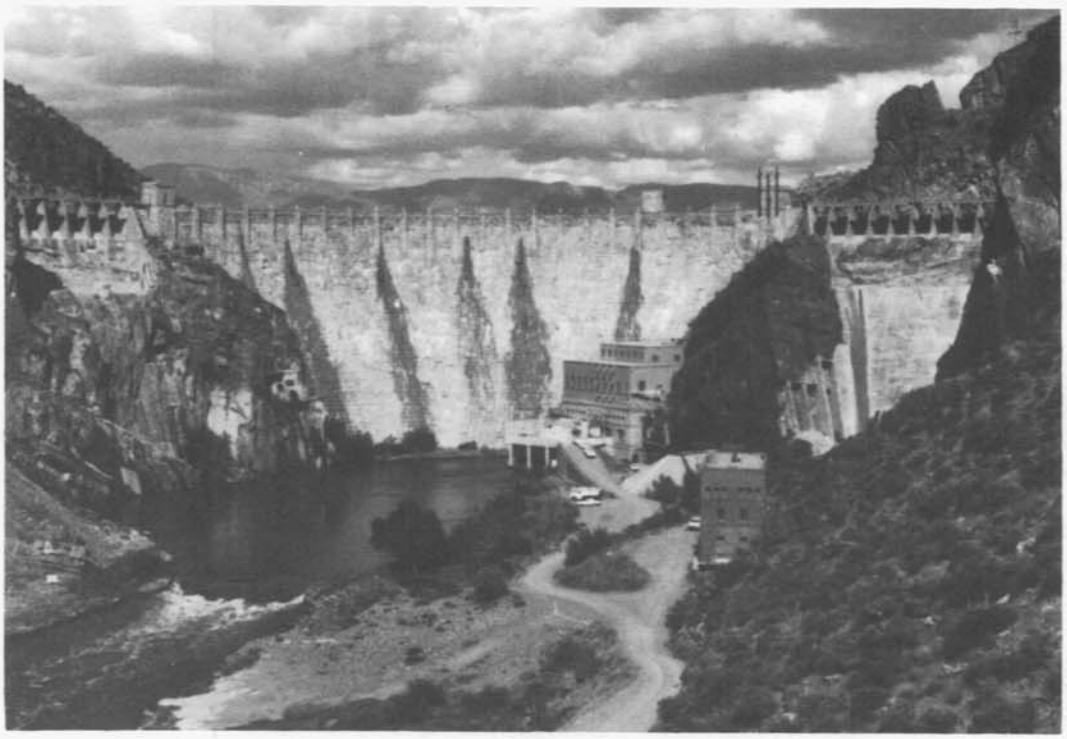
WATER OPERATION AND MAINTENANCE

BULLETIN NO. 106

DECEMBER 1978



IN THIS ISSUE

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

The Water Operation and Maintenance Bulletin is published quarterly for the benefit of those operating water supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning laborsaving devices and less costly equipment and procedures will result in improved efficiency and reduced costs of the systems for those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

Any information contained in this bulletin regarding commercial products may not be used for advertisement or promotional purposes and is not to be construed as an endorsement of any product by the Bureau of Reclamation.

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Division of Operation
and Maintenance Technical Services
Engineering and Research Center
Denver, Colorado 80225

Theodore Roosevelt Dam, Salt River Project, Arizona. Located on the Salt River in the south-central part of Arizona, about 48 km (30 mi) from Globe, Theodore Roosevelt Dam was one of the first large dams built under the Reclamation Act of 1902. Completed in 1911, the masonry arch dam impounds Theodore Roosevelt Lake which provides storage for irrigation, power production, and flood control. The lake is also extensively used for recreation purposes.

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INTRODUCTION

An article which appeared in an earlier issue of our bulletin stressed the importance of proper inspection of roofs. One such inspection revealed damage to a spray-in-place polyurethane foam roof. Beginning on page 1 is an article listing procedures for performing repairs on this type roof.

On page 3 is an article on improved drain inlet racks along the right bank of the California Aqueduct in the San Luis Field Division that are safer and more effective.

Cover a padlock and prevent theft and vandalism! Rocks and hammers have proven to be ineffective against these. Read page 6 and find how these padlock covers are designed.

Why a watermeter can save you money is described on page 9.

A teeter-totter pumping station? Beginning on page 10 is an article describing how this unique and workable pumping station solved the irrigation problems caused by fluctuating lake levels.

Before making a "lift," follow the basic points listed in the article on page 13.

Two timely articles about tires for winter driving appear on page 15.

Listed on page 17 are 10 principal factors which cause unsafe practices or unsafe acts by the individual.

ROOF MAINTENANCE[1]

A previous issue of our Water Operation and Maintenance Bulletin (No. 102) published an article entitled "How Are Your Roofs Doing?" The article stressed the importance of proper inspection rather than dwelling on numerous repair methods applicable for new types of roofing materials.

A recent inspection of a sprayed-in-place polyurethane foam roof revealed damage to the silicone rubber coating by hail, and subsequent damage to the foam from pecking birds. Patching the holes and recoating with additional silicone rubber was suggested to prevent deterioration of the foam, and the addition of mineral granules to the coating surface to minimize further coating damage. These mineral granules are a ceramic-type granule with baked-on enamel coating by 3-M. Several days of dry weather should precede the repair work.

The following procedure for performing the repairs was suggested:

1. Scrape dirt and deteriorated foam from all holes. Deteriorated foam is dark in color and very soft. Remove just enough to expose light-colored, sound foam.

2. Clean the coating around each hole or split by rubbing with a clean, dry cloth. Approximately 50.8 mm (2 in) around each hole should be sufficient. Some of the hail damage is difficult to see, being only splits approximately 12.7 mm (1/2 in) long.

3. Remove dust and dirt from the remainder of the coating with a stiff-bristled push broom. Use enough force to dislodge dirt in depressions but not so much as to injure the coating.

4. Fill all holes with Dow Corning No. 790 silicone sealant. Tool the sealant flush with the coating surface using a putty knife. Place a small mound of sealant over each of the small splits and flatten with the putty knife. The sealant is necessary since the coating will not bridge the splits. Allow the sealant to cure overnight. The sealant will not completely cure but should have a firm-enough skin to allow coating application the next day.

5. Apply Dow Corning No. 3-5000 silicone rubber construction coating. A medium nap, solvent-resistant paint roller may be used to spread the coating. Use between 6 L and 8 L (1-1/2 and 2 gal) per 9.29 m^2 (100 ft^2) or a minimum of 57 L (15 gal) over the 74-m^2 (792-ft^2) roof area. This is about as heavy as is possible to apply with a roller. Pour the coating on the deck, then move it around with a roller (wetted with the coating) to obtain a uniform thickness. Do not try to "roll out" the coating as would normally be done with a roller, since this would make the coating too thin.

6. Work small areas at a time. For example, select a 1.5- by 1.5-m (5- by 5-ft) area. Pour out approximately 2 L (1/2 gal) on the area and spread to uniform thickness with the roller. Saturate the roller before working the first area and allow it to remain saturated until the job is done.

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[1] Written for this publication by Bernard V. Jones, Materials Engineer, Materials Science Section, Division of Research, Bureau of Reclamation, Engineering and Research Center, Denver, Colorado.

7. Before starting the next 1.5- by 1.5-m (5- by 5-ft) area, broadcast the granules into the coating before it starts to dry (allow no more than 5 minutes drying). Leave about 300 mm (1 ft) or less uncovered with granules at each edge where a new work area will tie in. Overlap coating for the next work area over the previous ungranuled edge so that granules are always applied to wet coating.

8. Use at least 22 kg (50 lb) of granules per 9.29 m^2 (100 ft^2)–181 kg (400 lb) total–to obtain a uniform surface color with no apparent void areas. Moderate overapplication is better than underapplication.

9. Do not allow traffic on finished areas for 24 hours after granule application.

DRAIN INLET SAFETY RACKS ARE SAFER[2]

Along the right bank of the California Aqueduct, in the San Luis Field Division, there are numerous drain inlets which admit surface runoff into the canal during the rainy season. These drain inlets range in size from 106.68 to 182.88 mm (42 to 72 in) and are provided with safety racks to keep people and animals out of the inlet barrels, and also to prevent the entrance of floating debris. The racks slope up at an angle and are hinged at the top so they can be raised if necessary.

Sometimes, during heavy rains, waterborne debris stacked up on the racks causing water to back up into adjacent land and, at times, overtopped into the aqueduct. The racks had to be cleaned of debris by hand labor or, when possible, by equipment. The heavily plugged racks had to be swung up with a truck crane or other heavy equipment, which caused some damage to the racks.

On October 1, 1976, there was flash flooding from south of Los Banos to approximately the Little Panoche Dam area. Drain inlet racks became plugged with debris so quickly that it was impossible to get equipment to the sites in time to clear or raise them. The floodwaters caused extensive damage at some locations, when water overtopped the canal banks and backed up onto adjoining properties.

To make sure such a problem did not occur again, the top hinges were removed and placed on the base of the rack. These base hinges were moved far enough away so that the rack could be dropped down without striking the drain top. The racks were fastened in an upright position with a short length of small chain secured in a slot cut in a piece of metal angle, which was anchored to the existing top hinge anchor bolts.

During flood season, the racks could be opened quickly to relieve the heavy waterflows by cutting the chain and allowing the rack to drop. Afterwards, the racks could be lifted and secured back into position undamaged and ready to serve their safety purpose.

The figures on the following pages show the evolution of this safety and operational improvement.

For any additional details, please contact Alex Macias, Civil Maintenance, San Luis Field Division, California Department of Water Resources.

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[2] Reprinted by special permission of the Editor from Technical Bulletin No. 36, California Department of Water Resources.

Figure 1.–Safety racks hinged at top, original installation.

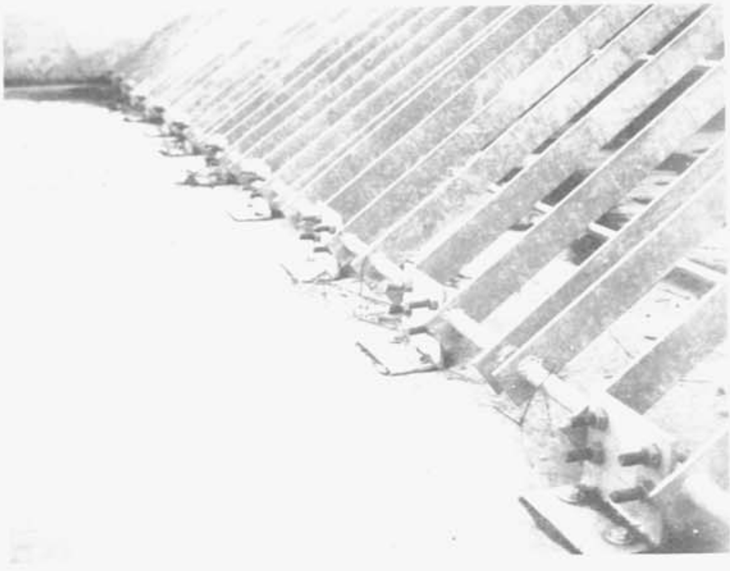

Figure 2.–Safety rack with hinges relocated to the base.

Figure 3.–Safety rack, new installation, with rack in the open position.

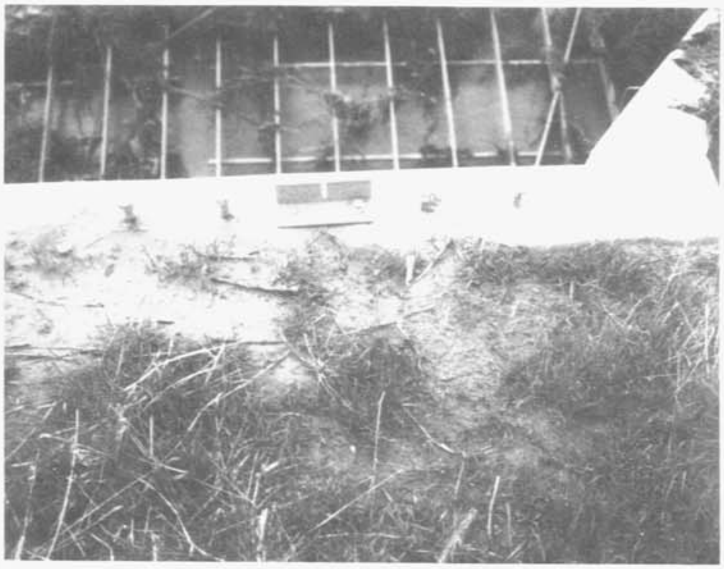

Figure 4.–Slotted angle-iron chain retainer to hold rack in place.

PADLOCK COVER[3]

Theft and vandalism at river gage stations, remote communication stations, and other installations on the North Platte Project in Wyoming have been an irritating and expensive problem. But not so anymore!

The padlocks used on the doors and hatches or lids at these installations were being battered or broken off by hammers, rocks, screwdrivers, bars, etc. Mr Abe Miller, Plant Mechanic at Alcova, Wyoming, designed and installed covers for these exposed padlocks. These covers can be permanently installed on the doors, or hinged so they can be swung out of the way when not in use. Similar covers can be constructed over built-in door locks that will protect them from external damage.

The material required for these covers is approximately a 0.186 to 0.279 m^2 (2 to 3 ft^2) of 4.76- or 6.35-mm (3/16- or 1/4-in) thick plate steel and can be built and installed for about $15 each. (See drawing on following page.)

Figure 5.–Door closed. Lock hidden, so that it is impossible to break with rocks.

[3] Material for this article was taken from Suggestion LM-78S-18 by Mr. Abe J. Miller, Bureau of Reclamation, Alcova, Wyoming.

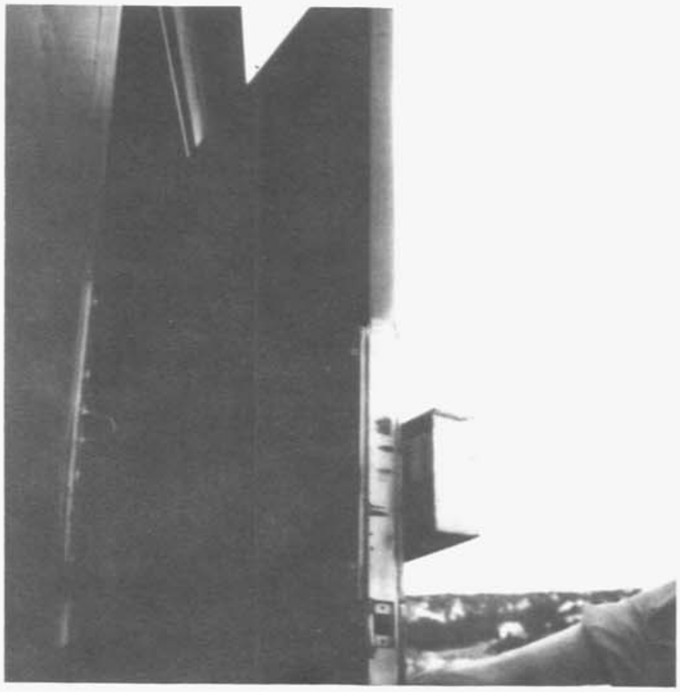

Figure 6.–Door open (hasp visible).

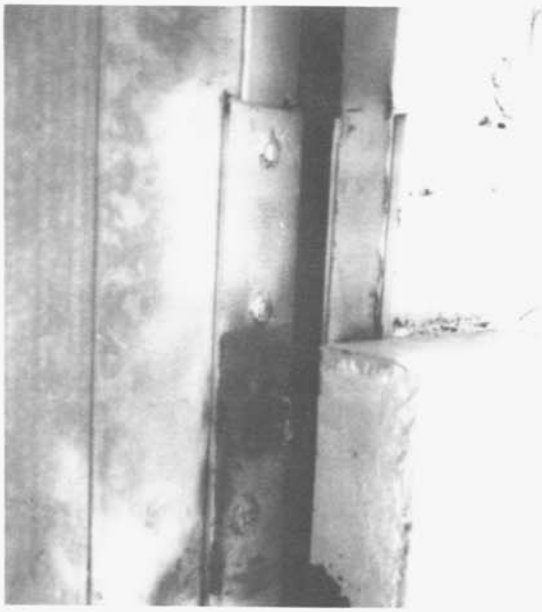

Figure 7.–Door closed (hasp covered).

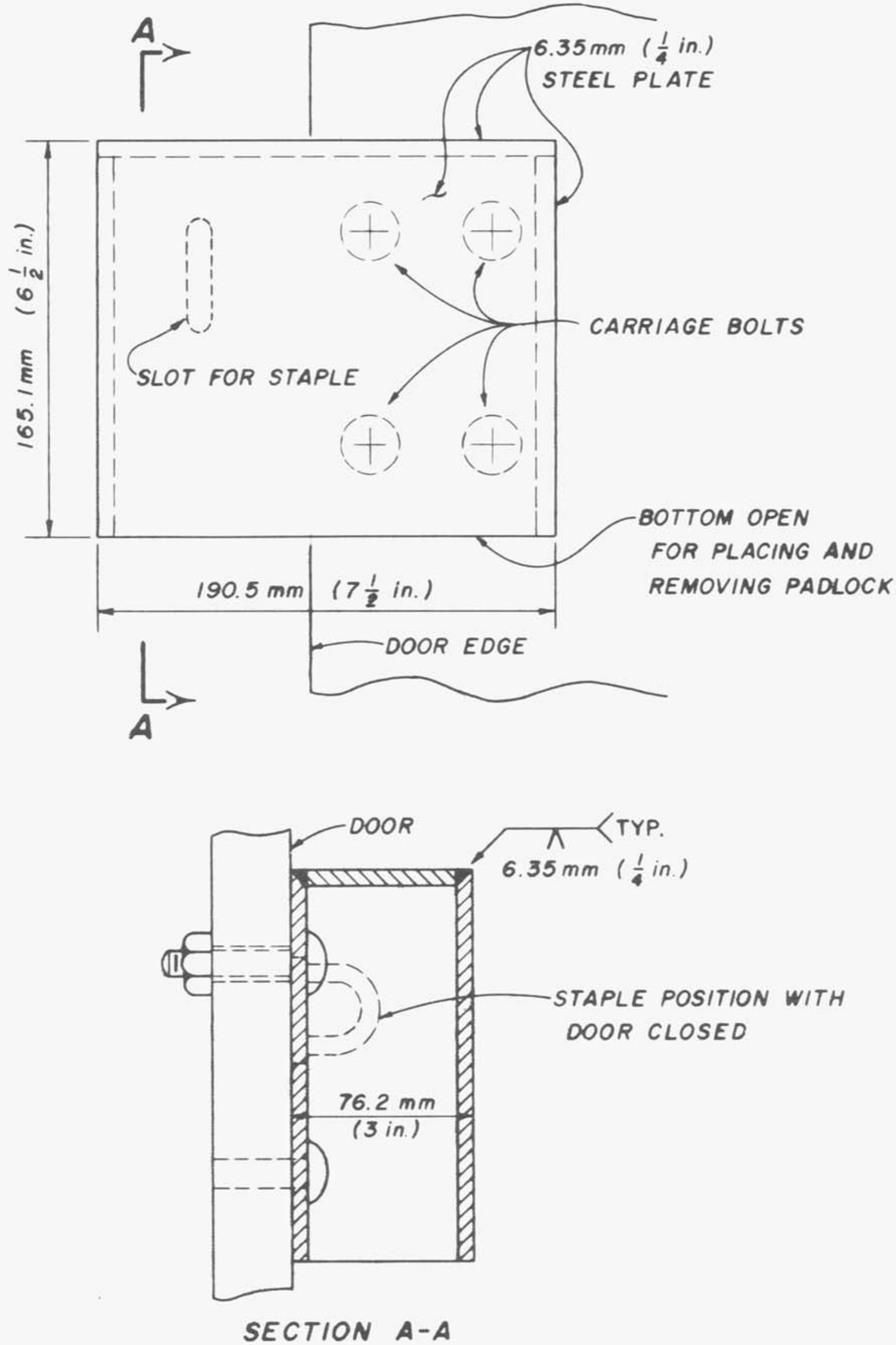

Figure 8.—Padlock cover.

WATERMETERS CAN BE MONEYSAVERS[4]

It is important to have a water flowmeter on irrigation wells for two basic reasons.

First, it enables irrigators to measure the amount of water applied to a field. Knowing how much to apply and when to apply the water comes first, of course. But the irrigator must know how much is being applied–how many inches of water pumped. A metering device does that. Metering can save money and energy if properly used.

The second reason for a water flowmeter is the rapidly diminishing ground-water supplies in some locations. There have been control areas–or ground-water management areas–established in the Upper Republican River and the Upper Big Blue River. Both of these control areas will probably institute rules on the amount of water pumped. This will call for watermeters.

If the meter is incorrectly installed, readings may be inaccurately high or low. Therefore, the irrigator may be applying less or more water than he thinks; a costly error.

To ensure good installation, the manufacturer's specifications should be followed. In ground-water control areas, the Natural Resources District may have specifications to follow; one being: The meter installation should be a certain required number of pipe diameters downstream from any pipe elbow, turn, or obstruction that could cause turbulence. Most meters are installed near the pump. The water must make a turn from vertical to horizontal flow as it reaches the surface. In addition, the action of the pump can give the water a swirling motion. So, it is important to keep these specified distances.

The most accurate readings can be obtained by purchasing a meter already installed in a length of pipe at the factory with straightening vanes. Second, the meter must be run in a full pipe. These suggestions, plus heeding specifications, give the most accuracy and satisfaction.

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[4] Reprinted by special permission of the Editor from a recent issue of the Nebraska Farmer.

GIANT TEETER-TOTTER LETS THE WATER FLOW [5]

Last year's severe drought in the Pacific Northwest created much hardship, especially for many farmers who irrigate with surface water.

Yet, even in years when water was plentiful, Russell and Ronald Rosenberg of Almira, had to cope with another problem in order to irrigate their hay land.

Russell and Ronald have a father-son partnership. They own and operate a ranch consisting of 5261 ha (13,000 acres) of range and 648 ha (1,600 acres) or dryland grain in Douglas, Grant, and Lincoln counties in eastern Washington.

They produce alfalfa hay on 49 ha (120 acres) for their herd of 75 commercial cows and nearly 300 registered Hereford females of British breeding. Their land is located approximately 13 km (8 mi) upstream from Grand Coulee Dam on a sandy bench along the south shore of Lake Roosevelt.

The Rosenbergs, and others who irrigate these benches along the lake, are confronted by an ever-present problem. The land lies within a vast geographic area vital in determining national and international agreements.

The Columbia River originates in Canada and is blocked by Grand Coulee Dam to form a 243-km (151-mi) long reservoir, officially known as Franklin D. Roosevelt Lake.

The lake level fluctuates due to flood control in Canada and Washington, power production, and the supply of irrigation water for the Columbia Basin Project.

Normally, the lake's lowest level occurs in March or April (when the Rosenbergs need to start irrigating). High water comes in June with snowmelt from Canada and surrounding mountains. Then, an adequate man-controlled level is maintained through the remainder of the irrigation season.

The Rosenbergs needed a permanent solution at their pump site for problems caused by the fluctuating lake level.

Furthermore, their irrigated land receives an average annual precipitation of 305 mm (12 in) during the winter. The growing season is usually hot and dry with consistently strong winds. They also must cope with the limited moisture-holding capacity of sandy soil.

"When we first decided to irrigate to increase hay production, we had a well drilled but found very little water. We then pumped from Lake Roosevelt in a ravine site which rapidly silted in due to the continuous fluctuation of the water level."

He added, "We had to have a pumping station at a different location where it would be capable of reaching the water at the lake's lowest level. We need a system which would automatically raise

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[5] Reprinted by special permission of the Editor from a recent issue of the Washington Farmer-Stockman.

to the highest level. A permanent setup would eliminate many tedious and risky hours required to change the motor, suction, and pipe. Besides, it was our only alternative."

The Rosenbergs hired a local engineering genius, George Thallheimer, to design and build their unique and workable pumping station. Construction had to meet esthetic requirements compatible to the ecology of the Roosevelt Lake recreational area.

In order to run the original four wheel lines and one hand move line (each nearly 0.4 km (1/4 mi) long) with a total of 151 sprinkler heads, the Rosenbergs' pumping plant includes a 111 855 W (150 hp) turbine pump at the lake site. (A 29 828 W (40 hp) booster pump is located at the edge of the hay field and is used only during the low lake level.) Water is carried 1646 m (5400 ft) to the lateral lines through 305 m (1000 ft) of 254-mm (10-in) mainline with the remaining distance in 203-mm (8-in) pipe.

Within the first 518.2 m (1700 ft) of pipe, there is a 106.7-m (350-ft) lift (at the discharge side of the pump) with an average 25° slope. Interestingly, Russell noted, "The lift at our station is greater than the 85.3-m (280-ft) lift at Grand Coulee Dam where the water is raised from Lake Roosevelt into Banks Lake for the Columbia Basin Irrigation Project."

Rosenbergs' pumping station resembles a high teeter-totter with its plank and support placed upside down.

A 61-m (200-ft) steel beam is weighted on the lake end by a floating barge which consists of decking, motor, and pump on four 3800 L (1000 gal) tanks. It is counterbalanced with a 2.44- by 3.66-m (8- by 12-ft), dirt-filled steel box.

The first 45.7 m (150 ft) of mainline pipe is attached to the beam from the floating platoon to the switchbox platform on shore. There, a hinged 90° elbow permits the pipe to automatically swivel on the continuing stationary pipe as the water level rises or lowers.

The Rosenbergs are able to handle normal fluctuations; they can start irrigating when they want to. Also, they are better situated to meet unforeseen problems–like in 1973 when the Columbia River reached a 95-year low level due to extremely dry conditions. They successfully coped with foreseen problems when the Third Powerhouse at Grand Coulee Dam was built in 1974. Nevertheless, the drought in 1977 did not greatly affect the normal level of Roosevelt Lake which rose early in the season that year.

When asked if they intend to expand their irrigated acreage, the Rosenbergs replied, "We cannot because we are limited by the contour of our land and the requirement of extensive revamping of the system. However, we are in the process of replacing the wheel and hand lines with a circle system, with little change needed. Some acreage will be lost on the corners, but we feel that we will make up in yields with coverage every 24 hours instead of every 9 days."

Figure 9.—This view, taken at low water on the lake, shows the extreme variation that occurs at the pump site.

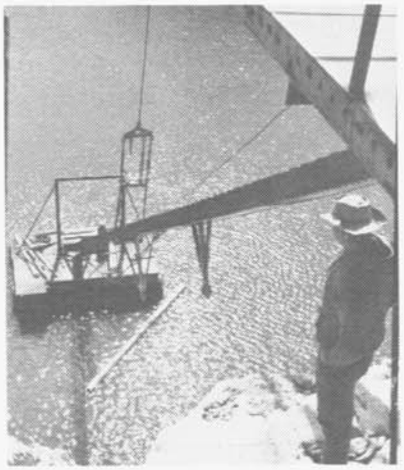

Figure 10.—Ron Rosenberg at the pumping station during low water in April.

TIPS FOR SETTING UP A MOBILE CRANE[6]

To personnel responsible for the operation of a mobile crane, the following steps should be taken before making a "lift." It should be verified that these basic points have been accomplished:

1. Locate the hoist line over the center of gravity of the load being hoisted. This will allow the load to be lifted without "swinging." The center of gravity of the load will always position itself under the boom point. This hazardous movement (swinging) is eliminated only by setting up "over the load."

2. Know the weight of the load. This may seem to be an obvious requirement; however, when investigating many accidents, it has been learned that in many instances actual load weight differed considerably from the estimated weight. When making lifts over 75 percent of the rated capacity, the load weight must be known exactly. Don't overlook the weight of the load block and any other rigging. All are a part of the load weight.

3. The maximum radius must be known at which the machine will be working or required to move the load. The farthest radius must be used to determine the lifting capacity of the crane from the load chart to ensure a safe hoisting operation. Remember, radius is measured from the "center of rotation" to the "center of gravity of the load."

4. Set up on a firm footing. If outriggers are used, they shall be fully extended and properly cribbed, if necessary, to provide support. Note: If outriggers are not fully extended, use the capacities given "on rubber."

5. Level the crane. A few degrees out of level can cause serious side loading of the boom, especially at longer boom lengths. Also, when swinging loads towards the load side, the radius will increase causing greater "tipping" forces on the crane.

Surely there are other important considerations when performing a hoisting operation, such as skill of the operator and proper rigging requirements. However, if these basic conditions have not been taken into consideration by the personnel responsible for the hoisting operation, then fundamental safe craning principles have not been met.

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[6] Reprinted with permission of Crane Inspection and Certification Bureau, Inc., from Safety Bulletin 122, No. 112, dated April 1977.

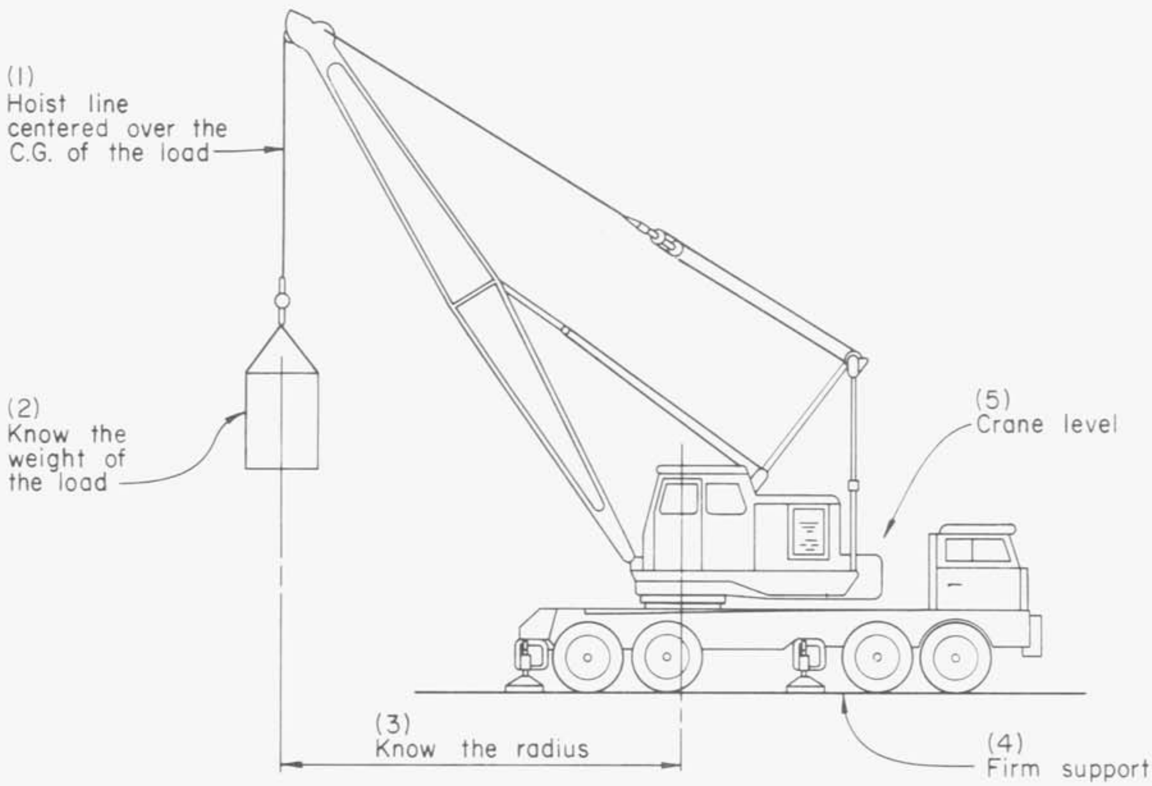

Figure 11.–Five basic steps to consider before making a "lift."

TIRES FOR WINTER DRIVING[7]

The U.S. Department of Transportation urges motorists not to mix radial tires with snow tires unless the snow tires are of radial construction.

If your car is equipped with radial-ply tires and you want to use snow treads, it is essential that radial-ply-constructed snow treads be purchased. Never mix bias or belted-bias-constructed tires with radials, because handling characteristics of the car will be adversely affected.

Many motorists consider radial tires equal in traction to snow tires. However, most states do not recognize radial tires as snow tires.

Snow tires should be inflated to the same pressure as recommended for conventional tires by the car owner's manual. Low pressure does not increase traction, and excessive heat buildup from underinflation may damage your tires.

If you plan to use snow tires, store your regular tires flat in a cool, dry place. Make sure they are out of the sun and away from electric motors, which produce rubber-deteriorating ozone.

If your car is in a skid, pump rapidly but lightly on your brakes until you slow down. If you begin to slide sideways, steer in the direction of the skid, foot off the brake pedal until you feel you are in control again.

If you are thinking about using studded tires (tires with studs, usually carbide tipped imbedded in the tread to help increase traction) check your state regulations to see when and if they are permissible. In some states, studded tires are legal year-round, while in others, there is a restricted period of use. Studded tires are illegal in Florida, Hawaii, Illinois, Louisiana, Minnesota, Mississippi, and Wisconsin.

Careful driving is vital in winter because of poor road conditions. Making the proper selection of tires can often be critical to safe driving.

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TIRE INFLATION PRESSURES

You could get caught by winter unless you check tire inflation pressures before the year's first severe cold front drops temperatures minus 1 to plus 5 °C (30 to 40 °F), Goodyear warns.

When combined with already underinflated tires, the 1- to 2-lb/in^2 pressure loss caused by the temperature drop could result in tires being badly underinflated when they are needed most–on ice or rain slick roads.

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[7] Reprinted from National Safety Council's Research and Development Newsletter.

Tires provide the best road handling and traction when properly inflated. Unequal tire pressures on the same axle–for instance, one tire inflated normally and the other underinflated–can cause a car to swerve when braking on winter-slick roads.

Proper inflation also is necessary to prevent premature tire wear. When a tire is underinflated, most of its contact with the road is on the outer tread ribs and they will wear faster than the rest of the tread. An overinflated tire produces the opposite wear pattern with the middle of the tread wearing the fastest.

Inflation pressures should be checked with an accurate hand gage when the tires are cold. Never bleed air from tires that are hot from extended driving or they will be underinflated when they cool off.

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UNSAFE WORK PRACTICES,
UNSAFE ACTS CAN CAUSE ACCIDENTS[8]

In almost any operation, unsafe conditions and mechanical failures are the easiest to control. Unsafe physical conditions can be seen and positive action can be taken to correct them. Eliminating or controlling unsafe conditions also helps to control unsafe work practices or unsafe acts by making the individual worker increase his awareness of personal work habits that could cause injury.

Human behavior is more complex.

Here are 10 principal factors which cause unsafe work practices or unsafe acts by the individual:

1. Did not know hazard existed. This may be from lack of experience, inability to recognize a hazardous condition, a temporary hazard created by a fellow employee, a chain of circumstances or lack of job training.

2. Indifference. The individual may know the safe method but may not care; this can be a temporary or continuing attitude. It is necessary that supervisors insist that certain standards be met by employees under their supervision.

3. Daring. This type of behavior blinds an individual to hazards that exist. Such an individual might also be classified as a clown, and there are enough problems in a job without clowns.

4. Poor work habits. From doing the same job day after day, poor work habits are often formed. Some may be formed early in the job and others may be developed later. This can be seen when an individual works many years and suddenly becomes an accident victim. He may have had poor work habits all along, and the law of averages finally caught up with him.

5. Poor example set. A new employee may follow the example of an older employee who has unsafe work practices or habits.

6. Laziness. All persons are lazy; it's the degree that becomes critical.

7. Haste. The desire to get something done fast can cause an injury or an unrealistic speedup on the job.

8. Temper. This can also be classified as impatience or lack of emotional control which can lead to an unsafe act.

9. Physical failure and fatigue. The individual may have physical limitations; he may be on a job he cannot handle properly. This may be because of poor eyesight, hearing, or general health.

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[8] Reprinted from National Safety Council's Research and Development Newsletter, dated January 1978.

10. Lack of training on the job. This can be the most glaring cause. A supervisor should be certain that each employee knows his job; if he does not, the supervisor is failing in his job. Lack of job training is a handicap. A supervisor has a responsibility to the employee as well as to the employer in carrying out necessary job training.

Many unsafe practices or unsafe acts cause damage to materials, products, and equipment but cause no injury. If an employee is injured, it is a safety problem; if not, some persons believe it is a production problem. Basically, it is the same problem–an unsafe work practice or unsafe act.

Unsafe acts are production problems whether you ruin the machine, the product, or the man.

Eliminate the unsafe work practices or unsafe acts from the work process and improve work output, reduce costs, minimize injuries.

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GPO 849-245

The purpose of this Bulletin is to serve as a medium of exchanging operation and maintenance information. Its success depends upon your help in obtaining and submitting new and useful O&M ideas.

Advertise your district's or project's resourcefulness by having an article published in the Bulletin! So let us hear from you soon.

Prospective material should be submitted through your Bureau of Reclamation Regional Office.