

SECTION IX - FACILITY LOAD AND OTHER DESIGN CRITERIA

9.01 SITING

All proposed structures will be located above the 638 feet NGVD flood pool. Site selection will be based on environmental concerns including soil types and topography, existing forest cover, and relationship to other structures and utilities.

- a. Buildings. Buildings will be located to maintain as much aesthetic appeal as possible. Because initial recreation area development at Mark Twain was based on consolidated recreation areas, all future developments will be located near existing roads and utilities.
- b. Topography. The area topography consists of very steep hills and valleys at the lakeshore but relatively flat hilltops. These flat areas will be used for all proposed developments to reduce erosion and costs.
- c. Trails. Trails were sited in proximity to existing and proposed developments. Trails are generally located above the 638 feet NGVD flood pool elevation. They will take advantage of geologic and vegetative esthetics.
- d. Roads and Lots. Road and parking lots will be sited on flat terrain near existing road systems. For the most part, they will be in open areas. Where they are located in wooded areas, minimum clearing using natural drainage will be the standard.

9.02 CAMPING AREA ROADS - See Section 9.11

9.03 BOAT LAUNCHING RAMPS - See Section 9.11

9.04 PICNIC SHELTERS See Section 9.11

9.05 COMFORT STATIONS See Section 9.11

9.06 DAY USE SERVICE EQUIPMENT - See Section 9.11

9.07 SIGNS - All new signs will be installed, as required, by project personnel and will conform to the USACE Sign Manual (EP 310-1-6a and -6b), and the Graphic Standards Manual, EP 310-1-6.

9.08 INTERPRETIVE FACILITIES – M.W. Boudreaux and Power Plant Visitor Centers, nature trails, markers, visual aids, and displays are provided as required.

9.09 WASTE AND DISPOSAL - Trash and refuse collection and disposal services are contracted to private haulers.

9.10 WATER AND SEWER DESIGN CRITERIA

a. Waste Collection and Treatment. The present sewer system was designed in accordance with the Missouri Department of Natural Resources requirements and the criteria set forth in the Corps of Engineers EM 1110-2-400: Planning and Design Criteria, and other standards and conditions as required by the Corps of Engineers. The use of septic tanks and absorption fields has been recently added to the waste collection and treatment facilities at Mark Twain Lake.

Generally, sewers at Mark Twain Lake were located to obtain maximum use of gravity flow mains. The gravity flow mains, which are a minimum of 8 inches in diameter, are, for the most part maintenance free, have a design life of 50 years, and have adequate reserve capacity for any future developments at the lake project. Lift stations and pressure sewers were used when gravity flow was not practical due to the topography. The lift stations collected waste from a specific area and transferred, via pressure sewer, the waste to the nearest gravity system or treatment facility. The pressure sewers were sized at 4 inches, which provides an economical size and has large reserve capacity for any possible expansion of the lift station associated with the pressure sewer. Various types of pumping systems were used at the lift stations depending on the specific design requirements of each site. The lift stations can be expanded and upgraded without the need to alter any of the pressure sewers.

Lift station sizing was based upon wastewater being pumped within a 12-hour day with a peak flow factor of 2.5 times the average of 30 GPD per person for campers and 5 GPD per person for picnickers using waterborne toilets. The minimum size for pressure sewers was 4-inch diameter. Minimum discharge from the lift stations was based on maintaining proper velocities within the pressure sewer and minimizing detention times.

Wastewater treatment was designed in accordance with the requirements of the Missouri Department of Natural Resources and Corps of Engineers EM 1110-1-501 Process Design Manual for Land Treatment of Municipal Wastewater, and other standards and conditions as required by the Corps of Engineers. Facility loading was based upon all camping spaces fully occupied in a weekend day without any additional overflows permitted to occur during seasonal or holiday peaks. Peak population was based upon four persons per day for each campsite, and eight persons per day for each picnic table. Picnic sites were based on four persons per day with a turn over rate of two.

Initially wastewater treatment consisted of two land treatment sites, John F. Spalding and Indian Creek, and one package wastewater treatment

plant at Ray Behrens. The package treatment plant at Ray Behrens was eliminated and its wastewater is pumped to the John F. Spalding land treatment system. This required a sewer line crossing the lake at the Lick Creek arm of Mark Twain Lake. Land application has been found to be more economical with regard to operation and maintenance than the sewage treatment plant. Originally, land treatment systems did not require a National Pollution Discharge Elimination System (NPDES) operating permit as required by a package treatment plant. However, in the 1990's, state regulations changed requiring no-discharge waste treatment systems with flows greater than 3000 gallons/day to have a State Operating Permit under state regulation 10 CSR 20-6.015. Consequently, a permit application for both land treatment sites has been submitted. The land application method of treatment meets all federal and state requirements and provides a better level of treatment than the package treatment facilities and with proper maintenance can function beyond the typical 25-year design life of a package treatment plant. The land treatment system was based on a loading of 26 pounds of B.O.D./acre/day. Three septic tanks and absorption fields have been added to the waste treatment facilities at Mark Twain Lake. Two septic tanks receive waste from fish cleaning stations and one septic system services the Willingham Building.

b. Water System. Initially, water supply for the lake area was provided by a municipal source, the Ralls County Water District, using Perry Missouri's water treatment plant. The water system was a surface storage reservoir, which collected rainwater. The development around the lake increased water demand, and the Ralls County Water System was combined with the Monroe City Water System. This connection provided a loop for the two systems and improved the dependability of the water supply. Currently, water supply for the lake area is provided by the Cannon Water District. The Cannon Water District has a lease with the lake project to utilize and maintain the project's two 75,000 gallon elevated water storage tanks and several hundred feet of water distribution lines needed to operate their water distribution system. The Cannon Water District has contracted with the Clarence Cannon Wholesale Water Commission (CCWWC) to purchase water. The CCWWC water supply is obtained from Mark Twain Lake. The contract stipulates purchase of a minimum quantity of water. Once, the specified quantity of water is received, the Cannon Water District starts obtaining water from Monroe City Water Treatment Plant (WTP) due to cheaper rates. The Monroe City WTP withdraws water from their reservoir.

The water supply within the project site was based on providing a minimum of 20 p.s.i. residual pressure under peak flow conditions. The future water system modifications will focus on continued improvement of the present conditions.

Water demand within the project was based upon 30 GPD average per person assuming that all water consumed in one day was used within 12 hours. The maximum hourly rate of demand was based upon a peak factor of 2.5 times average flow. Water mains are not looped. Sizing of internal service lines

to buildings is based upon fixture unit flow requirements in accordance with the National Plumbing Code. Generally, lines are 2-inch, 3-inch, or 4-inch PVC pipe.

Water mains are sized at peak flows to maintain required residual pressures for plumbing fixtures with reserve capacity for future project development.

9.11 TYPICAL DRAWINGS FOR PROPOSED FACILITIES

Typicals for proposed facilities are shown below. Figures 9-1 to 9-3 present the components configured as a shower building. The shower building is composed of four modules. These modules can be configured in a variety of ways to create buildings such as comfort stations, mini-shower buildings, and comfort-change stations.

Figures 9-4, 9-5 present a standardized design for a comfort station and Figures 9-6 and 9-7 display the plans for a campground fee booth.

Figure 9-8 and 9-9 include typicals for a picnic shelter, amphitheater, playground, fishing pier, boat launching ramp, park road, campsite, camper hookups, fire ring, picnic table and grill.

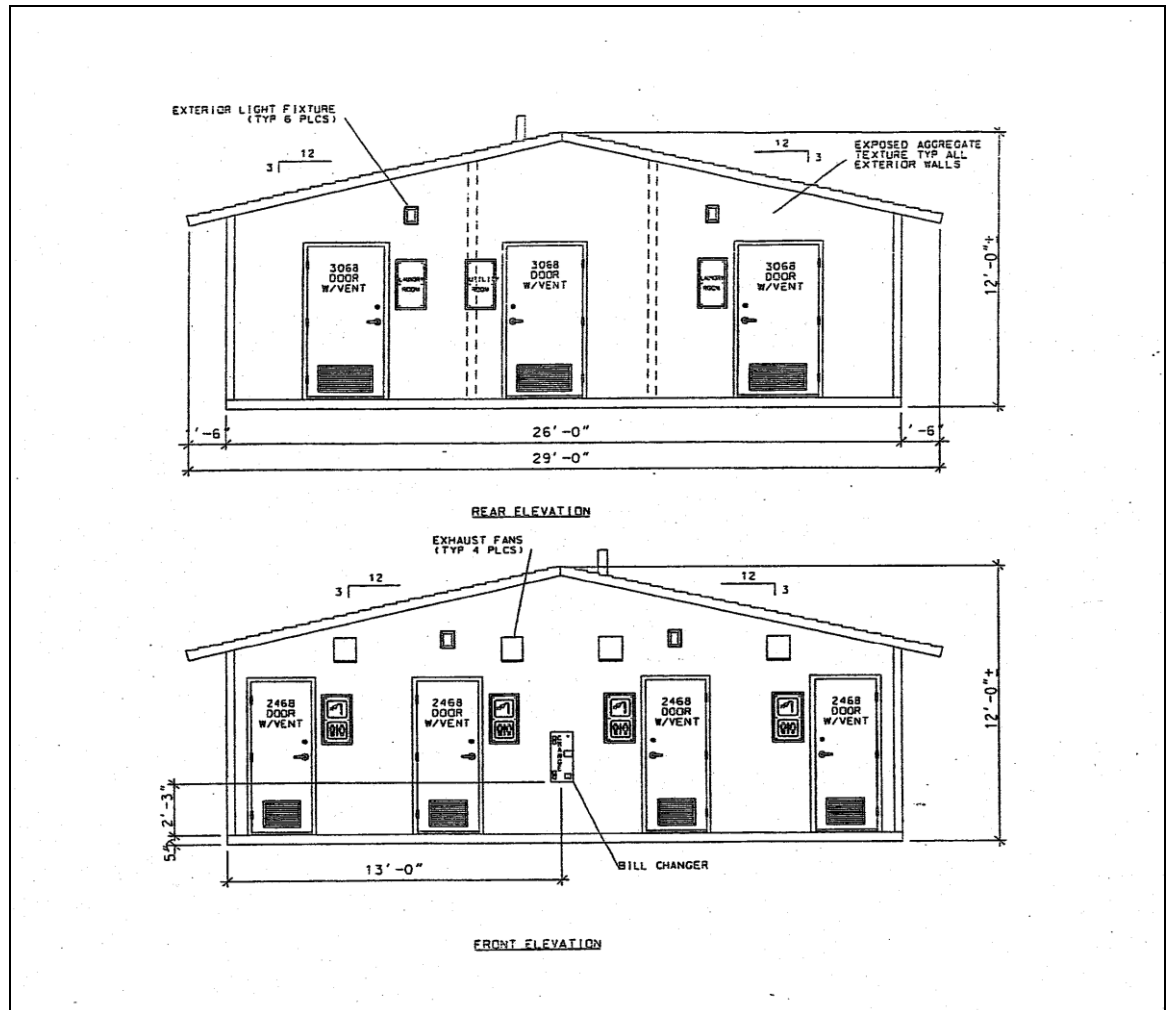


Figure 9-1. Typical Shower Building – Front Elevation

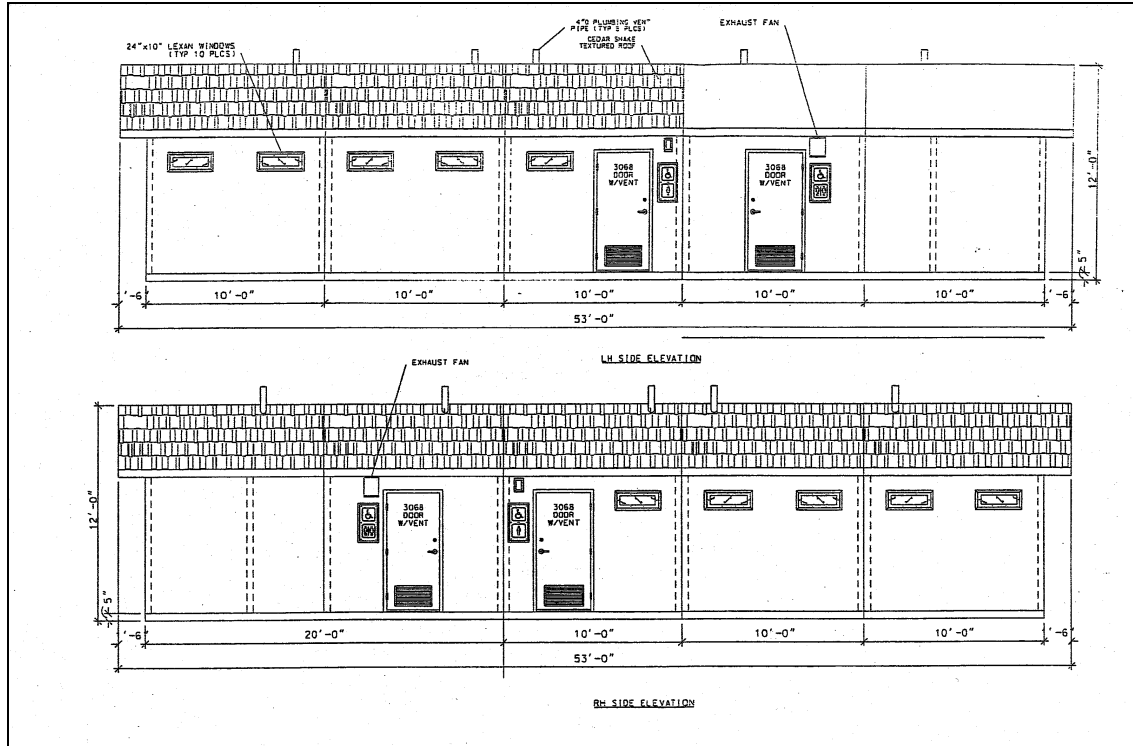


Figure 9-2. Typical Shower Building - Side Elevation

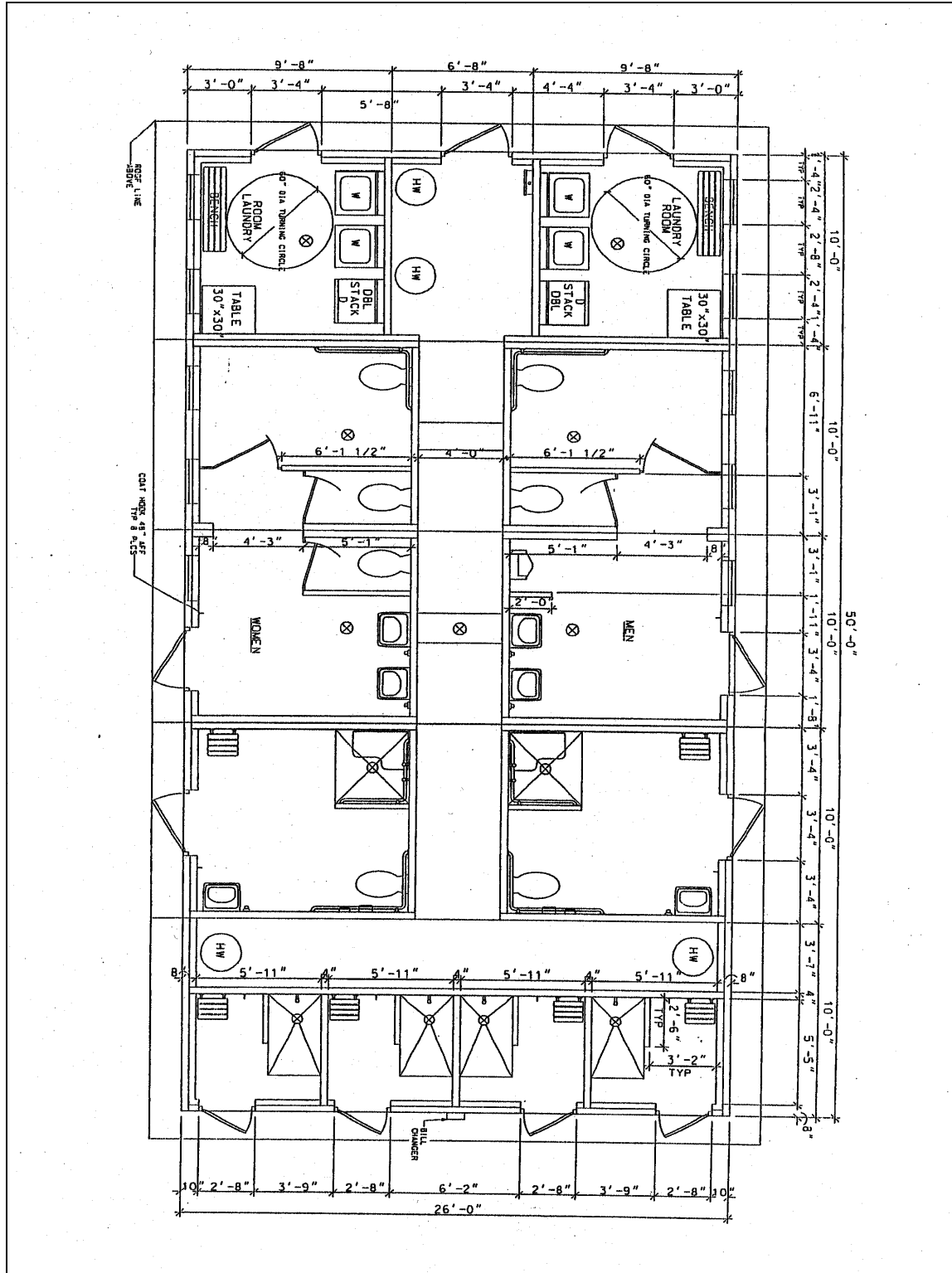


Figure 9-3. Typical Shower Building – Floor Plan

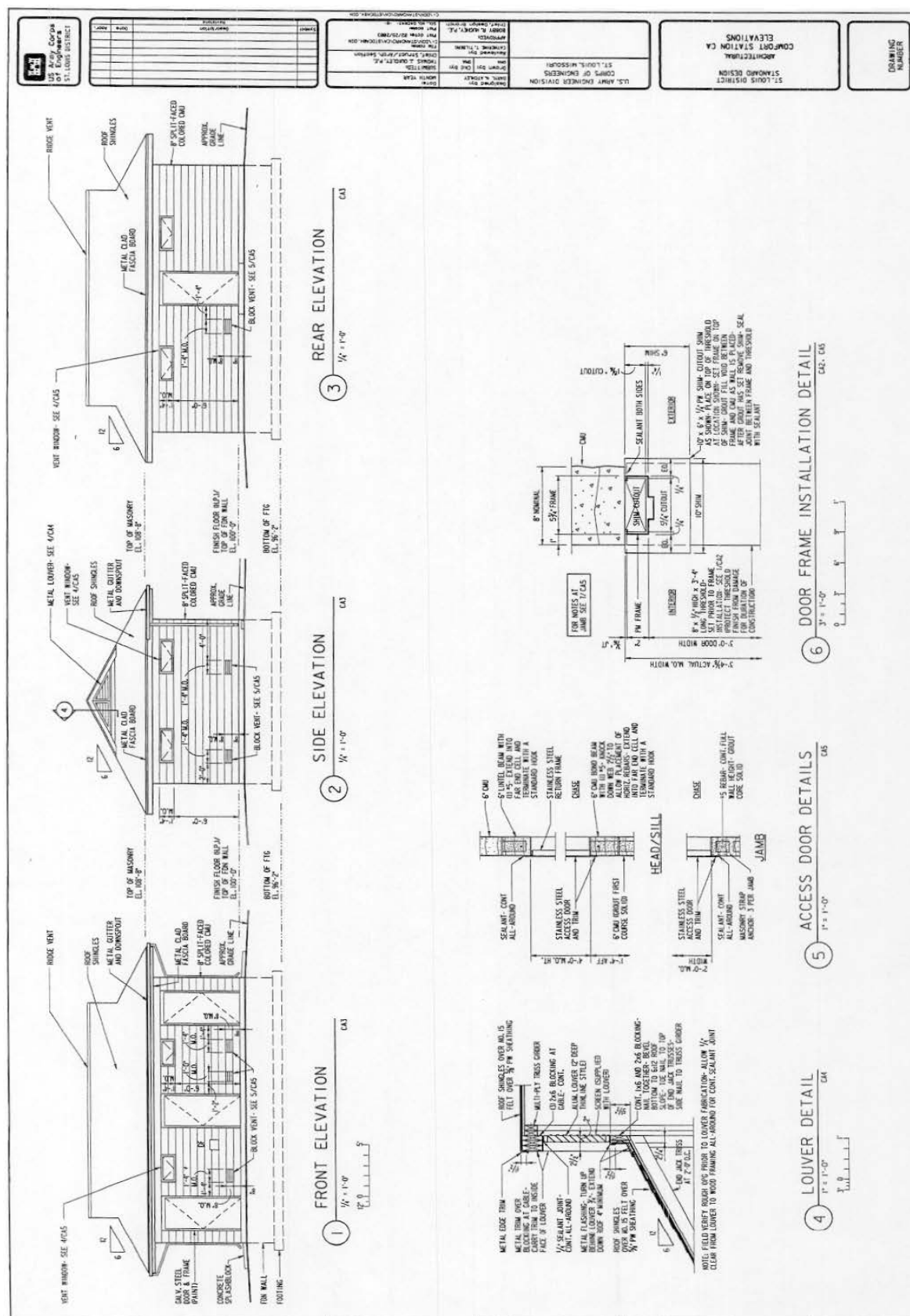
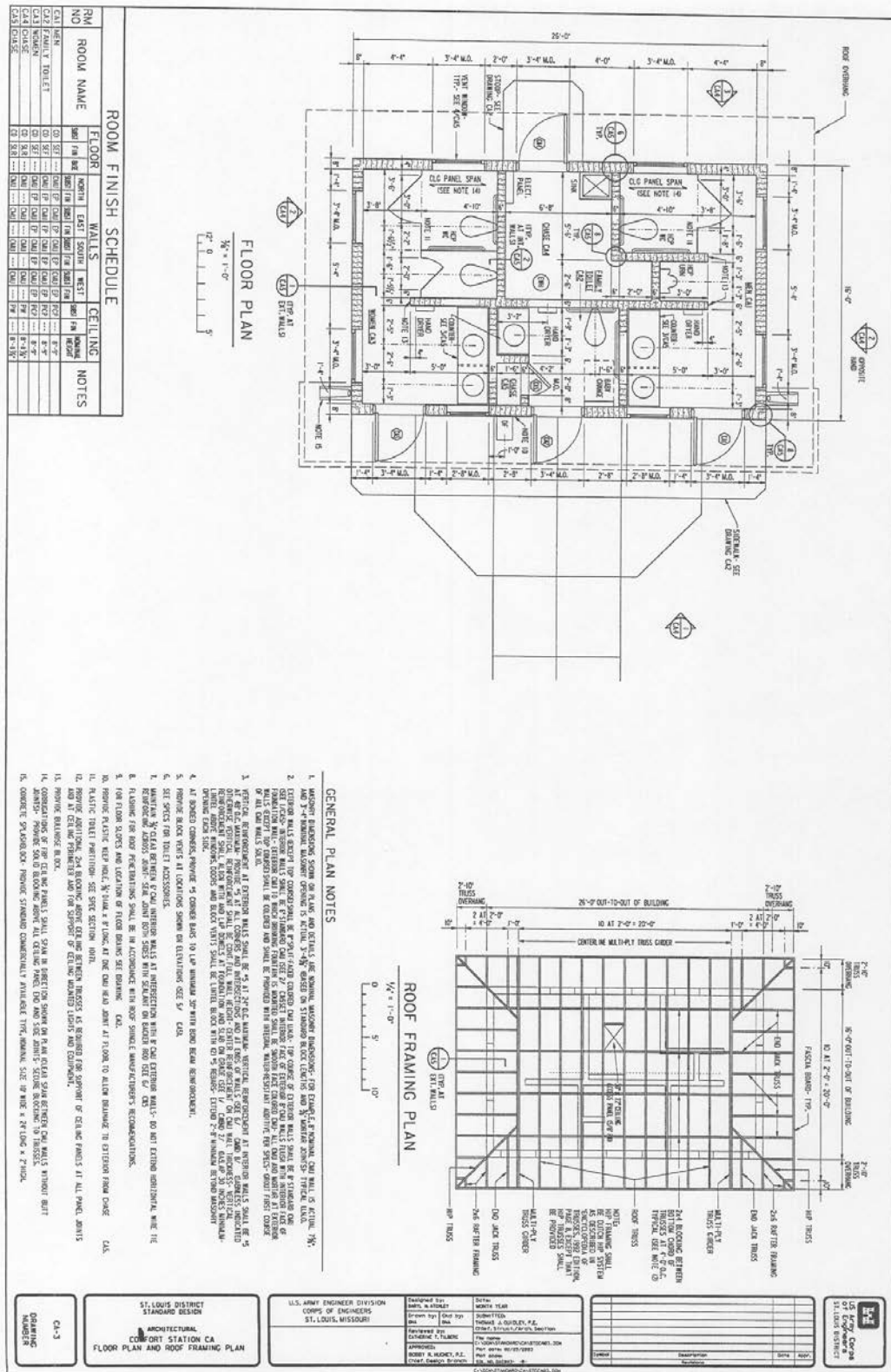


Figure 9-4. Comfort Station - Elevation



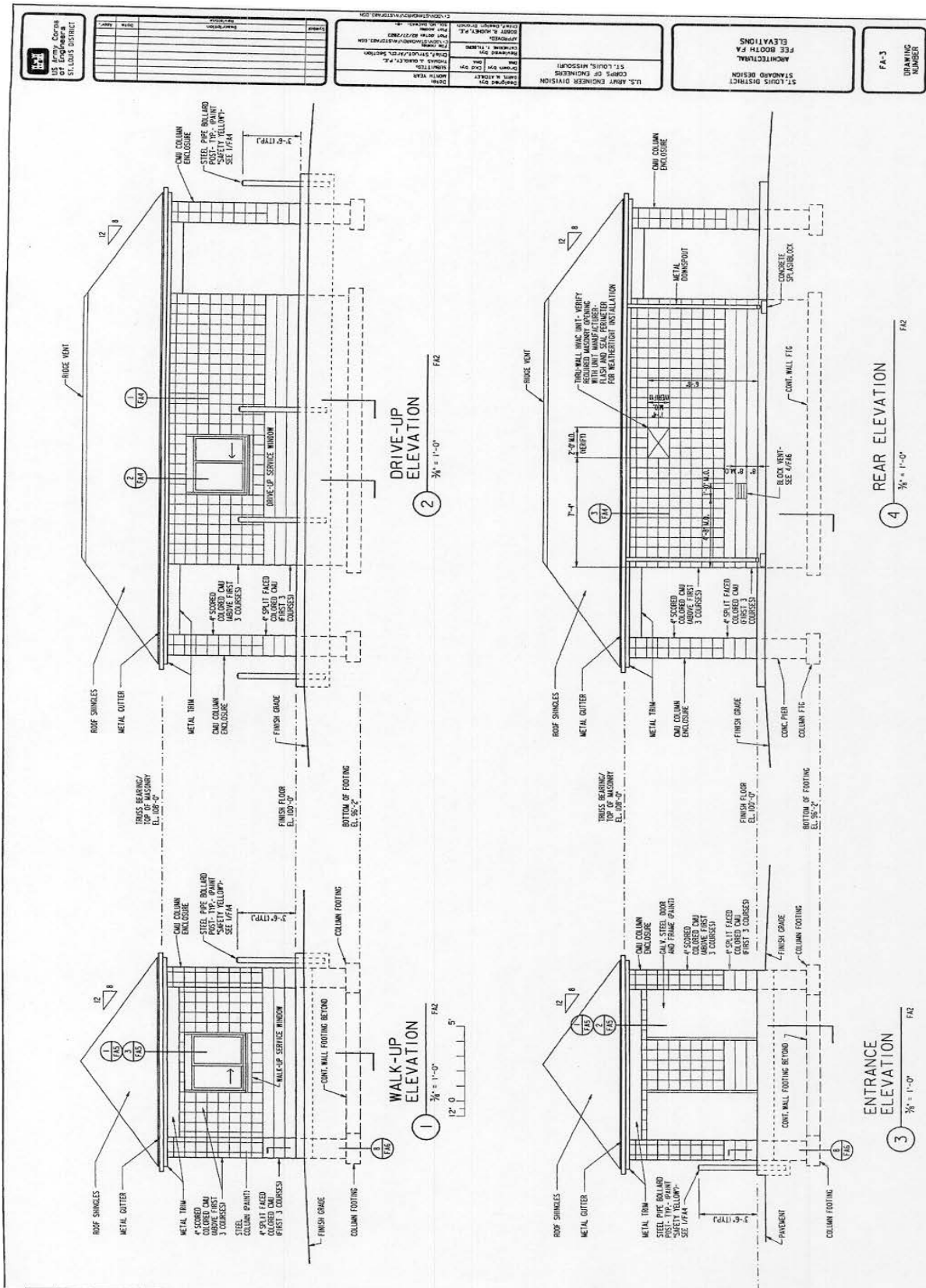


Figure 9-6. Fee Booth - Elevation

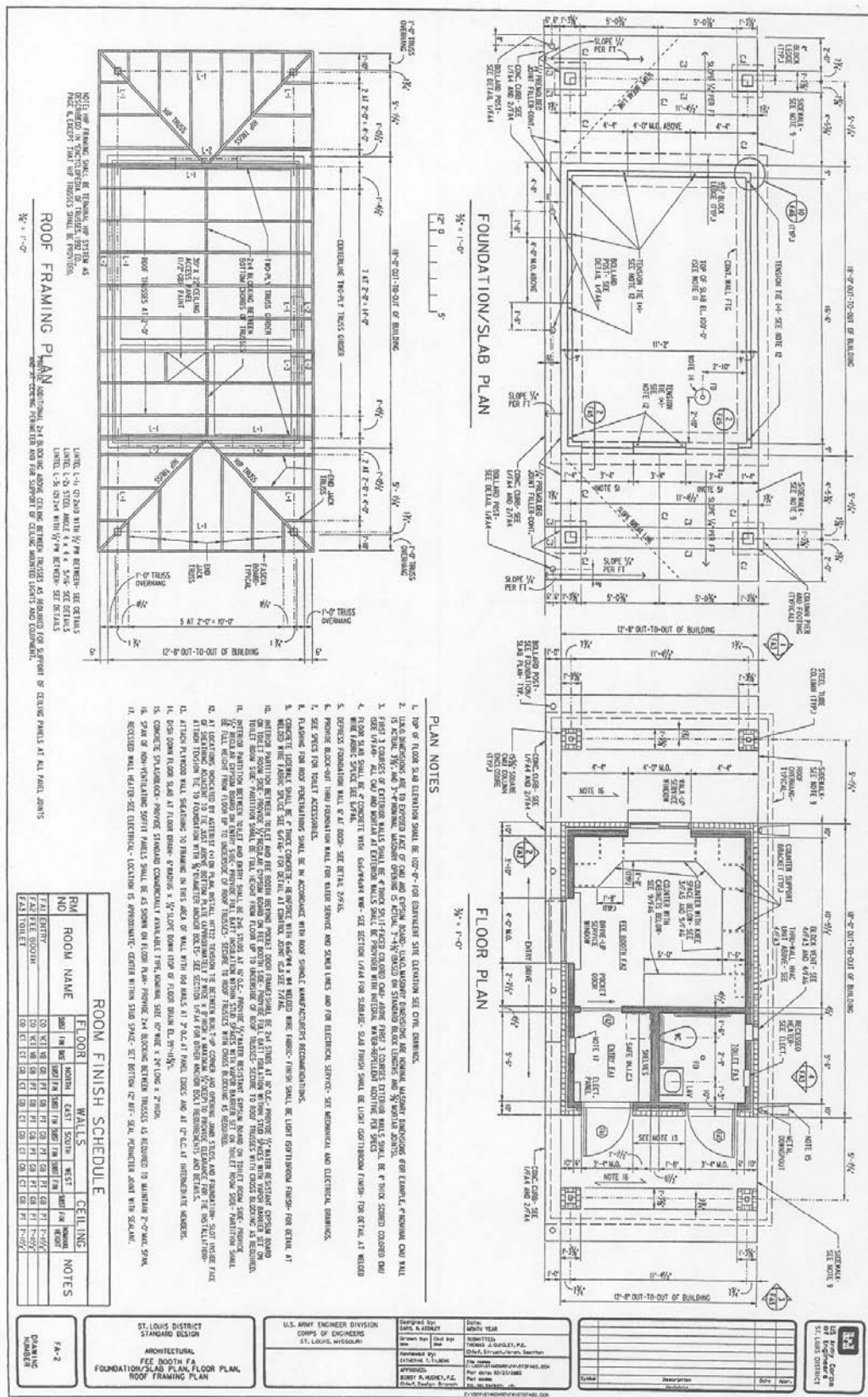


Figure 9-7. Fee Booth - Plan

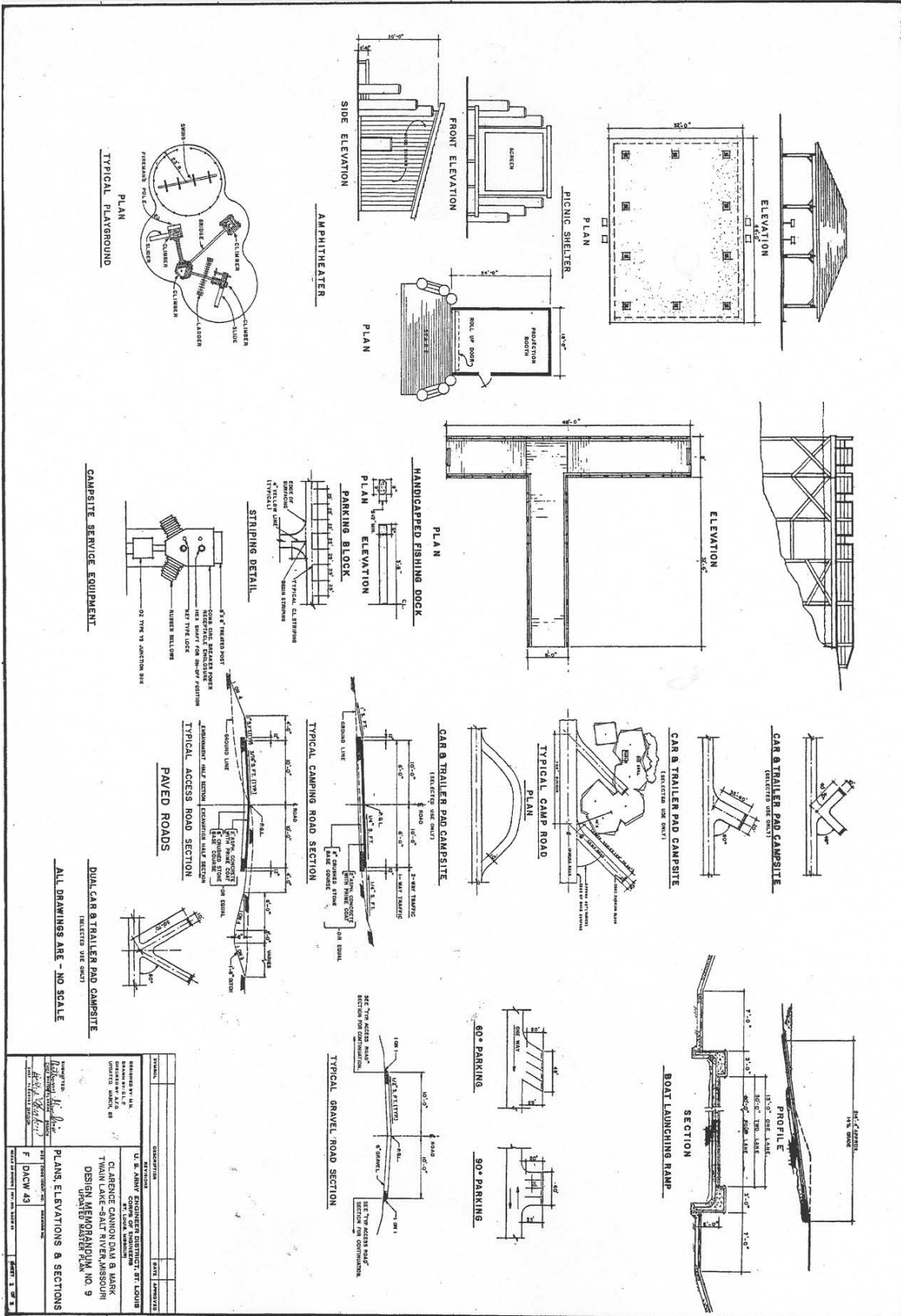


Figure 9-8. Miscellaneous Plans, Elevations and Sections

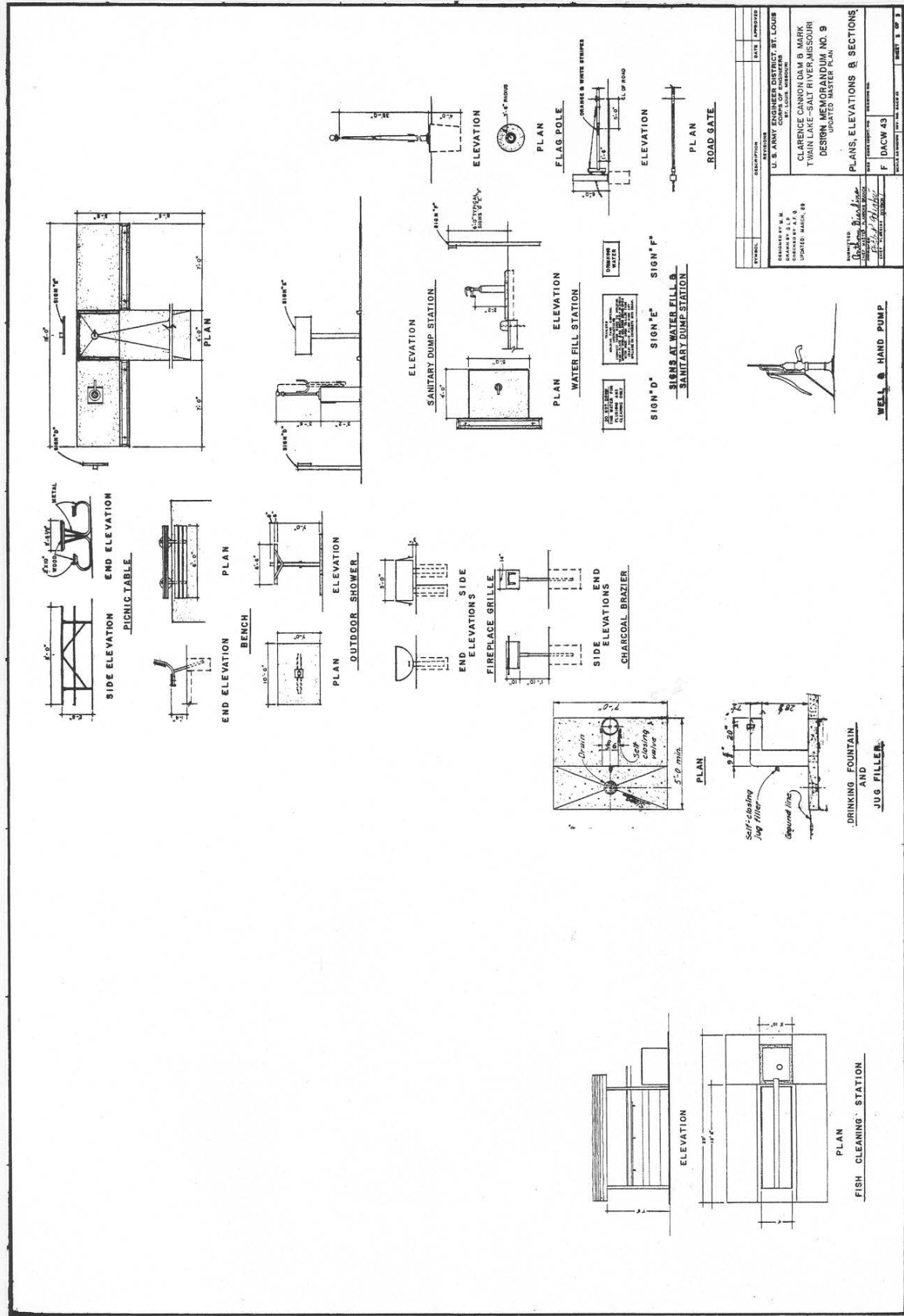


Figure 9-9. Miscellaneous Plans, Elevations, and Sections cont'd