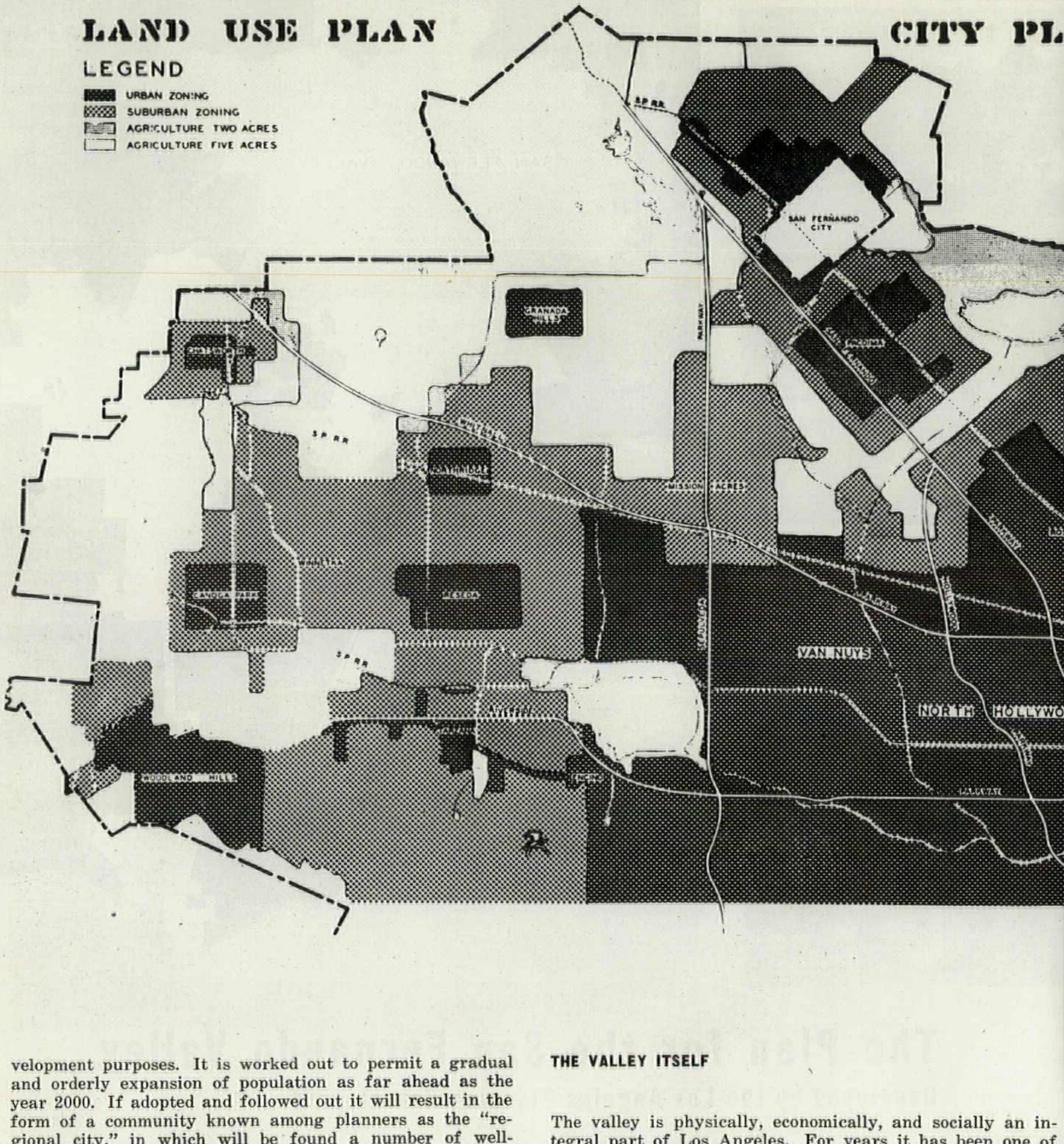
CHARLES B. BENNETT, DIRECTOR OF PLANNING
MILTON BREIVOGEL, PRINCIPAL PLANNER

(Assisting the Planning Commission in the revision of the text of the Los Angeles Zoning Ordinance is Earl O. Mills, City Planning Consultant, St. Louis, Missouri. Gordon Whitnall, Planning Consultant of Los Angeles, collaborated with Mr. Mills and the Planning Commission staff as advisor.)

For over a year the City of Los Angeles has been re-studying its zoning restrictions in an effort to pull together, into one up-to-date ordinance, all the zoning and other regulations that have accumulated on the books during the past two decades. As a result of that study, a great forward step is about to be taken which will have significance not only for the future of Los Angeles, but for many another still-expanding city.

The new proposals contain some recommended changes for the older parts of the city, but the thing that holds greatest interest is the zoning system to be applied to the San Fernando Valley (which contains approximately 212 square miles and comprises almost half the total area of Los Angeles). This is a precise but flexible zoning scheme that makes sense when related to present uses and the normal requirements that govern the actual need for land for de-

CITY PL



velopment purposes. It is worked out to permit a gradual and orderly expansion of population as far ahead as the year 2000. If adopted and followed out it will result in the form of a community known among planners as the "regional city," in which will be found a number of well-planned and moderately sized communities of reasonable density, separated by agricultural areas, the whole bound together by a well developed system of parkways and highways for various types of traffic. Provision has been made for a sufficient number and variety of recreational areas and airports to serve foreseeable needs.

As a preface to consideration for adoption by public authorities it was felt that, since planning is for people, it would be wise to give the public an opportunity to review the plans and endorse them. Consequently, sixteen evening meetings called by community Chambers of Commerce, Realty Boards, and other civic groups, were held in various parts of the valley. All of the factual data accumulated by the planning commission, together with tentative zoning and other plans, were presented and explained in elementary English. As a result of these meetings, the proposals received almost unanimous endorsement, proving that a logical sensible plan, presented in map form and explained in language the layman can comprehend, stands much better than an even chance of being accepted.

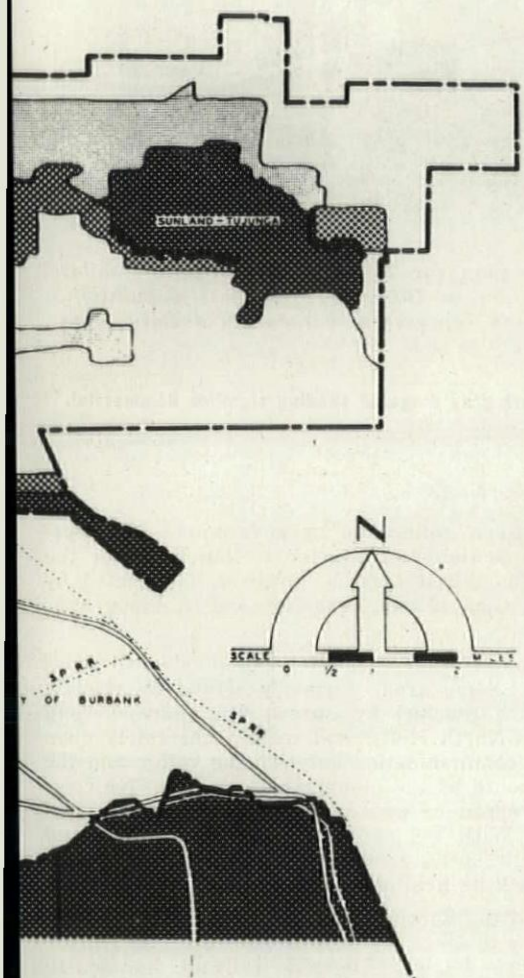
THE VALLEY ITSELF

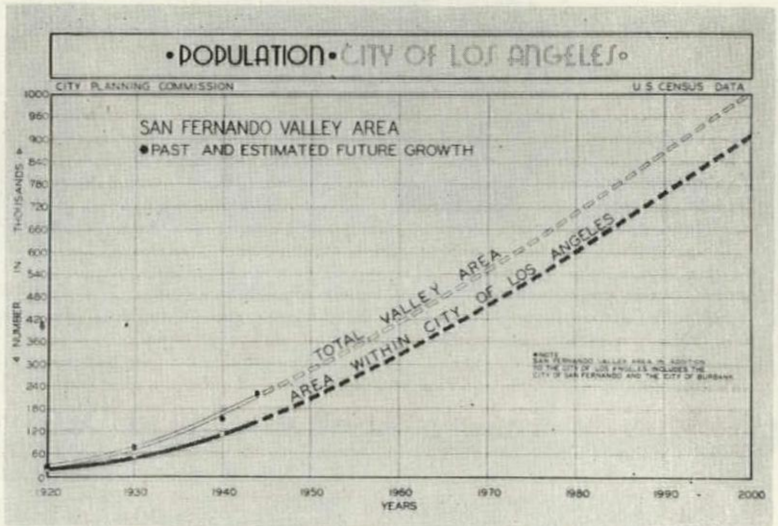
The valley is physically, economically, and socially an integral part of Los Angeles. For years it has been one of the important "bedrooms" of the city, as well as a substantial source of the farm products consumed by the people of the metropolitan area. Recently, partly due to war-induced industrial activity, it has enjoyed greatly increased population growth.

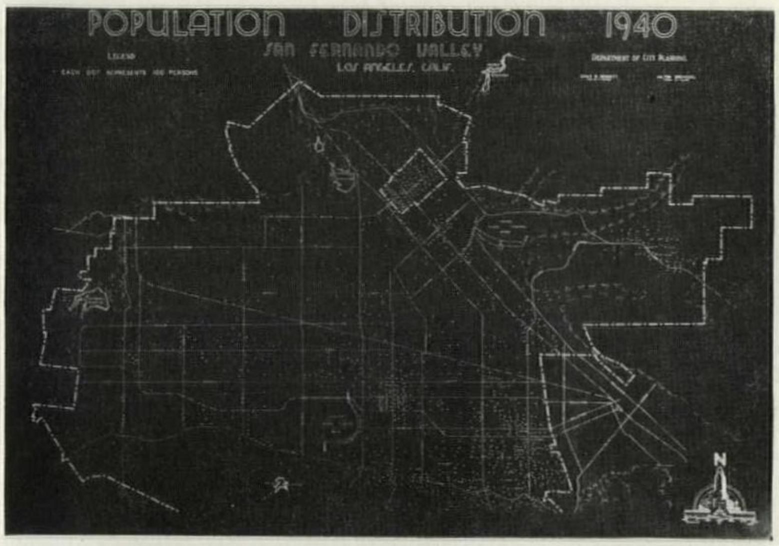
It was not until 1915 that the San Fernando Valley became a part of the City of Los Angeles. The first and largest single acquisition, including 170 square miles, occurred when the city brought water from the high Sierras. A big customer was needed, and the landowners of the valley required cheap water for irrigation. These factors led to the original annexation agreement; the rest of the valley was added on later occasions.

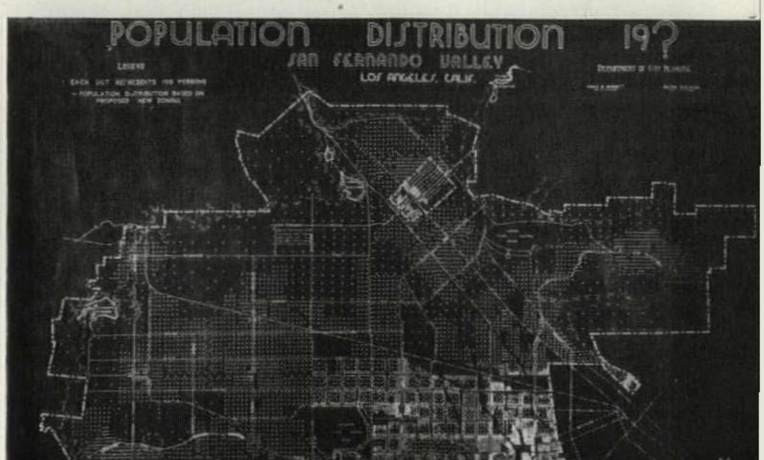
The valley is practically enclosed by mountain ranges and is separated from the older part of the city to the south by the Santa Monica Mountains. Its climate varies, with wet cool winters and dry summers. It enjoys an average growing season of 306 days. It is drained by the Los Angeles River which flows easterly along its southern edge.

From a population of 19,592 people in 1920 the San Fernando Valley jumped to 54,268 in 1930, an increase of 177 percent. The upward trend continued through the 1930's to reach 112,012 in 1940. The estimated population October 1, 1944, was 165,000. The two diagrams below show the distribution as of 1940 and the ultimate projected distribution at some future time, presuming the new zoning regulations to be followed.





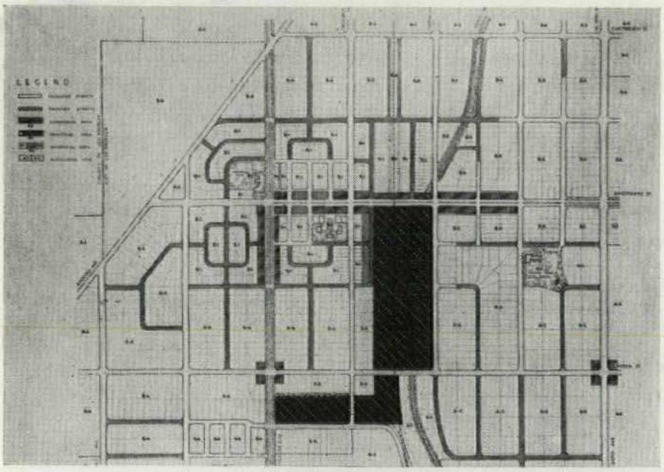




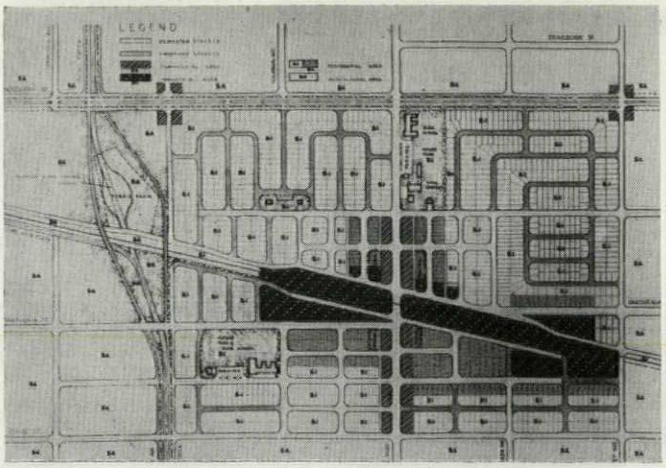
/inter and early spring rains have given rise to annual ood periods, but county and federal flood control authories are planning measures for eventual complete removal the menace of flood water damage. $25,000,000 was rently allocated by Congress to the Los Angeles region for ood control.

he first subdivision of the valley made it into four ranchos. y far the largest of these, the Rancho Ex Mission San ernando, containing 116,858 acres, began to be broken in 1869 when its southern half was sold, and was furer divided in subsequent years. It was not until 1876, owever, when the town site of San Fernando was laid out, at town lots were subdivided in the valley. The real eaking up of large ownerships began with the boom of the 80's. Later subdivisions have kept most of the area in rcels greater than one-half acre, and a large part of e valley is still in ownerships of more than five acres.

rbanization of land into town lots proceeded slowly until 20. Town sites had been established at Van Nuys, North llywood, Chatsworth, Canoga Park, Sunland-Tujunga, and n Fernando. Some scattered subdividing had occurred sewhere, but it was not until the boom of the 1920's that tensive land platting took place. Today, 33 square miles ve been platted into small lots ranging up to approx-



Proposed master plan for Chatsworth—1.93 square miles in area. Population in 1940, 435; ultimate population, 5,176. This growth represents increase in density from .4 persons per acre to 4.2.



Proposed master plan for Northridge—.75 square miles in area. Population in 1940, 490; ultimate population, 5,062. This growth represents increase in density from 1.0 persons per acre to 10.6.

In the community plans shown above, the heavily shaded areas are to be Industrial. The dark gray diagonal shading signifies Commercial.

imately 20,000 square feet. New communities have been started, some involving thousands of lots and covering substantial areas. There have also been many isolated subdivisions of various sizes scattered through the agricultural areas.

EXISTING LAND USE PATTERN

The area has been agricultural since it was first settled by the white man. The earliest settlers raised sheep, cattle, and horses. Later the valley became a huge grain field. Since 1913, when irrigation was introduced on a broad scale and the land was increasingly owned in smaller parcels, intensive growing of fruit and garden truck has replaced the wheat fields. In 1943, $20,000,000 worth of farm and dairy products were produced on 81 percent of the usable agricultural land.

Up to the war, little industrial growth took place, and that occurred mainly in food packing and processing. Recently manufacture of aircraft, together with parts and accessories, has grown up along the railroad lines in the valley. The City of Burbank, in the southeast corner, contains the Lockheed and Vega plants.

Commercial development has progressed surprisingly, stretching shoestring business along some of the most important streets and forming fairly small compact centers in a few of the smaller settlements.

Residential development, though widely dispersed, has grown into definite settlements with substantial populations at a number of points.

PUBLIC SERVICES

The rapid growth of Los Angeles has made it impossible to provide urban facilities to keep pace with the need. The valley, with its widely dispersed population, lacks these facilities more than any other section. Water and power are available everywhere, and gas and telephone service reaches most people. Streets, too, are quite well paved and provide easy access. Public health, fire, police, and library service, however, occur only at the most built-up centers. A large and costly school bus service is maintained by the Board of Education.

An adequate system of sanitary sewers is badly needed, due to the danger of pollution of ground water, but the cost of installing it would be prohibitive with the present sparse settlement. Some small areas are properly served, but the rest of the valley depends on cesspools and septic tanks.

The highway pattern, influenced by government land surveys, follows the section and quarter section lines for the most part. The northeast portion, however, is affected by the design of the City of San Fernando and by topographical conditions.

The valley has never been adequately supplied with mass transit facilities. Some areas formerly served by electric rail lines are now reached by buses. The more densely settled Van Nuys-North Hollywood section has fairly good local service, but communication between the valley and the rest of the city south of the mountain is meager. No comprehensive high speed or express intra-urban service has been developed. With the construction of parkways and their use by high speed buses, as recommended, proper communication will be available.

Three branches of the Southern Pacific Railroad spread out through the valley to serve the bulk of its industrial freight requirements. The Pacific Electric Railway handles a small volume.

BASIS FOR PLANNING

All surveys and investigations made indicate that any plan for this area must consider four elements:

(1) Agriculture, so important to the economy of the valley and of the metropolitan area, should be encouraged to develop further and be adequately protected against indiscriminate encroachment by town lot subdividers.

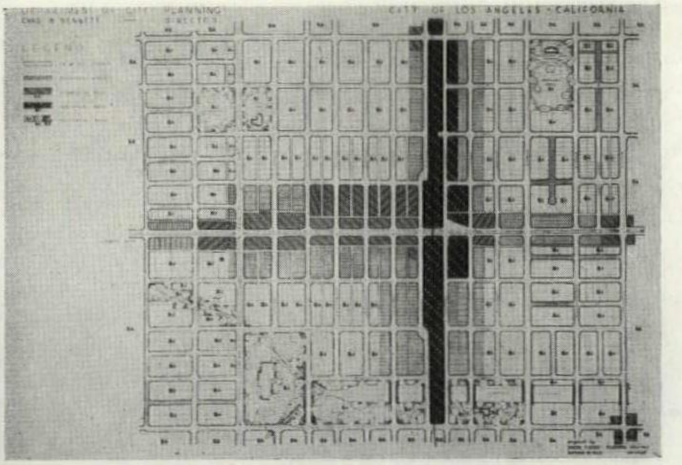
(2) The increasing number of people who are moving to the valley to escape the congested conditions of city living, but who continue to work in the city, are seriously overloading mass transit facilities and highways. The valley must be made as self-sustaining as possible by encouraging more industry to come in and provide local employment opportunities.

(3) Indiscriminate scattering of subdivisions through the valley has made it impossible to provide adequate public services for all. By limiting urban development to definite areas, such services can be economically provided.

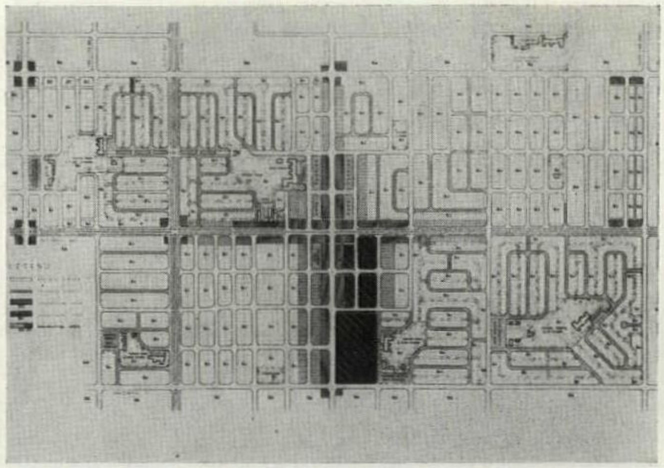
(4) The area of the valley (equal to that of Chicago), when related to past population growth and probable future trend, indicates the need for realistic avoidance of the fallacy of assuming it to be potentially one large densely-populated urban community within the next decade.

THE LAND USE PLAN

Several features of the plan for the valley distinguish it from plans of other sections of Los Angeles or other large cities. Because of its vast area and undeveloped nature it



Proposed master plan for Canoga Park—1.24 square miles in area. Population in 1940, 1,969; ultimate population, 10,007. This growth represents increase in density from 2.5 persons per acre to 12.7.



Proposed master plan for Reseda—1.88 square miles in area. Population in 1940, 1,544; ultimate population, 13,627. This growth represents increase in density from 1.3 persons per acre to 11.3.

The light areas denote various types of Residential, some with small scale agriculture.

has been possible to set aside large areas for agriculture while designating others for urban uses. This has been done by first delimiting areas which are to be urban, after careful analysis of present land use and ownership pattern. Nuclei of several towns are already established in various parts of the valley. Some of these were founded before the valley was annexed; others grew quite recently out of the progressive subdivision of farm lands. Communities that seem clearly self-contained are Van Nuys, North Hollywood, Encino, Tarzana, Woodland Hills, Reseda, Canoga Park, Northridge, Chatsworth, Granda Hills, Roscoe, Pacoima, San Fernando and Sunland-Tujunga, Winnetka, and Mission Acres.

In forming the community boundaries consideration was given to past and possible future population growth, nearby employment possibilities, relative geographic location, the possibility of early provision of complete public services, physical characteristics of the site, and other trends and factors that might influence continued growth. A master plan was then prepared for each community. This included: a study of the future town lot subdivision of unplotted areas within the new limits; a zone plan based on study of the most rational use of land, relating the distribution and areas zoned for industry and commerce to the ultimate population; a plan for location of schools, playgrounds, neighborhood parks, community centers, and business centers. These elements are woven together to form small, compact communities planned to have all the amenities of a country town and to be wholly self-sustaining. All the planned communities are separated from one another and encircled by agricultural greenbelts.

To encourage maintenance of the open character of these greenbelts, three agricultural zones are proposed. All land not specifically included in an urban zone is to be in one of these districts. Immediately surrounding each urban community is an R-A Suburban zone which permits farming and truck gardening, nurseries, greenhouses, raising of poultry, rabbits, bees, etc., incidental keeping of domestic animals, and the sale of products or commodities, provided no retail stand or commercial structure is maintained. The minimum lot area in this zone is 20,000 square feet and areas selected for this type of zoning are those in which the ownership pattern is predominantly in holdings of this size or larger, and where limited farming is now carried on.

Wherever possible, R-A Suburban zones are surrounded by A-2 Agricultural zones in which more intensive farming is permitted and two acres per dwelling are required, except that accessory living quarters may be constructed. In no case, however, may the lot area per dwelling be less than one acre.

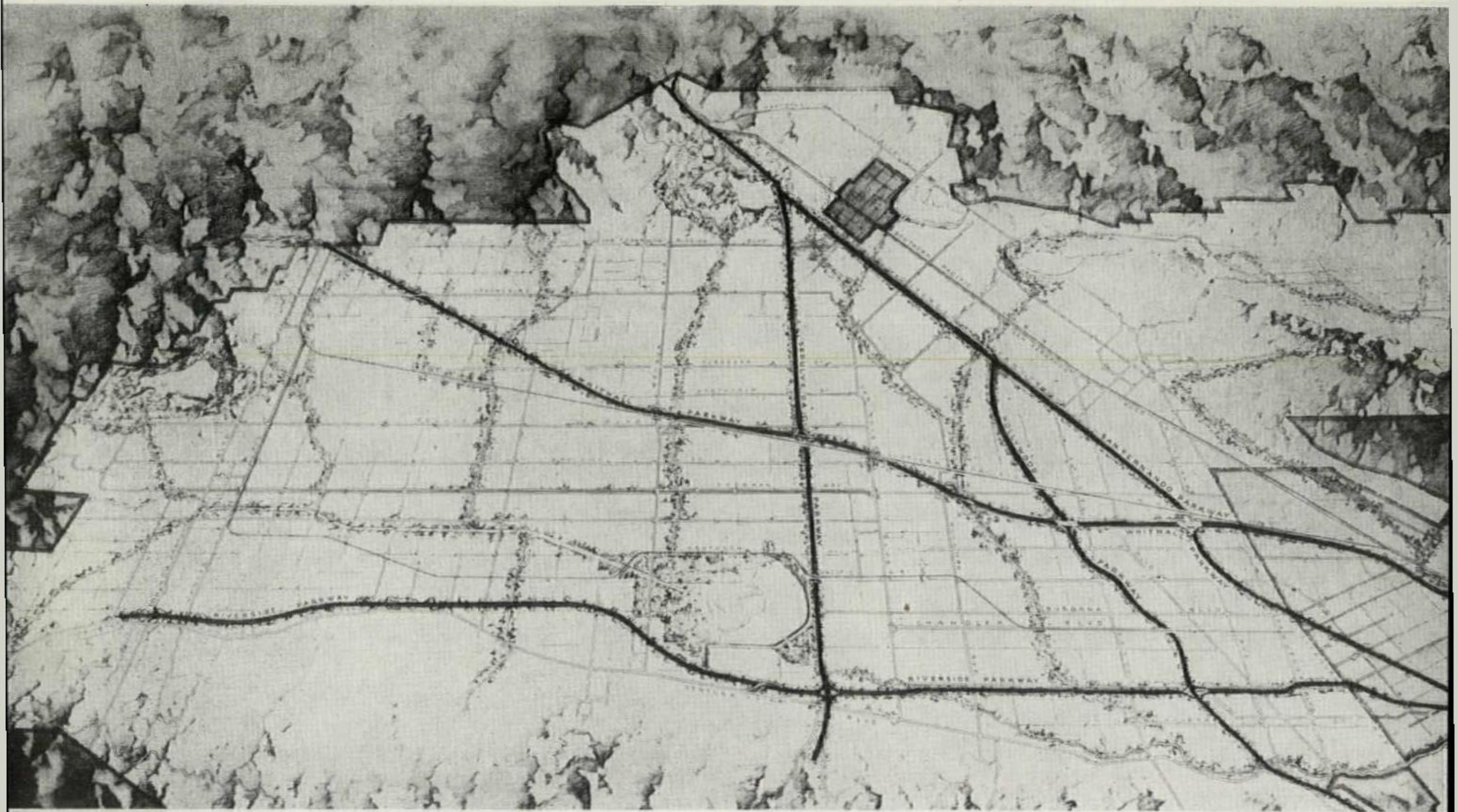
The rest of the valley is A-1 Agricultural in which all agricultural uses are permitted, including field crops, flower gardening, nurseries, greenhouses, orchards, apiaries, mushroom farms, and fruit and vegetable packing of products grown on the premises. Also permitted are the breeding, raising, training, and sale of practically every variety of fish, flesh, and fowl so long as the activity is not obnoxious or detrimental to the public welfare. No lot, farm, or other parcel of land in this zone may be less than five acres, an exception being made only in the case of churches, libraries, museums, public utilities, and hospitals of 20 beds or less.

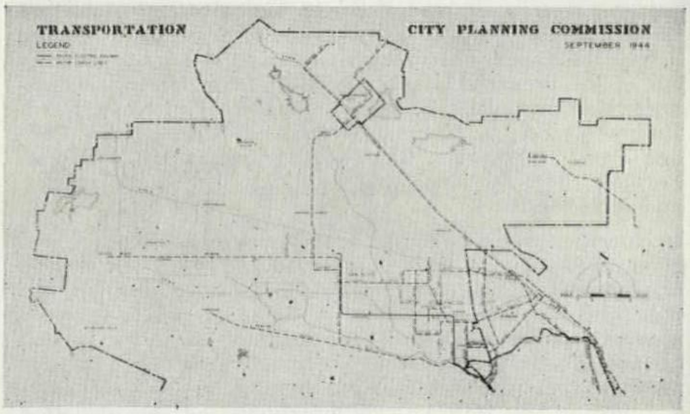
The following table shows a comparison between the present use of land and the distribution under the new plan.

	Present Conditions	The Plan
Area of the valley	212 square miles	212 square miles
Area in urban uses	32.8 " "	66.2 " "
Area in agriculture, mountains, and other open uses	179.2 " "	
R-A District		63.0 square miles
A-2 District		31.3 " "
A-1 District		51.5 " "

Of the 66.2 square miles zoned for urban uses in the plan, 6.08 square miles are set aside for industry, and 3.29 square miles are in open uses such as wash areas, leaving a net area for residential and commercial purposes of 56.8 square miles. Of this net area 17,328 acres or 27.0 square miles are unsubdivided. This is 47 percent of the net area zoned for urban uses. The thousands of vacant subdivided lots within the proposed communities and the 27 square miles of unsubdivided lands provide sufficient area for urban population growth for a long time in the future.

On the basis of the population densities permitted under the zoning ordinance and plan, that part of the San Fernando Valley lying within the city limits will accommodate 900,000 people. A projection of the population curve indicates that this figure will not be reached until the year 2000. Should the rate of population increase exceed the estimate it would in no way affect the operation of the plan. It would merely mean that the urban areas would have to be expanded sooner than originally anticipated. When the population in a community has grown to a point where the number of building sites is limited, its boundaries and urban zoning pattern can be expanded to include portions of the R-A Districts.





This bird's-eye map shows the position of the landscaped drainage channels and parkways projected for the future of the San Fernando Valley. Four large reservoir parks give well distributed opportunity for additional recreational facilities. Provision has been made for a number of playgrounds, several cemeteries, and two airports, one approximately in the center of the valley and the other at its eastern side between the two northernmost railroad lines. At the right is shown the existing transportation facilities.

RECREATION PLANS

Plans have been prepared for improving the appearance of the washes when flood control authorities have completed their channelization projects. It is proposed that the strips bordering the channels be suitably landscaped with native trees and shrubs requiring little attention, and in some cases to improve these areas with bridle paths and other recreational facilities. A circumferential pleasure drive running around the edge of the mountains surrounding the valley is also proposed. This drive would connect with the Mulholland Skyline Drive which runs along the top of the Santa Monica Mountains to the south.

Each community has a complete recreation plan based on the needs of the population ultimately expected. A community center for the grouping of public buildings is also proposed.

HIGHWAY PLAN

In general, hundred-foot boulevards have long been established on section lines and eighty-foot secondary highways on the quarter section lines. To change this pattern now would be impracticable. However, a plan of major thoroughfares, including limited access highways and parkways, has been prepared and superimposed over the existing major street pattern. This plan provides for free and easy intercommunication among the valley communities and between the valley and the rest of the city and metropolitan area. The whole highway pattern is woven into the main framework of parkways, which is a system of broad, high speed, grade separated, highways. Three of these traverse the valley east and west—one along the northeastern edge, another through the southern part, and a third through the center. Two north and south parkways will carry traffic from the passes through the mountains to the south to the northern outlets of the valley. There will be no grade crossings, but ingress and egress facilities will be built a mile apart or less. These parkways will accommodate mass rapid transit facilities as well as private cars.

To supplement the parkways, a system of limited access highways is planned, with grade crossings at approximately every half mile and as few other intersections as possible. To accomplish this, a main roadway flanked on each side by a service roadway is proposed.

Two other types of highway facilities included in the plan are the hundred-foot boulevards and the eighty-foot boulevards, designed to serve the more local traffic needs of the valley, particularly within the communities. They will carry the short haul traffic and act as feeders to the limited access highways and parkways.

The major thoroughfare plan will accommodate safely and expeditiously the traffic that will originate in, or that will pass through the San Fernando Valley. Each type of highway has a definite function to perform. The plan, like all the other plans that have been prepared is scaled to the ultimate population, and in the case of the highways, to the anticipated traffic loads.

Landscape Design Data

By Nelva Margaret Weber

Miss Weber, a graduate in landscape architecture at Illinois Wesleyan University and the University of Illinois, has, in ten years of practical experience in this phase of design, reduced many procedures common to all types of work to standard forms, tabulations, etc. She has also written for numerous popular and professional magazines.

INTRODUCTION

Landscape architecture is land planning, the design of unenclosed space, as opposed to architecture, if this is taken to be the design of enclosed space. The principles which make for good landscape design are no different from those which make for good architecture, sculpture, industrial design, or any other art. A discussion of those principles has no place here; besides, books have been written on the subject and it is already adequately covered.

Unlike painting and sculpture, landscape architecture is a practical art in the same way that architecture is. The landscape architect aims to wed use and beauty. Many are the examples of poor landscape design where only one or neither has been considered. Roads and paths with generous curves not only look more pleasant to the eye but are more practical since they "ride" better. A beautifully molded lawn with gentle slopes is better to look at and more functional than a flat surface that does not drain properly or a very steep slope that erodes into deep gullies. Too well known to mention is the foundation planting made up of a choice collection of evergreens which turns into a veritable forest to obscure the house facade and shut out all the light.

In the design and layout of many features of landscape architecture there are certain tools, knowledges, or sciences which can be of great help to the designer or detailer. Included is information which is difficult or impractical to carry in one's head, information which is easily forgotten unless it is used frequently. For ready reference the data sheet has proved to be a useful form. Do not be misled into thinking that landscape data sheets in themselves present a true picture of landscape architecture; neither does a collection of graphic standards on building represent architecture. They do not purport to give a complete course in the subject and many phases of both architecture and landscape architecture cannot be reduced to formulae, tables of figures, charts, or graphs. Some phases of landscape which, in part, lend themselves to this treatment might include information on circulation — walks, paths, roads, turn-arounds, steps, ramps; grading for various kinds of surfaces and various kinds of uses; service areas—their size, arrangement, and use; estimating—earthwork, construction, planting; and recreational features, both public and private, active and passive.

ALIGNMENT

The study of walk, path, and road alignment in its simplest form is concerned with straight lines and curves; its problems deal with the direction of the straight lines and the size of the curves.

The first study for a walk or road is usually a single line made over a topographic map; an attempt is made to have this line flow with the contours rather than run counter to them. Even this freehand sketch may be broken down into straight lines and curves and this is the next step in developing the exact alignment. Select any straight lines in the study and project them until they intersect other straight lines. These lines are tangents and they meet at the P.I. (point of intersection, Figure 1).

The next problem is to discover the radii of the curves which appear in the study. If the curves are fairly small, the easiest way to do this is to draw a series of concentric circles on tracing paper. Place the circles over the alignment study and match the curves as closely as possible. The center may be pricked through with the compass point and the radius measured. Also the P.T. (point of tangency) and the P.C. (point of curvature) are located by drawing a perpendicular to the tangent which passes through the center of the circle.

For a circle with a very large radius, this method is, of course, impractical. A carefully drawn freehand curve or a curve drawn with a spline line can be translated into a circular curve or a compound curve made up of two or three circular curves. A set of curve templates of varying radii is useful in determining the size of these curves.

While not so important for path alignment, for road work it is necessary to provide more information so that curves and tangents can be laid out in the field. For this work some knowledge of the geometry and trigonometry of curves is necessary (see Figure 2).

Point A represents the P.C. and point B, the P.T. The line VO bisects the angles GVB and AOB, the chord AB, and the arc ADB; it is perpendicular to the chord AB. Angle I is equal to angle AOB and angles AOV and VOB equal ½. AB is called the "long chord." T or the distance AV or VB is called the "tangent distance." The distance DF is called the "middle ordinate" and DV is called the "external distance." R is the radius of the curve ADB.

The "degree of curve" or D is the angle subtended at the center by an arc 100′ long.

$$D = \frac{5730}{R}$$

This is useful in solving some unknowns, as is demonstrated below:

$$R = \frac{5730}{D}$$

Length of curve $L = 100\frac{I}{D}$

$$\frac{R}{5730} = \frac{L}{D}$$

By means of trigonometry several unknowns may be found, providing the angle I and one distance such as the radius, tangent distance, or external distance are known or can be safely assumed. The following formulae are useful (letters refer to Figure 2):

When the radius and angle I are known:

$$\frac{T}{R} = \tan \tfrac{1}{2}I$$

Tangent distance	$T = R \tan \frac{1}{2}I$
External distance	$E = R \sec \frac{1}{2}I - R$
Long chord	$C = 2\,T \cos \frac{1}{2}I$
	$C = 2\,R \sin \frac{1}{2}I$
Middle ordinate	$M = R - R \cos \frac{1}{2}I$
or	$M = \frac{1}{2}\,C \tan \frac{1}{4}I$

In case these formulae seem too much for those who do not have engineering training, let them bear in mind that they are merely the solutions of right triangles.

Several engineering books contain useful curve information in tabular form. The angle I is measured very carefully with a protractor and tables for this angle are consulted. Values for R, L, E, and T may be found in this manner.

The following information should be given for each curve: the angle of intersection, the radius, and the length of curve. Other information such as degree of curve, tangent distance, and external distance are sometimes useful

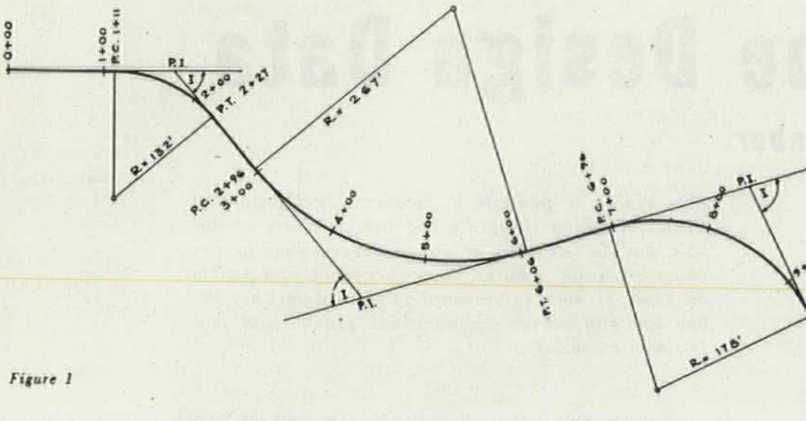


Figure 1

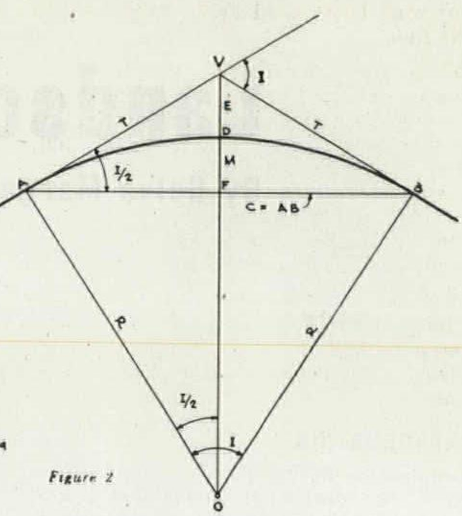


Figure 2

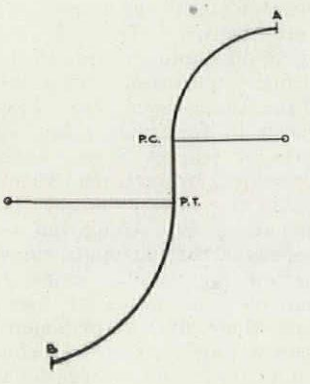


Figure 3

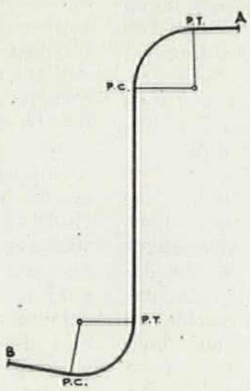


Figure 4

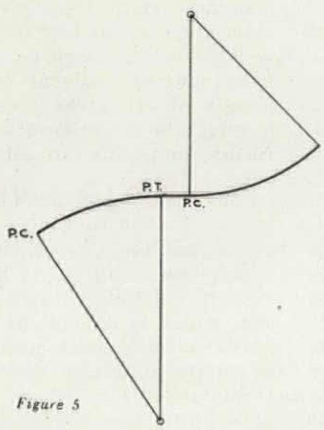


Figure 5

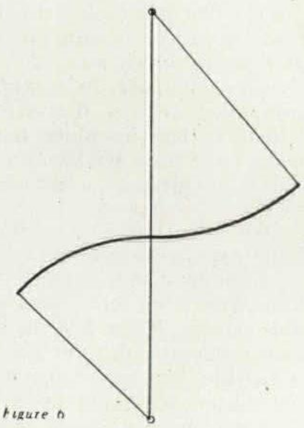


Figure 6

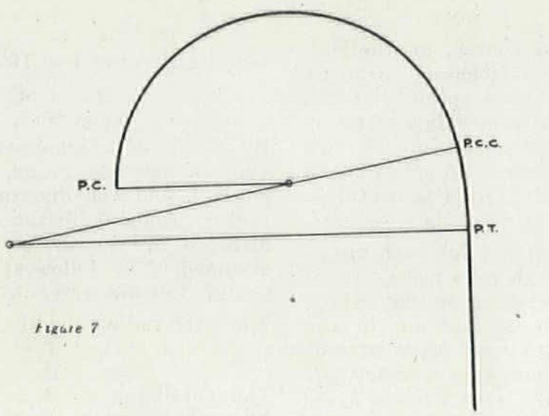


Figure 7

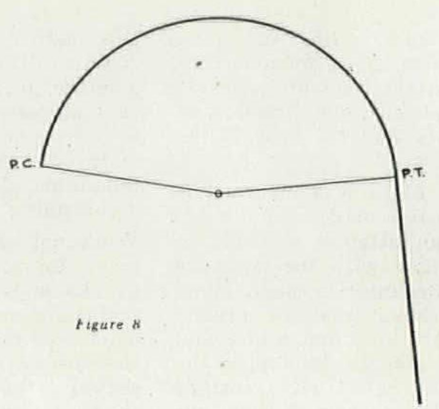


Figure 8

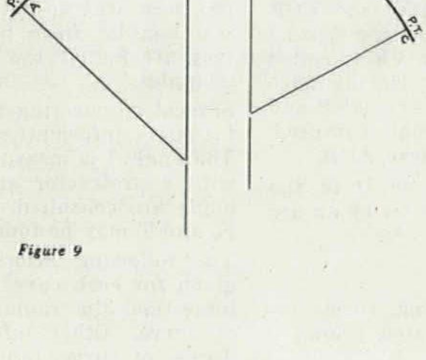


Figure 9

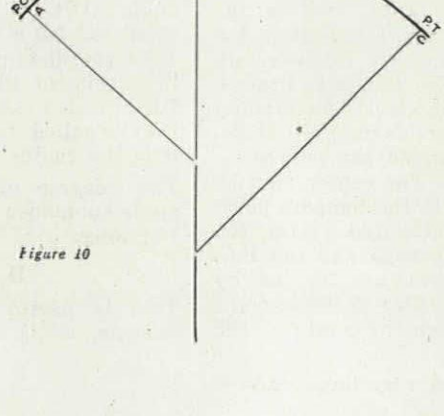


Figure 10

but may be figured by the engineer in the field.

When the curves and tangents are drawn carefully on plan and the curve data completed, the finished center line is "stationed" from left to right. 100-foot stations, sometimes 50-foot stations if the scale is large, are carefully put in with dividers. The stations of the P.C.'s and P.T.'s are entered on plan. So much for the technical data on alignment.

The landscape architect is perhaps more interested in the problem of producing pleasing alignment, a matter often passed over lightly in engineering circles. Actually it may cost no more to build an attractive alignment than an ungainly one. Pleasing lines are often a rather subtle matter of eye; the few suggestions included here may help in pointing out several things that make for better alignment.

A more pleasing alignment results when long curves and short tangents are used rather than short curves and long tangents (Figures 3 and 4). This is not always practical in some level sections of the country, but when the land is rolling, it is often cheaper. Paths can usually be laid out this way without difficulty.

Alignment is more pleasant when reverse curves are connected by a short tangent rather than joined directly (Figures 5 and 6). In road work this tangent has an additional value in that it is used for reversing the direction of the road super-elevation, or "banking."

Curves, especially those of short radii, are pleasanter if they are joined to the tangent by a short transitional curve of long radius (Figures 7 and 8).

Be careful about the direction of the tangent. It should suggest the line of progress and not proceed out of direction.

Avoid putting a tangent between two curves going in the same direction. This gives a "back-breaker" effect (Figures 9 and 10).

Keep the profile in mind while laying out horizontal curves.

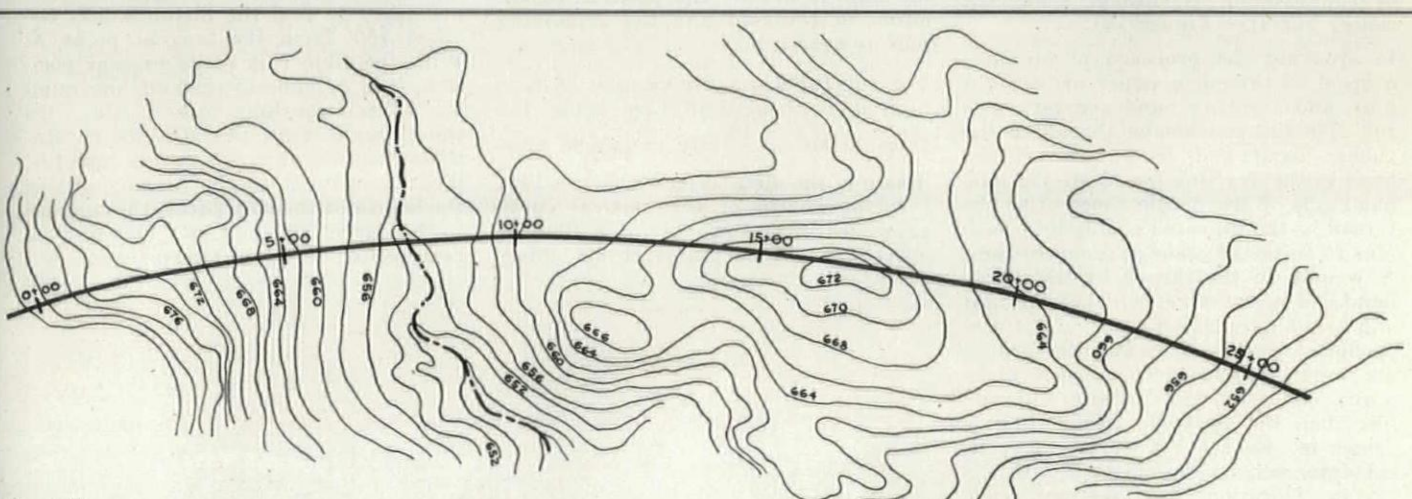


Figure 11

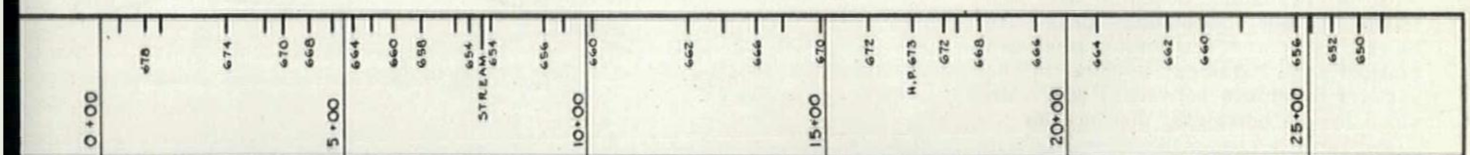


Figure 12

PROFILES AND VERTICAL CURVES

A profile of a path or road is made from an alignment drawn on a topographic map or plan (see Figure 11). For study purposes it is usually sufficient to plot a profile of the center line. The easiest way to transfer the center line information from the topographic map to the profile sheet is by means of a strip of paper tape such as that used in adding machines. Carefully mark the stations on the tape. Starting at the beginning or left-hand side of the plan, place the tape against the center line so that the first station mark on the tape corresponds with the first station on plan. On the tape, mark all existing information needed for the profile: existing contours, streams, bridges, crossroads, etc. Estimate the elevations of tops of knolls and bottoms of depressions and record these on the tape. Take off all of the center line information in this manner, holding the tape against the center line and matching the stations exactly (see Figure 12).

The next step is to plot up the information recorded on the tape. For this purpose, use profile or cross-section paper marked off both horizontally and vertically with an appropriate number of divisions. Decide on the scales at which

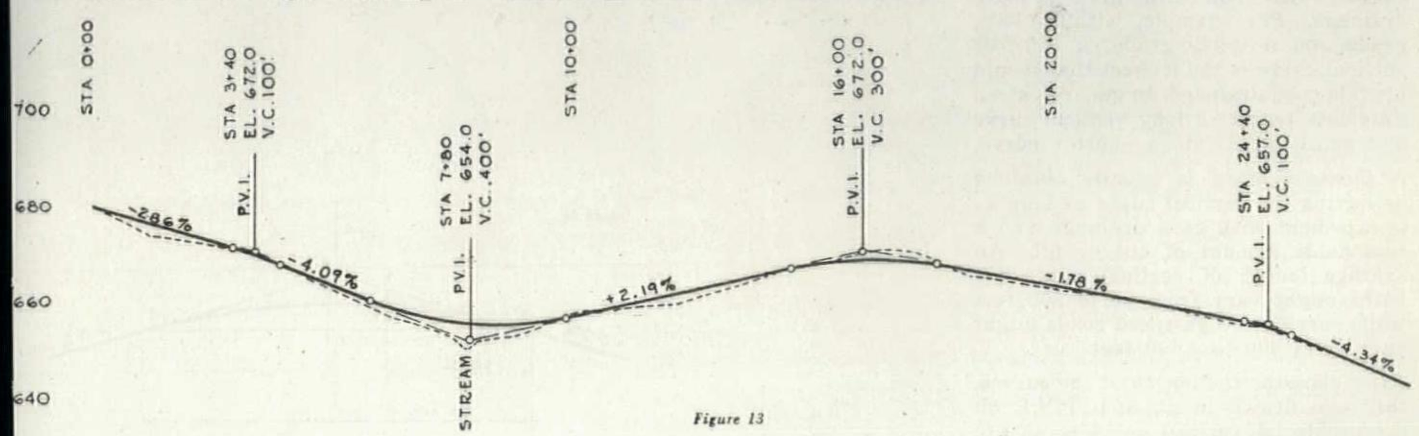


Figure 13

the profile is to be drawn. For the purpose of study the vertical scale is often exaggerated ten times; for example: horizontal scale, 1" = 20'; vertical scale, 1" = 2'. Horizontal scale naturally remains the same as the plan. Choose a datum elevation below the lowest elevation on the profile and mark the stations and the elevations at convenient intervals on the profile paper. Fasten the paper tape along the datum line so that the stations coincide. With T square and triangle, project up each mark on the paper tape and indicate each elevation with a dot in the proper location. Draw in streams, structures, etc., at their correct elevations and connect the elevation points with a dash line. This gives a complete profile of the existing conditions along the center line (see Figure 13).

In studying the proposed profile line, a spool of thread, a paper of straight pins, and a rubber band are very useful. Tie the end of the thread to the rubber band and fasten the rubber band to the drafting board off the left-hand side of the profile sheet. Use the thread as the proposed profile line, with pins to mark the peaks and depressions. A weight on the thread at the right-hand end of the sheet will keep it taut and give an accurate picture of the new profile. Adjust the pins until the grades are workable and there appears to be a reasonable balance between cut and fill; then the proposed profile line is drawn in. Each P.V.I. (point of vertical intersection) is marked with its proper elevation and station; each ascending and descending line is marked with its gradient. Starting with the left-hand side, ascending lines are marked +% and descending lines are marked —%. Gradient is equal to the vertical difference between P.V.I.'s divided by the horizontal distance, or

$$\text{Gradient} = \frac{\text{Vertical difference}}{\text{Horizontal distance}}$$

The remaining step is to add vertical curves. In road profiles the length of vertical curve is based on sight distance, a subject which is too involved to be treated here. In the case of both roads and paths with raised curbs, proper drainage of vertical curves in depressions must be considered. The sum of the two grades is a general guide to the maximum length vertical curve which will still give positive drainage. For example, with a —3% grade and a +2% grade, a 500-foot vertical curve is the longest that would provide good drainage. In general, steep gradients require a long vertical curve and gentle gradients a shorter curve.

A pleasant effect is usually obtained by having the vertical curve as long as is expedient with good drainage and a reasonable amount of cut or fill. An average length of vertical curve for paths might vary from 50 to 200 feet while curves on high-speed roads might vary from 400 to 1,000 feet.

After choosing the length of the curves, they are drawn in at each P.V.I. on the profile. A vertical curve is an arc of a parabola and, in order to draw it correctly, it is necessary to determine the location of point E (Figure 14). Here the vertical curve is 400 feet long; 200 feet measured horizontally on each side of BG, a line drawn vertically from the P.V.I. This curve is tangent at points A and C. A simple method of finding the location of point E is to connect A and C with a straight line. Point E is always halfway between points B and F. A French curve is the best instrument for drawing vertical curves. Adjust the curve until it passes through point E and is tangent at point C (Figure 15). The end of the curve where the radii are becoming increasingly smaller is used at E and the end where the radii are becoming increasingly larger is used at C. When one-half is drawn, the position of the curve is reversed and the remaining half is drawn in.

For careful work, the location of E is figured mathematically by using the formula $MC = \frac{lg.}{8}$ MC or middle coordinate is the distance BE (Figure 14); l is the length of the vertical curve expressed in stations (4 for a 400-foot curve); and g is the algebraic difference of the two grades to be connected by the vertical curve (+ 4.0 —(—3.0) =7). In Figure 4, $MC = \frac{4x7}{8}$ or 3½'. Measure down 3½' vertically from the P.V.I. to find E and draw in the curve as before.

Sometimes it is necessary to find elevations on the vertical curve at other points than the center. This may be done very quickly by using the slide rule as follows (Figure 16): on the A scale, set up the algebraic difference in grades (6). (+ 3.0 — (—3.0)). Directly below it on the B scale, set 8. Adjust the indicator to read one-half the length of the vertical curve (2) on the C scale; directly above it on the A scale is the MC (3). Suppose it were necessary to find the distance XY, the offset 150' from the tangent point A. With the slide rule in its present position, it is possible to read off any number of relationships such as this. On the C scale, read the distance in stations from the tangent, in this case 1.5; directly above it on the A scale will be the length of the offset from the tangent to the curve, XY, or 1.69'. This may be represented in tabular form.

Figure 14

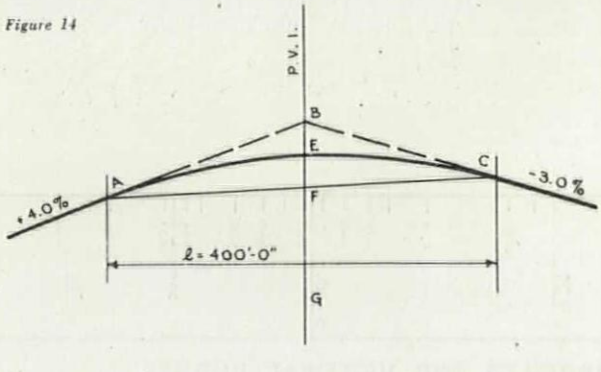


Figure 15

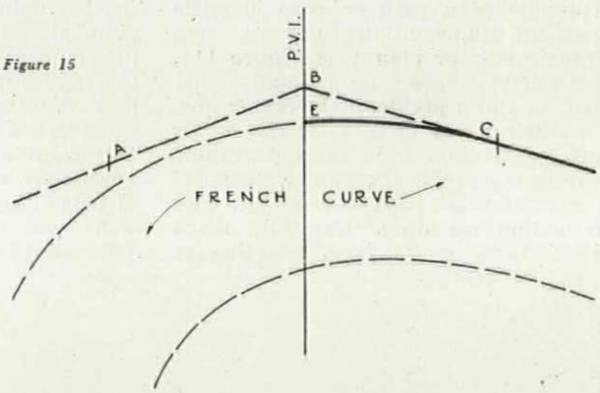
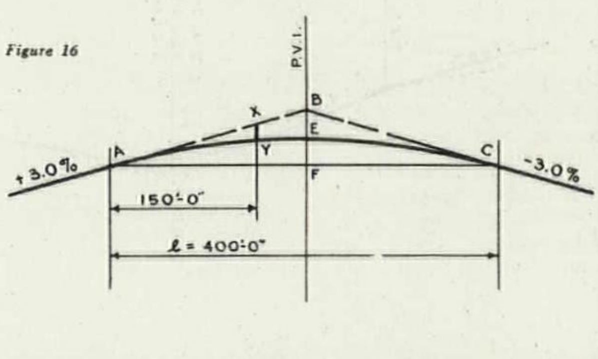


Figure 16



Scale A	g = 6	MC = 3	1.69'	Offset from tangent to curve
Scale B	8			
Scale C		$\frac{1}{2} = 2$	1.5 (150')	Any distance from the point of tangency

In road work vertical curves are generally used at each P.V.I. where the difference in grades is .5% or more.

When the proposed profile is completed it is often necessary to transfer this information to the alignment plan. This is best done by first locating the P.V.I.'s on plan by stations. Then interpolate to find the location of each proposed contour. Elevations on vertical curves must be taken directly from the profile; to increase the accuracy, they may be redrawn and exaggerated vertically ten times. This method may also be used in finding the approximate location of high points and low points on a vertical curve. Or the complete proposed profile may be taken off on paper tape as described earlier in this discussion. Transfer the information from the tape to the plan, taking care to match the stations exactly.

ESTIMATING TOPSOIL FOR PLANTING

The following list gives the amount of topsoil required for the planting of various types and sizes of plant material including a majority of the species used in landscape work in eastern United States.

In preparing an accurate estimate of the amount of topsoil required for a planting contract, it is necessary to figure topsoil for each size and type of plant. The unit of topsoil required for planting one tree, shrub, or vine of a particular size and type is given, together with some of the common species included in that bracket. Nomenclature follows the 1942 edition of "Standardized Plant Names;" names in parentheses are those used in common nursery practice. To find the total amount required, multiply the number of plants of a given size by the unit of topsoil given in the table. This unit allows for a sufficient amount with which to build an adequate saucer around the outer edges of the plant pit. No deduction is made for the volume of earth in the plant ball.

The unit of topsoil is based on the following sizes of plant pits:

A tree or shrub with a ball less than 4 feet in diameter is planted in a pit, the diameter of which is 2 times the diameter of the ball and 6 inches deeper than the ball.

A tree with a ball 4 to 5 feet in diameter inclusive is planted in a pit, the diameter of which is 1¾ times the diameter of the ball and 9 inches deeper than the ball.

A tree with a ball over 5 feet in diameter is planted in a pit, the diameter of which is 1½ times the diameter of the ball and 12 inches deeper than the ball.

A bare root tree or shrub is planted in a pit, the diameter of which is 2 times the spread of the roots and 6 inches deeper than the roots.

A vine or ground cover plant is set in a pit 12 inches in diameter and 12 inches deep.

The area of the plant pit in square yards is given for each group since it is useful in estimating the amount of mulch, lime, fertilizer, etc., spread over the plant pit.

I. DECIDUOUS PLANTS

A. Major Shade Trees

8'-10' high B.R.

Topsoil — 1.18 cu. yds.
Area of Pit — 1 sq. yd.
Acer rubrum
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Ulmus americana

**8'-10' high B. & B.
20" Ball:**

Topsoil — .56 cu. yds.
Area of Pit — 1 sq. yd.
Ginkgo biloba

24" Ball:

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.
Betula lenta
Koelreuteria paniculata
Liquidambar styraciflua
Liriodendron tulipifera

30" Ball:

Topsoil — 1.45 cu. yds.
Area of Pit — 2.2 sq. yds.
Fagus grandifolia (americana)
Fagus sylvatica

2"-2½" cal. B.R.

Topsoil — 1.31 cu. yds.
Area of Pit — 2 sq. yds.
Acer rubrum
Acer saccharum
Gleditsia triacanthos
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Ulmus americana

**2"-2½" cal. B. & B.—
27" Ball**

Topsoil — 1.18 cu. yds.
Area of Pit — 1.8 sq. yds.
Liquidambar styraciflua
Liriodendron tulipifera
Quercus borealis (rubra)

**2½"-3" cal. B & P.—
30" Ball**

Topsoil — 1.45 cu. yds.
Area of Pit — 2.2 sq. yds.
Acer rubrum
Acer saccharum
Ginkgo biloba
Gleditsia triacanthos
Liquidambar styraciflua
Liriodendron tulipifera
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Tilia europaea (vulgaris)
Tilia tomentosa
Ulmus americana
Ulmus procera (campestris)

**3"-3½" cal. B. & P.—
36" Ball**

Topsoil — 2.09 cu. yds.
Area of Pit — 3 sq. yds.
Acer rubrum
Acer saccharum
Gleditsia triacanthos
Liquidambar styraciflua
Liriodendron tulipifera
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Tilia europaea (vulgaris)
Tilia tomentosa
Ulmus americana
Ulmus procera (campestris)

**3"-3½" cal. B. & P.—
42" Ball—Collected**

Topsoil — 3.21 cu. yds.
Area of Pit — 4.2 sq. yds.
Acer rubrum
Gleditsia triacanthos
Quercus borealis (rubra)
Quercus coccinea

**3½"-4" cal. B & P.—
42" Ball**

Topsoil — 3.21 cu. yds.
Area of Pit — 4.2 sq. yds.
Acer rubrum
Ginkgo biloba
Gleditsia triacanthos
Liquidambar styraciflua
Liriodendron tulipifera
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Tilia europaea (vulgaris)
Tilia tomentosa
Ulmus americana
Ulmus procera (campestris)

**3½"-4" cal. B & P.—
48" Ball—Collected**

Topsoil — 3.92 cu. yds.
Area of Pit — 5.2 sq. yds.
Acer rubrum
Gleditsia triacanthos
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Ulmus americana

**4"-5" cal. B. & P.—
48" Ball**

Topsoil — 3.92 cu. yds.
Area of Pit — 5.2 sq. yds.
Acer rubrum
Gleditsia triacanthos
Liquidambar styraciflua
Liriodendron tulipifera
Platanus acerifolio (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Tilia europaea (vulgaris)
Tilia tomentosa
Ulmus americana
Ulmus procera (campestris)

**4"-5" cal. B. & P.—
54" Ball—Collected**

Topsoil — 4.9 cu. yds.
Area of Pit — 5.5 sq. yds.
Acer rubrum
Gleditsia triacanthos
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Ulmus americana

**5"-6" cal. B. & P.—
60" Ball**

Topsoil — 5.79 cu. yds.
Area of Pit — 6.5 sq. yds.
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus palustris
Tilia europaea (vulgaris)
Tilia tomentosa
Ulmus americana
Ulmus procera (campestris)

**5"-6" cal. B. & P.—
72" Ball—Collected**

Topsoil — 7.66 cu. yds.
Area of Pit — 7 sq. yds.
Acer rubrum
Gleditsia triacanthos
Platanus acerifolia (orientalis)
Quercus borealis (rubra)
Quercus coccinea
Quercus palustris
Ulmus americana

**6"-7" cal. B. & P.—
78" Ball—Collected**

Topsoil — 9.67 cu. yds.
Area of Pit — 8.3 sq. yds.
Acer rubrum
Gleditsia triacanthos
Platanus acerifolia (orientalis)
Quercus palustris
Ulmus americana

B. Secondary or Understory Trees

5'-6' high B. & B.—20" ball

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.
Amelanchier canadensis
Betula populifolia-collected
Carpinus betulus
Cercis canadensis
Cornus florida
Cornus florida rubra
Cornus mas
Crataegus in variety
Halesia carolina (tetraptera)
Magnolia in variety
Malus in variety
Photinia villosa
Styrax japonica
Viburnum prunifolium

Exception—

Betula populifolia, nursery grown; 18" ball.
Topsoil — .46 cu. yd.
Area of Pit — .8 sq. yd.

6'-8' high B. & B.—24" ball

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.
Amelanchier canadensis
Betula populifolia-collected
Carpinus betulus
Cercis canadensis
Cornus florida
Cornus florida rubra
Cornus mas
Crataegus in variety
Halesia carolina (tetraptera)
Malus in variety
Photinia villosa
Styrax japonica
Viburnum prunifolium

Exceptions—20" Ball:

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.
Betula populifolia

26" Ball:

Topsoil — 1.09 cu. yds.
Area of Pit — 1.6 sq. yds.
Magnolia in variety

28" Ball:

Topsoil — 1.26 cu. yds.
Area of Pit — 2 sq. yds.
Crataegus in variety-collected
Viburnum prunifolium-collected

30" Ball:

Topsoil — 1.45 cu. yds.
Area of Pit — 2.2 sq. yds.
Magnolia in variety-collected

8'-10' high B. & P.—30" ball

Topsoil — 1.45 cu. yds.
Area of Pit — 2.2 sq. yds.
Amelanchier canadensis
Betula populifolia-collected
Carpinus betulus
Cornus florida
Halesia carolina (tetraptera)
Malus in variety
Styrax japonica

Exceptions—24" Ball:

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.
Betula populifolia

32" Ball:

Topsoil — 1.65 cu. yds.
Area of Pit — 2.5 sq. yds.
Crataegus in variety

36" Ball:

Topsoil — 2.09 cu. yds.
Area of Pit — 3 sq. yds.
Crataegus in variety-collected except C. Crusgalli
Magnolia in variety
Viburnum prunifolium-collected

42" Ball:

Topsoil — 3.21 cu. yds.
Area of Pit — 4.2 sq. yds.
Crataegus crusgalli-collected

48" Ball:

Topsoil — 3.92 cu. yds.
Area of Pit — 5.2 sq. yds.
Magnolia in variety-collected

C. Deciduous Shrubs

15"-18" high B.R.

Topsoil — .037 cu. yd.
Area of Pit — .085 sq. yd.
Rosa in variety

18"-24" high B.R.

Topsoil — .098 cu. yd.
Area of Pit — .2 sq. yd.
Rosa in variety

18"-24" high B. & B.—15" Ball

Topsoil — .27 cu. yd.
Area of Pit — .55 sq. yd.
Deciduous Azaleas in variety

2'-3' high B.R.

Topsoil — .17 cu. yd.
Area of Pit — .22 sq. yd.
Acanthopanax sieboldianus (pentaphyllum)
Aronia in variety
Berberis in variety
Chaenomeles lagenaria (Cydonia japonica)
Clethra alnifolia
Cornus-bush varieties
Deutzia in variety
Forsythia in variety
Ilex verticillata
Ligustrum in variety
Lonicera in variety
Philadelphus in variety
Rhus in variety
Robinia hisbida
Rosa in variety
Viburnum in variety; except V. prunifolium
Weigela in variety

2'-3' high B. & B.—18" Ball

Topsoil — .39 cu. yd.
Area of Pit — .8 sq. yd.
Deciduous Azaleas in variety
Myrica pensylvanicum (caroliniensis)-collected
Vaccinium corymbosum-collected

Exceptions—12" Ball:

Topsoil — .17 cu. yd.
Area of Pit — .35 sq. yd.
Cornus racemosa (paniculata)
Viburnum prunifolium

3'-4' high B.R.

Topsoil — .27 cu. yd.
Area of Pit — .24 sq. yd.
See list under 2'-3' high B.R.

3'-4' high B. & B.—15" Ball

Topsoil — .27 cu. yd.
Area of Pit — .55 sq. yd.
Cornus racemosa (paniculata)
Syringa vulgaris
Viburnum prunifolium

Exceptions—20" Ball:

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.
Deciduous Azaleas in variety 3'-3½' high
Myrica pensylvanica (caroliniensis)-collected
Vaccinium corymbosum-collected

22" Ball:

Topsoil — .68 cu. yd.
Area of Pit — 1.2 sq. yds.
Deciduous Azaleas in variety 3½'-4' high-collected

4'-5' high B.R.

Topsoil — .39 cu. yd.
Area of Pit — .35 sq. yd.
Elaeagnus in variety
Euonymus alatus
H amamelis in variety
Ilex verticillata
Ligustrum in variety
Lindera benzoin (Benzoin aestivale)
Philadelphus in variety
Rhamnus in variety
Viburnum in variety (except V. prunifolium)
Weigela in variety

4'-5' high B. & B.—18" Ball

Topsoil — .39 cu. yd.
Area of Pit — .8 sq. yd.
Amelanchier canadensis
Syringa vulgaris
Viburnum prunifolium

Exceptions—22" Ball

Topsoil — .68 cu. yd.
Area of Pit — 1.2 sq. yds.
Vaccinium corymbosum-collected

5'-6' high B.R.

Topsoil — .53 cu. yd.
Area of Pit — .55 sq. yd.
See list for 4'-5' B.R. shrubs

5'-6' high B. & B.—20" Ball

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.
Amelanchier canadensis
Syringa vulgaris
Viburnum prunifolium

Exceptions—24" Ball:

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.
Vaccinium corymbosum-collected
Viburnum prunifolium-collected

D. Vines and Ground Covers

Topsoil — .037 cu. yd.
Area of Pit — .085 sq. yd.
Ampelopsis
Celastrus
Hedera helix
Lonicera japonica halliana
Pachysandra terminalis
Parthenocissus
Rosa—climbing and trailing varieties
Wistaria

II. EVERGREEN MATERIAL

A. Evergreen Trees

Abies
Juniperus
Picea
Pinus
Tsuga

5'-6' high B. & B.—20" Ball

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.

6'-8' high B. & B.—24" Ball

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.

8'-10' high B. & P.—30" Ball

Topsoil — 1.45 cu. yds.
Area of Pit — 2.2 sq. yds.

B. Varieties of Taxus

1. Standard Types

Taxus cuspidata

2½'-3' spread B. & B.—20" Ball

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.

3½'-4' spread B. & B.—24" Ball

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yd.

4'-5' spread B. & P.—27" Ball

Topsoil — 1.18 cu. yds.
Area of Pit — 1.8 sq. yds.

5'-6' spread B. & P.—30" Ball

Topsoil — 1.45 cu. yds.
Area of Pit — 2.2 sq. yds.

2. Spreading Types

Taxus baccata repandens
Taxus brevifolia (cuspidata brevifolia)

15"-18" spread B. & B.—15" Ball

Topsoil — .27 cu. yd.
Area of Pit — .55 sq. yd.

18"-24" spread B. & B.—18" Ball

Topsoil — .39 cu. yd.
Area of Pit — .8 sq. yd.

2½'-3' spread B. & B.—20" Ball

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.

3½'-4' spread B. & B.—24" Ball

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.

3. Upright Types

Taxus cuspidata capitata
Taxus media Hatfield
Taxus media Hicks

18"-24" high B. & B.—15" Ball

Topsoil — .27 cu. yd.
Area of Pit — .55 sq. yd.

2'-2½' high B. & B.—18" Ball

Topsoil — .39 cu. yd.
Area of Pit — .8 sq. yd.

2½'-3' high B. & B.—20" Ball

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.

C. Broad-Leaved Evergreens

18"-24" high B. & B.—15" Ball

Topsoil — .27 cu. yd.
Area of Pit — .55 sq. yd.
Azalea—evergreen varieties
Kalmia latifolia
Pieris floribunda

Exception—12" Ball:

Topsoil — .15 cu.yd.
Area of Pit — .35 sq. yd.
Ilex glabra

2'-3' high B. & B.—18" Ball

Topsoil — .39 cu. yd.
Area of Pit — .8 sq. yd.
Azalea — evergreen varieties
Ilex glabra 2½'-3' high
Kalmia latifolia
Pieris floribunda
Pieris japonica
Rhododendron in variety—2½'-3' high

Exceptions—15" Ball:

Topsoil — .27 cu. yd.
Area of Pit — .55 sq. yd.
Ilex crenata 2'-3' high
Ilex glabra 2'-2½' high

16" Ball:

Topsoil — .31 cu. yd.
Area of Pit — .62 sq. yd.
Rhododendron carolinianum — 2'-2½' high
Rhododendron catawbiense — 2'-2½' high
Rhododendron maximum—2'-2½' high

20" Ball

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.
Kalmia latifolia 2'-3' high-collected

3'-4' high B. & B.—22" Ball

Topsoil — .68 cu. yd.
Area of Pit — 1.2 sq. yds.
Kalmia latifolia
Pyracantha coccinea lalandi
Rhododendron in variety

Exceptions—18" Ball:

Topsoil — .39 cu. yd.
Area of Pit — .8 sq. yd.
Ilex crenata

24" Ball:

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.
Kalmia latifolia — collected

4'-5' high B. & B.—24" Ball

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.
Rhododendron in variety

Exception—22" Ball:

Topsoil — .68 cu. yd.
Area of Pit — 1.2 sq. yds.
Ilex crenata

5'-6' B. & B.—28" Ball

Topsoil — 1.26 cu. yds.
Area of Pit — 2 sq. yds.
Rhododendron in variety

Exceptions—20" Ball:

Topsoil — .56 cu. yd.
Area of Pit — 1 sq. yd.
Ilex opaca

24" Ball:

Topsoil — .81 cu. yd.
Area of Pit — 1.4 sq. yds.
Ilex crenata

6'-8' high B. & B.—30" Ball

Topsoil — 1.45 cu. yds.
Area of Pit — 2.2 sq. yds.
Ilex crenata
Rhododendron maximum

Exception—26" Ball:

Topsoil — 1.09 cu. yds.
Area of Pit — 1.6 sq. yds.
Ilex opaca