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Engineering - Basic  
Construction

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# *Final Report of Engineering Section*

## BASIC CONSTRUCTION

The Gila River Relocation Center was constructed by the M. M. Sundt Construction Company and the L. M. White Contracting Company, 1440 South Park Avenue, Tucson, Arizona.

Work was started April, 1942 and completed December 1, 1942.

The sub-contractors were responsible for part of the construction.

The Tucson Machine and Engineering Company of Tucson had the contract for installing a water softener.

The Fire Protection Engineering Company of Los Angeles, California installed a sprinkling system in the hospital.

The Tidmarsh Engineering Company of Tucson, Arizona had the contract for installing all refrigeration equipment in the refrigerated warehouses.

Philip Tullander of Phoenix, Arizona had the contract for all painting.

W. A. Beaubien of Phoenix, Arizona constructed two dormitories, four four-family units and two repair shops. The work was started December, 1942 and was completed in April, 1943.

Webb and Ganley Company of Tucson, Arizona constructed the administration building in Canal Camp and a fire station in each camp. The work was started in January, 1943 and was completed in March, 1943.

The contractor constructed barracks for evacuee living quarters, mess halls, latrines, laundry rooms, ironing rooms, recreation halls, hospitals, warehouses, auto repair shops, administration buildings, post office, cold storage warehouses, and a large camouflage net factory. A part of staff quarters and some dormitories and car shelters were also constructed.

Power lines for electric power and service to the camp were constructed. Water systems for domestic water

and fire protection were installed. Gas mains were also laid. Gas was purchased from the El Paso Natural Gas Company of El Paso, Texas.

#### Evacuee Barracks

The camps are laid out in square blocks with fourteen barrack buildings in each block. These buildings are 20 feet by 100 feet. Originally there were four rooms or apartments in each building. There is a door in each end of the building and two doors on one side for the inside apartments. Each building was numbered with the block number, the building number and A, B, C, or D for each apartment. Each apartment had a small oil stove for space heating that burned Number 2 burner oil.

The buildings are of frame construction with one-half inch sheetrock for siding. The buildings are off the ground from 18 inches to 2 feet and are on posts with concrete blocks (12 inches by 12 inches) for foundations. Because of the climatic conditions in southern Arizona each barrack has a double roof. The roof is slate-covered composition shingles.

Later it was necessary for W. R. A. to install additional partitions to provide space for people getting married and for bachelors and sick people.

All barracks were screened and had mastipave on the floors. Blocks 13, 41, 42, and 43 were used for schools.

There are 540 barracks buildings with a total of 1,980,000 square feet of floor space.

#### Mess Halls

One mess hall was constructed in each block. Each mess hall was equipped to provide meals for all evacuees living in that block. The buildings are 40 feet by 100 feet and are equipped with one large hotel gas range for cooking, one gas-fired hot water heater, three large dish washing sinks and one 40 cubic foot and one 20 cubic foot electric refrigerator.

The Canal mess halls have wood floors and the foundations are wood posts on concrete piers (12 inches by 12 inches). The construction is frame with sheetrock siding and slate-covered composition shingles on the roof. All the floors are covered with mastipave.

The Butte mess halls are the same as the Canal ones except for the floor. The floors are concrete. These are much more satisfactory. The wood floors in Canal did not hold up very well. Spilled water and the constant scrubbing and mopping caused the floors to wear very rapidly.

There were thirty-six mess halls with a total of 114,000 square feet of floor space. Approximately three hundred people ate in each mess hall.

#### Latrines

Two latrines were constructed in each block, one for women and one for men. Each latrine had a large gas-fired hot water heater. Wash basins and shower rooms were also provided.

All buildings were frame construction with sheetrock siding and composition shingled roofs. All buildings were constructed with cement foundations and floors. All buildings were provided with flush-type toilets.

There were seventy-two latrines with a total of 43,200 square feet of floor space.

#### Laundry Rooms

A laundry was constructed in each block. The building was frame with sheetrock siding and a composition shingle roof. They were all constructed with cement foundations and floors. Floor drains were provided.

Each building has twelve two-compartment cement laundry tubs. All buildings have hot water. There are thirty-six laundry rooms with a total of 36,000 square feet of floor space.

### Ironing Rooms

One ironing room was constructed in each block next to the laundry room. The building was of frame construction with sheetrock siding and a composition shingle roof. All ironing rooms are constructed with cement foundations and floors.

The buildings were provided with ironing boards. Electric outlets were installed along each wall for plugging in electric irons. However during the occupancy of the camps, very few of these buildings were used as ironing rooms. Most of the residents did their ironing in their own apartments. The ironing rooms were used mostly by the mess halls for storage of vegetables.

There were 36 ironing rooms with a total floor space of 20,160 square feet.

### Recreation Halls

One recreation hall was provided in each block. All recreation halls are frame construction with sheetrock siding, a double door in each end and with a double roof. The roofing is composition slate-covered shingles. The buildings were constructed on posts that rested on cement piers (12 inch by 12 inch). The buildings are 20 feet by 100 feet.

These buildings were used for recreation halls, churches, Girl Scouts, Boy Scouts and various other clubs. There are 36 recreation halls with a total floor space of 72,000 square feet.

### Hospital Group

A hospital was constructed in Butte and Canal. The Canal hospital is frame construction with sheetrock siding. The building is constructed on wood posts resting on concrete piers (12 inch by 12 inch). The building was equipped with one gas furnace. Hot air is blown through ducts for space heating. Mastipave was placed on all floors. The U. S. E. D. furnished the material and W. R. A. furnished the labor for laying the Mastipave.

This building was used almost entirely as a clinic and all bed patients were taken to the Butte hospital.

The Butte hospital consists of an administration building, doctors' and nurses' quarters, wards, surgery, out-patient building, mess hall, morgue, laundry, warehouse and boiler rooms. All the buildings are connected by a closed-in passageway. The laundry, boiler room and the warehouse are separate.

The main buildings are frame construction with 6 inch drop wood siding and sheetrock lining inside. The floors are 4 inch T. and G. wood (pine) and are covered with Mastipave. The foundation is of wood posts resting on cement piers (12 inch by 12 inch).

All the buildings have steam heat. Cooling is provided by evaporative-type coolers, 1200 and 8000 C. F. M. The coolers were installed on the roof and blow cool air through ducts into rooms and wards.

There are also a dental laboratory and an X-ray room.

A laundry was constructed near the boiler room to provide laundry facilities for the hospital and for the project. This is a very modern laundry building. It is of frame construction with a 6 inch drop siding and a concrete foundation and floors.

The boiler room is constructed on a cement foundation with galvanized sheet iron sides and roof. The building is equipped with three 85 H. P. gas-fired boilers. These boilers furnish heat and hot water to the hospital and laundry.

The warehouse is of frame construction. It is built on wood posts resting on cement piers (12 inch by 12 inch). It has wood siding and a composition shingle roof. The floor is wood. There are two buildings.

The hospital group consists of the following buildings.

	<u>Number of buildings</u>	<u>Floor area</u>
Administration	1	2905.75 sq. ft.
Doctors' & Nurses' quarters	3	6000 " "
Wards	7	30975 " "
Surgery	1	2212 " "
Out-patient building	1	4000 " "
Mess Hall	1	4000 " "
Morgue	1	1064 " "
Laundry	1	2000 " "
Warehouses	2	4000 " "
Boiler Room	1	1368 " "
Total		58,554.75 " "

#### Warehouses

Forty-one warehouses were constructed by the contractor. These buildings are of frame construction with 2 inch by 4 inch studding and sheetrock siding. The floors are cement and the buildings are constructed on cement foundations. The roof is slate-covered composition shingles. The buildings are 20 feet by 100 feet. The walls are 8 feet to the top of the plate line. The total floor space is 82,000 square feet.

#### Auto Repair Shop

Two buildings were constructed for auto repair shops, one in Canal and one in Butte. These buildings were constructed by the W. A. Beaubien Construction Company of Phoenix, Arizona. These buildings are 40 feet by 100 feet. There is a line of posts carrying a girder built up of 2 by 8's to carry the center of roof or truss span.

The building in Canal is constructed on a cement foundation and has cement floors. It is 10 feet from the floor to the top of the plate line. The building is of frame construction with sheetrock siding and composition roofing.

The building in Butte is the same as the one in Canal except that the distance from the floor to the top of the plate line is 12 feet instead of 10 feet. This was raised in order to accommodate large trucks. These

buildings are equipped with water closets, urinals and lavatories. The total floor space is 8,000 square feet.

#### Administration Buildings

The administration buildings in Butte were constructed by the Sundt and White Construction Company under the general contract. There were two buildings, one 40 feet by 100 feet, frame construction with wood siding and lined on the inside with sheetrock. The buildings have a cement foundation and floor. The roof is of composition shingles. There are also men and women's toilets in one end of the building.

The other building is the main administration building. It is constructed with a cement foundation and floor. The inside of the building is lined with sheetrock. The outside has 6 inch wood siding. The roof is covered with slate-covered composition shingles.

The director's office is in this building. One wing of the building is 40 feet by 120 feet on the front and 40 feet by 80 feet on the back. One wing is 40 feet by 160 feet on the front and 40 feet by 120 on the back.

The Canal administration building is 40 feet by 100 feet and is frame construction with sheetrock siding. The building is constructed with a concrete foundation and floors. Inside it is lined with sheetrock. The roof is slate-covered composition shingles. The building was constructed by the Web and Hanley Construction Company, 1415 E. Speedway, Tucson, Arizona. The total floor space is 18,000 square feet.

#### Post Office

The Post Office, constructed near the administration building, is frame construction with wood siding. The inside is lined with sheetrock. In addition, there are counters, windows and other facilities for taking care of the mail. The building has four inch T. and G. wood floors. It is constructed on wood posts set on 12 inch by 12 inch cement blocks. The roof is covered with composition shingles. The building is 20 feet by 100 feet with a small addition (20 feet by 28 feet) on the side and a small porch on the back. The total floor space is 2,560 square feet.

### Cold Storage Warehouse

Three cold storage warehouses were constructed, one at Canal and two in Butte. These buildings were frame construction with sheetrock siding. The inside was lined with one inch redwood lumber. The buildings were insulated with 8 inches of Falco wool. They have gable roofs and the attic was lined with Falco wool. The buildings were constructed on a cement slab, 6 inches of insulation were added and then a wood floor for the finish floor.

The buildings were 20 feet by 100 feet with a small meat cutting and receiving room on one side. Each building was equipped with a 7 H. P. York compressor constructed for Freon 12 refrigerant. The total floor space is 9,800 square feet.

### Car Shelters

Three car shelters were constructed. These buildings, 20 feet by 100 feet, are of frame construction with 6 inch redwood siding. The roof is of slate covered composition shingles. Two buildings have a cement floor and one has no floor. These buildings are constructed on a cement block foundation. Two buildings are in Butte and one in Canal. The total floor space is 6,000 square feet.

### Staff Quarters

Four four-family apartments were constructed for staff living quarters. These buildings are frame construction with sheet rock siding and have a flat roof. The ceilings are lined with sheetrock and have Kimsel insulation. Each apartment has a toilet and shower. The buildings are constructed on cement foundations and have cement floors. The buildings are 20 feet by 94 feet.

There were two dormitories constructed for staff members. These buildings are frame with sheetrock siding and have flat roofs with composition roofing paper. The buildings are constructed on cement foundations and have cement floors. Ducts were installed for heating and cooling. There is an opening into each room from the main duct. There is a central heating plant for each building which is oil-fired. The buildings are 20 feet by 160 feet. They were constructed by the Beaubien Construction Company of Phoenix, Arizona.

### Net Factory

A large camouflage net factory was constructed by E. W. Duhamel, 3719 N. Central Avenue, Phoenix, Arizona. The plant consisted of seven buildings, one large warehouse and six large sheds that were open on one side. The buildings are constructed of heavy timber on cement foundations with cement floors. There are two toilet rooms---one women's and one men's. The total floor area of the warehouse is 60 feet by 400 feet, of the cutting shed---24 feet 6 inches by 200 feet, of the women's wash room---22 feet by 82 feet, of the men's washroom---22 feet by 60 feet and of the five gar-nishing sheds---26 feet 4 inches by 250 feet.

### Fire Station

Two fire stations were constructed, one at Canal and one at Butte. The building at Canal was constructed to house two fire rigs and the building at Butte, to house two fire rigs. The buildings are frame construction with sheetrock siding. Both buildings have cement foundations and floors.

The front part of the building is constructed with a high flat roof to accommodate the fire rig. There is a wing running back at right angles for the firemen's quarters. The building at Butte has 2,440 square feet of floor space. The total floor area at Canal is 1264 square feet. The buildings were constructed by Web and Hanley Construction Company, 1415 E. Speedway, Tucson, Arizona.

### M. P. Camp

Eleven buildings were erected for the use of the Military Police unit stationed at the camp. One building (20 feet by 100 feet) was used as a mess hall. Three buildings (20 by 100 feet) were used for sleeping quarters. One building (20 feet by 100 feet) was used for officers' quarters. One building (20 feet by 25 feet) was used as an infirmary or for first aid. One building (20 feet by 100 feet) was used as an office and armory. Two buildings (20 feet by 100 feet) were used as recreation halls. One building (20 feet by 30 feet) was used as a guard house. One building (30 feet by 60 feet) was used as an auto repair shop. All the buildings are frame construction and have 6 inch wood siding. All building, except the shop, are constructed on wood posts resting on 12 inch by 12 inch cement piers and have wood floors. Except the shop and one recreation hall all the buildings have double roofs covered with composition shingles.

The shop building is 29 feet 5 inches by 60 feet and has a flat roof, cement floor and is constructed on a cement foundation.

There was one central wash room (20 feet by 30 feet) of frame construction with wood siding, a cement floor, cement foundation and a double roof. The building was equipped with a gas-fired hot water heater.

All the buildings were framed with 2 by 4's and have a light truss constructed of 2 by 4's and 1 X 6's for the roof. The trusses are spaced 4 feet on centers.

This completes the building construction done by contract. All other building on the project was done by the War Relocation Authority.

#### W. R. A. CONSTRUCTION

##### NEW

#### School Buildings

Eight new buildings were constructed for the High School use, four in each camp. Each group consists of an auditorium-gymnasium, science laboratory, domestic science building and shop.

The Butte auditorium has a frontage of 158 feet and a depth of 126 feet. The total floor area is 14,220 square feet. The main room has a clear area 80 feet by 96 feet by 20 feet high, with a stage at one end and a projection booth at the other. At each side are dressing rooms, shower rooms, toilets and storage rooms.

This is a timber frame building resting on concrete piers. The heavy frame, consisting of ten columns supporting five 80 foot clear span trusses, are fabricated with bolts and split-ring timber connectors. The floor of the main room and stage are wood. The floors of the auxiliary rooms on each side are concrete. The exterior is six inch wood siding and the roof is slate-surfaced composition. The ceiling of the main room is open to the roof. Heating is done with four oil-fired furnaces.

The auditorium in the Canal unit is similar in type of materials used and type of construction, but is only 77 feet wide and 106 feet long. The main auditorium room is fifty feet wide and 84 feet long with a stage. The dressing rooms and locker room are all located at one side with a storage room on the other. The total floor area is 6998 square feet. Heating is done with two oil-fired furnaces.

The science and home economics buildings are a wood frame resting on concrete piers. The exterior is wood siding. The interior walls are covered with gypsum board and the ceilings with one-half inch cane fibre board. The roofs are covered with slate-surfaced composition roofing.

The science building in Butte is 20 feet by 187 feet and contains three classrooms, two toilet rooms and storage closets.

The home economics building in Butte is 20 feet by 194 feet and contains three classrooms.

The science building in Canal is 20 feet by 169 feet and contains four classrooms.

The home economics building in Canal is 20 feet by 169 feet and contains two classrooms, two toilet rooms and storage closets.

The shop buildings are of the same construction, wood frame resting on concrete piers with wood siding on the exterior walls and a slate-surfaced composition roof. The walls are not lined inside and only one side of the partitions are covered with gypsum board.

The Butte shop is 40 feet by 120 feet and is divided into three rooms. The total floor area is 4800 square feet. The Canal shop is 20 feet by 80 feet and is not divided. The total floor area is 1600 square feet.

The Butte group of new school buildings is located just north of Block 43. The Canal group is in Block 12.

#### Staff Houses

The standard units for staff living quarters were four-family apartment houses, 20 feet by 96 feet and dormitories 24 feet by 140 feet containing ten double rooms, three single rooms, lounge, kitchen, laundry and bathrooms.

Four of the apartment house units and two of the dormitories were built in Butte by a contractor in the early days of the Center. These have concrete floors, wood frame, sheet-rock for siding on the exterior and for lining inside. The roofs on these buildings are flat with a slope in one direction and insulation between the roof and ceiling.

The heating is done by oil-fired heaters located on the ground floor. Coolers are located on the roof. Each heating unit and each cooling unit takes care of two apartments in the apartment units and each dormitory is cooled by two units and heated by one.

W.R. A. crews undertook the construction of additional apartment buildings in both camps and one dormitory in Canal. It was impossible to get the heating and cooling equipment for a system similar to the original buildings, so some changes in design were made.

Eight four-family apartment units were built by W. R. A. crews in Block 81 in Butte and six in Block X in Canal. One dormitory was built in Block X in Canal. All of these buildings have wood floors and frames, concrete pier foundations, wood siding and gable roofs covered with slate-surfaced composition roofing. The size and floor plans are the same as the first units built by the contractor. In the apartment houses individual gas heaters and individual coolers were installed.

#### Ice Houses

An ice storage building was built in Block 78 in Butte and one south of Block 23 in Canal. These buildings are built on a continuous concrete foundation and floor slab. The frame is wood. The walls, floor and ceiling are wood and insulated. The outside walls are wood-covered. The size is 20 feet by 28 feet.

#### Dairy

The dairy farm construction consisted of a milking barn, a milk house and a feed warehouse. There are sixteen feed lots equipped with concrete water troughs and feed mangers.

The milking barn is 36 feet by 105 feet. The floors, feed mangers and passageways are of concrete and slope to the north end of the barn. The outside walls are of concrete blocks laid five feet high between wood posts which support the roof. There are stanchions and manger space for fifty-eight cows.

The milk house is 20 feet by 60 feet. The walls and partitions are wood frame resting on continuous concrete foundations. The floors are concrete. The exterior walls are wood siding and the interior walls and ceilings, gypsum board. This building contains a cold storage room and six other rooms. The equipment consists of refrigeration and pasteurizing machines, sterilizer and an oil-fired steam boiler.

The feed warehouse is 20 feet by 100 feet with a concrete floor and a wood frame. The side walls are solid boarding about three feet high with the upper part covered with used concrete pads. All three buildings have gable roofs with wood sheathing and slate-surfaced composition roofing.

#### Poultry Farm

The poultry group consists of three laying houses 20 feet by 400 feet, four brooder houses 14 feet by 36 feet and one feed warehouse 20 feet by 100 feet, together with twelve chicken runs in connection with the laying houses.

The laying houses are supported by posts set in the ground. A double row of nests and a row of roosts extend the full length of each building. Side walls are partly boards and partly poultry netting.

The brooder houses have wood floors and a wood frame on mud sills. The outside walls are covered with rough boards.

All buildings have roofs covered with solid wood sheathing and slate-surfaced composition roofing.

The feed warehouse has a cement floor and a wood frame covered on the outside with rough boards.

The capacity of the brooder houses is 6000 chicks and of the laying houses, 12,000 laying hens.

### Hog Farm

At the hog farm there were built ten portable hog houses, size 10 feet by 14 feet and sixty farrowing houses, size 8 feet by 8 feet and a feed warehouse 20 feet by 100 feet. The portable hog houses were built on runners with a wood floor, walls of wood that could be opened in places for ventilation. These can be moved from place to place with a tractor. The farrowing houses were built in an 'A' shape with a minimum amount of framework and covered with rough boards. Some of them had wood floors and some had none. They were not equipped with runners, but were light enough to be easily moved from place to place.

At the time this is being written the portable hog houses and farrowing houses are being taken apart and the lumber salvaged for other use.

The feed warehouse has a concrete floor and a wood frame with an exterior wall-covering of gypsum board. The roof is sheathed with one inch lumber and covered with slate-surfaced composition roofing. There is an adjacent concrete slab outside for the use of a feed grinder. This warehouse was destroyed by fire and rebuilt on the same floor slab.

### Auto and Heavy Equipment Shop

Early in the life of the center a machine shop for heavy equipment was planned. Priority assistance was obtained and the foundation was poured. After that the project was abandoned and no use has been made of the work done.

### Road Construction

The road construction program included fifteen miles of oil-surfaced road and approximately eight miles of graded road, not surfaced.

The oil-surfaced road extended from Highway 87, where it enters the Gila River Indian Reservation at a point about seven miles south of Chandler, to the east boundary of Canal Camp at the Military Police area and included a connecting road to Butte camp and a loop through Butte to the warehouse and administration area.

The sub grade of this road is 28 feet wide at the top with a 22 foot strip of oil surfacing.

A list of structures placed by W. R. A. follows. One cattle guard; three box culverts, double 5 feet by 3 feet; seven culverts, concrete pipe 24 inches; one dip, 1200 feet; eight culverts, concrete pipe 24 inches (lengthened and reinforced by W. R. A.); one bridge, 20 feet span, rubble stone masonry abutments.

Work on this road was started by W. R. A. crews. In September, 1943 a contract was let to W. J. and J. C. Henson of Prescott, Arizona for the completion of ten miles of the road already started. This contract was completed in December, 1943 and gave the project an oil surfaced road connecting with Arizona State Highway 87.

By early summer, 1944, W. R. A. crews had completed the remaining five miles of surfaced road in this program. It was later sealcoated and gives the project a hard-surfaced road where traffic is heaviest.

About eight miles of dirt road connecting the project with State Route 187 and the railhead at Casa Grande was improved. The road was graded and storm water channels opened. No structures were placed in this part but it has proven satisfactory road for the limited amount of traffic which flows over it.

#### Camp Irrigation

A system of open irrigation ditches with concrete pipe street crossings was installed for watering trees, shrubs and lawns over the project. In Butte, the flow of water was entirely by gravity, but in Canal it was necessary to install a pump to boost the water from a canal to the high point of the area and from there it flows by gravity in open ditches. This pressure line was a concrete pipe 16 inches in diameter, about 1500 feet in length and with a rise in elevation of 14 feet.

#### Packing Shed

A shed for packing and loading vegetables was built in Field 47 about 500 feet north of Block 4. The floor area is 48 feet by 108 feet or 5184 square feet. An area 30 feet wide and the full length of the floor is covered by a roof and includes an enclosed office, an equipment room, toilet, an insulated room for storing ice and produce and an open area for packing. This floor is about three and one-half feet above ground level and rests on concrete piers and wood posts. The plate line is 12 feet above the floor. The en-

closed rooms are covered on the exterior walls with wood-siding and the roof is sheathed with one inch boards and covered with slate-surfaced composition roofing.

#### Flourine Filter Reactivating Plant

This building is located in Block 76. It is a wood frame structure resting on concrete piers and posts. The floor is about 4 feet above ground level. The area is 30 feet by 38 feet and entirely enclosed with gypsum board on the exterior. The plate line is 11 feet above the floor line. The roof is sheathed solid with one inch boards and is covered with slate-surfaced composition roofing. Two thicknesses of one inch boards are used for the floor. The interior is divided into two rooms, one room 9 feet by 30 feet for chemical storage and the remainder of the building for equipment. The storage room was lined with gypsum board.

Equipment consisted of project-built redwood tanks and troughs, a circulating pump, piping and connections for twelve filter tanks. This plant was operated for about five months. After which the use of fluorine filters was discontinued and the equipment removed from the building.

#### Cold Storage Warehouse

A cold storage warehouse was built in Block 76. This building is 30 feet by 100 feet with an 8 foot ceiling. The foundation is continuous concrete and the floor is concrete. The walls are wood frame, covered on the outside with wood siding. The roof is sheathed solid with one inch boards and covered with slate-surfaced composition roofing. On the inside there is a corridor 9 feet wide providing access to the five cold storage rooms which occupy 21 feet of the width of the building.

The insulating material used was vermiculite. Ten inches of vermiculite was placed on a rough concrete floor slab over which a solid sub-floor of one inch boards was placed and a four inch concrete floor was poured for a durable finish. The outside walls and ceiling were filled with insulation to a thickness of ten inches. The interior walls and ceilings of all the cold storage rooms are solid boarding one inch thick. The corridor walls and ceiling are covered with gypsum board.

Four of the storage rooms are designed for 35 degrees Fahrenheit temperature and the fifth for -10 degree Fahrenheit temperature. One of the 35 degree rooms and the -10 degree room are equipped with ceiling tracks and hooks for hanging carcasses of meat and with scales for weighing packages hanging on the track.

The equipment for refrigeration is housed in a room outside the building proper and consists of two York compressors using methyl chloride. One is driven by a ten horse power and the other by a seven and one-half horse power electric motor.

#### Gate Clerk Houses

Two small buildings, 8 feet by 12 feet were built, one at the north gate and one at the east gate of the project. These have a wood frame on mud sills with gypsum board for siding and a composition roof. These were used for shelter by the gate clerks and Military Police who were on duty at the gate.

#### LAND IMPROVEMENTS

A number of land improvements were made by the contractors and the W. R. A. The contractors improved all streets inside the centers. The streets were graded and graveled. Thirteen miles of streets were improved.

Each camp was fenced with a four-wire barbed wire fence with 4 inch by 4 inch posts. Very little land improvement was done by the contractor. Most of the improvements were made by the W. R. A.

The W. R. A. constructed an oil-surfaced highway from Highway 87, 6 miles south of Chandler, to the center.

Refer to W. R. A. construction. It gives all the details of land improvement.

#### Maintenance

A very effective maintenance program was carried on by the evacuees under supervision.

A crew was set up under the carpenter shop for maintaining all buildings and doing alteration work. From seven to twenty-five evacuees were used on this type of work depending on the amount of work to be done and the need for workers. At the beginning of the Project approximately thirty-five evacuees were used to lay mastipave in all barracks buildings. The U. S. E. D. furnished the material and the W. R. A. furnished the labor and supervision. A carpenter foreman was supervisor.

A crew of evacuees under the plumbing shop did all plumbing and plumbing maintenance. Repairs were made to water mains, hot water heaters, gas mains, gas stoves, showers, toilets and various other things by this crew. The crew ran from six to twenty-seven men depending on the need. This crew was under the supervision of the plumber foreman.

A crew was set up and a shop established for electrical and refrigeration maintenance. Approximately fifteen evacuees worked on this crew under the supervision of the electrician foreman. Part of the time we had a refrigeration foreman and part of the time the electrician foreman supervised the refrigeration crew.

We had considerable trouble maintaining the light sockets in evacuee barracks and mess halls and other buildings using the same type of socket.

Under the direction and supervision of the Senior Engineer the Superintendent of Construction was directly responsible for the maintenance program. The various foremen were responsible to the Construction Superintendent. Orders were given to him and then down the line to an evacuee foreman who was more successful in getting the work done by evacuees.

#### JANITORIAL SERVICE

The janitorial program was under the supervision of the maintenance foreman.

At the beginning of the project and for about one year the hospital, the schools, the staff quarters and the administration offices each had their own janitors. Later all janitors and the responsibility for janitors was placed under the Engineering Section. The janitors who worked in the

evacuee blocks were under the Engineering Section from the beginning of the Project. Originally one janitor was assigned to each block. Later three janitors were assigned to two blocks.

The Engineering Section budgeted for all funds for janitorial supplies and ordered all supplies. The evacuees were issued one issue of a broom, mop and other essentials in order to keep their barracks clean. The janitorial program was under the direction of the Senior Engineer.

#### OPERATION OF UTILITIES

Under the direction of the Senior Engineer the Utilities operation program was under the supervision of the utility operations superintendent. The utilities' operation consisted of the operation of the water pumps and system for domestic water supply, operation of sewer lift pumps, sewer disposal plants, hospital boilers, evaporative coolers, operation of chlorinators for chlorination of drinking water and the sewage effluent.

Not very much trouble was experienced with any of the equipment. With the inexperienced help that we had we tried to keep all equipment serviced and in good repair.

Water and sewer pumps were oiled and greased daily. The only trouble with the water pumps during the entire life of the project was a broken shaft on one of the pumps. These pumps are in good condition.

#### Sewage Disposal

The sewer plants operated very satisfactorily. Very little trouble was experienced. One evacuee was kept at each plant at all times to keep plants in operation.

During the entire operation of the sewer plants the Skimer motor in Canal burned out twice and had to be rewound. The Skimer motor at Butte was rewound once. There was a small amount of repair work done on the sludge pumps. These plants are in fair condition.

### Electric Power

During the operation of the Project some trouble was experienced with the electrical system. Most of the trouble however was not because of failure in the project system but failure in the system that serviced the project. Most of the trouble was caused by lightning during the summer months.

After the Project was in full operation we found that the main switch at the main transformer station was too light to carry the load. The switch was wound for 200 amps. We sent the switch to the factory and had it wound for 300 amp capacity. After this was done we did not have any more trouble with the switch. The electrical system on the Project is in very good condition.

### Signal System

The signal system was installed by the Army Signal Corps. A telephone system was installed for a communication system and for fire reporting. In each camp telephones were installed on telephone poles and in a box for fire reporting. There were twenty-seven fire-reporting phones in Butte. This includes one at the dairy, poultry and hog farm. In Canal there were 17 phones. This includes one at the M. P. post. This system furnished one phone to each occupied block. This system is in good condition at the present time.

### Refrigeration

There are four large cold storage warehouses on the Project. Three of these plants were constructed by the contractors and one by W. R. A. When the plants were constructed Freon 12 refrigerant was used. Later the units were changed to Methyl Chloride because the Freon was impossible to get.

There were also a number of domestic boxes for mess halls and staff quarters. We had some trouble with the Super Cold boxes in the mess halls. It was difficult to keep seals in the compressor units. Other than that very little trouble was experienced other than routine servicing.

Servicing was done mostly by the evacuees. We did not have a refrigeration foreman on the Project until July, 1944 and he stayed only seven months. The refrigeration work was supervised most of the time by the electrical foreman.

All the refrigerators are in fair condition and should give good service for some time. Some of the boxes need new enamel inside.

#### Water System

Water is furnished to the project by four deep wells that were drilled by contract. There are two wells in Canal and two in Butte. The wells are approximately 400 feet deep. The system in Canal differed greatly from the one in Butte.

In Canal water was pumped from the well into a 300,000 gallon concrete surface tank. The pumps were equipped with float switches so that pumps could be operated automatically. When the water reached a low level the pump started automatically and when the tank was filled the pump cut off. The water was pumped from this tank into the system and to an overhead tank constructed on a timber tower. The tank is of wood, fifty feet off the ground and has a 50,000 gallon storage capacity.

In Butte the water is pumped direct from the well into the system and into a 300,000 gallon wood storage tank. The tank is constructed on a high hill and is approximately 100 feet above the pump at the wells.

Because of the lack of storage space in this system it was very difficult during the summer months to keep the wood tank filled with water. It almost went to pieces several times because more water was consumed than we could pump. Therefore the tank would dry out and shrink, leaving large cracks.

One of the pumps was installed as a stand-by unit, but because of the number of evaporative coolers installed and the amount of water used for irrigation to get vegetables started it was necessary to use it full-time. This was prior to the development of an irrigation system from ditch water.

The only reservoir on the Project is the 300,000 gallon concrete tank at Canal Camp. There are four electric-driven turbine pumps for pumping water. One is on each well.

Well number 1 at Canal has a Worthington turbine pump driven by a sixty H. P., 440 volts and three phase, G. E. electric motor.

Well number 3 at Canal has a Peerless turbine pump

driven with a 60 H. P., 60 cycle, U. S. electric motor, 440 volts and 1800 R. P. M.

There are also two booster pumps in Canal that pump the water from the 300,000 gallon storage tank to the elevated tank. The two booster pumps are Fairbanks Morse centrifugal pumps driven with Fairbanks Morse electric motors. One pump has a 75 H. P., three phase, 60 cycle motor, 1755 R. P. M. One has a 50 H. P., three phase, 60 cycle motor at 1770 R. P. M. All control switches are square D.

Well number 2 at Butte has a Peerless turbine pump driven with a 125 H. P., 60 cycle U. S. motor, 440 volts, 1800 R. P. M. Its capacity is 850 gallons P. M. The pump depth is 220 feet.

Well number 4 at Butte has a Peerless turbine pump driven with a 100 H. P., 60 cycle U. S. motor, 1800 R. P. M., 440 volts. The pump is set at 220 feet capacity and 830 gallons P. M. All the pumps and motors have given good service and are in fair condition. There is one auxiliary pump in each camp. Well number 4 in Butte camp is equipped with a 6 cylinder gas engine (Climax). It has a 6 inch bore and a 7 inch stroke with right angle gear head. This engine was attached so that the engine could be started to drive the pump in order to supply water in case of power failure.

In the booster pump house at Canal was installed a gas engine driven electric generating plant. This plant is equipped with a six cylinder Buda engine. In case of power failure this engine could be started and could generate power to run the well pumps, booster pumps and sewer lift pumps. It was only necessary to use this equipment four times during the entire operation of the project.

All motors given above.

There was one chlorinator at Canal and two at Butte. The chlorinator at Canal was located in the booster pump house and forced chlorine into the line when the booster pump was running. The chlorinator is a Wallace and Tiernan and from eight to twelve pounds of chlorine was used each day. An average of from 500,000 to 1,200,000 gallons of water was used per day.

Wells number 2 and 4 at Butte Camp each have a Wallace and Tiernan chlorinator. Until well number 4 was put into operation the chlorinator on well number 2 was used. After well number 4 was put in operation only the chlorinator on this well was used. Ten to twelve pounds of chlorine were used each

day for from 600,000 to 1,500,000 gallons per day. These chlorinators gave very satisfactory service and are in fair condition.

There are 1792 hydrants in the water system. There were twenty-eight  $3/4$  outlets in each block. This was for irrigation and use by the evacuees. A fire hydrant is located convenient to each block about the center of the block on the street sides. Hydrants are located on the 8 inch water mains. There are forty fire hydrants at Canal and seventy-three at Butte which makes a total of one hundred and thirteen fire hydrants.

There are a number of shut-off valves in each camp. The valves are located so that each block can be isolated without shutting off other blocks. At Canal there are two 10 inch gate valves, thirty-nine 8 inch, fifteen 6 inch and three 2 inch. At Butte there is one 12 inch gate valve, eight 10 inch, thirty-nine 8 inch, thirty-four 6 inch, three  $4$  inch, two 3 inch and thirty-three 2 inch.

The pipe system is laid in a grid system so that water will circulate all through the system and there are no dead ends. At Canal all the pipe is sixteen gauge steel with welded joints. There is an 8 inch pipe along the streets and a 6 inch main runs through the center of the block connecting at each end to an 8 inch main. The 6 inch main serviced the wash rooms, laundry rooms and mess halls.

The sixteen gauge steel pipe in Canal was treated with tar and wrapped with number 15 felt paper. When the pipe was laid the contractor failed to treat the welded joints where the pipe was welded together. This caused us a great deal of grief. After the pipe was heated to weld the joints and placed in the ground the pipe began to rust at these joints. It was not long until a number of leaks started to develop. Soon we were repairing an average of four leaks a day. The mains in Canal are in very poor condition and will not be of much service in the future without being replaced.

There are in the Canal camp:

500	linear feet of 12 inch water mains
1,210	linear feet of 10 inch water mains
17780	linear feet of 8 inch water mains
4,560	linear feet of 6 inch water mains
3,070	linear feet of 2 inch water mains

All the above pipe is sixteen gauge steel except the 2 inch which is galvanized pipe with threaded joints.

At Butte camp we have a much better installation. The water mains are cast iron pipe with lead caulked joints except the four inch which is steel pipe with threaded joints. The same type system is installed at Butte as the system at Canal which is described above.

At Butte there is:

4,904 linear feet of 12 inch water main  
5,680 linear feet of 10 inch water main  
26,600 linear feet of 8 inch water main  
14,900 linear feet of 6 inch water main  
2,540 linear feet of 4 inch water main.

There has scarcely been any trouble or maintenance on the water system at Butte. This system is in good condition.

#### Sewage System

The sewer plant at Canal is located about one-half mile west of camp in line with the south-west corner of the camp. Because of the topography of the land the plant is located on the high side of the camp. The raw sewage was lifted from a sump into a 24 inch pipeline that carried the sewage to the clarifier.

The clarifier and digester were constructed by the contractor of cement. The skimmer is a Dorr, driven with a G. E. 1/2 H. P., 220/440 volt, three phase electric motor 830 R. P. M. The reduction gear is from the American Pulley Company. The Sludge pump is a Carter with 2 H. P., 220/440, three-phase electric motor (no name). The control switches are square D.

The effluent from the plants in each camp was disposed of on a ten acre plot of ground adjacent to the plant. This ten acres of land was leveled and bordered to receive the effluent. It was necessary to have irrigators to take care of the water. Water was turned in two or three borders at a time. When the borders were filled the water was changed to other borders and the previous ones given time to dry. After the ground was dry the water was turned in again. The effluent was not much of a problem during the summer months when evaporation is so great that the water evaporated in a short time.

The plants have given good service and are in good condition

### Electricity

The electricity for the Gila River Center is furnished by the U. S. Indian Irrigation Service located at Coolidge, Arizona. Power is furnished by the Coolidge dam and there is a generating plant at Coolidge.

At Sacaton are located three 1500 K. V. A., G. E. transformers. Current from these transformers is brought into the center at 7200 volts and is stepped down to the proper voltage in the blocks.

From Sacaton to the centers is constructed an overhead power line. There are 186,348 feet of number 2 B 7-strand copper wire, 32,480 feet of number 4 B. C. solid copper wire and 3,480 feet of number 6 solid copper wire. There are two hundred and one 40-foot poles in the transmission line and substation.

Within the camps there is 18,313 feet of B. C. copper wire, 79,970 feet of number 6 B. C. wire, 20,600 feet of number 2 B. C. wire. The service lines are 208,578 linear feet of number 8 weather proof wire, 37,080 linear feet of number 6 weather proof, 59,300 linear feet of number 4 weather proof and 1,600 linear feet of number 2 weather proof. All service wire has a carrying capacity of approximately 600 volts.

In camp areas there are eleven 25-foot poles, twenty-five 30-foot poles, and four hundred and nineteen 35-foot poles. For the location and size of the transformer see the plot plan of the centers.

### Telephones

A telephone line was constructed from Casa Grande, Arizona to the project. There were three trunk line connections to the outside. There are two P. B. X. switchboards, one at Canal and one at Butte.

There are a number of phones within the camps---in the offices, warehouses etc. There is also a fire reporting system that operates through the telephone switchboard.

The line from Casa Grande is constructed of number 6 B. C. copper wire. There are 371 20-foot poles, 177 25-foot poles, 49 30-foot poles and 9 35-foot poles.

Most of the lines within the center are constructed on the power poles below the power lines. The overhead lines within the center are in lead cable.

During the summer months some trouble was encountered with the phone system during electrical storms. The lightning struck our systems several times. The signal system, at the present time, is in good condition.