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NATIONAL PARK SERVICE  
UNITED STATES DEPARTMENT OF THE INTERIOR

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RESTORATION OF MABRY MILL

Section 1-T  
near  
Meadows of Dan, Virginia  
Blue Ridge Parkway

42 pp

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K. C. McCarter  
Landscape Architect  
1942

### Before Restoration

### After Restoration

Restoration of the group of buildings known as the Mabry Mill was begun during April of 1942, under approved CCC Project No. 720, by forces from Camp VA-NP-29, and in accordance with Drawings No. PKY-BR-1-T-2053.

The purpose of the restoration is the immediate preservation of the original structures as far as possible; to provide an interesting and informative exhibit to the traveling public; to retain a worthy example of mountain industry.

Pedestrian circulation from the parking area will be directive pathways. Paths were made by a small amount of rough grading and surfacing with a mixture of sand and sawdust. The path extends from the wagon bridge to the blacksmith shop and continues to the head race. A stile over the head race and steps down to a foot bridge crossing the small stream and loop of the return portion of the path. The main path continues along the open ditch to the swamp flume line. This is on high ground which affords picture views of the mill, head race, and swamp flume line. A small foot bridge crosses the ditch and the trail leads along another stream through a portion of the alder swamp to the head of the mill pond. This trail was located to afford the best vantage and picture point for the mill wheel. From the mill wheel the return trail follows up the small stream, under the trestle bridge and flume and loops into the main trail at the end of the bridge. The tourist route returns across the bridge and stile and then to the mill building.

The stile carries the foot path over the flume to the bridge across the creek.

A foot bridge, using locust stringers and oak planks crosses the flume ditch at the blacksmith shop. A similar structure for wagons was built a short distance above the shop to provide private access to the farm lands at the rear of the Mabry place.

A stock-pile of logs, sawdust, slabs, stacks of lumber, a rick of hand-rived roof boards add authentic interest to the yard area.

NARRATIVE

The history of this place is quite modern. Mr. and Mrs. Elias B. Mabry owned and operated the farm and industries for about forty years. The last five or six years before his death in 1934 Mr. Mabry was an invalid which resulted in the rapid deterioration of the flume lines, the water wheel, and saw units. The pond above the retention dam had silted up and the timber dam itself had partially collapsed. Inability to cope with depreciation of his own hand work caused Mr. Mabry finally to install an 8 H.P. kerosene engine to operate the two grist mills. During the several years of his infirmity Mrs. Mabry continued to grind meal; was considered an even better miller than her husband. Although a large woman, Mrs. "Eb" was not able to crank the engine and was dependent upon some passer-by, or the man who brought his meal to be ground, to get the engine started. The engine has been eliminated from the restoration.

The grist mills were evidently the initial installation, to be followed by the sawmill which necessitated a building wing to the east. Later a jig saw and planer were installed, and the main drive shaft and pulleys were moved to another wing on the west. The west wing was constructed over the old tail race by placing the structure on deep posts or piling. Concurrently with the grist mill we can account for the blacksmith and wheelwright shop.

The Mabry Mill group of buildings represents many forms of mountain industry essential to the needs of the farming population along the Blue Ridge. The Mabry Mill is the simple evolution of labor saving devices to supply simple needs.

The concentration of the "industries" at the one location was logical partly because the development of motive power was expensive in terms of mandays, and partly because the mechanical skill is secondary to most farmers. Thus we find the farmer-blacksmith becoming first the wheelwright, then the millwright, and incidentally performing the work of a carpenter, a miller, and a sawyer. Farmers, of necessity, are versatile workmen.

Here at the Mabry Mill we find the trade skills combined and imbued with an intuition and ingenuity to a degree which formed the nucleus of a mountain industrial unit.

Economically, the concentration of various crafts and trades is a sequence dependent upon the development of power and disposition of time. Power in excess is generally available with a water wheel prime mover. Milling is generally a part-time operation; lumber manufacture is a seasonal operation; blacksmithing is intermittent; and in the mountain trade, all are custom work. Alone, one job would hardly support the part-time farmer; together they provided full time occupation.

The farm community with its centralized industrial unit was almost self-supporting, much the same as urban communities. The mountain unit was a vital necessity because of the distance involved and means of

transportation to towns of any size. A four-day trip by horse and wagon provided the few pieces of cast iron or foundry work required. Steel and iron in the form of bars, rods, and sheets were hauled over tortuous mountain roads from piedmont industrial cities. For this reason the materials were used many times. A wagon tire, when no longer serviceable on the wheel, became a strap hinge, a wedge, an iron pin, a wagon-box strap, a clevis or cleat for plow or harrow.

Timber and stone were plentiful; cement and iron were not. Hence, the miller's first house was timber framed and jointed with mortises, tenons, and pegs. Masonry foundations and chimneys were mortared with clay. His barn was of log construction. With his own lumber mill, his second residence became a frame structure with clapboards outside and lined inside with tongue and groove siding. Hewed or puncheon timbers give way to saw-sized and dimensioned lumber.

At the Mabry site there are two grist mills, one for meal and the other for "chop." The latter is used to prepare mash for poultry, cattle, and hogs.

The meal rocks at Mabry Mill are considered locally to be the best rocks on the mountain. They were quarried six or seven miles from home and transported by oxen and sled to the site. They are apparently composed of porphyritic granite with clean sharp crystals composing the entire face, thus providing an even and sharp cutting surface.

Revenue from the milling operation was obtained by removing a toll of one-tenth of the meal after grinding. Since it takes an hour or more to grind a bushel of corn, the miller only made ten or fifteen cents an hour, plus all of the local gossip. It was customary to grind on Tuesdays and Thursdays. The farmer or the farmer's boy, generally on foot, sometimes bare-back on horse or ox, toted his "turn" of corn casually thrown over one shoulder if walking, or on the withers of old Dobbin if mounted.

Grinding bulks the meal to about the extent of the toll so the poke is full both coming and going.

Unlike the improvements in building construction resulting from the circular saw, the simple grist mill retains unsurpassed and unchallenged sway over the production of meal which is staple food to the mountain people. "Water ground meal" connotes not only texture, but flavor, and wholesome unbolted grain. Careful milling means constant testing by feeling of the meal in the grinding. Cracking the grain with the least amount of rubbing is essential to good milling. This means careful watching of the spacing between the "rocks" and control of the flow of grain from the hopper to the rocks. Small

diameter rocks are considered superior to large diameter, because the meal has less distance to travel while between the rocks which reduces the amount of heating.

THE WATER WHEEL

The original water wheel at the Mabry Mill was constructed about forty years ago by Mr. Mabry and Mr. A. N. Hylton, a local water wheel builder. The diameter was approximately 16 ft. The tail race was insufficient, and the wheel waded in the water, thereby losing considerable power. About 20 years ago the 16-foot wheel was replaced with a 14'10" wheel by Mr. Mabry and Mr. Hylton.

Failure of the dam and the flume lines left the wheel to the elements with alternate wetting and drying which quickly rotted all wooden members. The wheel literally fell apart when we attempted to move it.

The log cribbing of the wheel pit was rotted above the low water line. Several members were sound at the bottom course which has been continuously submerged for the past forty years.

The reconstruction of the wheel was done by Mr. A. N. Hylton. Mr. C. A. Goad, who had worked on much of the original mill construction assisted him. Mr. Hylton, at 70 years, is still a competent and active workman. Recently a widower, he prepared his own meals, performed his farm chores, and walked three miles to work, arriving one hour early. Most of the farmers in this vicinity do not recognize "war-time."

White oak, air dried for only a few weeks, was used throughout in the water wheel to conform to the previous work. Pine is considered to be just as durable if kept wet continuously.

The main shaft was hewed out of a 30-inch stick of white oak, 15 feet long. An axe and a broad axe were the only tools needed to make the 22" octagonal shaft. Locust bark was charred and steeped in an iron kettle over an open fire to make black ink for the "chalk-line." The ink stained the wet oak where chalk would not adhere.

Mr. Hylton wields the broad axe.

"Gudgeon" is the term applied to the metal axle which flares out into a cast iron cross which is let into both ends of the timber shaft. Iron bands are sweated on the hub to secure the gudgeon to the shaft. This reducer brings the diameter of the timber shaft from 22" to 3" of metal for the axle.

In each of the faces of the octagon three holes were mortised, one for the gear wheel arm and two for the water wheel arms. The mortise cuts were dove-tailed by sloping and undercutting one end face to fit a similar saw cut on the arm. When the arm was inserted, moved sideways and double wedged, a secure lock was completed.

For permanence masonry piers and walls replaced the log crib on which the original shaft was seated. Squared timbers surmount the piers. Into the top timber is dove-tailed a locust block on end to serve as a bearing block.

The frame for the layout of the wheel consisted of radial arms of 2" x 8" on edge. A compass arm of 1" x 4" laid flat was pivoted at center hub. The outer end of the compass arm was step-cut back to the center line to provide a radial scribe. Two holes in the compass arm set the scratch awl at the desired radius for intrados and extrados of the side cants or wheel segments. Locust pins were located outside of the scribe marks on top of the 2" x 8" radial arms.

The layout for the 48 buckets was made on the segments, and "L" shaped rabbets were chiseled into the planks. The bottom of the "L" was cut to receive a 2" x 4" with a beveled edge forming the bottom of the bucket. The other side of the "L" was cut to receive a 1" x 12" forming the front of the bucket. The back of the buckets were formed later by means of the lining inside the wheel.

A duplicate wheel was made for the other side on which the bucket cuts were reversed.

The wheel was taken apart and laid aside under cover pending assembly.

For the side cants it was necessary to use 2" x 15" x 7' oak planks to obtain the circular segments. It was possible to obtain this lumber from a nearby sawmill operation. The planks were placed on the frame and scribed. Saw cuts were made every 8" or 10" from the edge and the plank was then securely wedged into notches in two logs used in place of saw-horses. The circular segments were then roughly shaped with a hand axe; a draw knife chamfered the corners to the scribe line, and then an adze was used to hew to the line.

The segments were then returned to the frame and the ends were step-cut to form a pie-shaped lap-joint. Locust pins were used temporarily to hold the segments in place.

The assembly of the wheel is made in place. The shaft is lowered into the bearing blocks.

The gear wheel arms are inserted and double wedged into the shaft.

Segment wheel arms in place. Note taper and wedging of arms.

The gear wheel rim is built up from segments shaped on the same layout frame. A short segment is shaped and placed between the arms which forms a cover plate over the lap-joints of the rim.

The water wheel arms are placed next.

And the water wheel segments. (Note cuts for bucket boards.)

The bucket boards are cut and put in. During the assembly bolts replace the locust pins. Bolts through both waterwheel arms cinch the bucket boards between the rims of the wheel.

The lip of the front bucket board is beveled to a neat cutting edge which reduces water friction.

The back of the wheel is lined with 1" x 12" oak boards. These boards also make the back of the buckets.

The outer rim is covered with 3/8" x 3 1/2" strips which cover the joint cracks and lamination of rim segments.

This completes the waterwheel, and it is immediately put to use by admitting water to turn the wheel. This makes a lathe by which the gear-segment wheel can be trued. It was found that the 10-foot gearwheel was only 1/4" out of round.

The gear-segments are then bolted to the wheel. The entire wheel unit is shifted on the bearing blocks until the gearwheel meshes with the pinion gear. The bearing blocks are pinned together, grease is applied to the gears and the main axle, and the power unit is ready for operation.

For the preservation of the wheel it is essential to keep it wet at all times. A 5/8" hole was drilled in the flume gate to provide a continuous flow of water on the wheel. This small stream fills four or five buckets every few minutes which is sufficient to overcome friction and inertia, causing the wheel to revolve a few times before coming to rest. The splash also keeps the arms and shaft wet.

A narrow shed roof was placed just over the gear-segment wheel to keep off excessive splash which would quickly cut the grease on the gears.

|          |                     |
|----------|---------------------|
| L. to R. | A. Newton Hylton    |
|          | Charlie Arthur Goad |
|          | Elsie Scott         |

FLUME CONSTRUCTION

The water supply is brought to the wheel by means of the headrace and flume branches. The flume to the right leads across a draw into an open ditch for about 150 feet, thence a flume trestle crosses an alder swamp to another open ditch, which picks up water from three small streams. The flume toward the left is short, to connect with an open ditch at the blacksmith shop which extends past the proposed parking area from whence it follows the embankment 200 feet to a 2' x 4' masonry collection box at the stream. The open trestle flume was replaced by two 6" terra cotta pipes in covered ditch along the embankment for about 125 feet.

The branch flumes enter the headrace at the level of the top board. This permits the use of the headrace and a couple of hundred feet of branch flumes to act as a small but immediate reservoir for starting or additional power demands. It permits the flow of water in the flumes to catch up and thus acts as an equalization compartment.

The headrace is stopped just short of top-center of the wheel to prevent over-shooting. The main gate is framed in at the top board; the bottom board moves vertically. This affords considerable velocity as the water hits the wheel.

The trestles are 6" to 8" locust posts with cap member. Caps were drilled for 1" locust pins into posts. Cross braces are 2" x 6" pine.

Two stringers of 3" x 6" pine span two bents.

Yokes are of white oak. The 4" x 4" bottom members are dapped to receive 2" x 4" side members which are pegged with a half-inch locust pin. The top member is a 2" x 4" on edge, dapped near both ends to tie the two side members. The yokes are 2'6" on centers.

The sides of the flumes are 1" x 12" oak boards and are placed before the bottom boards of similar material. The bottom is two boards wide of 1" x 10". The lining boards are laid cracks apart to allow for swelling.

A diversion gate was placed in the flume line over the swamp by hinging one piece of siding between yokes. The gate swings crosswise to provide full diversion.

Flume completed and running full.

The headrace is merely a larger flume. The bottom is three boards wide, and the sides are two boards high. The yokes are 4" x 4" in all members.

THE MILL BUILDING

Repairs to the mill building were extensive, particularly at the ground line. Dry-wall stone footings were replaced under the grist mill and sawmill rooms. Wet-wall stone masonry was placed around the water wheel pit and mill pond. Sixteen truck loads of debris were removed from the sawmill space. Sills were replaced with locust timbers to avoid termite destruction. Floor joists were replaced with white oak round edged timbers removed from the residence building. Oak board flooring in widths from 6" to 12" was replaced throughout. Ventilation was provided for the under floor area.

Oak roof shakes were replaced with similar hand-rived "boards" over the entire building.

Framing and vertical board siding was left intact. The broken transom window in the gable end over the grist mill was replaced with a similar window.

The vertical board door on the west elevation was replaced with two hinged shutters to avoid the hazard of someone stepping out and into the mill pond.

THE GRIST MILL

Each mill consists of one fixed bottom stone and a revolving top stone, with the grinding surface in the horizontal plane. The bottom rock is hung in the platform frame, carefully leveled and securely wedged into surrounding timbers and all voids cemented for tightness. In the bottom rock a 6" hole is drilled, which is then bushed with a wooden bearing made of locust wood. The bushing in turn is bored to fit the vertical drive shaft. A ring groove at the top of the wooden bearing holds a grease saturated rag around the shaft. The grease ring is covered with a circular piece of old belting to keep the flour out and the grease in. Then comes the top-rock inverted on the pivot end of the shaft. The top-rock has a funnel shaped hole through it to admit the grain from the hopper above. This hole necessitates supporting the rock with an inverted "U" shaped metal hanger and a cross arm to transmit power. The pivot point is well above the center of gravity of the rock. The weight of the top-rock is transmitted through the shaft to a cup casting on a cross member of the timber frame. Space between rocks is controlled by a series of levers which shift the timber cross member. The drive pulley is mounted below the rocks on the shaft. Guide pulleys are used to control belt tension.

We are amazed to find that with the exception of the steel shaft, metal hanger bar, cup casting, a few nails and bolts, the grist mill is entirely a home-made machine. The rocks are closely encased by means of a wooden shell which is surmounted by a frame holding the hopper. Just below the hopper is a "V" shaped trough called the "shoe." The shoe is hung on the frame at one end and the other end rubs an extension of the shaft called the "shaker." Lowering or raising the free end of the shoe controls the rate of feed of the grain. The shaker provides a continuous flow so essential to good grinding.

Restoration included new foundations under the grist mill frames to remove the "rack" incident to the heavy top-rock revolving at several revolutions per minute.

The repairs to the grist mill consisted of replacing all adjustment wedges, realigning shafts, replacing wooden vertical bearings, leveling bottom rocks, repointing the four abrasive faces of the rocks, placing collars around the wooden shells, replacing metal wire cleats on one of the shaker shafts, rebuilding one shoe, and realignment of belt guide pulleys.

THE SAW MILL

The saw frame is constructed of timbers, upon which the saw arbor is mounted, together with home made clutch, transmission friction pulleys, and reverse pulleys which control and operate the movement of the log carriage. Gears and shafting were mostly salvaged from thresher machine parts and assembled into a workable mechanism to accomplish the purpose at hand. Friction pulleys were made by laminating circular pieces of belting material backed with a wooden disk. A single lever operating one of the friction wheels in two directions enabled the operator to change the speed of travel of the log carriage or provided additional power if the cut was heavy. The friction pulleys permit flexibility in starting the forward movement of the log carriage in much the same manner as a clutch in an automobile.

The saw arbor frame was dismantled and wooden pulleys rebuilt and levers readjusted. Upon assembly it was anchored in with the new floor framing.

The saw carriage was tightened up and new rack timber installed. Old style carriage heads and gear were bought from a mill of similar age and appearance to replace the heads which had been sold for scrap iron. For the same reason it was necessary to purchase an ancient 42-inch, ten-tooth, circular saw. We were very fortunate to obtain these two items because the older types are fast disappearing from breakage, rust, and high price of scrap metal.

The platform which receives the logs from whence they are rolled back onto the carriage was rebuilt to conform to the height of the carriage-heads.

Levers to the water-gate in the flume above the water wheel which places control of power within reach of the sawmill operator was aligned and partial replacement of wood members was made.

THE WOOD SHOP

The jig-saw and table were rebuilt around the sawflume, table, pulleys, and connecting rod which were found among the debris. Placement was made by workmen who had previously operated the machine.

Likewise the tongue and groove assembly was rebuilt around the mandrel, head, and double bit.

This room contains the main drive shaft from the water wheel and drive pulleys to all machinery. The bull wheel for the saw drive had been placed at the other end of the shaft in order to use the kerosene engine after the saw mill went out of use. The engine was removed from the building, and drive pulleys were placed in their normal positions. A new 30" pulley was built for the jigsaw drive.

Little information could be obtained on the planer which was used in this room. It was sold by Mrs. Mabry several years ago, together with considerable scrap iron and all of the belting. The planer was not restored.

BLACKSMITH & WHEELWRIGHT SHOP

The original location of the blacksmith shop was adjacent to the Parkway between the mill building and the entrance gate. This location interfered with the Parkway construction. The structure was unstable, having been directly in contact with the ground for many years. Bottom logs were rotted in the forge room. Sill members were entirely gone in the lean-to portion used as a wheelwright shop.

The building was marked, dismantled and relocated on the opposite side of the yard area.

Dry-wall masonry footings were used to grade of proposed fill. Earth floors were made by filling with clay from the mill pond excavation.

Bottom logs were replaced out of chestnut.

The lean-to was replaced on the down hill side.

Hearth was reconstructed with stone masonry using clay for mortar and back fill.

The bellows and frame were replaced from another old forge. The tuyere was rebuilt from a wagon wheel axle spindle. The leather on the bellows is in bad condition and must be replaced before the bellows will be operable.

An anvil was purchased and blacksmith tools and quenching vat will be replaced to return this building to its original function.

Completed blacksmith shop and fill around the building restore the original appearance.

In the foreground is an old two-roller sorghum mill which was purchased, the sweep replaced, and located between the mill and the shop for tourist interest. Boiling vats have not been obtained for this mill. Sorghum mills are common in this mountain country. Several farmers generally use the same mill, furnishing their own horse or ox to pull the sweep and their own help to feed the mill and boil the sap down.

The wheelwright shop in the lean-to consisted of a work bench and a hinged spindle where Mr. Mabry fashioned the hubs and spokes for wagon wheels. The felloes were sawed on the jigsaw in the mill building.

Ten or twelve feet of strap iron are bent in this frame to make the circular tire rim. It is then measured with a wheel scribe and welded in the blacksmith shop.

A bonfire of chips and bark heats the tire rim red hot. It is then placed on the wooden wheel to burn its shape into the felloe. The log trough quenches the iron and shrinks the tire to a tight fit. Too much shrinkage will "dish" the wheel.

Charcoal for the forge was made by burning chestnut logs as stacked in the open field and quenching with water before the logs were completely consumed by the fire.

ROOF BOARDS

Making "boards" is a favorite two-man job. For these roofs we sawed red-oak logs into 32" - 34" lengths and hauled them to the area. Each length is end split into eights by means of an axe, a large maul and a couple of wooden wedges. The pie-shaped segment then has the heart point removed, losing about 3" of the radius and leaving about 4" to 6" of radius. This block is called a "bolt." In order to obtain 4" to 6" wide boards, the logs must be 16" to 18" diameter or larger. The bolts are split again with the axe or wedge and thrown into the pile for "riving."

Riving is done with a tool called a "frow" similar in shape to an old fashioned straight razor with the blade pointing down and the handle up. The blade is about 12" to 14" long and 2 1/2" wide. The handle is about 16" long.

The blade is centered and driven into the end of the bolt with a hand maul. The opposite end of the bolt is then placed between two logs and leverage is applied to the handle of the frow. As the split progresses down the bolt the frow follows until the hand may be inserted to apply pressure. The direction of the split can be modified by turning the bolt over and applying the pressure in the direction of the desired split.

Each length of log will provide about 128 boards of 3/8" thickness. The boards are ricked in piles about five feet high and a heavy stone or chunk of wood put on top to keep the wind from scattering them. The boards may be dired or put on the roof immediately. It is a well known phenomena on the mountain that boards must be placed in the right phase of the moon to prevent warping and curling.

The roofs were replaced on the mill building and the blacksmith shop. Roofs were laid "board" fashion which means every course is doubled with only a small amount of lap. The pieces as rived are called "boards." Tapering one end of this "board" makes it a "shingle."