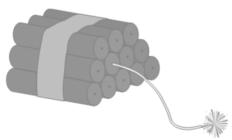


# The Primer



*Newsletter of the Golden West Chapter, International Society of Explosives Engineers  
430 32nd Street, Suite 100, Newport Beach, CA 92663*

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## ***In this issue . . .***

**President's  
Message  
pages 1-3**

**Editors Notes  
pages 4-7**

**The Helms Pumped  
Storage Project  
by Wes Bender  
pages 8-13**

**Advertisers  
pages 14-17**

**Fire in the Hole  
page 18**

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## ***President's Message...***

### **Hey Members, Guests & Supporters**

In 2018, the Wesley L. Bender Scholarships were awarded to: America Aguilar-Andrade (left) and Charity Goldsmith Ding (right).



Dianne Bennett Photography

The Wesley L. Bender Scholarship Fund of the Golden West Chapter awards two \$8000 scholarships to qualifying individuals who are related to an employee in the explosives industry or related field and who wish to pursue collegiate studies. Each scholarship will be paid at the rate of \$1000 per semester.

Continued on next page

## **The Primer**

### ***President's Message...***

America is attending Napa College in Napa CA, working towards a degree in Computer programming. America's Dad, Tony, has worked for 25 years at Bodean Company's Mark West Quarry in Santa Rosa CA. Charity's Dad, Norm, is a Production Supervisor for 14 years at Specialty Minerals Mining Company in Ione, CA. Charity is attending York College in York Nebraska working towards a degree in Criminal Justice. Charity plans on using her degree to become an agent for the Department of Fish & Wildlife. By the way, as well as her Mom, Dad and sister Gracie, she is quite the active Sporting Clays shooter!

We were honored to have Winston Forde, Executive Director of the ISEE, attend our business dinner meeting in February. Winston's message to the chapter members was that the ISEE would continue to support the chapters. That promise came to fruition with a letter to our chapter recently from the Chapter development committee chair Cam Thomas; Membership Committee Chair, Danny Ray Leach and ISEE Membership Manager & Chapter liaison, Patrick Lang.

I would like to share with you some of the things they are working on. Once again, this year the ISEE is offering an incentive for chapter leaders and potential leaders to attend the ISEE Annual conference in Nashville January 26-30, 2019. They are offering \$1,000 US and free registration for either the conference or the blasters leadership weekend. This is targeted at people who would not normally come to the conference. Those who are found eligible will need to be in a chapter leadership position or be a chapter member who would be interested in becoming a chapter leader. There is a limit of one incentive opportunity per chapter over a two-year period. Please see the attached Incentive application for complete instructions. Applications are due by December 1, 2018. There will be the usual Chapter breakfast and meeting which I will be attending along with any interested GWC members or hopefully, the recipient of the incentive award (which is a requirement). The ISEE is asking for chapter input on ideas for a guest speaker, major issues facing our industry, round table discussion ideas and chapter awards presentations. Continue to alert the ISEE of our special events or and any training events. They just need to know how they can help support them.

Continued on next page

## ***President's Message...***

NEW- They are working on setting up a Members Only website where chapters can go for information on a wide variety of subjects such as drilling, blasting, monitoring, regulatory, accidents, etc. They welcome any ideas or suggestions for materials. That's just some of the ways the ISEE is hoping to help support the chapters. Although it was hot and dry, our annual Wes Bender Scholarship shoot was a success. Due to conflicts in scheduling we had only 13 participants. Thanks to donations from our members, loyal sponsors and participants, we were able to raise some money towards the scholarship funds. Our BBQ chef, newsletter editor and board member Mike Burneson surprised us all with an awesome New York Strip lunch with all the fixings. In attendance and helping with the event were GWC members and spouses, Gerald & Mary Hackler, Donna Chiurato, Ladd Stephenson and of course, Mike Burneson. And from afar, participating officers, Jerry Fulgum (He cuts the checks!) and Joe Stack, making the announcements. Thanks guys and to all of you for your donations and efforts to make this a successful event. See the Newsletter for Mike B's comments and pictures from the event.

If I don't see you in Nashville, make sure to mark your calendars for our next business dinner meeting scheduled for Saturday, February 23<sup>rd</sup> 2019 and our next scholarship fundraiser shoot scheduled for a much cooler Saturday, May 11<sup>th</sup> 2019..

Until then, Be Safe!  
Your president,  
Mike Chiurato

## The Primer

### Editors Notes:

Congratulations to our scholarship winners America and Charity. We had some good scores at this years Coon Creek fundraiser. We have moved the event to an earlier date to try and avoid the heat. I hope you enjoy the photos. In this issue of the Primer is an interesting article (part 1) of the Helms Pumped Storage Project by Wes Bender. We will discuss the February 23rd 2019 business meeting in greater detail in the Winter issue of the Primer to be published in December.



Editors Notes:



## The Primer

### Editors Notes:



**Editors Notes:**



## The Helms Pumped Storage Project

by Wes Bender

In the mid to late 1950s, Pacific Gas & Electric (PG&E) built two dams in the Sierra east of Fresno. The upper dam, on Helms Creek at an elevation of 8200 feet, impounded Courtright Reservoir. The lower dam, on the North Fork of the Kings River, at an elevation of approximately 6550 feet, impounded Wishon Reservoir. Courtright has a capacity of 123,000 acre feet and Wishon a capacity of 129,000 acre feet. These two dams were to eventually make possible the Helms Creek Pumped Storage Project, part of PG&Es Kings River Project.

A pumped storage project acts as a hydroelectric storage unit that is capable of reusing the same water over and over again. During peak electricity demand times, water flows from the higher reservoir down through the powerhouse and into the lower reservoir, generating the needed additional power. When demand for power is reduced and electricity is less expensive, the system is reversed and water is pumped back up to the upper reservoir. The Helms Project uses three Francis Pump/Turbine-Generators to accomplish this. Nuclear power plants are most efficient when they are at or near capacity. Diablo Canyon Nuclear Power Plant can be used more efficiently because it can power Helms for pumping when other demands are low. Pumped Storage plants are net users of power, consuming more power than they generate because of friction losses. Total generating capacity at Helms is a little over 1200 megawatts, enough to power nearly 900,000 average homes.

In 1977, after all the engineering had been accomplished and the necessary permits obtained, PG&E put the main part of the project out to bid. The project consisted of putting inlet/outlet works in Courtright and Wishon reservoirs, excavating a powerhouse deep within Lost Peak, excavating and lining the connecting tunnels, sinking shafts, and constructing and/or improving the access roads required for the project.

Viewed from above, Lost Peak is a teardrop shaped mountain that trends roughly north and south (see Figure 1 on the next page). It is bounded on the east side by Helms Creek Canyon (and partially by the North Fork of the Kings River) and on the west side by Lost Canyon. Courtright Reservoir is at the north end of the mountain while Wishon Reservoir is at the south end, some 3.6 horizontal miles from Courtright. All but the inlet/outlet works, the Lost Canyon viaduct and some peripheral structures are contained within the mountain.

Near its northernmost end, Lost Canyon narrows and turns to the northeast slightly toward Helms Creek. In doing so, it cuts across the path of the tunnel route from Courtright to the powerhouse penstock, necessitating a viaduct (a large diameter pipe) to carry the water across the floor of the canyon.

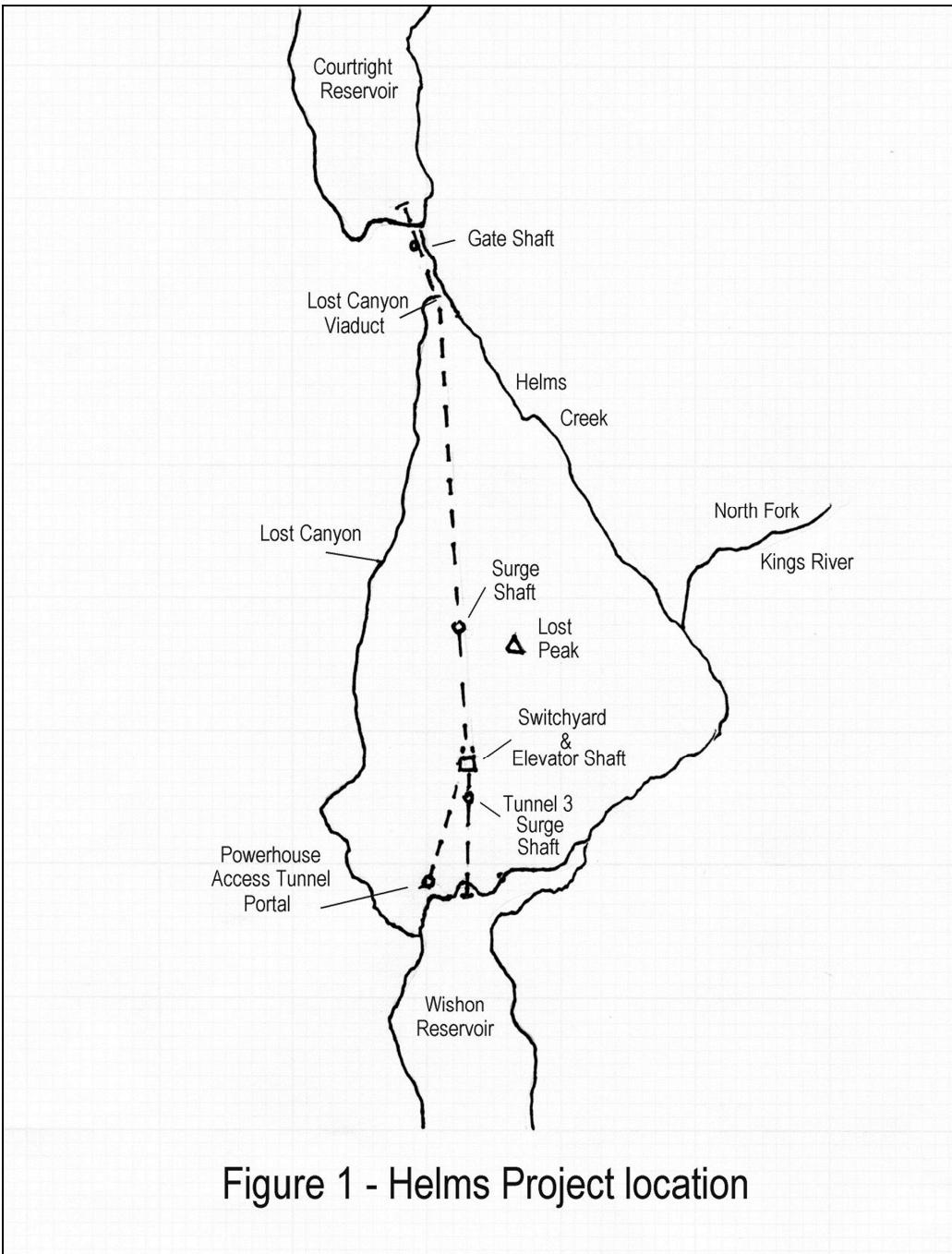


Figure 1 - Helms Project location

Because of the size of the project, it wasn't likely that any one major contractor had the ability to bid the project alone. The winning bid was submitted by the consortium, Granite-Ball-Groves. This consortium consisted of Granite Construction Co. the managing partner, Gordon H. Ball and S. J. Groves Construction Co.

Well in excess of a million cubic yards of rock would need to be blasted; much of it at powder factors in excess of 5 pounds per cubic yard, so competition for supplying the explosives was quite fierce. The three major powder companies at the time, Atlas, DuPont and Hercules, in conjunction with their distributors, put together very competitive bids.

Hercules and Alpha Explosives had worked to assist Granite with formulating their proposal. Dale Johnson and Tom Beck from Hercules and Charlie Strohm and I (representing Alpha) attended the project award unveiling in Fresno. We couldn't be certain that we would be awarded the explosives business but we were hopeful for a positive outcome. As the evening wore on, Joe Luco, Granite's Helms Project Superintendent, was getting quite a bit of pressure from our main competitor to use their products. Eventually Joe came over to Charlie and suggested that we all go to dinner. Apparently we had obtained the explosives business. Not long after that Charlie went to Algeria to assist a contractor building a natural gas plant, and I became Alpha's main representative at the Helms project.

The first order of business was to set up magazines on the project site. Portable magazines were set in place at Wishon Reservoir for explosives for the inlet/outlet works there and for road building. Initially, the access tunnel also used explosives from this location, but after the access tunnel had been driven a short way into the mountain, an underground chamber was blasted out of the granite and used for storage of explosives for the access tunnel and powerhouse excavation. Additional magazines were set in place at the upper end of Lost Canyon for explosives for the driving of tunnels at that location and for the inlet/outlet works at Courtright.

Early delivery of explosives was mostly from Alpha's location at Lincoln and consisted mainly of Unigel in 2 x 16 and 1-1/4 x 8 sizes. Some of the very early blasting was done electrically, but eventually all initiation was accomplished with Ensign-Bickford's Nonels.

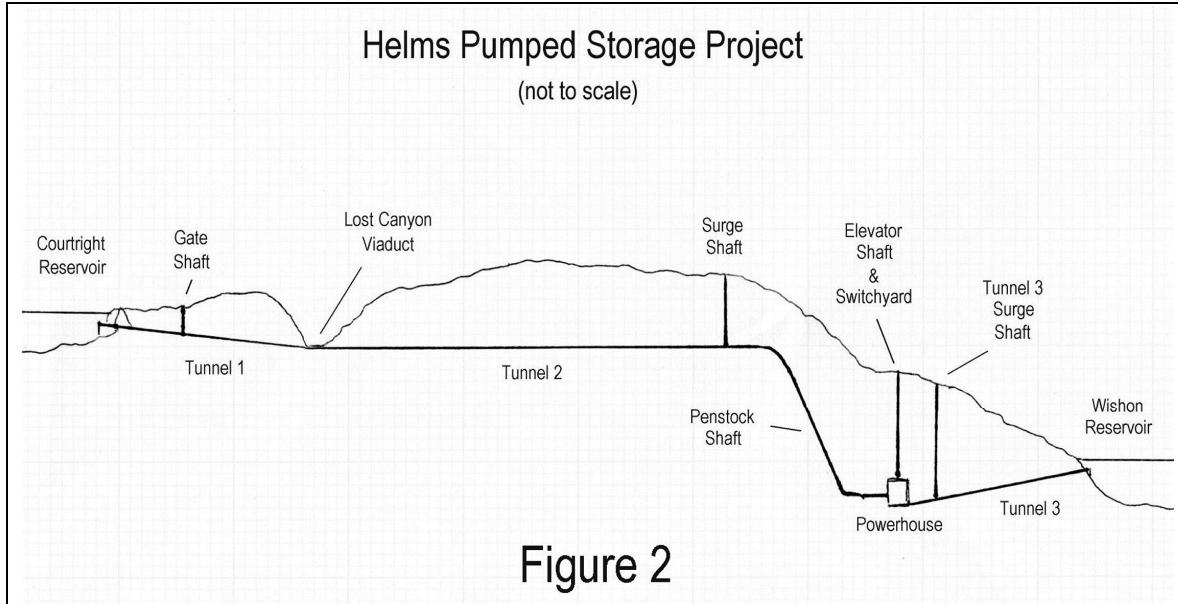
As production blasting ramped up, Alpha ordered explosives to be delivered directly to the project magazines from the Hercules plant at Carthage, MO. Once the tunnel portals had been squared off at Wishon, Courtright, Lost Canyon and the access tunnel, five tunnel headings were driven simultaneously. Tunnel 1 was driven from both Lost Canyon and from Courtright. Tunnel 2 was driven from Lost Canyon south toward the top of the penstock. Tunnel 3 was driven from the Wishon inlet/outlet works toward the powerhouse location and the access tunnel was being driven from its portal a few hundred feet to the west.

While these five tunnels were being driven, every Monday morning two 40,000 lb truckloads of Unigel were delivered to the site. In addition, every Thursday morning another 40,000 lb truckload of Unigel arrived.

As the project was using a lot of Nonels, Ensign-Bickford would send a truck out from their Simsbury CT plant with two months supply of detonators. Half would be delivered to the project and the other half would be unloaded at Alpha's Lincoln facility. Alpha would then deliver these to the project the following month.

Four vertical shafts were eventually opened. None of the shafts could be excavated until the tunnel beneath them was open. The smallest was for the gate structure just south of the inlet/outlet works at Courtright. The main surge shaft for tunnel 2, the elevator shaft over the powerhouse and the surge shaft for tunnel 3 were all raise bored. To sink such a shaft, a raise bore machine is set up on top of the ground surface directly over the tunnel or underground excavation. A special large diameter drill steel and a 12" – 14" drill bit are used to drill down into the tunnel below. The bit is removed and a 6 to 8 ft diameter cutting head is brought into the tunnel and mounted on the end of the drill steel. The machine then rotates the cutting head while at the same time exerting a lifting force. The cuttings fall down into the tunnel through slots in the cutting head. If the diameter of the finished shaft needs to be larger than the cutting head, drilling and blasting is then used to slash rock to enlarge the shaft. This rock is also mucked out through the tunnel or excavation below.

The profile of the Helms Project is shown in Figure 2. It should be noted that, because the project was a little over 10 times longer than it was tall, I've taken some literary license in drawing the profile.



All tunnels were 38 foot diameter horseshoe shaped tunnels. The penstock decline was also 38 feet in diameter. Tunnel 1 was approximately 3350 feet in length. Tunnel 2 was approximately 8300 feet long from Lost Canyon to the top of the penstock decline. The penstock decline (See Photo below) was approximately 1625 feet long and branched into three smaller tunnels before it entered the powerhouse. Tunnel 3 was approximately 3900 feet long. The Access Tunnel was approximately 3600 feet long. All of the above water transporting tunnels except the penstock were lined with concrete to a 27 foot diameter. The penstock had a steel liner because of the increased pressures anticipated.



View Down the Penstock Decline – 1980 photo courtesy of PG&E

The powerhouse excavation (located within the mountain directly below the switchyard) was approximately 325 feet long, 125 feet high and nearly as wide.

My archived notes don't include the diameters of the shafts, but by scaling the exposed diameters from Google Earth images, I believe the tunnel 3 surge shaft was approximately 14 feet in diameter and the upper part of the tunnel 2 surge shaft was approximately 65 feet in diameter. The elevator shaft, which also carries the power cables to the surface is not exposed but would have been somewhere between the size of the other two shafts.

There are several interesting items on the internet that pertain to the Helms Project. If you have access to Google Earth, you can look down on the entire project area by going to:

<https://earth.google.com/web/@37.05089528,-118.94905821,2128.44077039a,11551.32317051d,35y,-0h,0t,0r>

From that altitude, one can easily see Courtright and Wishon Reservoirs and the switchyard that is located directly above the underground powerhouse. If you zoom in you can also find the top of the tunnel 2 surge shaft. It is approximately 450 meters (1475 feet) west of Lost Peak. At the north end of the mountain, the viaduct that carries water across the floor of Lost Canyon is readily visible, as is the gate structure near the dam. At the south end, Wishon reservoir appears to be quite low and would indicate that water has been pumped up to Courtright in preparation for the next power need. At the time of this space photo, the top of the intake/outlet structure at Wishon is visible. The portal for the access tunnel is also visible a few hundred feet west and slightly north of the Wishon intake structure.

An older You Tube video can be found on the internet at:

<https://www.youtube.com/watch?v=i1yfCdsrMdA>

Dean Hansen, the access tunnel and powerhouse excavation superintendent, is interviewed in the video which was shot during excavation for the project. Some of you may have met Dean back in the day or through some of his later consulting gigs.

From the beginning of construction in 1977 until late 1981 when most of the excavation was complete, I usually visited the project about three times per month, or more often if necessary. In the next issue of *The Primer* we will delve into some of the issues that were encountered during construction at Helms.

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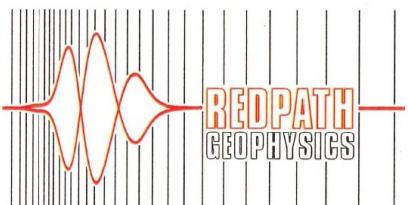
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Chapter Activities 2019  
Crab Feed Business Dinner  
Saturday February 23<sup>rd</sup> 2019

## The Primer

### Fire in the Hole...

**An engineer dies** and reports to the pearly gates. St. Peter checks his dossier and says, "Ah, you're an engineer — you're assigned to hell."

So the engineer reports to the gates of hell and is let in. Pretty soon, the engineer gets dissatisfied with the level of accommodations and starts designing and building improvements.

After a while, they've got air-conditioning and flush toilets, escalators, elevators and so on ... and the engineer is a pretty popular guy.

One day, God calls Satan on the telephone.

"So, how's it going down there in hell?" God says.

"Hey, things are going great. We've got air-conditioning and flush toilets and escalators. There's no telling what our engineer is going to come up with next!" Satan says.

"What? You've got an engineer? That's a mistake — he should have never gotten down there. Send him back immediately!" God says.

"No way! I like having an engineer on the staff — I'm keeping him!" Satan says.

"Send him back up here or I'll sue!" God says.

Satan laughs uproariously and answers:

"Yeah, right. And just where are you going to get a lawyer?"