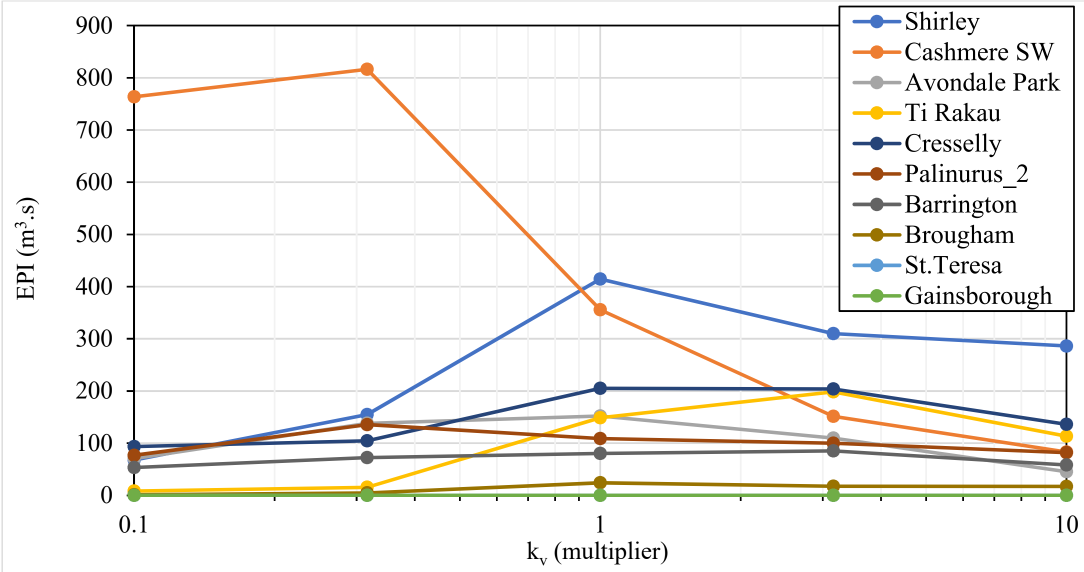


Figure 1. Computed EPI values with different hydraulic conductivity parameters for sites with different manifestation orderly plotted from extreme (top) to none (bottom). The baseline case is the k_v determined using the Robertson & Cabal (2015) CPT-kv correlation, which is based on I_c value.

Findings:

1. EPI values for sites without ejecta manifestation (e.g., Gainsborough and St. Teresa) are always zero for different kv value. The significant k_v contrast of the highly-stratified deposit prevents the upward seepage-induced secondary liquefaction at shallow elevation to occur and this process is well captured by EPI. EPI is capable to distinguish sites with and without ejecta effectively as it can capture the post-shaking upward seepage mechanism. The changes of GWL, k_v and input motion PGA do not influence the computed EPI, which confirms that the layer stratification is the main reason why ejecta was not produced at these two sites.

2. The computed EPI values for sites with more ejecta manifestation are more sensitive to changes of k_v value. However, EPI for these sites are always greater than zero which are consistent to the field observation.

3. The in-situ k_v value is a difficult parameter to obtain and it can vary within one order of magnitude. The Robertson & Cabal (2015) CPT- k_v correlation estimates a reasonable k_v value for typical soil materials and is used as the baseline in this study. The severity criteria of EPI is derived empirically after comparing the computed value to a set of field observation case history. That process requires acceptable baseline assumptions and should be determined to provide a consistent comparison. The estimation trend resulted in this study is based on where Robertson & Cabal (2015) is used to estimate kv, therefore, it is recommended for other applications.

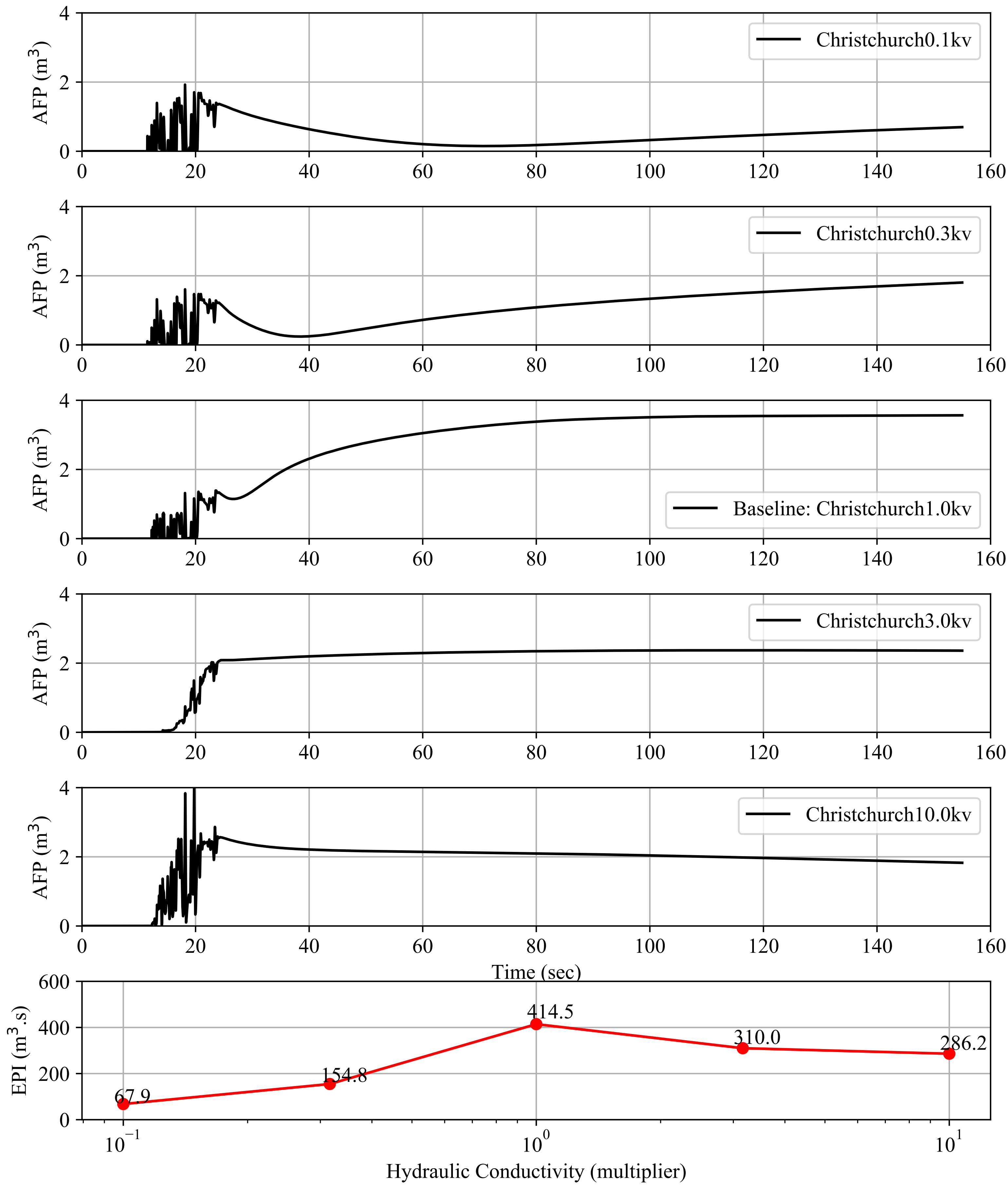
4. The variation of EPI during shaking is lower and increase during the advection process. As expected, the hydraulic conductivity is not primary parameter that control the generation of excess pore pressure during shaking. However, once the shaking is stop the advection process is primarily controlled by hydraulic conductivity.

5. During shaking, k_v influences the dissipation of u_{exc} where **high-k_v soil dissipates the u_{exc} rapidly and prevents liquefaction**. Conversely, *low-k_v deposit dissipates the u_{exc} slowly causing liquefied state becomes easier to reach during a continuos shearing* .

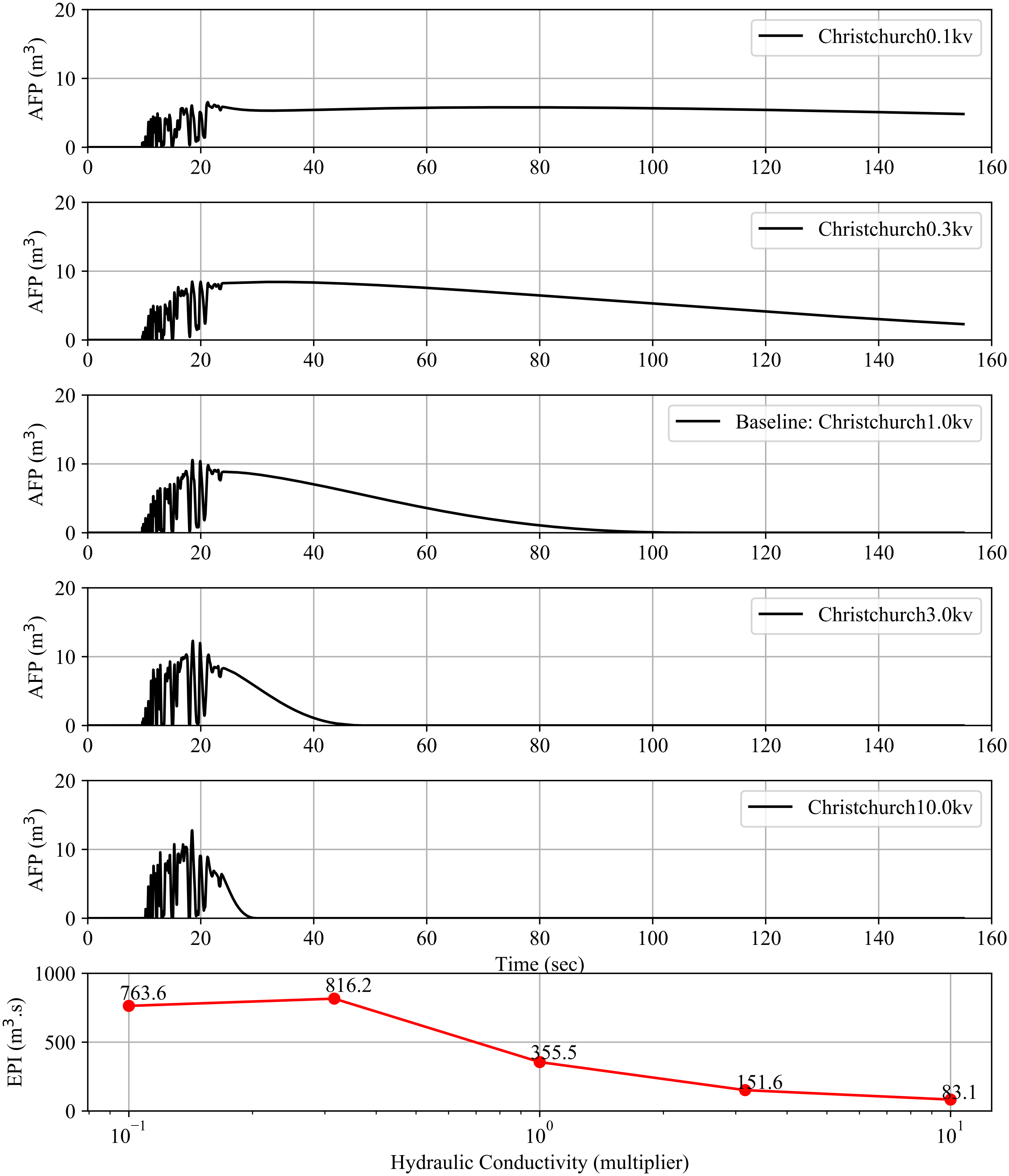
After shaking, k_v influences the dissipation of u_{exc} of the whole system profile where, on the other hand, **high-k_v soil triggers a more intense upward seepage resulting secondary liquefaction** at shallow critical elevation. Conversely, *low-k_v prevents secondary liquefaction as the intensity of the seepage is lower* .

In conclusion, as k_v value balances the consequence during and after shaking, when both conditions are met simultaneously, a system profile will have a peak EPI values at a right k_v value as shown in the sensitivity study.

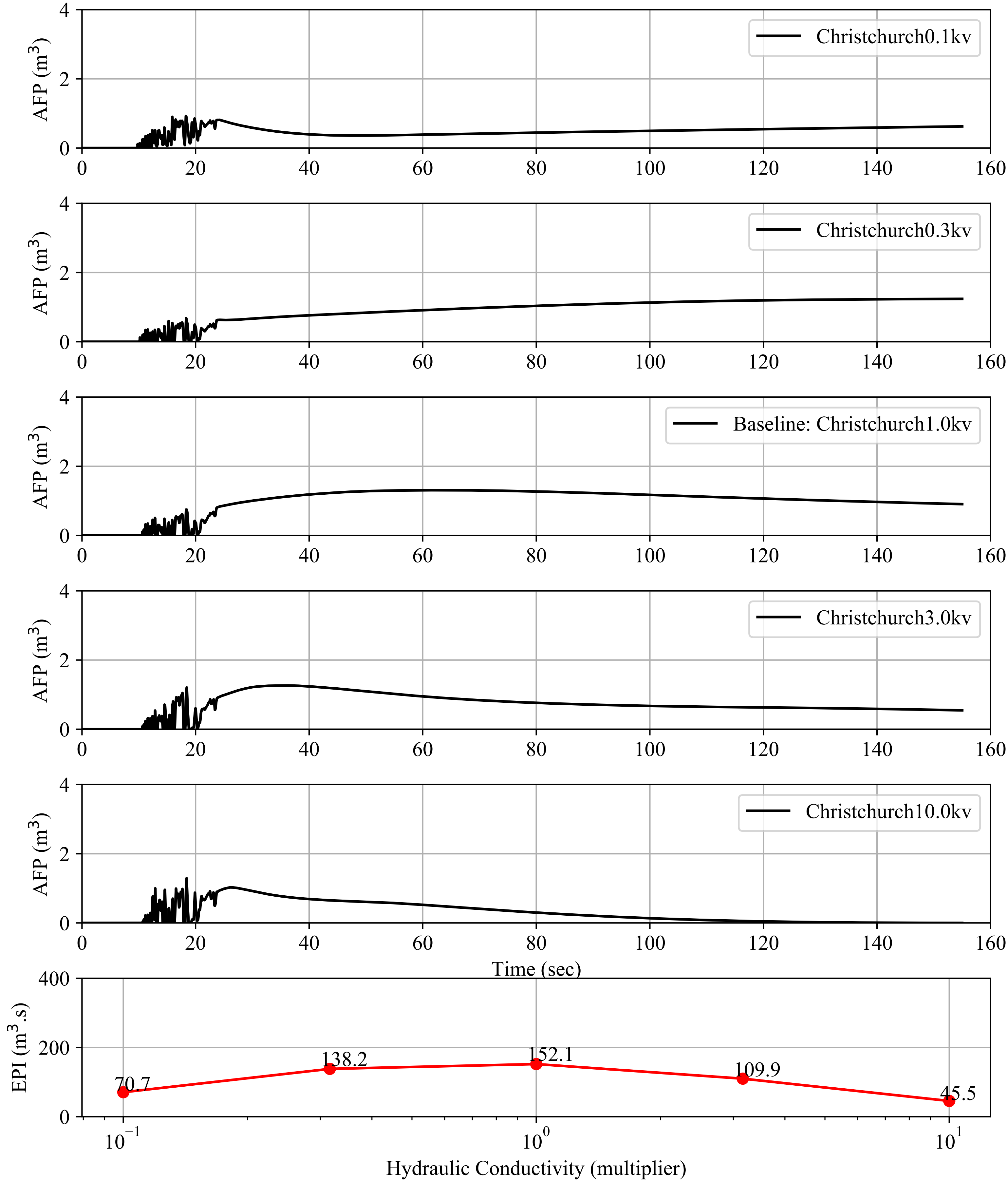
Hydraulic Conductivity Sensitivity Analysis - Shirley School



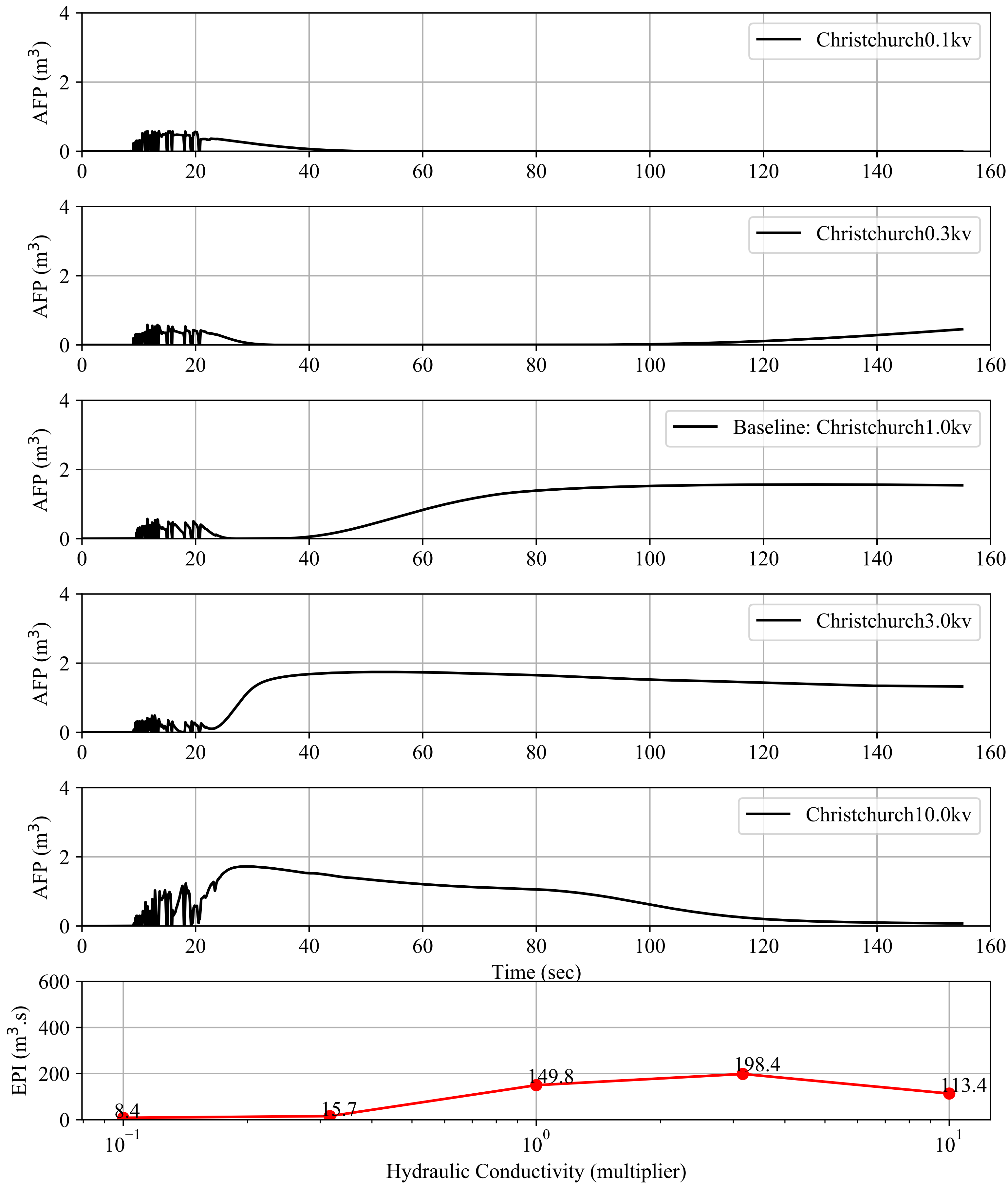
Hydraulic Conductivity Sensitivity Analysis - Cashmere SW



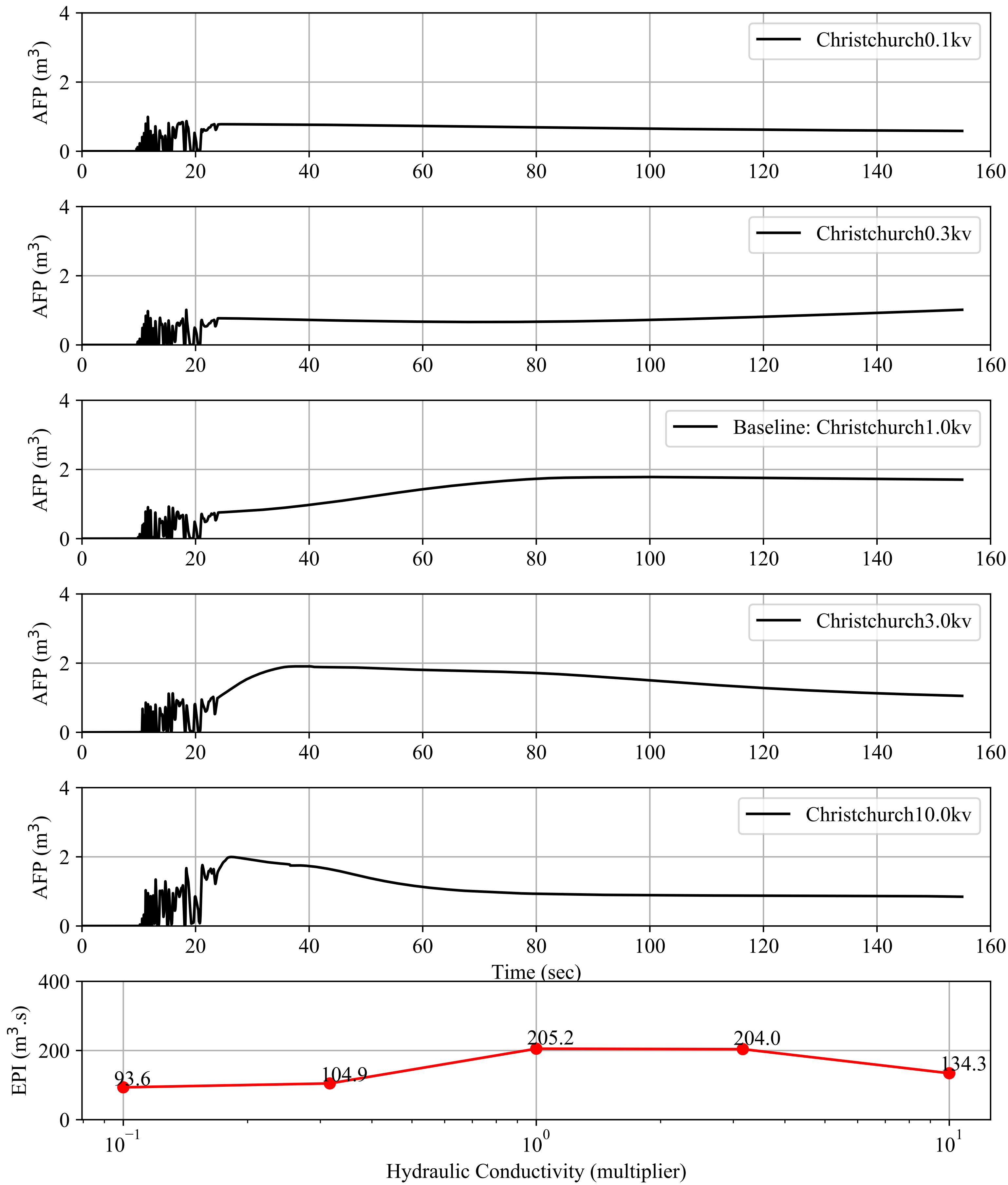
Hydraulic Conductivity Sensitivity Analysis - Avondale Park

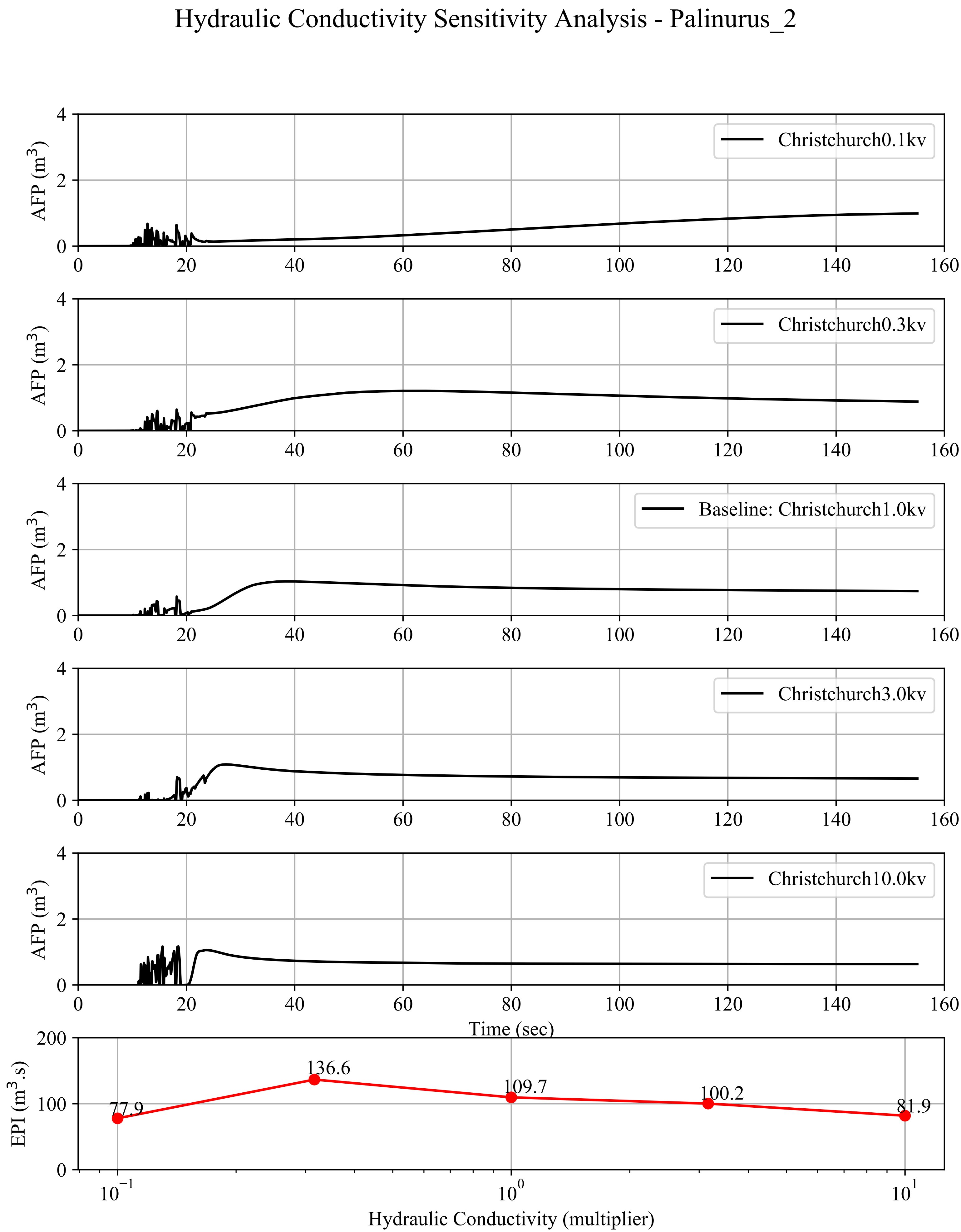


Hydraulic Conductivity Sensitivity Analysis - Ti Rakau Reserve

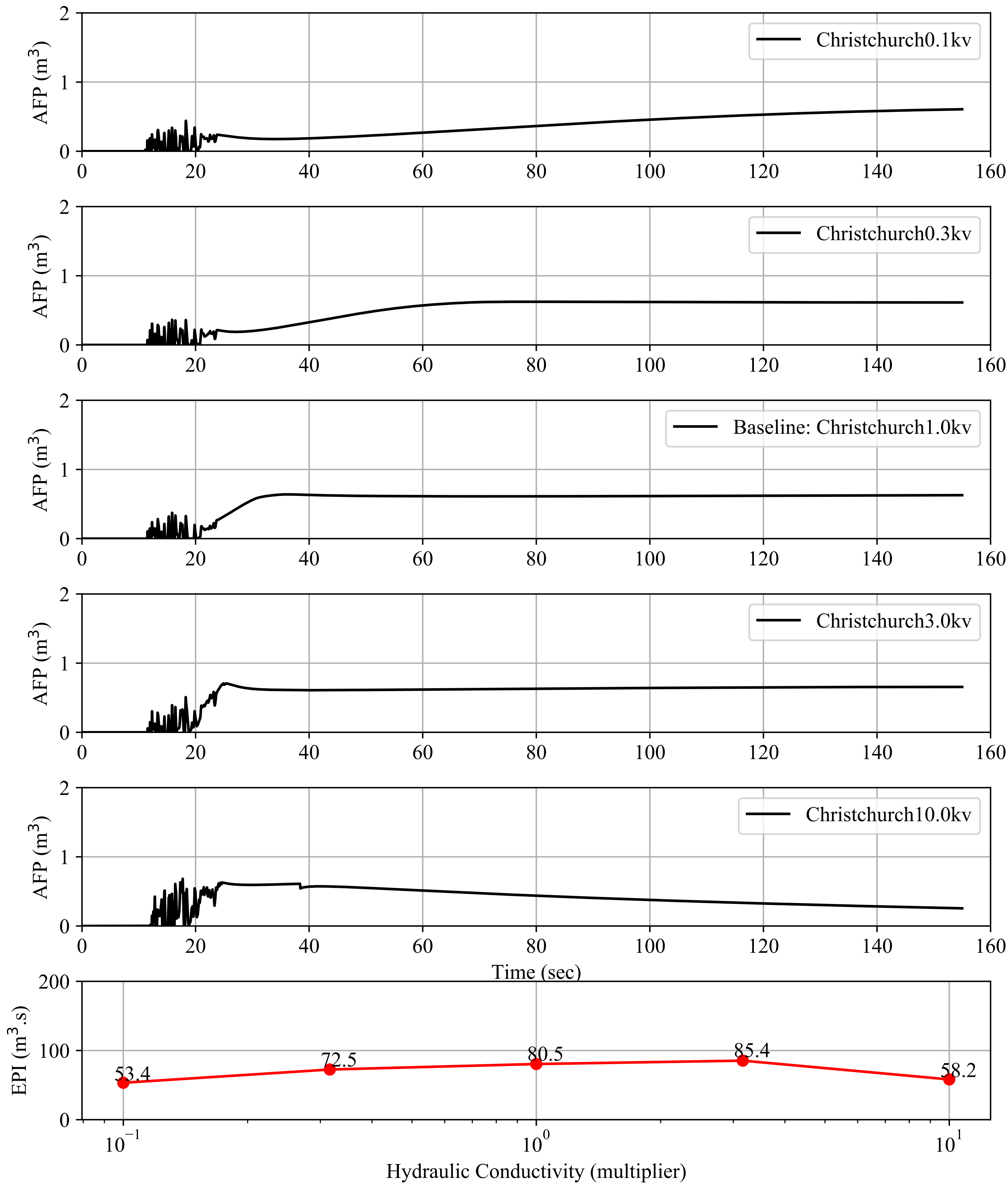


Hydraulic Conductivity Sensitivity Analysis - 15 Cresselly Place

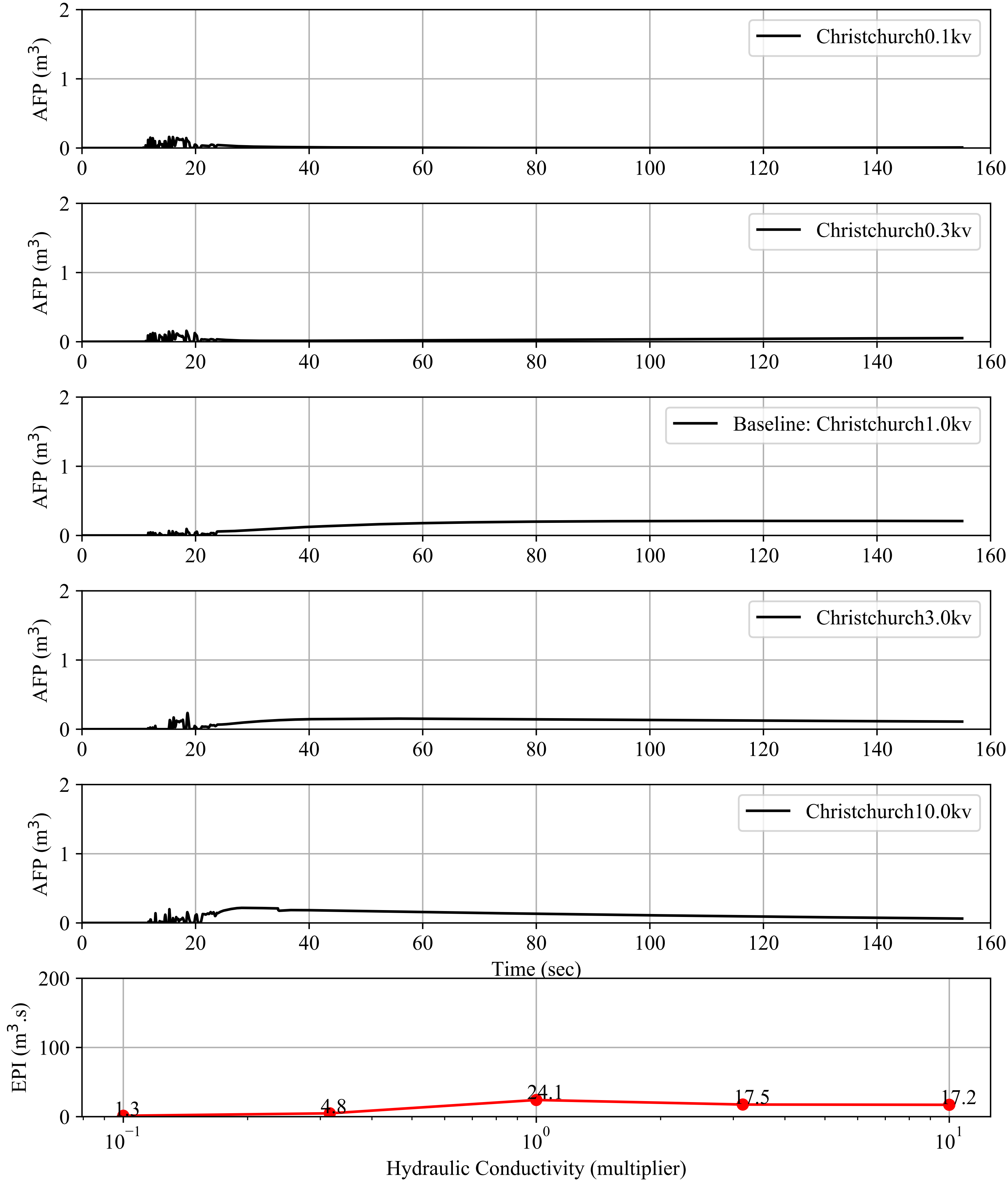



Hydraulic Conductivity Sensitivity Analysis - Palinurus_2
Christchurch0.1kv
Christchurch0.3kv
Baseline: Christchurch1.0kv
Christchurch3.0kv
Christchurch10.0kv
AFP (m3)
Time (sec)
EPI (m3.s)
77.9
136.6
109.7
100.2
81.9
Hydraulic Conductivity (multiplier)

Hydraulic Conductivity Sensitivity Analysis - Barrington Park



Hydraulic Conductivity Sensitivity Analysis - Brougham St



Hydraulic Conductivity Sensitivity Analysis - St. Teresa