

HW-5.1: PORE PRESSURE PREDICTION— EUGENE ISLAND 330—ANSWER SHEET

GOAL:

This homework supplements the discussion of pore pressure prediction discussed in Chapter 5 (Flemings, 2021). We will predict pressure in the E.I.-330 A20ST well. See Chapter 5, Figures 5.4-5.6, and 5.13, (Flemings, 2021)). We will use the normal compaction trend parameters that you derived in HW5.1. We will both calculate by hand and use the spreadsheet 'NCT_Spread_sheet_and_PPP_EI-330' to predict the pressure.

HUBBERT APPROACH

Goal: Use Hubbert's approach to predict pore pressure in the E.I.-330 A20ST well. See Chapter 5, Figures 5.4-5.6.

APPROACH:

$$\sigma_v' = \sigma_v - u \quad \text{Eq. 1}$$

$$u = \sigma_v - \sigma_v' \quad \text{Eq. 2}$$

$$n = n_0 e^{-\beta \sigma_v'} \quad \text{Eq. 3}$$

$$u = \sigma_v - \frac{1}{\beta} \ln \left(\frac{n_0}{n} \right) \quad \text{Eq. 4}$$

Based on the normal compaction trend shown in Figure 1 (i.e. $\beta = 2.15 \times 10^{-4}$ and $n_0 = 0.38$), calculate the pore pressure (u) and fill in Table 1 and then plot these values in Figure 2. Double your value of β and re-calculate the pore pressure and place in the right column of Table 1.

Depth (ft)	n	U _h (PSI)	σ_v (PSI)	u (Eq. 4) (PSI) $\beta=2.54 \times 10^{-4}$ PSI ⁻¹	u (Eq. 4) (PSI) $\beta=5.1 \times 10^{-4}$ PSI ⁻¹
4714	0.24	2091	4123	1937	3030
6657	0.25	2951	5987	3991	4989
7231	0.31	3206	6543	5547	6045
7854	0.30	3482	7157	6009	6583

Table 2. Exercise for estimating pore pressure at EI-330.

Example Calculation:

$$u(4714 \text{ feet}) = 4123 - \left(\frac{1}{2.15 * 10^{-4}} \right) \ln \left(\frac{0.384}{0.24} \right) = 1937 \text{ psi}$$

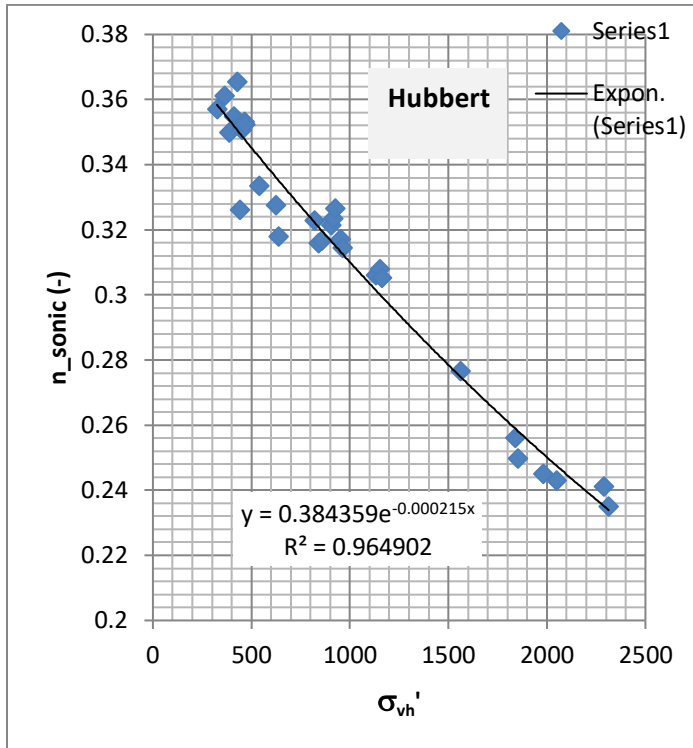


Figure 1: Compression curve from NCT Exercise. This analysis shows $\beta = 2.15 \times 10^{-4}$ and $n_o = 0.38$ (Eq. 3)

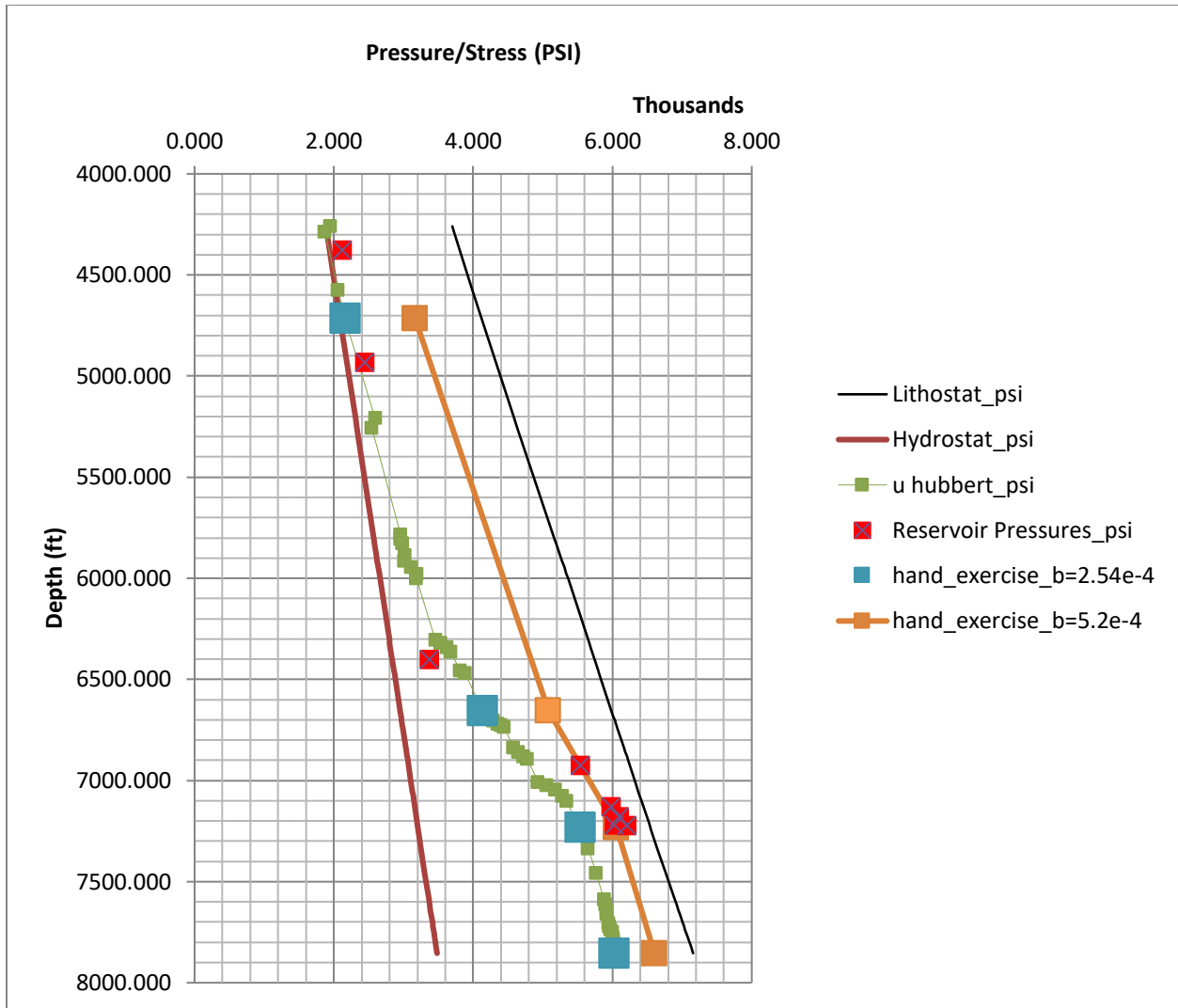


Figure 2: The hand-calculated points are shown and the prediction from the spreadsheet 'NCT_Spread_sheet_and_PPP_EI-330' is overlain

BOWERS

CALCULATE THE VALUE OF THE PORE PRESSURE AND FILL IN THE TABLE BELOW AND THEN PLOT THESE VALUES IN FIGURE 2.

Depth (ft)	Vel (ft/s)	Uh (psi)	Sv (psi)	u (psi)	σ_v'
4717	8102	2189	4239	2080	2159
5258	8289	2440	4754	2442	2312
5945	8439	2757	5423	2986	2437
7210	6668	3345	6638	5595	1043
7854	6788	3644	7273	6142	1131

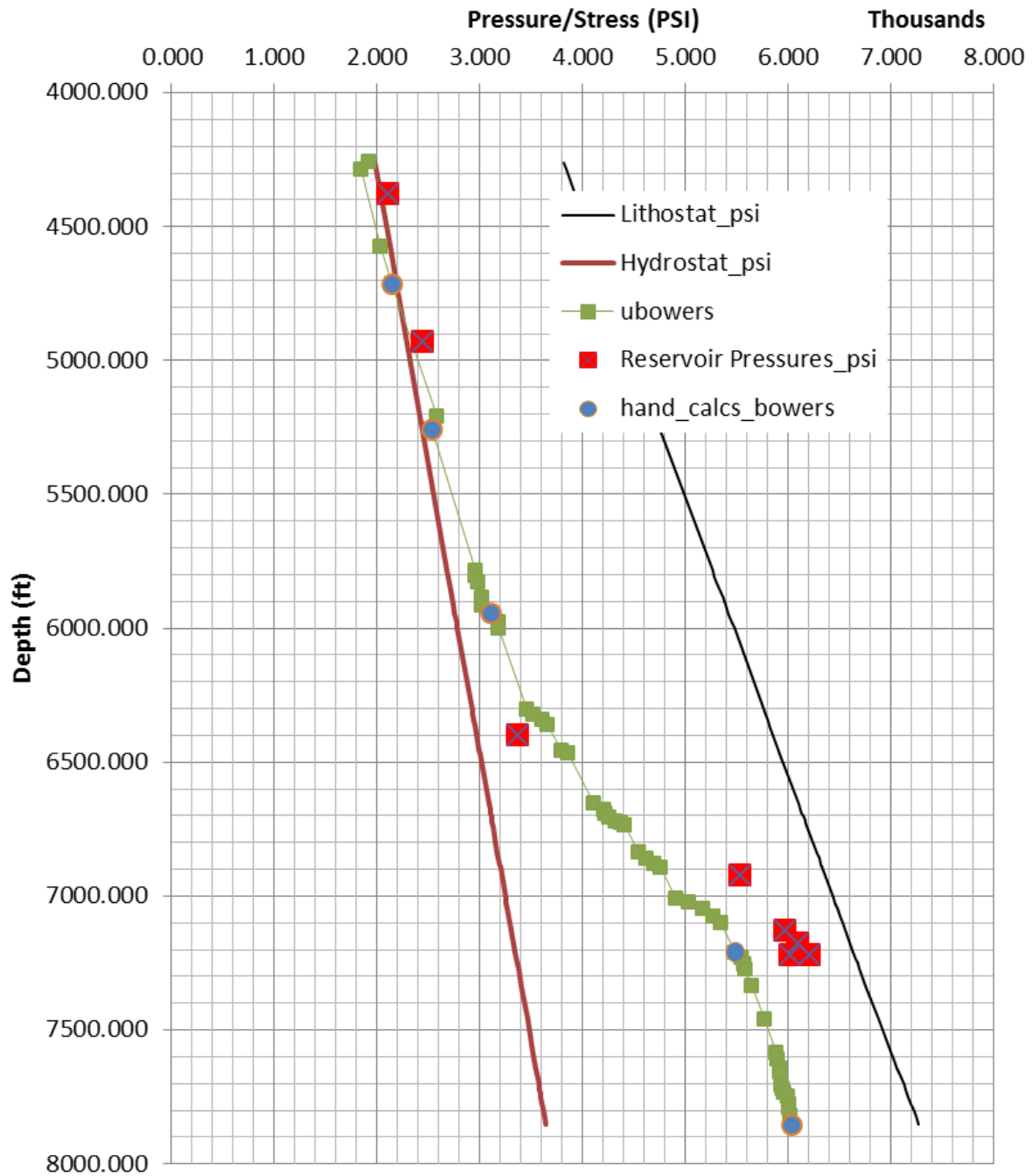


Fig. 3. The hand-calculated points are shown and the prediction from the spreadsheet 'NCT_Spread_sheet_and_PPP_EI-330' is overlain