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ENGINEERING AND DESIGN

Recreation Planning and Design Criteria

ENGINEER MANUAL

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, D. C. 20314-1000

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Manual
No. 1110-1-400

31 July 1987

Engineering and Design
RECREATION PLANNING AND DESIGN CRITERIA

1. Purpose. This manual provides guidance compiled from experience and research for use in the planning and design of recreation areas, sites and facilities.

2. Applicability. This manual is applicable to all HQUSACE/OCE elements and field operating activities responsible for planning, design, construction and rehabilitation of new and/or existing recreation developments.

3. Discussion. The criteria and standards presented herein are intended to produce safe, efficient, cost-effective recreation facilities that are accessible and enjoyable to all. The designs must provide for the health, safety, security and comfort of the visitor in all aspects of development. It sets out specific design considerations which, when applied, can eliminate confusion and duplication of effort. Additional guidance is given in the form of construction details and examples of existing, design concepts. The illustrations were selected for their soundness of design and their capability for meeting the public need for recreation facilities.

FOR THE COMMANDER:

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DEPARTMENT OF THE ARMY
U. S. Army Corps of Engineers
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CHAPTER 1

GENERAL CONSIDERATIONS

1-1. Purpose. This manual provides guidance compiled from experience and research for use in the planning and design of recreation areas, sites, and facilities. The material in this manual is intended to produce safe, efficient, cost effective recreation facilities that are accessible and enjoyable to all.

1-2. Scope. This manual presents basic design considerations for major components of recreation areas and contains specific guidelines which can eliminate confusion and duplication of effort. Additional guidance is given in the form of construction details and examples of existing design concepts. The examples were selected for their soundness of design and their capability for meeting the public need for recreation facilities.

1-3. Applicability. This manual is applicable to all field operating activities responsible for the evaluation, design, construction, renovation, rehabilitation, management, and administration of all new and/or existing recreation developments on Government lands.

1-4. General. The design must address concerns for functional use, creative design, environmental harmony, and economical construction and operation. The design must provide for the health, safety, security, and comfort of the visitor in all aspects of development.

a. Visitor Needs. Recreation development should consider current public needs and the scope of activities, facilities, and management duties required to fill those needs. Each site selected for a specific use should support the present requirements and be evaluated for potential future expansion. The designer must research all available information such as the Master Plan, Natural Resources Management System data, State Comprehensive Outdoor Recreation Plans, and current and anticipated visitation.

b. Area Selection. Areas chosen for development should be in accordance with the current Master Plan and must support the proposed use. Activities should be compatible with surrounding land uses to minimize conflicts and avoid overuse of the resources.

c. Cost Effectiveness. Care must be taken to avoid overdesign and underdesign in both size and number of facilities. Economy of scale and life cycle cost analysis using cost effective materials must be considered. Facilities should be consistent with anticipated visitation and the carrying capacity of the site. Cost effective off-the-shelf items should be incorporated where compatible with resource use objectives established in the Master Plan.

d. Interdisciplinary Team Approach. The design of all facilities shall be a fully coordinated team effort among the planning, design, construction, operation, and non-Federal elements. This interaction shall begin with initial planning concepts and continue throughout the construction and operational phases of the project. Items such as roads, parking areas, launching ramps, campsites, beach developments, and similar facilities should be field staked, evaluated, and field adjusted by the design team during the developmental phase. The design team shall periodically visit the sites/areas during construction to determine whether field conditions are as anticipated and to consult with construction personnel in interpreting the plans and specifications. These site visits will also be used to observe and correct any problems not apparent or fully evaluated in the design. The team approach should be used for all aspects of Federal projects as well as for the review and approval of plans to be developed by non-Federal entities. The evaluation process is not finished when construction is complete. The team should observe facilities during project operations to correct inconsistencies between design and usage and gain experience for future design.

1-5. Design Flexibility. The various recreation opportunities created by the national diversity in types of projects, resource base, user profiles, recreation season require flexibility.

a. Site Selection and Layout. Selected sites should be conducive to development and enjoyment of outdoor recreation. Such sites may include: open meadows and woodlands adjacent to streams and other water bodies, level and rolling terrain, and natural features such as waterfalls, rock outcroppings, and specimen trees. It is desirable for the site to relate closely to areas designated for forest and wildlife conservation for the mutual protection provided.

b. Consolidation of Facilities. Economy of scale must be considered in the development of an area. It is generally more cost effective to develop, operate, and maintain a large comprehensive site than several small single use areas. Common sense must be exercised to provide the desired recreation experience and establish proper density of facilities.

c. Design for Efficient Operation. Areas should be developed for single uses with their controlled entrances. However, in the event of consolidation of multiple use areas, a single controlled entrance to the consolidated area is the most efficient.

1-6. Design For Lease Outgrant Potential. Area and facility design and renovation should consider the potential for non-Federal participation in the development and subsequent operation and maintenance. The design team should develop positive working relationships with existing as well as potential local sponsors. Initial costs and O&M capabilities of the local sponsor must be considered when establishing the scope of the development.

1-7. Standardization. It is impractical to create absolute standards for all types of recreation facilities. Regional and environmental needs and user profiles must be analyzed. Facilities design must take into account common local building materials, availability, building practices, regional architectural themes, compatibility with adjacent development, State and local building codes, and maintenance practices. Designs will be developed along regional environmental boundaries and should be reviewed periodically to ensure flexibility and continued applicability. Off-the-shelf structures and standardized components must be considered.

1-8. Future Development In Existing Areas. Development may be permitted in existing areas under certain circumstances. Where modification or renovation of existing facilities is required, special design attention shall be given to:

- Improve health, safety, and security features for the visitor

- Resource carrying capacity

- Maintain environmental quality

- Reduce O&M costs

- Enhance revenue collection potential

- Attract potential non-Federal sponsors

In existing areas capital costs already invested should not be considered as the primary governing factor for determining the types of future use of an area. Changes may be made where necessary and justified.

1-9. Barrier Free Facility Design. All design shall provide for equal access to and utilization of facilities by all visitors. Standards for the design of handicapped accessible facilities are presented in Uniform Federal Accessibility Standards (49 FR 31528). The standards are to be applied during the design, construction, and alteration of buildings and facilities. There are, however, certain situations where these provisions need not be provided. They are:

a. Certain overlooks such as observation towers or decks that are only accessible by steep trails or a series of stairways.

b. All comfort stations within a common recreational site need not be accessible. If site conditions exist that would make it cost prohibitive, provide at least one accessible station in the most convenient location within the area.

c. All boat ramps and courtesy docks need not be accessible if prohibitive by site conditions. If multiple ramps and docks are to be provided within a recreational area, at least one should be accessible.

d. Not all camp sites within a campground need be accessible, provided an appropriate number of assessible sites are included.

e. All primitive camping areas need not be accessible.

f. All hiking, walking, and nature trails need not be accessible.

1-10. Environmental Protection and Enhancement. Designs should minimize the impact of development on the natural environmental qualities of the site. A meeting with representatives from environmental agencies in the early stages of planning is encouraged. This will preclude difficulties in obtaining certain permits prior to the construction phase. The design team should closely monitor the construction and operational activities to ensure compliance with prescribed environmental protection requirements.

1-11. Carrying Capacity. A quality recreation area is dependent on design and construction that is fully compatible with the physical attributes, resource, and social carrying capacity of the site. Under no circumstances should facilities be forced on the resource to meet a prescribed number of facilities. The carrying capacity of the resource should be determined in accordance with guidelines contained in U.S. Army Engineer Waterways Experiment Station (WES) Instruction Report R-80-1.

1-12. Access and Circulation. Access and circulation roads into recreation areas play a major role in influencing the recreation experience. The design and location of roads, parking areas, boat ramps, walks, steps, and trails must be in accordance with the philosophy and intent of how the public will use and participate in the recreation activities. Criteria, data, and basic design considerations for access and circulation in recreation areas is the subject of EM 1110-2-410 and must be used in conjunction with this manual.

1-13. Information Transfers. The importance of information transfer cannot be overemphasized. It is critical to the success of recreation programs that the people involved in the planning, design, and operation of facilities exchange ideas, information, and technology. This information can be from field visits, conferences, and publications.

CHAPTER 2

HEALTH, SAFETY, AND SECURITY

2-1. General. The health, safety, and security of the general public at recreational areas must be designed into facilities from the beginning of the planning stage and continued throughout the design, construction, and operation stage. Engineer manuals and regulations in the 385 series establish the safety program requirement for all Corps of Engineers activities and pertinent provisions of these publications will be applied. All facilities and equipment will comply with applicable Occupational Safety and Health Administration (OSHA) standards, National Fire Protection Association standards, and Consumer Product Safety Commission standards and guides. Corps standards established in this manual will also apply to facility design in outgranted areas.

2-2. Protection and Control. Access to recreation areas should be controlled with natural barriers such as berms, ditches, gates, barricades, and/or fencing. This protects the natural resources and the general public by keeping them within designated areas and away from potentially hazardous conditions.

2-3. Gates/Barricades.

a. Control gates shall be located at the main park entrance and at entrances to camping loops, picnic areas, and other recreation facilities that must be temporarily closed for maintenance, quiet hours, seasonal closures or overuse rejuvenation.

b. Barricades will be installed where a road has been closed and vacated due to inundation. Warning signs shall be placed at sufficient distances from the barricade to allow gentle vehicle stops.

c. Where the occasional inundation of a road occurs, a temporary barricade, in accordance with Manual on Uniform Traffic Control Devices for Streets and Highways, will be installed. These barricades shall be installed when lake forecast indicates a road will be impassable due to flooding. The barricades shall be removed as soon as the road is usable.

d. Rocks, earth berms, shrubs, trees, ditching, etc., may be used as barricades where considered appropriate for traffic control.

2-4. Fencing. Total or partial fencing of park boundaries may be required to prevent park users from trespassing onto adjacent private property, to restrict vehicular access to designated areas, and to adequately delineate property lines to prevent encroachment by adjacent land owners. Fencing may also be required to protect the public from hazardous conditions such as steep bluffs, outlet works, and to provide security for sensitive areas such as maintenance storage areas, oxidation ponds, water and sewage treatment

facilities) electrical switch yards, historical and archaeological sites (reference FM 19-30, AR 190-51, ANSI-C2, AR 190-13). Fencing materials shall be functionally and aesthetically appropriate for intended use: barbed wire for control of cattle, split rail, chain link, or guard post; highly visible cable next to subdivisions; six-foot chain link with three strands of barbed wire around sensitive areas and hazardous conditions such as maintenance compounds, radio building, switchyards; and woven wire with one or two strands of barbed wire around service facilities such as water and sewer treatment facilities. Pedestrian gates, stiles or openings will be placed in the fence at reasonable intervals to provide public access to unrestricted public lands. Policy and guidance on fencing of project boundaries are provided in ER 1130-2-400.

2-5. Guardrails. The use of guardrails should be limited to sharp curves, high roadway embankments, and fills around structures that are located close to roadways and for barricading straight-in access roads that end in the lake. Aesthetically compatible material should be used within parks.

2-6. Buoys. Buoys or buoy lines shall be provided to alert boaters to restricted areas, swimming areas, danger zones, hazardous areas, slow speed areas, boat lanes, etc., and shall conform to the current Uniform State Waterway Marking System. Where no boat traffic is to be allowed (such as outlet works, spillways, water intakes) buoys shall be interconnected with steel cable, booms, or other suitable devices so as to prevent unauthorized entry. Buoys and suitable warning signs shall be placed and maintained upstream and downstream of an outlet work. Buoys shall be located upstream from a maximum discharge through the outlet works or draft tubes. Floating warning signs, attached to the buoy lines, shall be of sufficient size to adequately warn boaters before approaching the hazardous area. Downstream buoys and suitable warning devices shall be placed to prevent fishermen from entering strong currents released during high discharges.

2-7. Signs. Signs shall be provided only where needed to regulate traffic, warn of hazardous conditions, establish restrictions (and restricted areas) and to provide information. Examples of sign placement are bluffs where diving is prohibited, slippery surfaces on boat ramps, downstream of dams and tailraces, restricted areas for authorized personnel only, prohibited fishing areas or boating areas. Detailed guidance on all traffic and warning signs and their placement shall comply with the current Manual on Uniform Traffic Control Devices for Streets and Highways and chapter 4 of EP 310-1-6. Informational bulletin boards will be provided in public use areas containing project maps, emergency numbers, Title 36 rules and regulations, safety tips, and general information.

2-8. Telephones. Where feasible, public pay phones will be provided in public use areas. Phone service should also be provided to entrance stations for security.

2-9. Courtesy Boat Docks. Courtesy boat docks, minimally sized to accommodate safe use and suitable for handicapped access, should be provided at all

boat ramps when economically feasible to install and maintain (see para 1-9c). Floating courtesy docks are preferred on pools that fluctuate. Fixed docks may be used on stationary pools. Docks shall be located as close to the ramp as possible without creating boat traffic congestion to provide short-term convenience. Access to the dock shall be directly adjacent to the ramp.

2-10. Lighting.

a. Safety. All boat ramps, major road intersections, and major facilities (such as restrooms, group shelters entrance stations) will have adequate lights, when available at reasonable cost. Care should be taken not to over light certain areas and detract from the atmosphere of the recreational experience.

b. Security. All maintenance areas, outlets works, and other major service facilities will have sufficient lighting to protect against vandalism and theft.

2-11. Access Roads to Boat Launching Ramps. Access roads to launching ramps shall be designed to require a deliberate turn from the approach onto the ramp. Traffic control devices, such as barricades, traffic islands, or berms, may be used to ensure access roads are not in direct alignment with the ramp. As a general rule, provide 25 car and trailer parking spaces per lane, except where demand or site conditions require deviations.

2-12. Power and Communication Lines. Overhead power and communication lines will not be permitted across boat launching access roads, parking lots, or areas where sailboats are rigged. Overhead power and communication lines in other areas shall have clearances that comply with ER 1110-2-4401.

2-13. Park Entrance Facilities.

a. A manned park entrance facility is normally provided at major use areas for visitor information and assistance, surveillance, security, and fee collection. Gates and other vehicular controls should be provided in order to control quiet hours traffic. Emergency telephone numbers should be posted near public telephones in a well lighted area.

b. Physical security of the entrance stations should be considered in design. Since these structures serve as a receiving and temporary storage point for user fee funds, a secure vault or safe should be considered in the design of these facilities.

2-14. Steps, Walks, Ramps, and Handrails. Access to buildings and other recreational facilities should be via safe, well lighted steps and walks. Handrails and ramps should be provided as required in EM 385-1-1.

2-15. Industrial Hygiene/Health Hazards. Recreation areas should not present health hazards to the public. Information on any hazardous material should be provided to the Resource Manager identifying necessary controls and precautions to be taken during operation and maintenance.

CHAPTER 3

STRUCTURES

3-1. General. The basic objective in the planning, design, construction, and maintenance of comfort stations, camper washhouses, shelters and other buildings in recreational areas is to provide adequate facilities for the use and support of the visiting public. The structures should be identifiable, convenient, and economical to construct and maintain. The structures should be attractive but not the focal point of the public recreational experience. Design factors should include, but are not limited to:

a. Building shapes and forms should be sensitive and complementary to the natural environment in which they are sited and they should be reflective of the character and style of other major structures in the vicinity.

b. Building and landscape designs shall reinforce each other in achieving compatibility with the environment through the use of forms, pattern, textures, colors, and materials. The building and landscape should complement the site, blending rather than contrasting, using natural forms and materials rather than artifical to present a uniform design statement of quality aesthetics.

c. Building materials, finishes, and systems selection should reflect those which may be procured, constructed, and maintained at a reasonable cost. Selections should consider the quality requirement of the work force, the inefficiency of a remote construction site, and replacement costs. The structures will be planned for a 25-year life. Actual design of site specific structures will require a 25-year life-cycle cost analysis of major materials and systems which will consider first costs and maintenance costs.

d. Buildings should be functional and energy efficient, utilizing natural lighting and ventilation without undue compromise to public health, security, and privacy standards.

e. Pre-engineered, prefabricated or pre-cut structures may be considered in lieu of individually designed structures. However, prior to proceeding with design, a 25-year life-cycle cost analysis shall be performed on the two types of construction including a determination of the impact on aesthetic/climatic environmental values and maintenance requirements.

3-2. Appendixes. Appendix C contains definitive floor plans of certain structures addressed in this chapter. The floor plans are considered conceptual standards for Corps-wide use. Building sizes may vary to suit

specific project requirements. For example, the number of toilet fixtures may increase or decrease, the width of the pipe chase may vary with specific mechanical equipment requirements and shelter sizes may vary with the number of tables covered. Floor plan concepts will, however, remain constant unless exceptionally small or large buildings are required which would give undesirable aesthetic proportions to the building design. In such cases requiring a change, a waiver from higher authority is required. New design concepts, aesthetic features, and environmental themes shall be compatible with the intent of the standards provided herein. Four different architectural themes are shown for each floor plan. Their use is not mandatory but serve as examples of achieving compatibility in various climatic environments. Appendix D contains suggested construction materials and details of accepted practice.

3-3. Sanitary Facilities. These structures provide toilet facilities for the visiting public. They are normally free-standing and sited in an unobtrusive but convenient location in day-use, camping, and boat ramp areas. User safety should be considered in siting these structures in order to minimize the need for the user to cross roads. Design guidance contained in this chapter is relative to functional floor plan. Types of toilets such as pit, vault, waterborne or composting are considered as methods of disposal and are not discussed in this chapter. The total number of plumbing fixtures to be provided in a recreation area is to be based on the average weekend day, 10-hour visitation during the prime recreational season at the specific site (see EM 1110-2-501, Part 2). In addition to the number and type of plumbing fixtures indicated for the various sanitary facilities, a single unisex toilet room shall be provided. The unisex toilet is to provide facilities for the handicapped and for nonhandicapped persons who may require assistance from a person of the opposite sex, i.e., father-daughter, mother-son, or disoriented spouse. One water closet and one lavatory shall be provided in comfort stations. One water closet, one lavatory, and one showerhead shall be provided in each washhouse and bathhouse. All fixtures in unisex toilets shall be barrier free. One drinking fountain should be provided on the exterior of each sanitary facility or in the near vicinity. The drinking fountain should be accessible to the handicapped. The fountain should not be located in the immediate vicinity of exterior lighting because of insect attraction. A utility sink may be provided in a storage room or pipe chase area. Hose bibbs with removable handles should be provided in each toilet area.

a. Comfort Station. A comfort station should be sited and sized to provide facilities for the majority of users inside a 600-foot radius. This distance is optimum and may vary where local codes or site conditions require a larger or smaller radius. For example, if the recreational site is linear, the travel distance to a comfort station should be increased rather than providing an additional structure. The following plumbing fixture allowance indicates the approximate number of persons per fixture:

	Water closet	Lavatory	Urinal
Men	250	330	200
Women	100	250	0

b. Camper Washhouse. These structures provide toilet and shower facilities in camping areas where visitors will spend one or more day/nights. Optimum siting parameters are the same as for comfort stations.

The following plumbing fixture allowance indicates the approximate number of persons per fixture:

	Water closet	Lavatory	Urinal	Showerheads
Men	250	200	200	100
Women	100	200	0	100

A laundry room may be provided and equipped with coin/token operated clothes washer (1) and clothes dryer (1). A built-in counter for folding/sorting clothes may be provided. The laundry room should have its own access and not be directly accessible from either of the toilet/shower areas. In extreme conditions comfort stations may be used in conjunction with washhouse structures in a common camping area. This may be necessary in order to provide convenient toilet-only facilities. In this event, the total number of showerheads would remain constant while the total number of water closets, lavatories, and urinals in the area may increase in order to be convenient to the users.

c. Bathhouses. These structures provide toilets, shower, and clothes changing areas in support of swimming areas. Facilities for the handicapped are to be provided regardless of whether the beach is accessible to the handicapped. In addition to the functional areas mentioned above, a small private room may be provided which serves as a small storage room, first aid area, and personal use of the staff. Basket storage, concessions, or office areas are not provided unless requested and funded by the cost-sharing sponsor. An enclosed shower area is optional. Free-standing shower facilities should be provided outside the bathhouse structure for sand removal. The following plumbing fixture allowance indicates the approximate number of persons per fixture:

	Water closet	Lavatory	Urinal	Showerhead	Change Rooms
Men	330	330	200	200	200
Women	175	330	0	200	200

3-4. Water Supply/Pump House. The structures are normally free-standing and located at the well head. Consideration may be given to locating the equipment within a pipe chase area of a comfort station or washhouse structure. The advantage of this location is to reduce vandalism and the cost of the pump house construction. If included within a toilet facility, any modification to provide additional space for the equipment should be compared to the cost of a separate building. Care must be taken to ensure that state and local health requirements are met regarding the separation of water supply and sanitary disposal facilities. Whether free-standing or included within another building, attention must be given to maintenance access, particularly the ability to remove and replace items such as well pumps and piping. If a free-standing pump house must be provided, the architectural treatment should be consistent with other structures in the area. Interior finish should be minimal since these structures are not for public use. The pump house may be a pit type structure where aesthetics or freeze protection are an issue. Where large water storage tanks are required, adequate visual screening should be provided.

3-5. Shelters. These structures provide the visiting public protection from the elements. Shelters are normally sited in day use areas, but may, with limited application, be sited in campgrounds.

a. Individual Units. These shelters may be provided in areas where tree cover is minimal or where protection from inclement weather is essential. Their sizes may vary from that required to shelter a single picnic table in a picnic area to that required to shelter several tables. The provision of sidewalls is discretionary and is dependent on protection requirements, prevailing winds, and scenic views. In the selection of material for the impact area, consideration should be given to existing soil conditions, granular material, or hard surface.

b. Group Shelters. These shelters provide an assembly area for visitor group activities such as picnics, meetings and/or interpretative programs. Sidewalls are not usually provided; however, one or more walls may be constructed if required by site conditions. Group shelters should be handicapped accessible and sized for 4 to 12 six-person picnic tables with adequate circulation space between tables. The floor should be a smooth, hard surfaced material, such as brushed concrete. Cooking facilities such as a fireplace or adjustable charcoal grills may be provided. They may be integral with the shelter or provided as free-standing units adjacent to the shelter. If free-standing, the direction of prevailing breezes is to be considered for smoke control. Water, lighting, power outlets, and trash receptacles should be provided. Design of the roof structural system should consider use of post and beams rather than trusses or rafters, to reduce the occurrence of bird roosts and the attraction of undesirable insects and other pests.

3-6. Overlooks. Overlook structures, with or without a roof, may be provided in locations to maximize the enjoyment of the area by the visiting public. They are accessed by road, walkways, or trails. Appropriate parking for cars and buses should be provided when justified by the number of expected visitors. Overlooks should be accessible to the handicapped, the elderly, and the young. However, if accessibility is economically prohibited due to site conditions or the configuration of the overlook, such as a tower, consideration should be given to the development of an additional overlook which will provide an optimum view but would allow handicapped, elderly, and young an opportunity to participate. The observation area should provide seating and a hard surfaced deck material. A comfort station and/or drinking fountain may also be provided if justified by the visitation.

3-7. Entrance Stations. These structures are small buildings, located within or adjacent to the entrance/exit roadways to camping areas or day-use areas. They may be occupied by one or two persons whose basic functions are to assist visitors, assign camp sites, and/or collect user fees. Windows and doors in these structures should afford the occupant a view of both incoming and outgoing traffic. A pass window on each side should be provided to enable the occupant to transact business without leaving the station. Security considerations must be given to the safekeeping of the collected fees. These considerations include, but are not limited to, a counter with cash drawer, a secured vault or safe, adjustable shades or blinds to obscure the occupant when money is being counted. A small private toilet may be provided if required by site conditions. The structures should be heated and/or air-conditioned according to climate conditions. Control stations may be permanent structures or temporary buildings mounted on skids. If a physical barrier is required, special design features such as plantings, water courses, or changes in elevation should be used to avoid a fenced in condition. The layout of the actual entrance station itself should also be given special design consideration to prevent the commercial look. It should also be designed and located with the movement of visitors as a primary factor. Power, telephone, and restroom facilities should be provided.

3-8. Fish Cleaning Stations. These structures are free-standing buildings which may be provided in areas of concentrated fishing. Site orientation should consider prevailing wind direction. They are normally roofed structures which are open on two or more sides, however; they may be fully enclosed by screening where conditions warrant. An impervious scaling and cleaning table is to be provided with a metal or (polyvinyl chloride) (PVC) trough to collect the waste. Water faucets, electric lighting, and fish grinders may be provided. Waste is usually contained in an underground holding tank.

3-9. Visitor Centers. Visitor centers are provided to disseminate project related information to the visiting public. Information presented should

help the visitor enjoy the project facilities and its benefits and understand the role of the Corps of Engineers. When a visitor center is not provided, a portion of the project office may be used as an information center. The size, scope, and complexity of visitor facilities will vary, but all share the basic objectives of accommodating and informing the visiting public (see ER 1130-2-401).

CHAPTER 4

UTILITIES

4-1. General. Utilities must be provided as necessary to support recreation facilities and the needs of the public. Appropriate alignment and location is very important for aesthetics, costs, and management reasons. Accurate visitation data are extremely important in the design of all utility Systems. Design for new projects should be based on anticipated or projected visitation. Area renovation should be based on actual historical visitation figures. In the design of utility systems emphasis will be placed on the costs of installing, operating, and maintaining the systems. These systems must meet all Federal, State, and local criteria and standards for health and safety. Utilities such as power and telephone lines, water, gas, and sewer mains, which occupy or cross road right-of-way, should be considered in location and design of the road. Normally, all utility lines should be placed underground unless cost or special conditions make such an installation prohibitive. Underground utilities should be located outside the roadway to avoid any disturbance to traffic during utility maintenance activities. Underground alignments can be traced by the placement of metallic tape in the utility trench. Electric and telephone lines may be placed in a common trench. Water and sanitary lines should be placed in separate trenches from power and telephone lines.

4-2. Power. Where feasible, all electric power lines should be placed underground inside recreation areas. Lines between use areas and lines from site boundaries to use areas can be placed above ground only if they do not interfere with safety, maintenance, or aesthetics. Overhead lines should not be placed where they become a safety hazard to sailboats and are not to be placed over access roads to boat launchings ramps or parking lots. Overhead powerlines should be aligned behind forest cover out of view where feasible. Clearances are to be thoroughly checked in accordance with NFPA-70, ANSI C2 and ER 1110-2-4401.

a. Private power utilities serving the facility are to be contacted at the concept stage to assure power is available in the vicinity and that utility connection charges are included in cost estimates.

b. Electricity may be provided to campsites and fees charged in accordance with ER 1130-2-404. Electrical hookups at campsites should be placed on the drivers side, at the rear of the parking pad. Ground-fault circuit interrupters (GFCI) are to be installed in accordance with NFPA-70. The main switch is to be located above the flood control elevation.

c. Exterior Lighting. Vandal resistant exterior lighting is to be provided where appropriate for the safety and security of the visitor. Exterior lights should be controlled with photoelectric cells or timed switches.

d. Solar Powered Lighting. Where economically feasible, and for safety and security, solar panel powered lighting should be considered where utility power is not available or utility line installation is too expensive.

4-3. Telephone Service. Public pay telephone service should be provided where appropriate for visitor safety and security.

4-4. Water Supply Systems. Water systems serving recreation areas are similar in some respects to rural community systems. As a rule they are rather compact, have branching type distribution piping, and must respond to widely varying water use rates which may be affected by many variables including:

- State and/or local regulations
- Location
- Type of facilities provided
- Visitation
- Visitor use
- Seasonal requirements
- Day of the week
- Special events
- Irrigation requirements
- Weather conditions

a. Corps Guidance. Table 4-1 provides estimated use rates for determining water supply needs for facilities at various recreation areas.

b. Peak Water Use. Peak water use rates suitable for design purposes may be determined by consideration of particular facilities to be provided together with an estimate of the maximum expected visitation. Detailed guidance is provided in EM 1110-2-503.

c. Water Sources. Potable water will be used in all supply systems. Municipal water systems will be utilized whenever feasible. The second most desirable source for a recreation area is wells. In the event of competing sources other than municipal systems, the source chosen should be based on capitalized cost and not merely initial cost. If the system requires chlorination special attention must be made to ensure safe working conditions for employees (Use of hypochlorinators is the preferred method).

d. Water Storage. The quantity of water storage is dependent upon amount and reliability of water source and variation in use. Operating level of water storage and distribution line size should be such that a minimum pressure of 30 to 40 p.s.i. exists at each building requiring flush valves. The location of water storage tanks, hydropneumatic tank, standpipes, or elevated storage tanks should be such that they do not detract from the aesthetics of the area.

Table 4-1

WATER SUPPLY REQUIREMENTS

The following values should be used to determine water supply needs for the various types of areas. Accurate visitation projections are required.

DAY USE	
Picnic--comfort station	5 gpcd*
Overlook--comfort station	4 gpcd
Boat Launching Ramp--comfort station	3 gpcd
Bathhouse	10 gpcd
OVERNIGHT	
Camping--washhouse	25 gpcd
Camping--washhouse w/washing machine	30 gpcd
Camping--showerhouse	25 gpcd
Camping--comfort station	10 gpcd
Camping--non-waterborne toilets	3 gpcd
Groupcamp--washhouse	25 gpcd
SANITARY DUMP STATION	
Campground	10 gal/hr/fixture
Boat	10 gal/hr/fixture

*gpcd=gallons per capita per day; based upon standard flush fixtures and standard showerheads. Where State design quantity standards are higher than the Government's, the State's quantities shall take precedence.

References- EM 1110-2-501.

- EM 1110-2-503.

- WES TR EL-85-1.

e. Campground Service. Health standards need to be strictly observed. A frost-free spigot is recommended in areas that will be used during cool weather periods to avoid freezing. Frost-free antisiphon equipment with adequate drainage should be selected which will not allow contamination from ground water near the surface to enter the water line. If a water supply system needs to be winterized, low point gravity flow drain lines and force air connections will be provided. Feeder lines to individual campsites should carry a maximum pressure of 40 p.s.i. pressure reducer. This reduction will provide adequate water pressure without damaging the water lines in recreation vehicles.

f. Fire Protection Requirements. EM 1110-2-503 provides criteria for determining fire flow requirements. Generally, structures addressed in this chapter shall be constructed in accordance with NFPA, the Uniform Building Code, or local building codes, whichever are the most stringent.

g. Hot Water Service. Water heaters in washhouses may be gas, either natural or liquid propane (LP), or solar powered if more cost effective than electricity.

4-5. Sewage and Wastewater Systems. Sanitary waste disposal and/or treatment is one of the most crucial aspects of park development. Adequate disposal and/or treatment of all waste is a necessity and park development and expansion cannot proceed without these facilities. All designs for sewage disposal or wastewater treatment systems shall be in compliance with all State and local requirements.

a. Sewage Disposal. The most desirable method is to tie into a municipal system where feasible. This should be done even if initial costs are somewhat higher than other disposal systems, as the system may prove economical on a capitalized cost basis. Where municipal waste treatment systems are not available, and on-site treatment and disposal are required, land treatment should be evaluated as an alternative to any positive discharge treatment system. A life cycle cost analysis should be used to evaluate disposal system costs. If sewage lagoons are used they should be fenced and out of sight. If this is not possible, a buffer of plant materials should be provided to screen the lagoon from the view of visitors. Care should be taken to locate all treatment systems down-wind from the recreation complex.

b. Vault, Pit, Sand Filter, and Waterless Composting Systems. If permitted by State and local health standards, these systems may be used if visitation is too low to justify connecting to a central system or it is impractical or not recommended to connect.

c. Specific Guidance. EM 1110-2-501 part 2 provides sewage quantities for use in the design of sewage and wastewater disposal systems. The design

and specification for sewage disposal systems is site specific. The selected system must be cost effective and meet all required state and local standards. Accurate visitation projections are required to determine sewage treatment needs.

4-6. Sanitary Dump Station. The sanitary dump station is necessary to provide for the dumping and cleaning of campers' sewage holding tanks in a designated area. The dump station should include washdown facilities. The dump station should be located above the flood pool or be water tight to prevent flotation caused by flooding; be visually screened from public view; and, if feasible, allow connection to the campground sanitary system. When this is not possible a storage vault will be provided at the site. One station should be provided for each 100 sites or fraction thereof. Where boats have holding tanks a marine sanitary pump-out station should be provided in the vicinity of marinas or boat launch areas as required for health and safety. These stations should be accessible to boats while they are in the water. The design should consider the ease and access of pumping out the holding tanks of such facilities. Potable drinking water hose bibbs should be provided in the vicinity of the dump station to allow fresh water supply for camper units.

CHAPTER 5

LANDSCAPING

5-1. General. Areas selected for recreation development may possess outstanding natural features of earth, rock, water, or plant materials. It is the responsibility of the design team to ensure that these attractions are used to optimum advantage during site development. Inventory the physical properties of the site and determine which features are most conducive to the proposed development. Design should be adapted to utilize these features to the maximum extent. Existing plant materials should be incorporated into the proposed design whenever possible. This can be accomplished by laying out the proposed facility so that existing trees or shrubs are utilized in planting islands or natural areas. Existing trees and vegetation that are to be retained within the limits of the construction area should be cordoned off or fenced to prevent damage. Tree wells or retaining walls might also be used to protect the existing ground line of plant materials designated to be retained. In some cases, thinning of existing vegetation may be desirable. Fifty to sixty percent shade is more desirable and conducive to all activities. Dense shade is the least desirable. Thinning should include selective clearing of undesirable trees to allow unrestricted growth of young vigorous trees, especially hardwoods. If additional plants are required, they should be native species indigenous to the site or ornamental species that are growth zone compatible. These species should be low maintenance varieties and hardy to the area. The use of a tree spade to transplant trees from an adjacent site should also be considered. Facilities should be placed where desired grade already exists. If it is necessary to alter the grade of the site, it might be advantageous to remove and stockpile the topsoil from the area to be disturbed for use in restoration measures. Contoured earth berms should be considered in the landscape plans to enhance the aesthetic qualities of the site. Water courses or natural springs should be staked or fenced to prevent damage from contractor activities.

5-2. Vegetation Planting. The specific function or purpose of plants should be the basis for their use in a recreation design. Plants should not only be used for beautification, but should be used in solving environmental, management, and wildlife habitat concerns. The following is a guide for the use of plant materials in solving these problems.

a. Architectural. Closely spaced plants create walls and screens. Undesirable views, such as junk yards, service and storage areas, parking lots, garbage stations, electrical transformers, and many other negative features, can be screened with plants, berms, and/or architectural fences. Effective screens of plant materials and/or berms can also seclude activities such as sunbathing, camping, picnicking, or nature-watching. Proper selection and placement of plants must be considered for areas requiring security and surveillance.

b. Engineering. Trees, shrubs, ground cover, and turf may be used to control soil erosion. One such process, known as biotechnical soil protection, uses plants as major structural components, often in conjunction with traditional engineering techniques. The live vegetation is installed as

structural members. The various types of bioengineering systems provide immediate stabilization, while the shoots and roots develop to form a permanent vegetative cover and roots reinforce the soil. The systems use native plant material collected in the vicinity of the project to assure the material is well adapted to site conditions. The plants installed shall be members of the natural pioneer community which will act to stabilize and improve soil and prepare the site for the natural succession of a diverse plant community. Wind erosion can also be reduced by using plants as windbreaks. Plant materials have also proven to have some effect in reducing noise. Noises associated with recreation activities such as swimming areas, playgrounds, and ballfields may be reduced by proper use of plant materials. Plants may be used to assist in controlling traffic, while adding to the visual quality of the environment. Properly placed plants can be used to control the traffic associated with bicycles, automobiles, motorcycles, pedestrians, and animals. Plants can many times be substituted for fences, chains, posts, and wires when used to control or direct traffic.

c. Climatological. Trees, shrubs, ground cover, and turf, or even a combination of these are effective in reducing direct as well as reflected solar radiation. They absorb heat, provide shade, and create dead air spaces. Plants can also control wind. Through techniques of placing plants, the wind can be controlled by obstruction, guidance, deflection, and filtration.

d. Aesthetic. Plants contribute to the aesthetics of a recreation area and provide visual relief from manmade structures. In an increasingly manmade world, plants are a welcome relief because of their diversity of form, color, and texture. Although plants are a three-dimensional element, their shadow, reflection) or silhouette may be more important aesthetically than the plant itself. As a three-dimensional object, the plant may be viewed as a sculptural element, viewed for its texture, naturalness, or color.

5-3. Vegetation Maintenance. Perhaps the most critical factor in designing for maintenance reduction is proper selection of plant materials. An incorrect choice of plants will cause increased maintenance. Native trees and shrubs should be selected if at all possible and then allowed to develop into their natural form without being altered by pruning or shearing. Through proper design and placement of plant materials maintenance can be greatly reduced. Spacing of trees and shrubs without regards to their mature size is a common problem in landscaping design. Many times young plants are located too close to structures, utilities, or walks and as the plant matures, pruning is required to control plant growth. Frequently, large trees are located under or too close to power lines and excessive trimming or complete removal is later necessary. Removal of snow from roads and parking areas is another factor which might influence placement of plant materials. Drifting of snow may occur from improper placement of certain plant material. Trees which drop messy fruit should be avoided in traffic areas or where they will cause increased maintenance. Existing vegetation that is diseased, damaged, or otherwise undesirable should be selectively removed. Use of salt for snow removal should be avoided. Salt residue can damage or kill plant materials.

a. Trees. The location and growth characteristics of trees can affect overall maintenance requirements. Tree spacing is a critical factor in mowing ease. Trees placed in open lawn areas might require hand trimming) or spacing between trees may prohibit access with large gang mowers. Proper selection of tree species may also reduce maintenance at a later date. The root structure of some trees lift sidewalks or damage asphalt paths and should be avoided. The size of leaves from some varieties may cause maintenance problems. Consideration should be given to providing irrigation systems to vegetation which requires additional water and is not located in an irrigated area.

b. Shrubs. Most of the design principals that apply to proper placement of trees likewise apply to initial location of shrubs. One of the most common errors is placing shrubs too close to buildings, walks, or paths causing continual pruning and other maintenance problems.

c. Ground Covers. Proper selection of ground cover species will determine the maintenance which will be required later. Wild flowers or other native plants and grasses should be used if suitable. A slow growing ground cover will leave bare spots and increase soil erosion, encourage foot traffic, and create excessive maintenance because of weeds. A good rule in ground cover design is to space hardy fast-growing plants so they will cover the site as quickly as possible. Long-lived species should be selected if possible.

d. Turf. Since mowing is the greatest time consuming maintenance activity associated with lawns, special attention should be given to design features which will reduce problems in this area. Do not create small patches of grass in hard-to-reach locations. Consideration should be given to creating natural or low maintenance areas such as unmown grasses or wild flowers. (See WES IR R-86-2.) Berms, curves, and slopes should be gentle to facilitate mowing. Slopes of 3-foot horizontal to 1-foot vertical (3H:1V) or flatter are recommended. Mowing strips, borders of brick or concrete set flush with the lawn and used to separate the planting areas from grass, will cut down on trimming. Edging material, such as metal, heavy plastic, or treated lumber, may also reduce the need for hand trimming and will control grass.

5-4. Erosion Control. Preventing soil erosion at newly developed and existing sites is a major concern throughout the Corps. Control measures must consider future maintenance requirements; for instance) the use of riprap in small drainage swales along access roads that are mowed should be avoided. Methods of controlling or minimizing soil erosion include:

a. Plant materials as discussed above.

b. Proper site grading.

c. Retaining walls, riprap or terracing.

d. Ditches or swales.

e. Drainage structures.

f. Erosion control blankets, fabrics and mesh materials.

g. Hay or straw mulch with asphalt emulsion.

5-5. Fire Protection. Selective pruning and clearing of dry brush and grasses and other locally approved methods of control should be considered in geographical areas prone to seasonal wild fires. Coordination with State and local fire control agencies should be undertaken.

CHAPTER 6

SUPPORT ITEMS

6-1. General. The quality of camping, picnicking, or other recreational experiences is often contingent upon the quality, type, and design of support facilities available. The challenge to the designer and manager is to provide aesthetically harmonious, functional facilities which are durable, vandal resistant, and economical to install and maintain.

6-2. Tables.

a. Picnic Tables.

(1) Many standard designs exist for construction of tables. There are also several commercial sources of well built, economical, prefabricated units and components. The choice of design and construction materials should be based on long-term economy, site-specific functional requirements, durability, comfort, safety, aesthetics, and ease of maintenance or repair. These factors should not inhibit creativity in harmonizing these and related facilities into the overall site setting.

(2) Tables and related facilities should be located on delineated impact areas reinforced to avoid site deterioration. Such impact areas should be located on the passenger door side of camping vehicles. Tables in picnic areas should be level and located in shade or open sites free of roots or stumps, without reinforcement, provided soil compaction will not be a problem. Ideally, tables should be located where afternoon shade is available but, to avoid bird droppings, not directly under trees or branches. They should be sited away from the edge of impact areas, steep slopes, or other obstacles, and 6-10 feet away from a fire ring or grill. At least one table per camping or picnic area should be designed and designated for, and be accessible to, handicapped persons. These sites should be close to restrooms and other support facilities.

(3) Portable tables facilitate off-season storage and provide flexibility in meeting varying site conditions and public use demands. Heavy-duty wooden tables are durable, minimize theft, and allow rearrangement to accomodate user preference. Light-weight tables may have to be secured to prevent theft or large scale displacement. Protruding stakes and chains or similar anchoring methods that may present a safety hazard shall not be used.

(4) Design features of tables should include:

- 6 to 8 foot lengths

- Attached benches

- Rounded or chamfered edges
- No protruding bolts or other safety hazards
- Ease of sitting without climbing over obstructions
- Barrier-free for handicapped
- Rust-resistant metal parts
- Ease of maintenance and repair
- Wooden benches in climates where metal benches tend to be cool and damp or very hot
- All wooden parts shall be splinter resistant and treated with preservative approved for human contact

b. Accessory Features. Depending on local or regional conditions and needs, accessory features may be designed into, or associated with, picnic tables. A wind or sun screen may be desirable in particularly windy or exposed areas. If a covered table is installed, shelves or storage boxes can often be incorporated into the roof support structures to provide added convenience at minimal cost. This is especially helpful at primitive or walk-in camping areas where the user otherwise has little available storage area.

c. Serving Tables. While not an essential component of camping or picnic facilities, park users appreciate a small, portable table for holding camp stoves, serving meals, washing dishes, etc.

6-3. Grills and Fire Rings. Where wood is available, campers often desire a warming fire as well as a cooking source. Combination fire rings and grills should be provided to meet these needs. Fire rings at campsites and primitive camping areas contain campfires and help prevent wildfires. They also tend to prevent proliferation of campfire scars which result when campers are free to build fires in locations of their choosing. At picnic areas, and where wood is not available for warming fires, an upright charcoal grill may be provided. Larger charcoal grills are also desirable for group use.

b. Fire Rings. A fire ring is often the best way to meet demands for a warming/cooking fire where wood is available and fires are not prohibited. These fire rings can be made of metal, fire brick, or natural stone. Steel reinforcing bars should not be used with masonry, as differential expansion will cause cracks. Circular units best fit the shape of a fire and are aesthetically attractive. They can be fabricated in-house or purchased off-the-shelf from various supply sources. A gravel, pumice, or other porous base, with drain tile if necessary, is essential to facilitate drainage of rainwater. Anchor stakes will reduce vandalism. Fire rings should be located a minimum of 10 feet away from a picnic table and overhanging vegetation and, if possible, should be sited downwind of the main living space.

c. Individual Grill. Upright charcoal grills may be provided at campsites where wood is not available, where camp fires are prohibited, at barrier free campsites, and at picnic sites. Depending on local use patterns, grills may be provided at all picnic sites. These grills should have adjustable grate height settings, rotation capability, hinged or removable grate for easy cleaning, and be firmly anchored to prevent theft or relocation.

d. Group Use Grill. One or two large upright grills should be provided at each group picnic shelter or area for large cook-outs. These units should have 1000+ square inches of cooking area and meet the other general specifications as individual grills. One or two standard size individual grills may also be desirable for those occasions when the large grills are not necessary.

6-4. Lantern Holders. Portable lantern holders should be provided at all campsites. Besides providing a needed service, lantern holders help prevent damage to trees from lantern burns when lanterns are hung from nails or wires attached to trees. More than one lantern holder may be desirable, since many campers use more than one lantern for increased illumination. Portable lantern holders allow campers to position light to meet their specific needs. Holders may have single or double lantern hangers. The distance from the ground to the lantern hanger should be approximately 6-1/2 feet.

6-5. Trash Receptacles.

a. Dumpsters. Centralized dumpsters should be utilized where commercial services are available, and when it is cost effective. Siting should take into consideration ease of access by service vehicles, convenience to the park user, and aesthetics. Dumpsters should be located on a nearby level concrete or gravel pad which is well drained. The dumpster site should be screened with natural or planted vegetation, attractive wooden fencing, or other aesthetic screen. Prevailing winds should be considered in locating the site if odors are likely to be a problem. The site should have direct access by service vehicles to minimize time spent and distance traveled within a recreation area. Ample turning and maneuvering space should be planned for the service vehicle.

b. Consolidation of Individual Receptacles. Where use of a centralized dumpster is not practical or cost effective, individual receptacles should be grouped and placed in convenient locations. Separate receptacles should only be used when the above method is unavailable or impractical. Individual receptacles (normally galvanized trash cans) should be secured to prevent overturning or theft. Lids should also be secured to the can or holder. Animal proof covers or holders may be required where such disturbances are a particular problem.

6-6. Benches. Benches should be provided as appropriate at sites such as picnic areas, campgrounds) playgrounds, overlooks, vistas, rest stops along trails, or other sites which would enhance the recreational experience or meet the needs of the user. They can be creatively combined with other park elements in an economical fashion, such as topping a playground barrier with a 2 x 10 board to provide a functional seat on which children can rest and parents can supervise. They can be designed to blend with the surrounding setting, such as using a split log bench on a nature trail. Off-the-shelf units can be purchased, or benches could be made to specifically harmonize with a particular setting. As a general rule, benches should be comfortable, durable) and attractive, and be placed on the proper location and orientation to best achieve their basic purpose. Wooden seats and backs, treated with a preservative approved for human contact, are generally preferable to metal or other materials. Creosote and penta chlorophymel treated woods are not approved for human contact.

6-7. Other Support Facilities. Other facilities may be provided to meet specific needs. As with all park facilities, the design and planning of miscellaneous service facilities should be considered with long-term economy and public safety in mind. Some collateral support facilities, such as sanitary facilities, drinking fountains, telephones, and informational signs, are covered in other chapters of this manual. Other facilities may include, but are not limited to the following:

a. Firewood Bins. Firewood dispensing units may be provided at centralized or scattered locations for storage of wood for sale, or for free use of wood cut in grounds maintenance operations.

b. Aluminum Can Collection Station. Containers may be provided for the public to deposit aluminum cans for recycling by a non-profit group, such as a local scout unit. The organizations may be willing to sponsor such a project by constructing and maintaining the station.

CHAPTER 7

SPECIFIC AREAS

7-1. This chapter provides information and guidance related to planning and design of specific areas within recreation areas, sites, or facilities.

7-2. Camping Areas.

a. General. Camping areas are provided at projects as designated in an approved master plan or other approved documents. The design of facilities should provide for public use while protecting the resources. A range of design criteria is established to provide flexible standards for the designer to adjust to existing conditions, resources and, where appropriate, local sponsor's standards. Various levels of campground development can be provided to satisfy diverse camper preferences. Camper surveys indicate a preference for water oriented campsites. Camping areas should be physically separated from day use areas.

b. Area Design. An analyses of slopes, soils, vegetation, climate, and adjacent land use are important first steps in determining location of camping areas. Team concept and field design are the keys to providing quality campsites. Utilizing available shade, minimizing erosion and drainage problems, and retaining the aesthetic quality can only be accomplished by careful field design.

(1) Slope Analysis: General Guidelines. Finished slopes are not to exceed 3H:1V or the material's natural angle of repose wherever possible.

(a) 0-1 percent slope - Drainage could be a problem, watch for high water table, unstable soils, and surface rock formations.

(b) 2-6 percent slope - Few limitations, camping areas should be primarily located on slopes of this nature.

(c) 7-14 percent slope - More expensive construction (cuts and fills) and greater impact on natural resources. Slopes in excess of 15 percent should be avoided.

(2) Vegetative Inventory. Determine what trees and shrubs, if any, can be utilized in the campground for shade, buffer, screening, or privacy. Also locate unique areas to preserve such as remnant hardwood forests, glades, wetlands.

(3) Adjacent Land Use. Identify existing land uses that enhance or detract from a user's camping experience.

(a) Enhancers. Panoramic views, vista clearings, natural interests (such as rock formations on shorelines), road/access, availability of utilities.

(b) Detractors. Generators of noise, smells, and unsightly conditions such as rock quarries, landfills, sewage treatment facilities, chemical by-products, major intrusions (powerlines, traffic corridors, pipelines).

(4) Climatic Conditions. Consider weather effects, such as sun exposures, wind directions, rainfall predictions, on both a seasonal basis and a micro/macro environmental scale.

c. Sizing. Determination of a campground size is dependent upon the carrying capacity of the resources, the type of camping, camping demand, economics, and type of management. This information is normally determined in the master plan and/or feature design memorandum.

(1) Demand. The demand for camping at a project depends primarily on the regional population, the character of the population, other available camping in the area, and the amenities offered, both natural and manmade. Anticipated visitation at new projects can be determined by comparing existing projects in similar settings. For updating existing projects, visitation records, visitor surveys and the experience of on-site personnel can provide valuable information in determining anticipated demand. Provide one camp space for each camping unit anticipated on a normal weekend day during the peak month of visitation.

(2) Economics. The number and density of camping units in a campground will largely determine the cost of constructing the facilities. For general and group camping, densities which will minimize road and utility lengths and provide adequate distance between pads will also reduce costs for operations and maintenance. A useful guideline for construction and operational cost effectiveness for the optimum number of camping sites in a campground should be approximately 150. A lesser number of campsites generally creates high per user costs and greater numbers may create problems of visitor control and overcrowding of facilities. For walk-in or boat-in primitive camping, an exception to this guideline can be made.

(3) Carrying Capacity. A camping area should be designed to accommodate the anticipated numbers of campers while minimizing impacts on the natural resources. The terrain, slopes, climate, soil types, and vegetation will determine the carrying capacity. One must also consider the social carrying capacity of an area. It is important that these elements are evaluated by the multidisciplinary team through the design and construction stages of developing a campground. See WES IR R-80-1.

d. Traffic Controls. Campgrounds should have only one entrance. A controlled gate structure will improve campground safety, reduce vandalism, and provide for controlling the hours or seasons a campground is available for use. A well designed entrance area layout will allow for orderly fee collection, while controlling ingress and egress to the campground. The design should include a turn around at the entrance station for visitor convenience. It will also provide an area for disseminating information about the area. Camp loop roads should be one-way whenever possible to enhance traffic flow and minimize clearing and cuts and fills. Two-way roads and cul-de-sacs may be provided when justified by physical constraints. Camp loops should be designed so that they can be closed if necessary to consolidate campers for management purposes.

e. Facilities. Campground facilities can range from minimal development in primitive areas to full hookups and waterborne sanitary features with showers in maximum development areas. Four levels of development are shown on table 7-1 to be used as guidelines for the range of facilities. It is not necessary for every project to have all four levels of development. Terrain, location, resources, and user preferences will dictate the extent of development in a given area.

(1) Tent and Trailer Camp Space. Provide one camp space for each expected camping unit on a typical weekend day during the peak month of use. A variety of camping spaces (back-in, pull-through, multi-unit, etc.) should be used as dictated by existing terrain features and anticipated user preferences. Typical layouts of various camp spaces are shown in figures 7-1, 7-2, 7-3, and 7-4. Also reference WES MP R-85-1 and IR R-87-1.

(a) Terrain and vegetation will largely determine the spacing of developed camp spaces. Where adequate vegetation for screening and buffer is available, the camp spaces may be placed closer together. Optimum spacing between sites, should range from 50 to 100 feet center-to-center.

(b) Camp spaces should provide a near level (max 2% in all directions) parking areas of not less than 45 feet in length and 12 feet in width. Access to the camping space should be ramped up or down (max 10%) from the access road to avoid excessive cuts and fills.

(c) Back-in camping spurs should be aligned at 40 to 60 degree angles to the flow of traffic. If greater angles are necessitated by terrain, a turning radius should be provided by flaring the entrance to the spur. Wheel stops should be provided.

(d) Pull-through camp spaces should be located on the right-hand side on one-way roads.

Table 7-1

LEVELS OF CAMPSITE DEVELOPMENT

FACILITIES \ DEVELOPMENT LEVEL	MAXIMUM	INTERMEDIATE	MINIMUM	PRIMITIVE (Walk-in)
Access Roads	Paved	All Weather Stabilized Surface	All Weather Stabilized Surface	Gravel
Circulation Roads	Paved	All Weather Stabilized Surface	Gravel	None
Comfort Stations	Waterborne Flush	Waterborne Flush, Vault, Chemical or Compost	Vault, Chemical or Compost	Vault, Chemical or Compost at Trail Head
Washhouse	Yes	Optional	None	None
Designated Spaces	Paved or Compacted Gravel, Multi-use	Compacted Gravel, Multi-use	Compacted Gravel, Multi-use	Space Dictated by Location of Fire Ring
Multi-Family Pads	Up to 30%	Up to 30%	Up to 30%	None
Potable Water	Individual Sites	Multiple Source	1 Source	At Trail Head
Sanitary Dump Station	Yes	Yes	Optional	None
Individual Sanitary Hookups	Optional	None	None	None
Wastewater Drain	Optional if Tied to Sewer System	None	None	None
Refuse Containers	Centralized Locations or Individual Site	Centralized Locations	Centralized Dumpster	Dumpster at Trail Head
Picnic Tables	Yes	Yes	Yes	Optional
Fire Rings and Grills	Fire Ring and Grill	Combination Unit Fire Ring/Grill	Fire Ring or Grill	Fire Ring
Individual Electrical Hookups	Yes	Optional	None	None
Lantern Poles	Yes	Yes	Yes	Optional
Amphitheaters	Yes	Optional	None	None
Playground Equipment	Yes	Yes	Optional	None
Group Shelter	Optional in All Camping Areas	In Group Camping Areas	Optional in Group Camping Areas	None

LAYOUT REQUIREMENTS

1. Stabilize living area and maintain a 0-2% grade.
2. Maintain a maximum 2% grade on rear 30 ft. of parking area with a 10% maximum grade on the entrance.
3. Retain existing vegetation when it does not conflict with grading.
4. Maintain a minimum of 10 ft. distance between the table and fire grill.
5. Do not place fire grill within the circulation paths between the table, tent pad and parking area.
6. Maintain a 5 ft. minimum horizontal distance and a 20 ft. minimum vertical distance between fire grill and vegetation.
7. Locate fire grills downwind from picnic tables if possible.
8. Patio may be detached from parking spur if area features are more compatible to the layout.
9. Evaluate potential camping unit location and adjust for optimum topographic, vegetation, drainage, etc.
10. Living area (patio) should be approx. 625 sq. ft. in area and situated to correspond to entrance door of R.V.
11. Camp spur may be curved to better fit site conditions.
12. Cut and fill slopes shall be designed based on soil and site conditions (3 horiz. to 1 vert. or flatter is desirable).
13. Patio area may be terraced where site conditions require and be accessed by steps.
14. A separate tent pad area 12' x 14' is optional and may be included where site conditions allow.
15. When living area is located between the parking spur and circulation road, sufficient space and buffer must be provided for privacy.

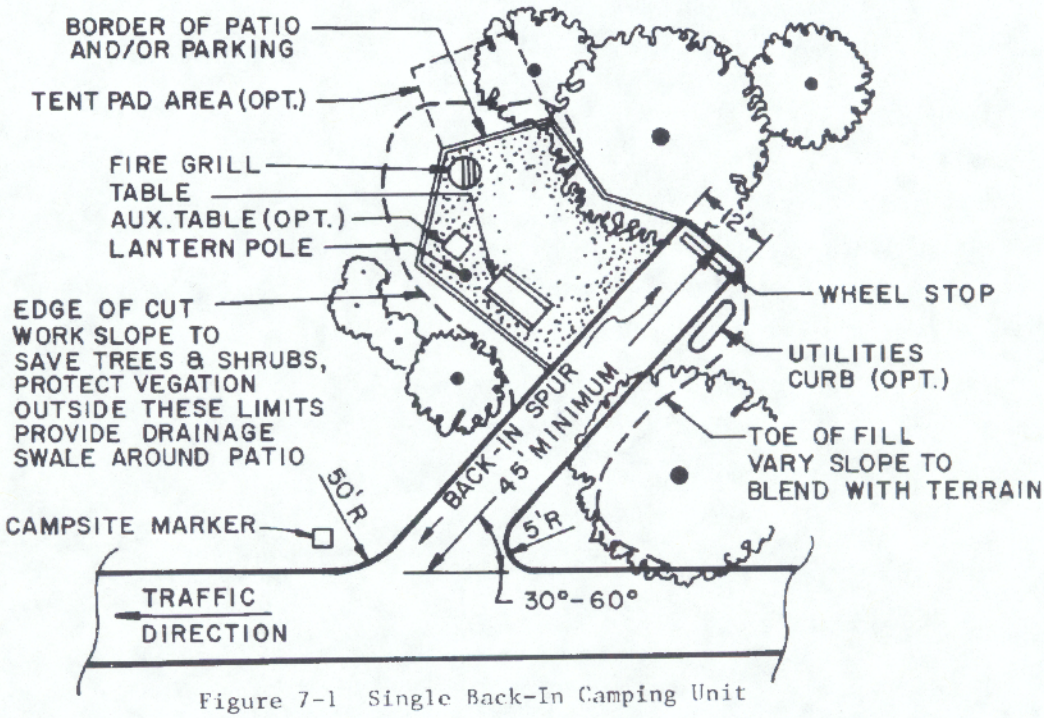

Figure 7-1 Single Back-In Camping Unit

LAYOUT REQUIREMENTS

1. Same as Fig. 7-1, Single Back-In Camping Unit.
2. Patio area for double unit may be increased up to 175% of single unit patio as necessary.

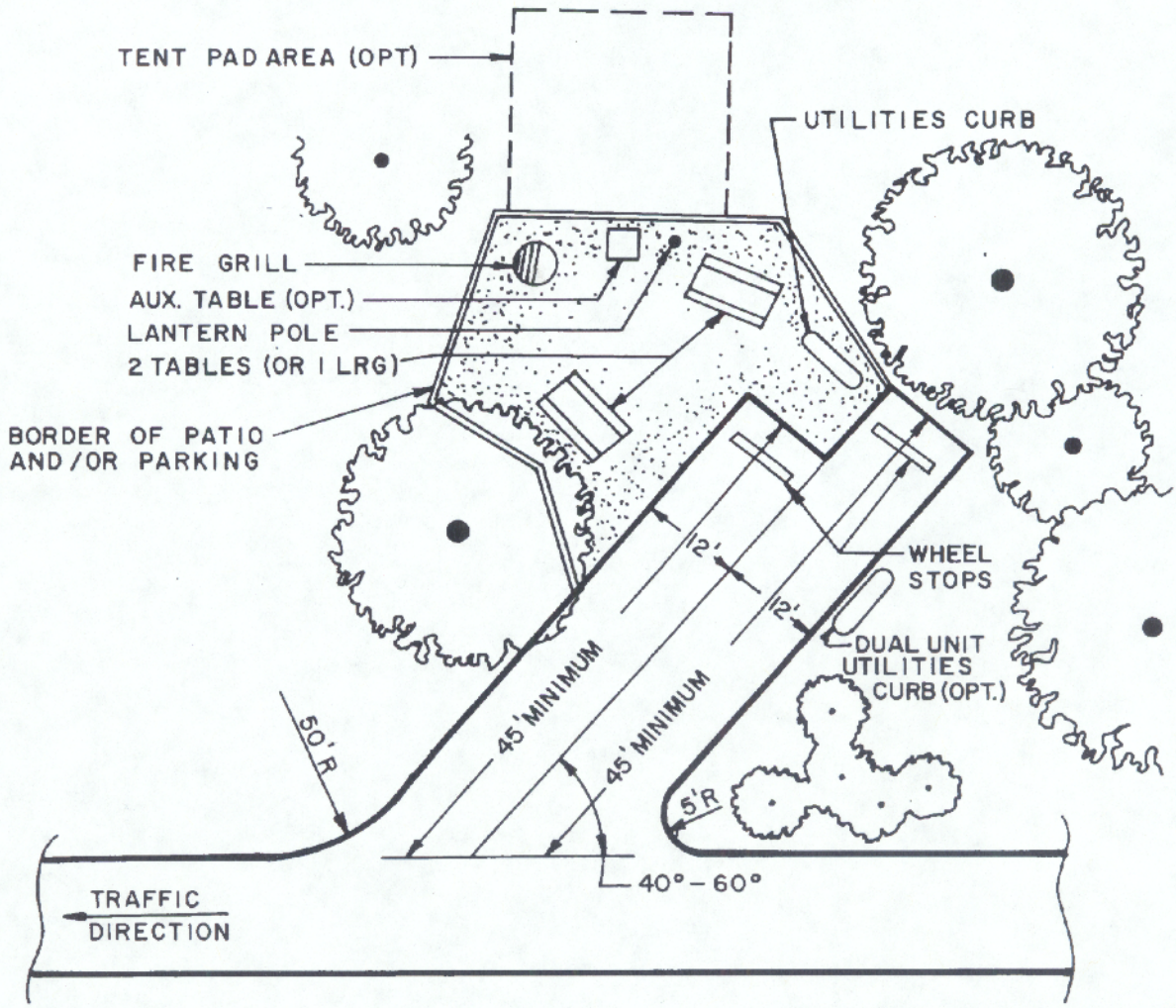

Figure 7-2 Double Back-In Camp

LAYOUT REQUIREMENTS

1. Same as Fig. 7-1, Single Back-In Camping Unit.
2. Pull through unit shall be located only on right side (passenger side) of circulation road.

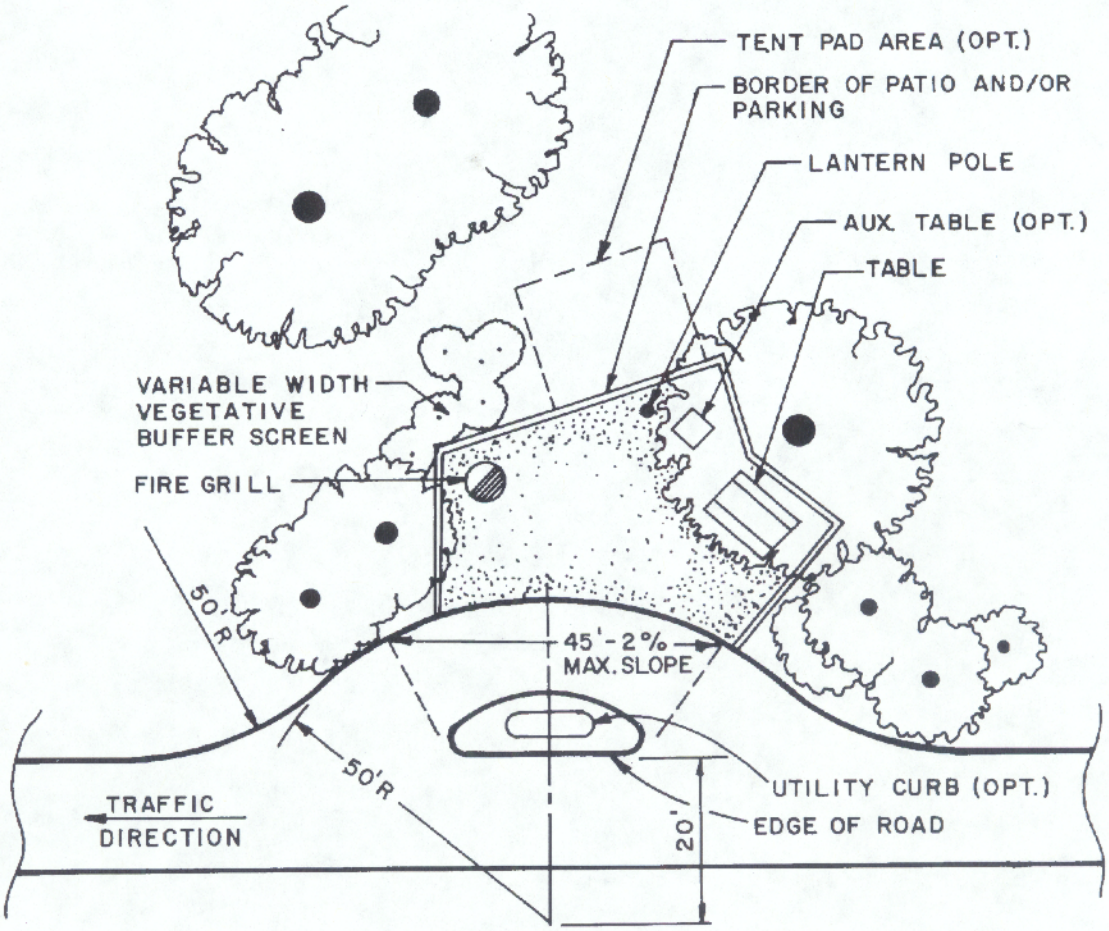

Figure 7-3 Single Pull-Through Camping Unit

LAYOUT REQUIREMENTS

1. Same as Fig. 1, Comments 1 and 3 thru 6 for Single Back-In Camping Units.
2. The 4 ft. wide access trail should have a stabilized surface.
3. Living areas should be located a minimum 50 ft. from parking area.
4. Divert runoff water from adjacent areas around living area.
5. Number and arrangement of parking facilities to be determined by user requirements and site conditions.

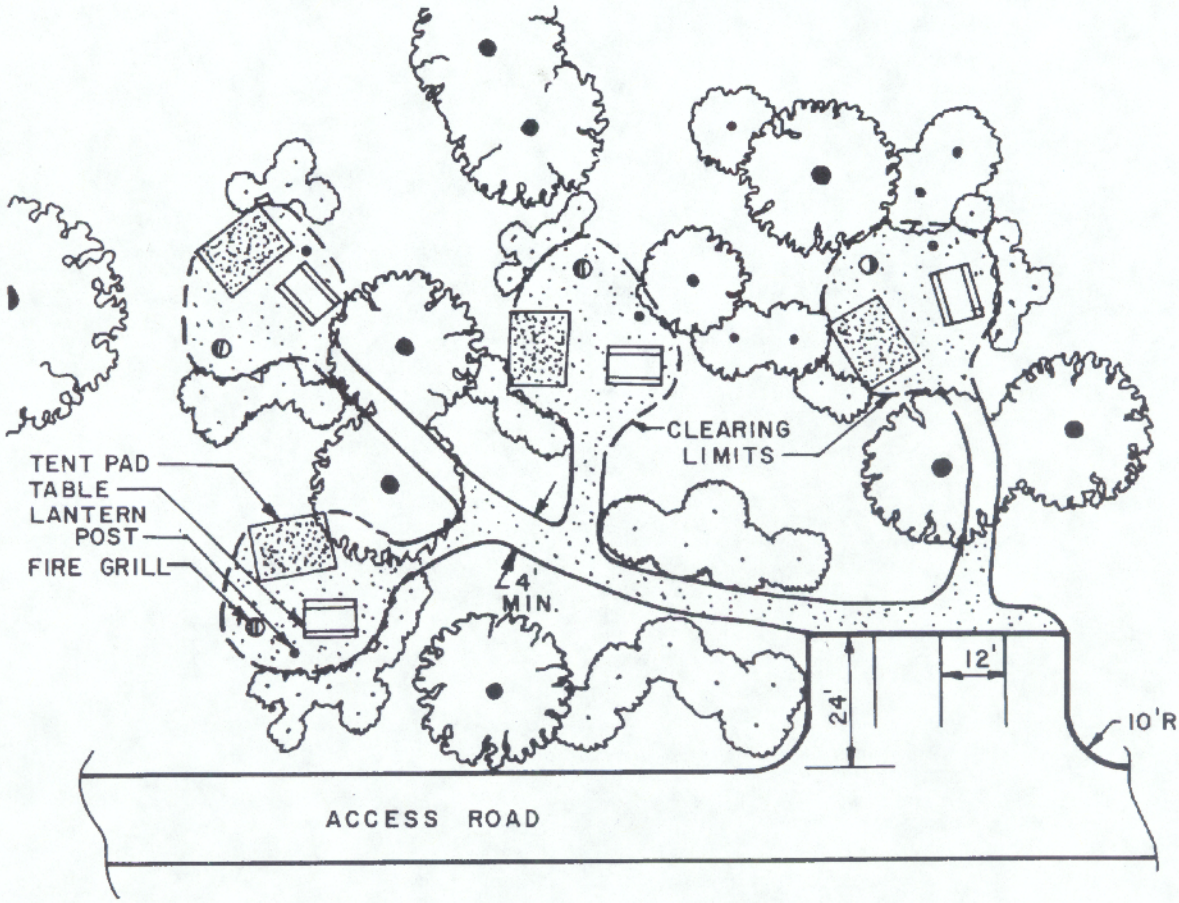

Figure 7-4 Walk-In Tent Sites

(e) Patio or living area should be located adjacent to passenger side of parking space. Living area should provide adequate space for placement of support equipment (picnic tables, grills, lantern hangers, etc.). Generally, 625 square feet is adequate. Additional space for a tent pad (approximately 12 feet by 14 feet) may also be provided at a portion of the sites. Support equipment should be restricted to the living space.

(f) The impact area (parking and living area) should be constructed of a reinforced base such as compacted aggregate. Avoid coarse materials such as pea gravel or creek gravel which have a tendency to roll. Impact area should be outlined with timbers or railroad ties, installed and maintained at grade to define the camp space, minimize site impacts and provide flexibility of campground management.

(g) Utility hookups should be placed to the left rear of a single parking unit or the rear of a double parking space (see figure 7-1). Provide curb or bumper posts to prevent impact of vehicle with hookup.

(h) Consider shading when siting camp spaces. Landscaping or existing tree cover should eventually provide approximately 60 percent shading for the impact area. Morning sun and afternoon shade is most desirable. Open field construction should be avoided due to the cost of landscaping and establishing tree cover. If landscaping is required, select plant materials that are indigenous to the area.

(i) Each campground should contain some campsites which are wheelchair accessible. Such sites should be paved or hard level surface. Tables should have overhang on one end of the table. Width of parking space should be increased by two feet. Campsites designed for the handicapped should be conveniently located near accessible sanitary facilities.

(j) When demand and site conditions permit up to 30 percent of the sites in a campground may be group or tandem sites.

(2) Campground entrance stations should be provided at all fee areas to provide visitor control and collect fees. The station should have exterior security lighting, adequate visibility, and restroom facilities in or near the building. A telephone may also be provided for the safety and security of the visitor. Dual lanes should be provided to accommodate traffic which does not need to stop.

(3) Washhouse. Washhouses and comfort stations should be provided in each developed campground. See chapters 3 and 4 for design criteria.

(4) Non-Waterborne Toilets. Non-waterborne toilets may be provided in areas without water and sewage systems or where needed when waterborne facilities are closed for the season.

(5) Wastewater Drains. Individual camper hookups may be provided where a sewage disposal system is available. Optional grey water drains may be provided in accordance with State and local requirements.

(6) Sanitary Dump Station. Provide one for each campground, as appropriate. The preferred location is along the outbound lane of the access road near the campground exit. Stations should contain two water towers--one for cleaning and another to refill potable water containers. Towers and drain should be accessible from both sides. Provide visual screening as approprite.

(7) Water Supply. Water hookups may be provided to individual campsites; however, a minimum of one water tap with pressure reducing valve for up to 10 camping units should be provided. Locate not more than 300 feet from farthest campsite where possible. For a primitive area, provide the water tap at the trail head.

(8) Electrical Hookup. Electricity may be provided at each camping unit where fees will be collected. Each pedestal should have a 3-prong 15/20 amp receptacle with GFCI breaker and one 3-prong 30 OR 50 amp receptacle installed in accordance with the National Electrical Code (NFPA-70).

(9) Play Areas. May provide playgrounds and play areas. May also provide areas for open play softball, horseshoe pits, etc.

(10) Boat Tie-up and Beaching Areas. Where the opportunity exists along the shoreline an area may be provided to accommodate campers boats. Consolidate the area to minimize conflict with other shoreline uses.

(11) Swimming Beach. A small beach may be provided in the campground where natural site conditions permit.

(12) Parking for Visitors and Extra Vehicles. Provide adequate space for parking of boat trailers, visitor parking, and extra vehicles within the campground complex or for emergency parking. Posts or anchoring devices for securing boat trailers may be provided. User requirements and site restrictions will determine the number of visitor parking spaces. Parking can be designated at or near the entrance station or at centrally located areas in the camp area, or at individual sites where conditions permit.

(13) Fireplace or Grill. Furnish a combination fireplace--grill and/or pedestal mounted grills for each camping space.

(14) Picnic Table. Provide a table within the impact area for each camping space (except primitive area).

(15) Refuse Accommodations. Provide centralized or clustered trash recepticles. Utilize individual plastic bags to be deposited by the camper to centralized dumpster, where practical.

(16) Serving Table. Optional convenience facility furnished at well-developed area for preparing meals.

(17) Lantern Poles. Provide at each campsite to prevent lantern damage to trees.

(18) Campsite Markers. Campsite numbering may be on a separate post, on trash can holder, or marked on the spur surface.

(19) Amphitheaters. Small amphitheaters with rustic seating may be provided at campgrounds. These should be provided with electricity, a screen for projectors, a fire circle, lighting, and a podium. Seating should be oriented, where possible, to avoid direct viewing into the sun.

(20) Boat Ramps. Boat launching ramps with courtesy dock may be provided for the convenience of the camper. Campground ramps should be for the use of campground users only. A limited boat ramp parking area should be provided where site conditions permit.

(21) Primitive Facilities. (Walk-In/Boat-In Areas) Clear and designate camping spaces in areas of naturally level slope. Provide fireplace or fire circle. Provide refuse container at trail head. May provide non-waterborne toilet facility. May provide parking and potable water at trail head according to projected needs.

f. Group Camping. Areas for two kinds of group campers can be provided: campers that travel together in caravans and groups such as church or youth organizations. Caravan campers can be accommodated in typical campgrounds, especially when camping loops are provided which can be reserved by the group. A group fire circle can be provided. The organized group camp area should be removed from other public use facilities, varying in size and designed to accommodate groups on a non-exclusive, short-term reservation basis.

(1) Campfire/Fire Circle. Provide one for each small group camp. May contain small amphitheater.

(2) Group Shelter. A shelter may be provided for each group camp loop. Fireplace or cooking facilities may be provided in shelter with two side walls optional. Large group shelter provided at central location if desired. Waterborne restroom facilities may be included as a part of the structure.

(3) Water Supply. Furnish one tap for each small group camp area.

(4) Electric Supply. Electricity may be provided as required for health safety and security.

(5) Washhouse and Comfort Stations. These facilities may be provided in group camp areas in accordance with design criteria in chapters 3 and 4 of this manual. Non-waterborne toilet facilities may also be provided.

(6) Play Area. Provide cleared area for field games such as tag, flag football or kickball. Support facilities such as backstops are optional.

7-3. Picnic Areas.

a. General. Picnic areas are provided at projects as designated in an approved master plan or other approved documents. The design of facilities should provide for public use while protecting the resources. A range of design criteria is established to provide flexible standards for the designer to adjust to existing conditions, resources and, where appropriate, local sponsor's standards. Vairous levels of picnic development can be provided to satisfy diverse user preferences.

(1) Site Planning. Sites for which development is being planned should be analyzed to identify significant natural features such as overlooks and determine how they can be utilized to enhance the planned facility.

(a) The interdisciplinary team should inventory the site and gather information relating to topography, vegetation, streams, drainage sources, soils, and other natural features which will influence the basic design.

(b) A decision which must be made early in the design process relates to traffic control and how vehicular traffic will be handled. Also of importance, is land use adjacent to the site. Major transportation routes or highways may require extensive screening or special buffer treatment to eliminate noise. Undesirable development or conflicting activities located near the proposed facility may also require a buffer or screening.

(2) Support Facilities and Special Site Relationships. The support facilities to be located in the picnic area should be governed by site specific requirements. Standards relating to design and placement of facilities vary from state to state but might be used as a guide, if appropriate. A major factor in the number of facilities planned for a development is the carrying capacity of the site. Picnicking frequently occurs in conjunction with other day use activities, such as swimming and hiking. Support facilities, such as restrooms and parking areas, should be conveniently located for users of multiple activities.

(a) Sanitation. The type of comfort station in a picnic area should relate to the level of services provided and be in compliance with state and local code requirements. Vault-type, chemical or composting toilets may be considered where utilities are not available. Comfort stations should be conveniently and inconspicuously located in the picnic area without distracting from the site. Screening to lessen visual impact may be appropriate.

(b) Shelters. A shelter may be provided over each table where shade is necessary and tree cover is not available. Group shelters should be available for visitors regardless of tree cover. The size of such shelters should be determined by the estimated visitor use. Panels or walls may be necessary on one or perhaps several sides of the shelter to protect users from prevailing winds. An integral fireplace/cooking grill and electrical service may be provided.

(c) Parking. The number of parking spaces required for a picnic area should be based on projected use and resource carrying capacity. Fewer parking spaces are required in areas with frequent turnover rates compared to sites where visitors remain throughout the day. Parking should be located to minimize road crossing and be near the facilities they serve but care should be taken not to occupy prime development areas. Screens or buffers may help to lessen the impact of the parking area. Surfacing of the parking area is dependent on the level of use. Parking areas should be marked to prevent unstructured parking and less efficient utilization of parking space. Buses and large recreational vehicles may require special design considerations. Overflow parking, usually gravel or turf, should be provided at all anticipated heavily used areas.

(d) Water Supply. The quantity and location of drinking fountains or spigots should be determined by visitor use. An ideal location is attached or adjacent to a comfort station, although other locations should be considered not more than 300 feet from the most distant site. Spigots and wells are to be constructed in accordance with public health regulations.

(e) Grills. Adjustable grills may be provided at all sites.

(f) Tables. Table and bench combinations may be constructed in accordance with paragraph 6-2. If the unit is stationary, a wearing pad of concrete, asphalt, or finely crushed gravel will eliminate dust and mud around the table. Portable units should be moved periodically to prevent deterioration of the site. For group picnicking areas, tables should be spaced as needed.

(g) Playgrounds. Open, level areas should be available for participation in field sports. Play equipment may also be provided.

(3) Interrelationship of Support Facilities to Enhance Revenues. Special design considerations must be taken into account when fees will be charged for the use of facilities. These special features generally relate to the convenience of fee collection and proper separation of the fee activities from the non-fee activities.

(4) Visual Resource Protection. Care should be taken during design to protect the existing visual resources and also to ensure the completed facility does not in itself create an unsightly appearance. Borders, screens, and buffers created by the use of plant materials and earth berms should be used to eliminate or lessen the visual impact of objectional views.

(a) Sign Proliferation. Over use of signs is distracting and confusing to the visitor. Signs should be used only when absolutely necessary and be in compliance with chapter 4 of EP 310-1-6. A fully coordinated project sign plan should be developed as part of the design process. A substitute for directional signing could be plant materials or physical structures such as low fences or retaining walls.

(b) Location and Screening of Trash Facilities. Facilities for trash collection must be conveniently located where they will be used, but not dominate or appear unsightly. Screens created from plant materials or walls assist in keeping these facilities out of view.

(c) Use of Natural Materials to Screen/Enhance Views. Proper placement of plant materials will screen unsightly views. Plants can also be used to enhance views by creating a frame or border for the desired vista.

7-4. Swimming Areas.

a. General. Swimming beaches will be provided at water resource development projects as authorized in the Master Plan or other approved document. The primary priorities in the design of a beach will be the safety of the user, the effects that the physical features of the site will have on the beach and future operation and maintenance considerations such as fee collection for special use permit areas. Beaches may be designed in support of multiple use activities or as a single use area. Small beaches may also be designed in conjunction with support facilities such as shelters to disperse visitor use. In addition, as specified in ER 1130-2-400, where concentrations of swimming exists, beach development should be considered to ensure safety of the visitor and protection of the project resource. The design of Corps managed beaches will consider the policy that lifeguards are not provided at Corps beaches. The basis for evaluating site selections must consider:

(1) Existing or projected visitation. User patterns should be determined from visitation records, area use observations, and user survey data sources. For new beaches visitation trends at similar areas at the project or other locations should be used to establish sizing requirements for the beach.

(2) Accessibility. Beaches should only be developed where vehicle entrances are feasible A where such entrances can be controlled or separated from other area uses. Access to a beach in a multiuse area should not interfere with other uses, create safety hazards, or adversely impact the area.

(3) Slope gradients. The slope of the land both above and below the water line is one of the determining factors in the selection of a good beach site. Slopes in the underwater portion of beaches should ideally range from 2 percent to 5 percent, but because of terrain, beaches may be required where slopes approach 10 percent. The most desirable slope being as flat as possible to disperse swimmers. Beach bottoms will be designed to eliminate sudden changes in grade or drop-offs in the 0-5 foot depth. Pre and post-impoundment studies are required to ensure acceptability of gradients at all future beaches. Daily, seasonal, and yearly water level fluctuations due to irrigation, flood control, evaporation, power generation, or other factors must be considered in beach design to assure optimum utilization. On any beaches developed in the future, a detailed inspection of the underwater portion of the beach will be accomplished just prior to opening to the public. The inspection should include necessary detail to reveal sinkholes, depressions, or dangerous drift material and corrective actions should be taken prior to opening of the beach. Record of these inspections and corrective actions should be placed in project files. Safety will be the prime consideration in beach development.

(4) Soil composition and stability. Sites should be selected which offer a proper base for a sand beach. Beaches should not be located in areas where extensive siltation occurs or is expected to occur.

(5) Water Characteristics.

(a) Water quality at all beach locations must be acceptable for swimming. Prior to detail design water quality sampling data must be collected, analyzed and coordinated with appropriate State agencies.

(b) Beaches will be located where adequate water circulation is present to assure continued acceptable water quality. Barriers and coves generally offer the best protection against wind and wave action; however, dead water coves should be avoided. Adequate circulation is also necessary to remove surface debris that may deposit on the beach.

(6) Health Considerations. Swimming beaches will be planned to provide protection from boats, fuel spillage, sewage and industrial outfalls, and boat wakes. The beach should be sited to ensure maximum southern exposure where possible. However, in non-Corps areas where lifeguards are provided western exposures should be avoided if possible so as to reduce afternoon glare to the lifeguards. Insofar as possible, beaches should be located upstream from boat ramps, marinas, etc., in order to minimize or avoid effects of fuel spills. Beaches should not be planned where concentrations of waterfowl exist.

(7) Surface Drainage. During the planning and design of a swimming beach, special emphasis must be given to surface drainage.

(a) Surface runoff must not be allowed to drain across the beach area; therefore, the runoff from any area upland of the beach must be diverted. Methods of diversion might include grassed swales, terracing, inlets, landscaped walls, etc. Methods of diversion should complement the beach development and minimize impact to the site. If possible, outfall of diversion should be located downstream of the swimming beach.

(b) Runoff from the parking areas shall be controlled and diverted to an outfall away from the beach area. If outfall is necessary toward the lake, it should be located downstream of the swimming beach.

(c) Runoff from commercial agricultural activities in the watershed such as ranching or farming should be considered when locating beaches.

b. Design Criteria. Figure 7-5 demonstrates a typical schematic layout of a swimming beach area.

(1) Buffer zones. Beaches including turf sunbathing areas should be separated from parking areas with an adequate grass buffer when possible. Trees should be left, as practicable, in the turf areas adjacent to sand beaches. If surface runoff is anticipated to be heavy, diversion contouring or ditches should be designed to carry runoff water away from the beach turf area and swimming area. Placement of picnicking facilities in the buffer area should only be done if absolutely necessary. If such facilities are designed into the beach area, they should be located so as not to interfere with the primary purpose of the beach.

(2) Design Carrying Capacities. Beach sizing should be based on the assumption that approximately 60 percent of the total numbers of bathers will be on the beach at one time with 30 percent in the water and 10 percent elsewhere. As a rule-of-thumb a turnover factor of 3 will be used for design purposes. Ideally 50 sq. ft. of sand and turf and 30 sq. ft. of swimming area inside a buoyed safety zone should be provided for each person. Beach capacities will vary according to the attendance, supervision, size of beach, anticipated usage, and type of beach experience desired. Any space standard used to compute beach capacity should be flexible enough to accommodate these factors on a local level.

(3) Vertical Limits. The upper limits of graded areas should be based on an analysis of daily, seasonal, or yearly water level fluctuations. The lower limits should be 6 vertical feet below the normal summer pool elevation. Any deviations in the minimum limit should be fully justified. The beach and adjacent underwater areas should be graded on a constant slope. Underwater slopes should extend at least 10 horizontal feet beyond the lowest placement of buoy lines.

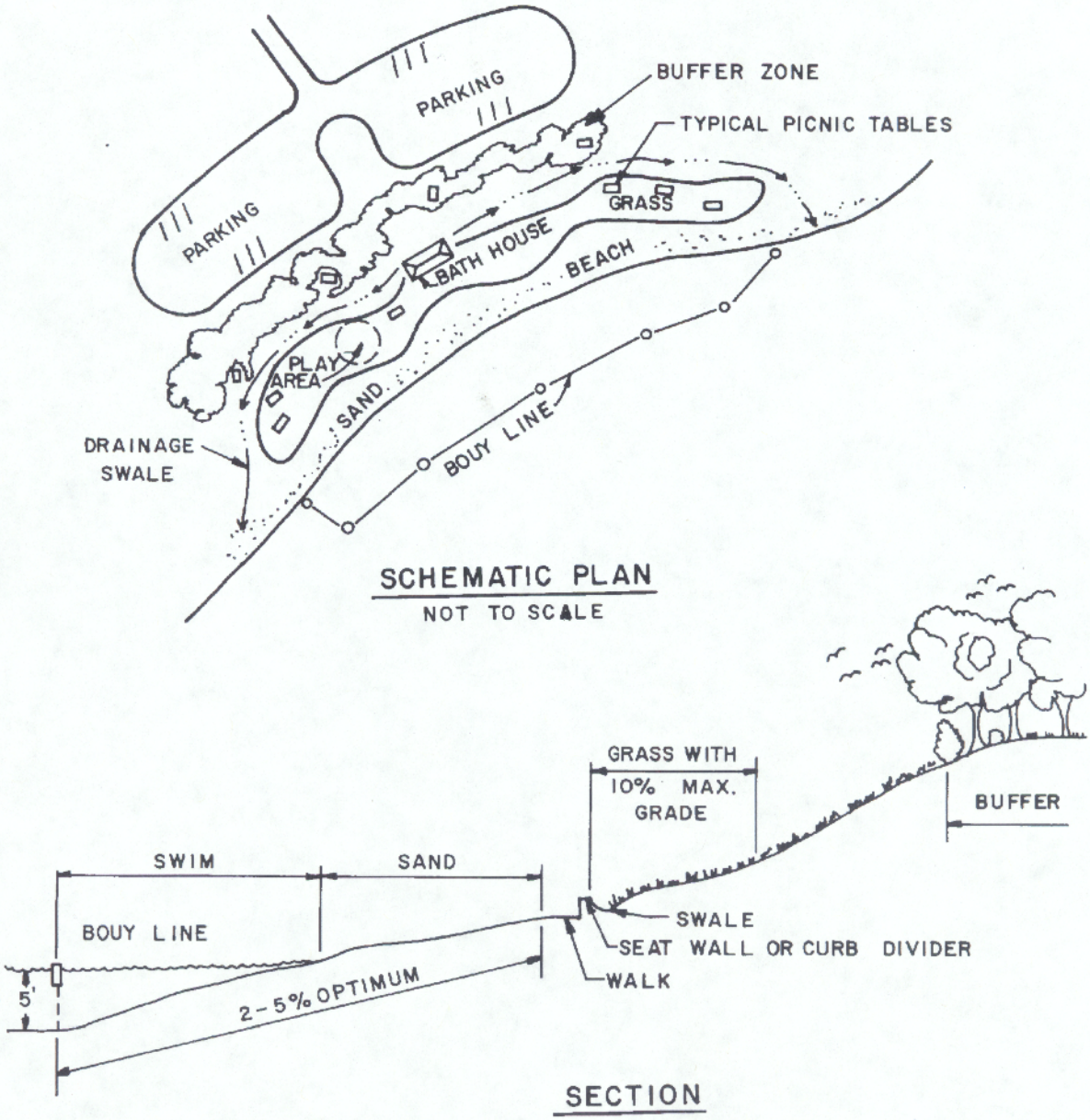

Figure 7-5 Schematic Layout of Swimming Beach Area

(4) Beach Site Preparation.

(a) Beach construction prior to water impoundment: The area will be cleared of all trees, shrubs, and manmade objects. The area will be stripped to a minimum depth of 6 inches. This soil may be stockpiled for later use if suitable. All depressions and holes will be filled with suitable material and compacted. Grading operations shall be performed to establish the gradient specified in paragraphs 7-4a(3) and 7-4b(6). All fills will be constructed in lifts not to exceed 12 inches and shall be compacted to a specified density. Sand as specified below will be placed on a prepared stone base to a uniform thickness to reduce turbidity. A layer of nonwoven filter fabric may be placed on the base prior to sand placement.

(b) Beach construction with water impounded. A detailed survey and inspection of the area is required as stipulated above. Grading requirements will be established based on this survey. All trees and stumps within the beach area will be removed. Holes and depressions shall be filled with granular materials such as sand, gravel, or crushed stone. Special efforts will be taken to ensure that all holes are properly filled. The beach area will be constructed in accordance with above. The swimming area shall be graded to the design gradient. Any fills required to bring the surface to proper grade shall be constructed with granular (cohesionless) material. Sand shall be placed within the designated area. Six inches of sand in excess of the design thickness should be specified to control final grades.

(5) Sand. A minimum depth of 2~0" of sand should be applied on all above water beach areas. Coarse sand should be used if available to resist wave action.

(6) Diving Platforms and Swim Floats at Non-Corps Areas. Diving areas rafts, floats, platforms, or similar facilities are not permitted in Corps managed areas and may be provided at non-Corps areas under lease or license agreement. These types of facilities should be discouraged. If permitted, rafts, floats, or diving boards up to 3 meters high will be located only where a minimum of a 12-foot depth of water can be maintained. A minimum of 15 feet depth of water must be available for boards higher than three meters. All facilities described in this paragraph must be anchored in a safe manner so they will not move from the designed location. Anchors should be designed to permit detachment so the facility can be removed from the water for maintenance or repairs. It is assumed that 20 percent of the swimmers will use a diving facility and a minimum of 50 square feet of surface water should be provided per diver. Rafts used to support diving boards or swim floats should be stable, properly anchored, and large enough to prevent movement during maximum use.

(7) Facilities for the Handicapped. Where practical, a paved walkway at least 4 feet wide with metal handrail should be integrated into the beach area to aid handicapped persons in gaining access to the swimming area. The swimming area for the handicapped should be marked off at the end of the walkway and handrails may be considered for the area.

(8) Buoys and Markers.

(a) The limits of the swimming area will be marked off by buoy lines or foam filled floated pipe lines. The PVC pipe buoy is preferred in beach areas that will experience heavy traffic. Larger beaches may be sectionalized so that one or two sections can be used on slack days and additional sections utilized as needed during heavy use hours or days. International orange colored floats will be provided every 15 feet on buoy lines or at all angles when PVC pipe is used. No lines will be anchored to trees, rocks, or walls.

(b) Off-limits areas around hazardous areas such as shallow water should be marked by buoy lines or floating pipelines.

(c) Ideally, buoy lines used to mark the limit of the swimming area should be placed in water not more than 5 feet deep. However, at lakes where water level fluctuations occur, this would locate the buoy line in shallow water which would critically limit the usefulness of the swimming area. In such cases, buoy lines should be placed in relation to the mean water level. In lakes where significant water level fluctuations occur, buoy lines must be designed so they can be adjusted as necessary.

(d) A minimum of two warning marked buoys or floating signs indicating the "boats keep out" symbol (diamond shape and international orange) should be spaced at a maximum of 200-foot intervals and should be located to provide adequate warnings to vessels approaching the swimming area from various locations. The buoys should be between 100' and 300' from the swimming area buoy lines.

(9) Additional Safety Measures.

(a) Life saving devices consisting of life jugs, a ring buoy and line, and one 10- to 12-foot pole (shepherd's hook) every 200 feet may be located in beaches where lifeguards are not provided. Life jugs may also be provided. Depth gauge poles should be placed at regular intervals along buoy lines. First aid stations may be provided, where conditions permit.

(b) In areas designed for non-Corps sponsors lifeguard facilities may be provided. Where lifeguards are to be provided by the non-Corps sponsor, a lifeguard stand or platform at least 6 feet high should be provided for every 200 feet of beach or fraction thereof. It should be equipped with an umbrella and a storage compartment for a first aid kit and other supplies.

(c) Bulletin boards or signs, prominently placed where swimmers can readily see them before entering the area, will be provided to post emergency phone numbers, safety messages, and other information.

c. Support Facilities.

(1) Bath Change Shelters. A minimum of one bath change shelter should be provided for each swimming area with an expected peak attendance of 600 swimmers on a normal weekend day. These change houses should be between 200 and 500 feet from the water's edge. Whenever possible, dressing rooms should be combined with sanitary facilities and showers. Interiors of bathhouses should be of a readily cleanable material and floors should have a non-slip surface, impervious to moisture and sloped to drain. Open air or outdoor showers should be used where practical to reduce cost. If an open air facility is the only facility provided, a 3- to 4-foot roof shelter may be considered for protection from rain. All bathhouses or shelters should be designed for pressure hose cleaning.

(2) Water Supply and Sanitary Facilities. All beaches with an expected visitation of 400 or more per day should have waterborne toilets.

(3) Parking Areas.

(a) Parking areas should be provided within 800 feet of the beach, with 500 feet being desirable. The size of the parking area should be determined from the beach capacity. As a rule-of-thumb one parking space should be provided per three people. Deviations based on site specific conditions may be justified. Additional parking may be required where multiple use activities are provided and/or spectators are anticipated. Parking configuration should minimize pedestrian conflict with vehicular areas and circulation.

(b) Parking areas should preferably be paved and have parking stripes. Curbing, bumper blocks, guardrails or posts should be provided where necessary.

7-5. Sports and Play Areas.

a. General. Active play areas for all age groups, with consideration for the handicapped, are provided in conjunction with recreation facilities such as camping areas, picnic areas, and beaches. This provision can best be accomplished by designating the necessary space for users to participate or spectate in an area that will minimize impacts on the environment. Where feasible, these play areas should be located in conjunction with other supporting facilities such as parking, restrooms, and water. Additional support items to consider are benches, trash receptacles, water fountains, trails, fencing, etc.

b. Control. Play areas should be designed to prevent the need to cross vehicular roads to access campsites, bathrooms, water fountains, or other points of attraction for young children. If road crossings cannot be avoided, play areas should be located so that necessary crossings occur where there is adequate stopping distance along the roadway. Crossings should be adequately signed and marked. Speed control devices such as rumble strips or speed bumps should be used where deemed necessary. Provisions should be made to promote ease of foot traffic to cross the road without having to jump ditches or confront other obstacles.

c. Sports and Play Fields. Where demand or project visitation and terrain permits, a minimum of 2 to 4 acres of open field should be provided for field sports such as touch football, soccer, track and field activities. This can include activities requiring hard surfaced areas such as all-purpose courts. Refer to TM 5-803-10 for additional types of activities, layout, and construction details.

d. Children's Play Areas. Children's play areas should be included as an integral part of a public use area. The specific layout and shape of each play area will be governed by the existing conditions and the facilities to be provided. In campgrounds, play areas for small children ages 3 to 5 (tot lots), should be small and dispersed throughout the area so they are close to a group of campsites. Play areas for children over 5 can be more centralized and are generally larger. The selection of safe playground equipment should be the major design consideration. Equipment with sharp angles should be avoided. There are commercial sources of well-built durable play facilities available and should be used when cost effective. The play areas should be bordered with materials such as wood, timbers, concrete curbing, to help contain the surface material and to clearly define the play area limits. Care should be taken in selecting the border materials with consideration given to safety, aesthetics, economy, vandalism, and maintenance requirements. The impact area should be designed and constructed to provide for adequate drainage. A cushion material, either natural or man-made, should be provided as the surface for the play area. Metal play equipment such as slides or climbing bars should be oriented or located to minimize heating by the sun. Play equipment should not be located too close to the water. To minimize disturbance to the campers, the play areas should be located reasonably close but not in the middle of a campground. Though standard play equipment such as swings, slides, and merry-go-rounds can be provided, the designer is encouraged to be creative in design, selection, and placement of play equipment such as climbers, play walls, contoured earth mounds or sand areas. Equipment used in play areas should utilize natural materials and features indigenous to the area. When possible, benches or seats should be provided in shaded areas and within close proximity to play areas where children can rest and adults can watch their children. In any case, the design should complement its natural setting with consideration given to the use of existing vegetation and tree cover.

7-6. Fishing Areas.

a. General. Fishing facilities are provided to enhance shoreline fishing opportunities created by the water resource project and to assure safe fishing access. Whether these facilities are located in the vicinity of the dam or tailrace, they should be sited in such a manner that their use will not interfere with the operation of the project or threaten the safety of the user. Detailed guidance on design can be found in the State of New Mexico's Accessible Fishing.

b. Siting.

(1) Restricted Use Zone. Most projects will have established a zone immediately above or below the dam in which public use is restricted. Such areas will be clearly marked and adequate barriers provided. Such barriers may be a combination of physical (railing, fence, cable) and regulatory (signs, buoys) deterrents. Fishing facilities should be sited a minimum distance of 200 feet from the edge of restricted use zones.

(2) Corollary Public Use. Fishing facilities may be provided in conjunction with other public use accommodations such as picnic areas and campgrounds. However, care should be taken to avoid interference with non-compatible facilities such as near swimming beaches or boat ramps.

c. Facilities.

(1) Access. When other convenient means of access is not available, provide stairways to permit safe access of fishermen to tailrace or discharge areas. These may take the form of steps, ramps, or grouted riprap. Concrete should have rough-broom finish. Handrails should be provided in conjunction with stairways or ramps.

(2) Platforms. Fixed platforms may be provided along discharge channels. Such platforms and access ramps should accommodate wheelchair users. Provide railing around the perimeter of the platform and access ramp. Platform may be multilevel in areas with large fluctuations. Benches may be provided on the platform. In areas with no current, floating fishing platforms may be provided.

(3) Fence or Railing. Provide fence or railing as required for safety along steep banks and to deter access along restricted use zones.

(4) Fish Cleaning Stations. Fish cleaning stations, either open or screened, may be provided with water spigots, scaling and cleaning benches, carcass grinders and drains as required in areas of concentrated fishing use. Provide a drop pipe into a double baffled septic tank, with provision for pumpout as necessary.

(5) Access Roads and Parking. Provide parking spaces for the vehicles anticipated on a typical weekend day during the peak month of use. Access roads shall be two-way.

(6) Water Supply, Refuse Collection, Electrical Service, Sanitary Facilities. Provide facilities in fishing areas where sufficient visitation exists.

7-7. Hunting Areas.

a. General. Hunting area facilities may be provided at those water resource projects with a sufficient land base and where considerable hunter demand can be expected. In contrast with other public use facilities the overriding concern should be to disperse the use patterns over a large area and to minimize user densities. This may also negate the need to provide sanitary waste facilities and/or refuse collection.

b. Siting. Establish areas clearly separated from high density public use or concentrated private development. Utilize existing road systems that terminate at the project boundary wherever practical. Site facilities at the edge of areas intended for low density, natural areas, or wildlife management area designation.

c. Facilities. Provide a road and parking area to each access point. Parking areas should be delineated with a fence or other restrictive barrier to prevent vehicle access beyond the access point if natural features do not accomplish this. Walk-through gaps should be provided. Signs or bulletin boards should be posted at each access point which describe the limits and use restrictions of the area. Signs should be posted to clearly indicate the boundary of the hunting area to advise hunters when they are entering adjoining private property or high density public use areas. The distance between access points is dependent on several factors including hunter demand, terrain, existing roads, available land area, and predominant game species. Normally the distance between hunter access points should be at least one mile. Portable toilets might be considered in areas where hunting activities occur for only short periods such as 1 or 2 weeks.

7-8. Natural Areas. Natural area facilities, such as boardwalks, observation platforms and blinds, may be provided at water resource projects for viewing unique natural features such as glades, geologic formations, native grass, timber stands, or wildlife. Provide road, parking area and, interpretive display or bulletin board identifying the features of interest. Interpretive trails may also be provided. Sanitary facilities and refuse collection may be provided where sufficient visitation exists.

7-9. Information Areas.

a. General. Information areas provide facilities to promote an understanding of water resource problems, needs, opportunities, and objectives. Facilities must communicate and interpret effectively. Interpretive and information devices must be functional; economical to install, maintain, and replace; and aesthetically pleasing and harmonious with the surrounding resources. Information area facilities include campfire circles, amphitheaters, signs, overlooks, and visitor centers. Visitor centers are addressed in ER 1130-2-401. Interpretive services are addressed in ER 1130-2-428. See Park Practice Program for typical designs of various information area facilities.

b. Campfire Circles. Campfire circles are appropriate for small informal presentations without audio-visual support. Campfire circles may be appropriate for daytime activities in group camps and environmental study areas. One or more campfire circles may be located in an area served by a larger amphitheater for informal presentations and user-initiated activities (e.g., campfire songs, prayer services, marshmallow roasts) etc.). Campfire circles may be provided in campgrounds, group camps (day and overnight), and environmental study areas.

c. Amphitheaters. Amphitheaters are provided for presenting interpretive programs. Amphitheaters may be designed with a stage platform and projector screen for presenting audio-visual programs. Amphitheaters may be provided for interpretive programming in overnight areas (e.g., campground, lodge, or group camp). The following design details are recommended:

(1) Location. The location of amphitheaters should:

(a) Be easily accessible by target audience from trail or road.

(b) Have a neutral or complimentary backdrop with no distracting views in background.

(c) Curtain effect from trees or steeply rising terrain in background is desirable.

(d) Screen security lights and street lights that could shine on projection screen.

(e) Screen stray lights from passing vehicles.

(f) Minimize distracting noises from boats, campsites, etc.

(g) Be located away from other activities (e.g., a concession) which could lure audience away from the program.

(h) Have a north-south orientation of axis of projection booth to avoid light from sunset.

(2) Terrain/Slope. The terrain should:

(a) Be a natural shaped bowl requiring little or no grading.

(b) Not exceed 30 degrees slope measured from horizontal at bottom of screen to avoid distortion in the viewing angle.

(3) Seating. The seating should consider and provide for:

(a) The use of a cone shaped pattern.

(b) One seat per overnight unit.

(c) One seat per user in group camp or environmental study area.

(d) Half logs or pressure treated lumber.

(4) Lights. Adequate low level lighting may be provided for:

(a) Visitor safety and security.

(b) Operational requirements before and after the program.

(5) Electricity. Electricity may be provided by either a permanent supply or portable generators with muffled sound.

(6) Projection Booth and Screen. Where front projection is required:

(a) Projection booth location shall be determined by screen size and projector lenses.

(b) Provide, where practical, remote control at projection booth and at the left side of stage.

(c) The screen surface should be painted white and surrounded with a dull black finish.

(d) The screen should be no larger than 12 feet by 12 feet in size.

(7) Rear Projection Booth. Where rear projection is required:

(a) Provide translucent screen, mirrors, and adequate distance to throw projection onto screen.

(b) Consider work and storage space requirements.

(8) Ground Surface. Impacted areas, such as walkways, aisles, and in front of benches, shall be surfaced with gravel or crushed stone; avoid the use of rounded stone.

d. Signs. The location, design, and construction of administrative signs shall be in accordance with EP 310-1-6, chapter 4. The number of signs shall be kept to the absolute minimum to meet information needs.

(1) Interpretive Signs. Signs and related devices may be used to interpret built, natural, and cultural resources of the water resource project. They may also be provided to interpret major water resource project features, resources, events, or practices.

(2) Interpretive Markers. Interpretive markers and plaques may be used to identify or commemorate a particular site, feature, or event instead of presenting an interpretive story. Markers and plaques may be provided to identify or commemorate a significant site, feature, person, or event when detailed interpretation is not required.

e. Overlooks. Overlooks may be developed to provide a view of the water resource project features. They may also be provided where features of outstanding scenic value or unique interest to the visitor exist. Vistas may be created by selective clearing and pruning of vegetation to enhance desirable views.

f. The design of an overlook should be in harmony with the surrounding area and relate to the feature being viewed. Signs, plaques, or other interpretive devices may be incorporated into the design. Parking and sanitary facilities may be provided when required for health or safety reasons. Selective clearing should retain foreground vegetation to add depth of field. Provide a balance in selection of tree species to remain. Avoid the appearance of clearcutting. The addition of landscape plantings may also be used to enhance the view.

7-10. Marinas.

a. General. Marinas may be provided at projects as designated in the approved Master Plan or other approved document in accordance with guidance in ER 1165-2-400. All aspects of marina design will conform to guidance provided in this manual. The primary objective in the planning and design of marinas is to provide adequate facilities for use by the visiting public. All facilities provided both on land and on the water, must be safe, convenient, and economical to construct, operate, and maintain. Facilities should also be aesthetically attractive and compatible with surrounding facilities.

b. Development Plan. In the planning and design of marinas there are numerous elements which must be considered. A comprehensive site plan showing all proposed marina and support facility development must be prepared in accordance with the approved Master Plan. The type of marina--commercial, club, or municipal will influence specific requirements for operation, security, controls, and amenities. The anticipated usage, based on market analysis, will have a direct influence on the services provided and the type and number of ramps, docks, land storage facilities, maneuvering areas, and traffic flow patterns. Detailed guidance on the design, operation and maintenance of marinas and related facilities is provided in the following references: NWSC B-15; NFPA 303; "Layout and Design Guidelines for Small Craft Berthing Facilities" by the State of California; and Marinas by the National Marine Manufacturers Association.

c. The development of onshore facilities should consider, but not be limited to:

(1) Access roads.

(2) Parking for cars and trailers.

(3) Dry boat storage.

(4) Sales and service area.

(5) Comfort stations (reference chapter 3 and appendix C).

(6) Boat launching ramps, equipment, and maneuvering areas for power and sailboats.

(7) Sanitary waste disposal and/or treatment systems.

(8) Utility supply systems.

(9) Fuel supply systems.

(10) Fire control systems.

d. Offshore development should consider:

(1) Provide safe water depth of boat channels and storage basins.

(2) Erosion and silt prevention controls.

(3) Ice, wind, wave, flow damage controls.

(4) Floating and/or fixed walkways and docks.

(5) Floating fuel supply system.

(6) Utility supply systems.

(7) Sanitary waste holding and/or disposal systems.

(8) Fire control system.

(9) Water surface fluctuation damage control.

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APPENDIX B

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APPENDIX C

DEFINITIVE DESIGNS FOR RECREATION STRUCTURES

To Be Published

(A task force to be organized by DAEN-ECE-I will evaluate existing designs and develop regional definitive designs for recreation structures.)

APPENDIX D

SUGGESTED CONSTRUCTION MATERIALS AND DETAILS

To Be Published

(A task force to be organized by DAEN-ECE-I will develop suggested construction materials and details for recreation structures.)