

NORTH STAR HISTORIC CONSERVANCY

THE STAR

NEWSLETTER

Summer 2021

Power for the North Star Mine

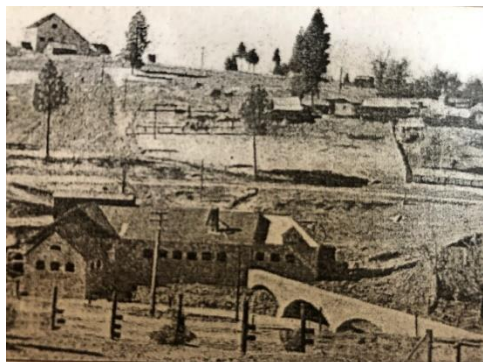
Contributions of two local men: Arthur De Wint Foote & Lester Pelton

by Laurie Harrison-Dayton and Joan Clappier

Arthur De Wint Foote's success at the North Star Mine is due in part to the efforts of another local, but less-known, man: Lester Allen Pelton, from Camptonville. Pelton developed the "Pelton Wheel" by refining the long-used water wheel to make it a more viable source of power. Pelton refined the water wheel by placing a divider in each bucket that directed water sideways so none of it would bounce backward and hit the back of the next bucket in line, reducing efficiency.

Power was needed at the North Star Mine to pump out the water that collected underground and to haul the quartz containing the gold to the surface. Originally the principal source of power was the steam engine powered by burning wood. Massive amounts of wood were burned

every day by the many mines in Grass Valley and Nevada City. As a result, the forests in the area were denuded, as seen in the picture on the left.



*Looking West from Power House.
Note aqueduct lower right for 22" water pipe.*

*30-foot Pelton Wheel,
inside the North Star Mining Museum*



James Hague, North Star owner, asked his brother-in-law Arthur De Wint Foote to develop a source of power that didn't require wood. At that time, the transmission of electricity was in its infancy. Foote felt it was a potential source of power but he wasn't sure it would be safe enough for the miners, a chief concern of his. He looked to another source of power instead - the Pelton Wheel.

Pelton's original wheel had a diameter of 2.5 feet. By the mid-1880s there were many Pelton wheels from 2 ft to 6 ft diameter in local mines. Foote wanted to *significantly* increase the size to gain sufficient power but he met with resistance from Pelton, who feared it might be too dangerous. Together they compromised on an 18.5 ft diameter wheel.

The 18.5 ft wheel worked well and provided much needed power, but as the mining operation kept expanding the need for more power continued. Foote decided to construct a 30-foot wheel. Pelton disagreed again, but Foote was confident in his calculations and had it built. It was (and probably still is) the largest Pelton wheel ever built.

The Mining and Scientific Press
December 1920 issue reports that when the wheel was used for the first time the locals "lined the fences to see her blow up when started, but they were disappointed."

Interesting note: It is a common misconception that the North Star Pelton Wheel was driven by the water in Wolf Creek, which flows past the Power House.



A water wheel for a traditional grist mill has water from a flume falling on the top of the wheel. The weight of the water is what pushes the blades of the wheel down. That would produce only a small fraction of the power required for a hard-rock gold mine. As described on page 3, the Pelton wheel is driven by the force of very high velocity water.



To honor Lester Pelton and his contribution to mining history, there is a monument in the little town of Camptonville. It's about a 40 minute drive from Nevada City, north on highway 49. The monument is on the left just as you enter the town.

The wheels operated from 1898 until 1933, by which time the mine had been fully switched to electric power. The 30-foot wheel was saved from demolition by a group of local citizens and is now on display at the North Star Mining Museum, 933 Allison Ranch Road in Grass Valley.

Diving a Little Deeper into Pelton Wheel Details

There are two key elements to obtaining power efficiency of a Pelton wheel:

1. The shape of the bucket and location of the splitter
2. Having the water hit the buckets at very high velocity



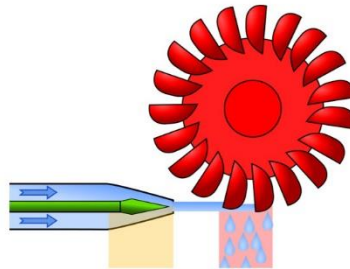
Benefits of the shape:

The water comes out of the nozzle and strikes the center of the splitter. This sends half the water around each side, which balances the bucket. As the water travels around the curve, the force of the water is still pushing on the bucket, thus the bucket and wheel get the majority of the force delivered by the water. The angle at which the water leaves the bucket is sloped out slightly to avoid affecting the following bucket.

The second essential element to get full benefit from a Pelton wheel is high-speed water. When William Bourn, Jr., took over the Empire and North Star mines, he had the foresight to build a reservoir at over 3,000 ft elevation in Grass Valley. He brought water down to the Empire mine in a 22" diameter pipe, then sent the "used" water through a 20" pipe to the North Star. When additional water pressure was needed for the larger wheel, a new pipe was run under Empire Street, taking water from the 22" pipe before it went to the Empire. This pipe crossed Wolf Creek in an aqueduct, which is still there as a walkway across the creek (see Power House picture page 1). This resulted in an 818' pressure head from the reservoir to the 30-ft Pelton Wheel.

Right: Diagram of Pelton Wheel operation.

Close to the wheel, the 22" pipe diameter gets stepped down and the final nozzle head narrows to a 1.75" opening. The reduced diameter increases the velocity of the water as it hits the bucket. The nozzle is aligned with the splitter of the bottom bucket and the water hits the bucket at high velocity.



For those of you who like numbers ...

818' pressure head from reservoir to Power House

354 lbs pressure per square inch when water hits buckets

The 30-ft Pelton wheel developed 1,000 hp at 65 rpm

They were lifting 500-700 gallons-per-minute of water out of the mines, with the pumps running non-stop (24/7).

Reference: Gold Giants of Grass Valley: History of the Empire and North Star Mines 1850-1956, by Roger Lescohier. Available at Empire Mine State Park gift shop.

Thanks to North Star Mining Museum docent Frank Hamlin for his review and contributions to this article.

President's Message

Paula Campbell, President



For most gardeners, spring color in the garden stands alone.

During the summer and winter, I try to be thoughtful and contemplative, perhaps planning for this clear pink (not bluish, not bubblegum!) next to that soft grey foliage and perhaps a darker orange and a bit of blue. Then more planning: when do they bloom, water needs, how tall, do we need something spiky?? And planning for the near and far vistas, paths, benches. I'm thinking I need a spreadsheet!

But spring blooming plants are not part of these calculations because in my garden and in my heart, spring is a time for wild, chaotic, splashy and glorious color all over the garden. If a few purple rhododendrons are grouped together, that's lovely but so is the magenta lychnis blooming right through the brilliant pink (bubblegum!) rhododendron. All color rules are suspended as I am in the growing garden again, marveling at a huge mountain of forsythia covered in yellow threatening to smother all who come near.

A year of quarantine brought worry for the health of ourselves, our loved ones, and those in our community, plus financial strain for businesses and individuals. My hope now is for all of us is to feel the joy of spring again.

We have had a difficult year at the North Star House with events and client rentals cancelled, fewer volunteers because of safety concerns, and worry about the health of our North Star family.

We have been blessed with very, very generous donors who made it possible for us to emerge from a challenging year financially stable. Thank you all for your support.

Volunteer work restoring the house and improving the landscape continued through this year though with many restrictions and very careful planning. Restoration work on the ground floor is truly, truly amazing. Please plan on attending a docent tour or any of the public events being planned for this summer and fall. You will be impressed with the beautiful, skillful carpentry which has brought this area of the house to life. It is a delight just to walk through.

From the extended North Star family, we wish you good health and welcome you back to the house.

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Newsletter Editor: Joan Clappier

Construction Progress during the Shut-Down

By scaling back the workforce and observing mask and social distancing guidelines, the volunteers were able to keep working.



Welcome Back!

The North Star House
Saturday, July 10 5-7 pm
Open House

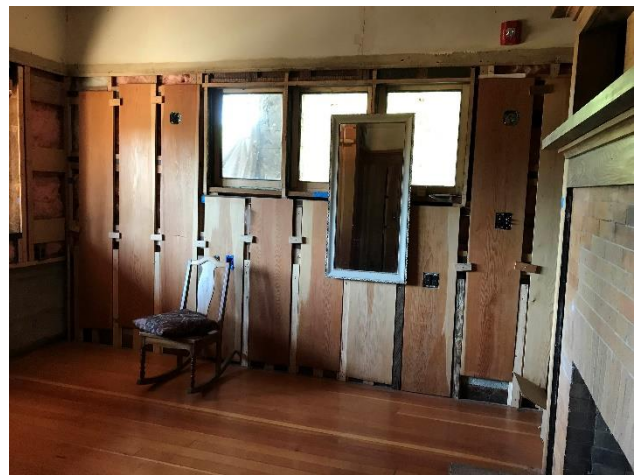
House & Garden Tours * Music * Free Admission
Food & Drink Available

Come see the improvements we've
made during the shut-down.

 **The North Star House**
Historic House designed by
famed architect **Julia Morgan**
12075 Auburn Rd, Grass Valley
www.theNorthStarHouse.org

Mary Hallock Foote's study (below) is finally getting its makeover. New wiring has been done and the exterior walls have been insulated.

Paneling is going back up. (The mirror is on the wall because there was a wedding at the House the day before this picture was taken and this is the "groom's room".



Study being restored

LIBRARY: This room presented extra challenges because all of the original woodwork had been removed by the previous owner. Fortunately, we had some pictures to help us restore it to the original design. The next challenge was to acquire enough new cedar for this room plus the cabinets in the



Bench seats and paneling around fireplace

Dining Room. With help from several entities, we received a shipment of cedar during 2020 and we were able to start.



Bookcase, paneling and original style windows

DINING ROOM:



In this room, too, the shipment of new cedar enabled us to finish a project. The cabinets in the dining room had been reduced to some shelves with curtains and sheets hung to cover the contents. The picture we had of the original cabinet was old and poor resolution, but Larry was able to learn enough from it to replicate the style of the cabinet doors. The windows were hand-made in the original style. And the badly damaged buffet top was refinished. It's a major step up for this room.



The Dining Room is looking lovely.



The corners, nooks and crannies are getting finished in the Living Room



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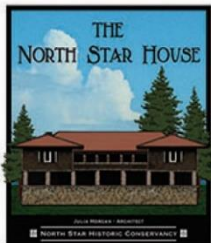
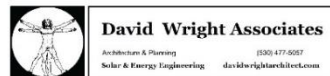
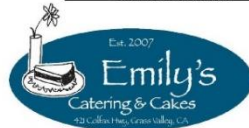
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Earn!

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NORTH STAR HISTORIC CONSERVANCY

P.O. Box 1538, Grass Valley, CA 95945

www.TheNorthStarHouse.org 530-477-7126

Our Vision is to restore the unique rural roots of Julia Morgan's North Star House as a center for exchanging ideas, nurturing the arts and fostering learning. Your support makes this possible.

We invite you to join us: Become a Member ❖ Make a Donation

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Upcoming Events at The North Star House



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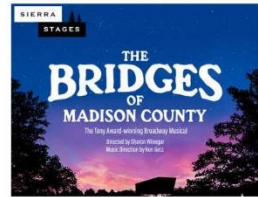
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Save the Date

AutumnFest
at the North Star House

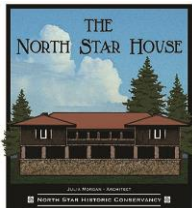
Sunday, October 17, 2021

Soroptimist International
of the Sierra Foothills
&
North Star Historic Conservancy
are partnering to present
a fun, Autumn event

Garden Shop Tours Heritage Garden
and much more

We're still planning ...
Look for details this summer

We're working on other Events . . .
Stay tuned to our website and Facebook page



North Star Historic Conservancy
P.O.Box 1538
Grass Valley, CA

www.TheNorthStarHouse.org

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