

STATE OF OREGON  
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES  
800 NE Oregon St # 28 Portland, OR 97232  
MISCELLANEOUS APPLICATION  
(In compliance with rules and regulations pursuant to ORS 520)

NW Natural Reichhold Pool

(Company or Operator) (Lease) (Well No.)  
Sec. 23 T 6N R 5W Surveyed Coordinates (if directional, BHL & SHL):

SW 1/4 Sec 23 T6N R5W

Wildcat: \_\_\_\_\_ (or) Field Name: Reichhold Pool County: Columbia

Signature: H. Jack Meyer  
Date: 11-9-00  
Position: Geologist Gas Storage Dept.

Use this form for applications to deepen, rework, abandon, or any other proposed procedure on an existing well.

This form must be submitted unless verbal approval has been given. This application becomes a permit when signed and dated by DOGAMI in the box below.

The present condition of the well, including complete casing record, is as follows:

NA.

Following is a detailed account of proposed work:

See attached letter.

PERMIT APPROVED BY  
DOGAMI ON NOV. 17, 2000  
BELOW.  
Dan E. Wermiel  
Pet. Eng. Specialist

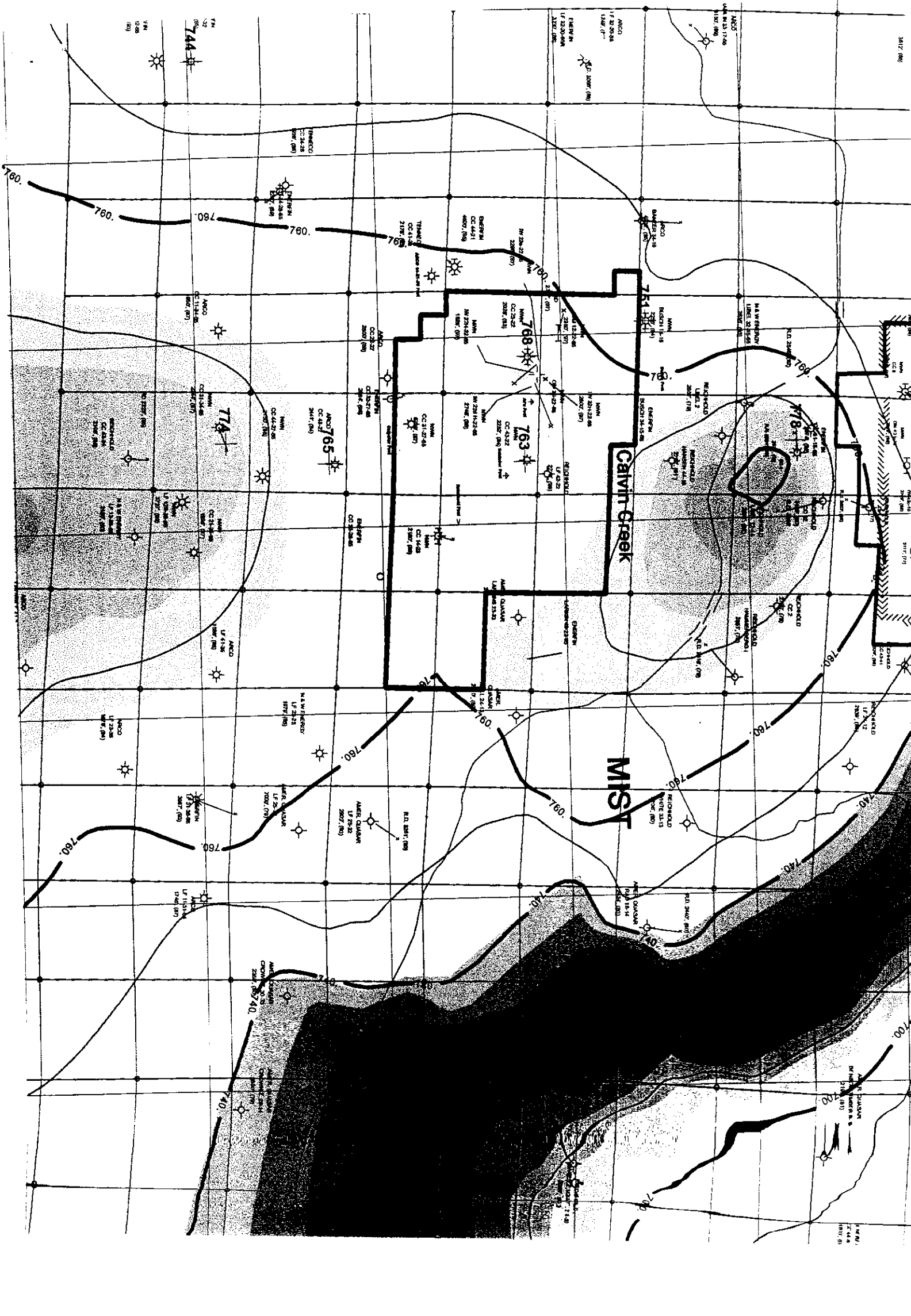
Company/Operator: NW Natural

Signature: H. Jack Meyer  
Position: Geologist Gas Storage Department  
Date: November 9, 2000

SEND WELL COMMUNICATION TO: SEND WELL COMMUNICATION TO:

Name: H. Jack Meyer  
Address: 220 NW Second Ave.  
Portland, OR 97209  
Phone: (503)226-4211 ext 4683

DOGAMI APPROVES APPLICATION TO USE 675 psig AS THE MAXIMUM RESERVOIR PRESSURE FOR THE REICHOLD POOL FOR NATURAL GAS STORAGE PURPOSES. THIS IS FOR THE AREA DESCRIBED BELOW: T6N, R5W: SW 1/4 SEC. 23 - N 1/2 N 1/2 SEC. 26; NE 1/4 NE 1/4 SEC. 27; S 1/2 SE 1/4 SEC. 23. COLUMBIA COUNTY, OREGON.



November 9, 2000

Mr. Dan Wermiel  
Oregon Department of Geology and Mineral Industries  
800 NE Oregon St. #28, Suite 965  
Portland, OR 97232

Re: Mist Gas Field Underground Storage - Reichhold Pool Reservoir Pressure

Dear Dan,

NW Natural would like to use 675 psig as the maximum reservoir pressure for Reichhold Pool for storage purposes instead of the calculated discovery pressure of 646 psig. Discovery pressure is the usual norm for determining the point at which a storage reservoir is "full." The reason for the request for a higher pressure is that Reichhold Pool was discovered and began production two years after four nearby pools (Al's, Schlicker, Busch and CC 43-27-65) went on line. It is believed that Reichhold Pool is hydraulically connected to these pools and experienced a reduction of pressure due to the lowering of aquifer (hydraulic) pressure within the C&W Sandstone aquifer because of gas production in the nearby area.

A potentiometric map of the C&W Sandstone aquifer (attached) has been constructed for the Mist Field. Among other initial pressure data, it utilized the initial bottom hole pressure data from the Busch 14-15-65, CC 23-22-65, CC 43-22-65 and CC43-27-65 wells. The standing water level at the Busch reservoir was 751 ft. above sea level; at Al's pool it was 768 ft. above sea level; at Schlicker pool it was 763 ft. above sea level and; at the 43-27-65 pool it was 765 ft. above sea level. (The formula used for the above data is: Standing water level above sea level = Pressure/hydrostatic gradient (0.441 (reservoir water)) minus the sub sea depth to the gas water contact.) These data points were all developed within one year and prior to any significant gas production in the area. The calculated discovered (calculated from surface pressure as recorded by ARCO) reservoir pressure in Reichhold pool of 645.6 psig equates to a standing water level of 694 ft. above sea level. This is 70 feet or ~30 psig below what would be expected for the pool. As all four nearby pools had been producing for two years by the time ARCO discovered Reichhold pool, the reduction in pressure is believed to be the result of the hydraulic connection among the pools. A similar hydraulic phenomena is present in the Bruer/Flora Pool area. There the initial standing water level of the C&W Sandstone ranged from 740 ft. above sea level to 759 ft. above sea level. It currently ranges from about 510 ft. above sea level to 700 ft. above sea level (observation well data).

For the above reasons it is believed that 675 psig is more representative of the reservoir pressure in Reichhold Pool at the time of discovery of the four other pools.

Sincerely,  
H. Jack Meyer  
H. Jack Meyer  
Geologist - Gas Storage Development Department

Cc C. Roth - NW Natural

Well	Pressure (psig)	Gas/Water Contact	Standing Water Level
Busch 14-15-65	813.3	-1093 ft.	+751 ft.
CC 23-22-65	728.9	-885 ft.	+768 ft.
CC 43-22-65	675.9	-770 ft.	+763 ft.
CC 43-27-65	687.2	-793 ft.	+765 ft.
CC 14-23-65	645.6	-770 ft.	+694 ft.