**Descriptive and inferential statistical methodologies have proven effective in creating a proactive 'alarm', accurately identifying Pump Failures with Horse Power (HP) and Pump Efficiency (PE) emerging as key variables of interest. Effective monitoring of these variables will allow the reliability engineering team to shut the unit down before future asset failures occur, preventing costly repairs and revenue loss.**


Statistical Alarm Plot - Surjek Unit

Legend: Pump Efficiency — Horse Power — PUMP FAILURE (1 or 0) — Regressive Equation
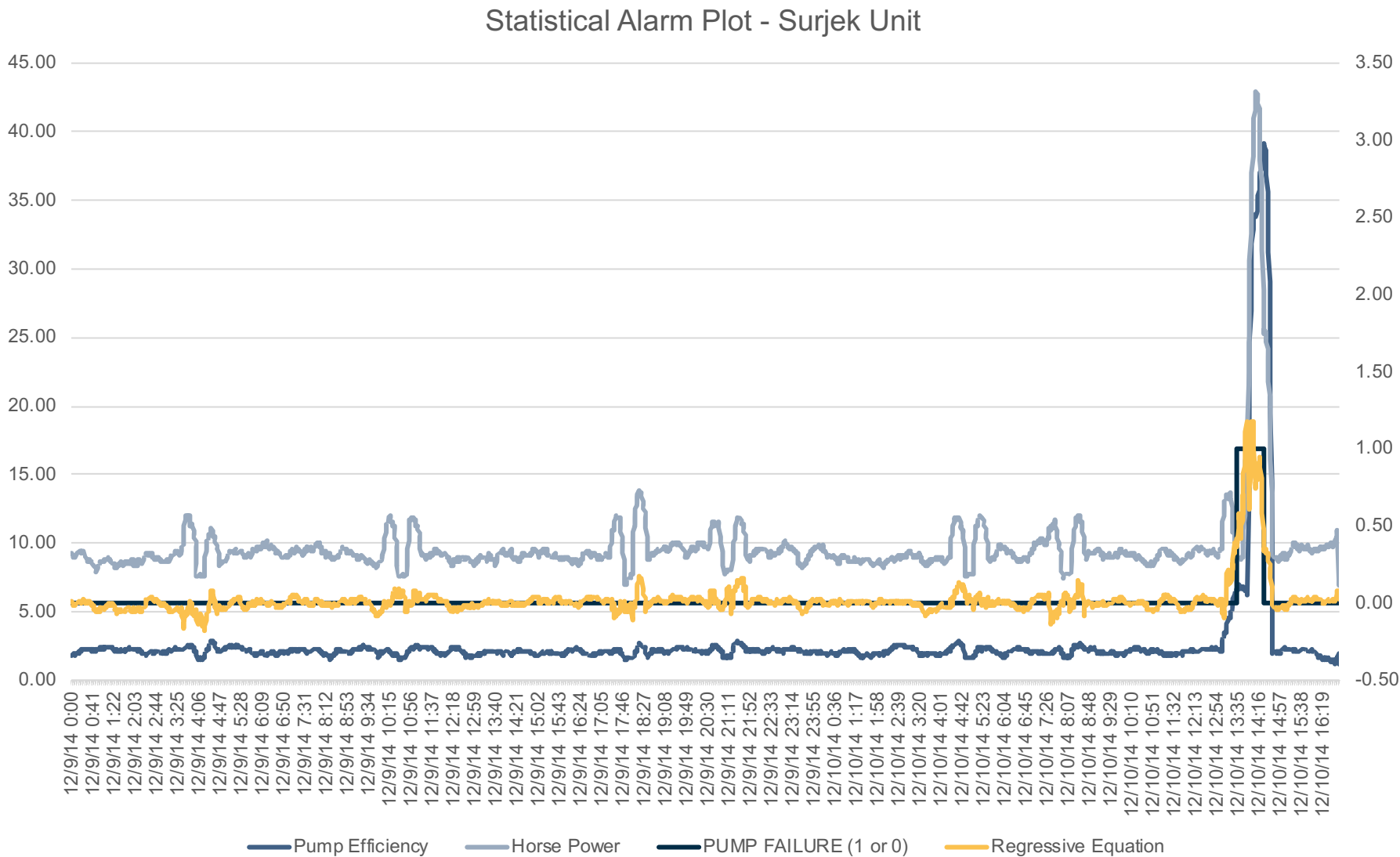
*Southern Water Corps Desalination Pump Performance Data from 12/9/14 – 12/10/14

Descriptive Analysis has enabled us to clearly identify particular signature abnormalities showing clear signature changes in both Rolling Standard Deviation and Rolling Mean Datasets when observed over the respective failure period of interest.
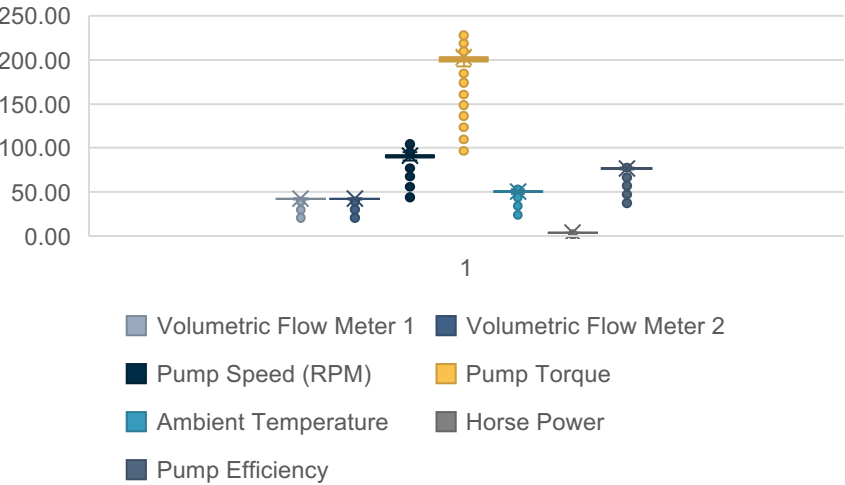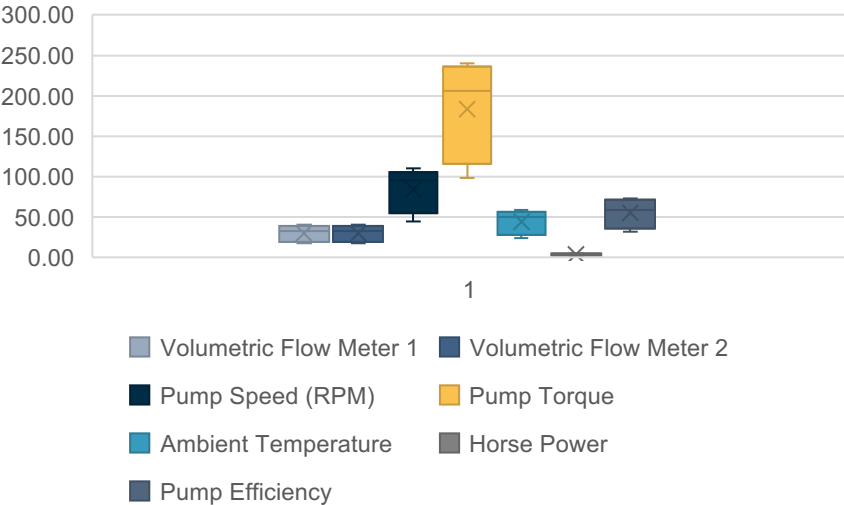

Rolling Mean Chart

Rolling Stdev Chart
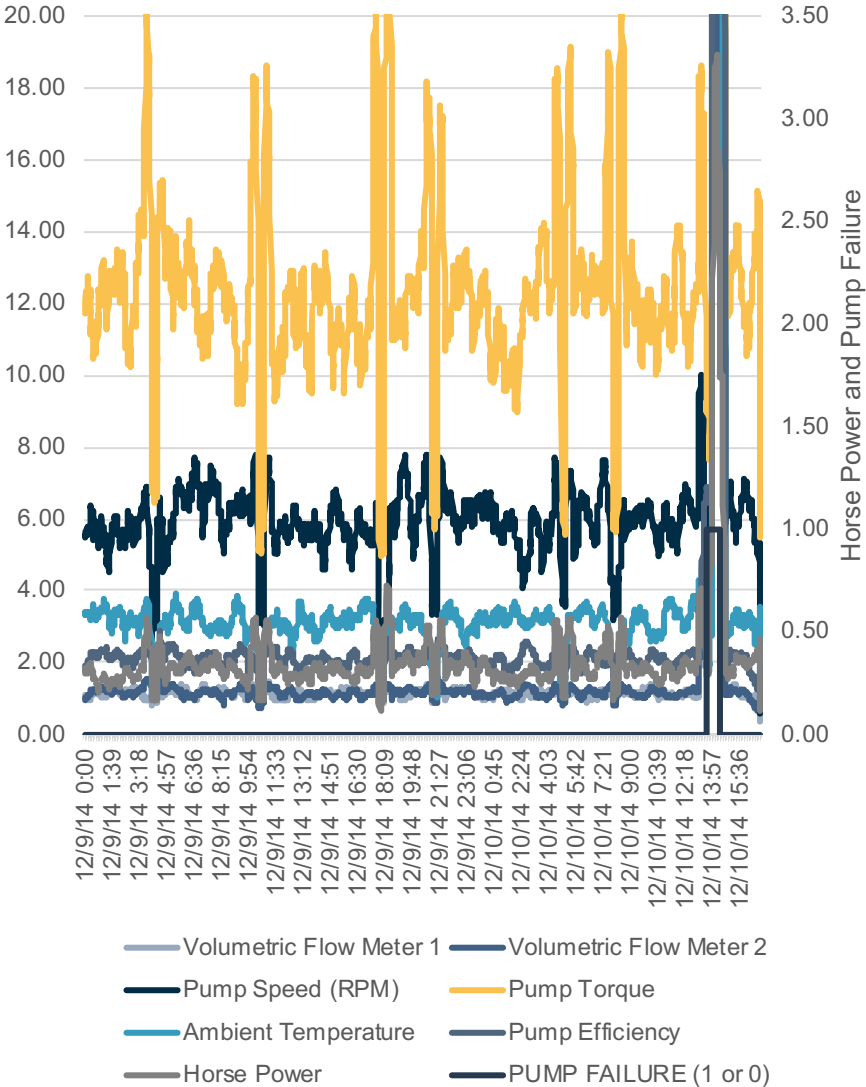
*Southern Water Corps Desalination Pump Performance Data from 12/9/14 – 12/10/14

Further segmentation of the data via binary means (Pump Failure = 0 or 1) illustrated through box charts, show a clear signature difference between that of normal behaviour and that of Failure with Pump Torque, Pump Speed, and Pump Efficiency showing the 3 largest variances.
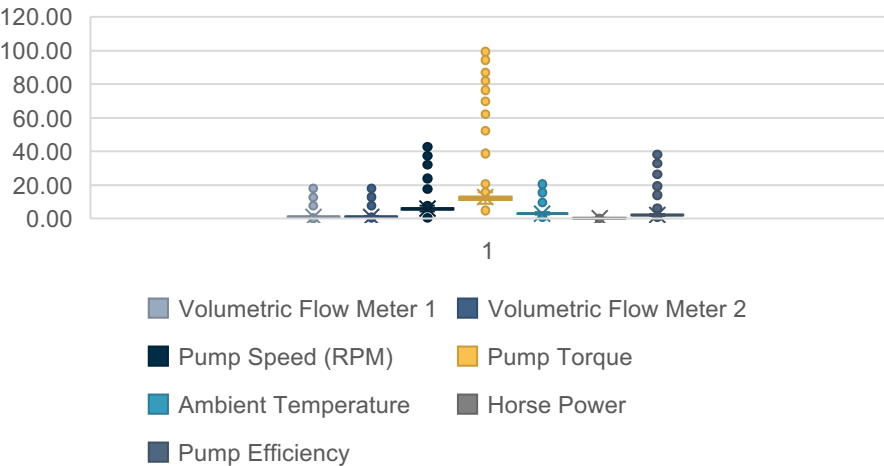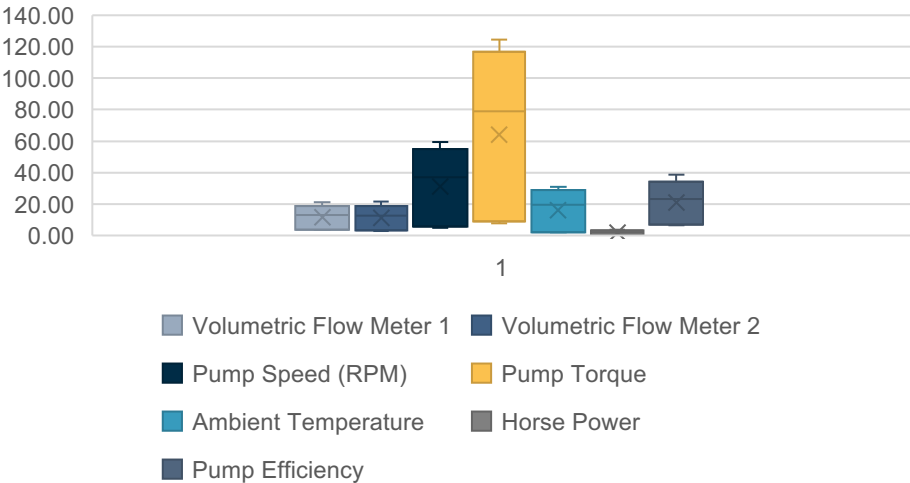

Rolling Mean Pump Failure = 0

Legend: Volumetric Flow Meter 1, Volumetric Flow Meter 2, Pump Speed (RPM), Pump Torque, Ambient Temperature, Horse Power, Pump Efficiency

Rolling Mean Pump Failure = 1

Legend: Volumetric Flow Meter 1, Volumetric Flow Meter 2, Pump Speed (RPM), Pump Torque, Ambient Temperature, Horse Power, Pump Efficiency

Rolling Stdev Pump Faliure = 0

Legend: Volumetric Flow Meter 1, Volumetric Flow Meter 2, Pump Speed (RPM), Pump Torque, Ambient Temperature, Horse Power, Pump Efficiency

Rolling Stdev Pump Failure = 1

Legend: Volumetric Flow Meter 1, Volumetric Flow Meter 2, Pump Speed (RPM), Pump Torque, Ambient Temperature, Horse Power, Pump Efficiency

Correlation analyses across datasets yield particularly interesting insights with Pump Efficiency and Volumetric Flow negatively correlated with Pump Failure in the Rolling Mean Dataset, while Horse Power and Pump Efficiency show a strong positive correlation in the Rolling Standard Deviation Dataset.
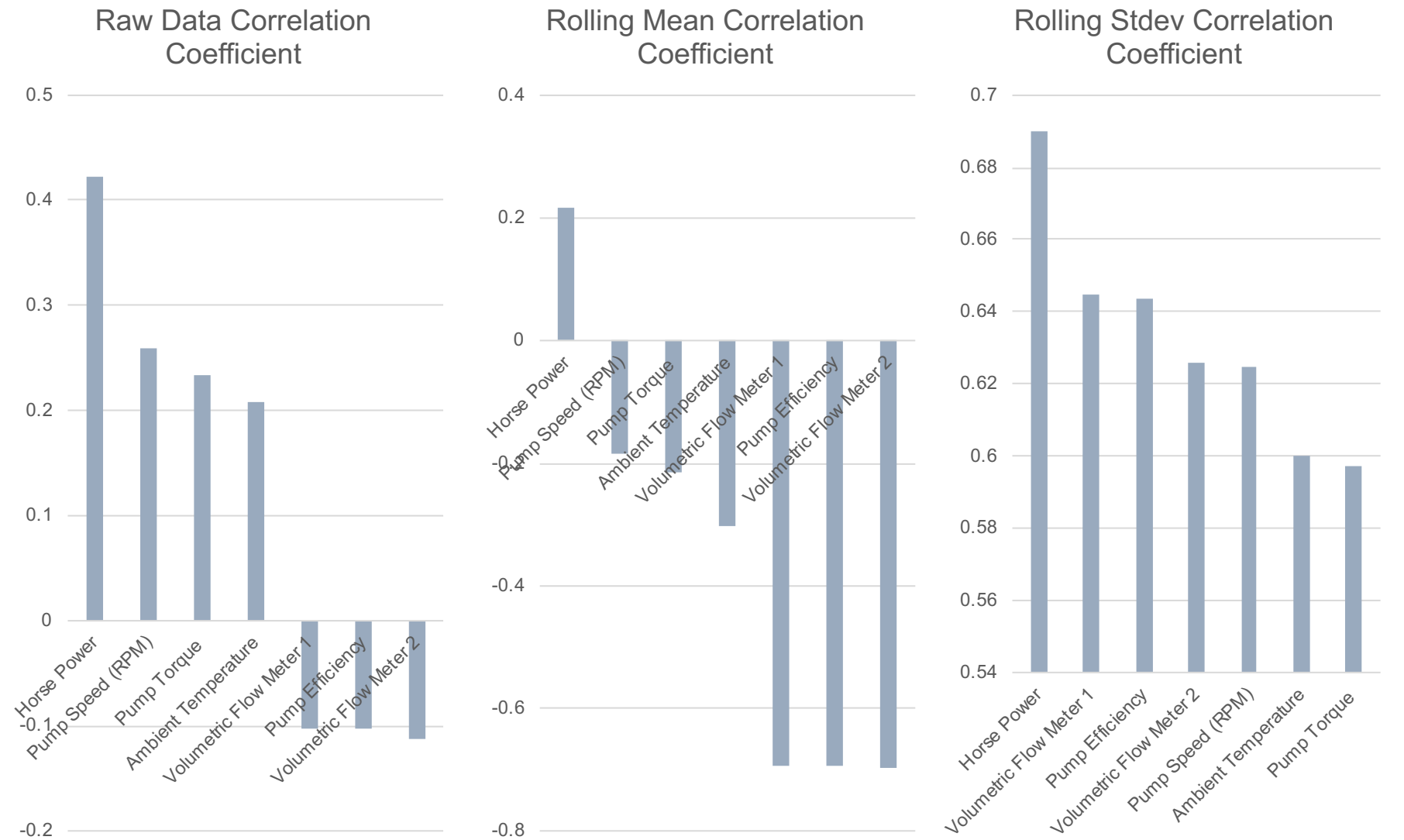
*Southern Water Corps Desalination Pump Performance Data from 12/9/14 – 12/10/14

Lastly, analysis of the statistical significance of variables contributing towards Pump Failure reveal that with a R Squared of 0.779, a linear model is a good fit for the data with both Rolling Mean and Rolling Standard Deviation datasets contributing key information to understand Pump Failure mechanics.

Ranking of Variable Significance
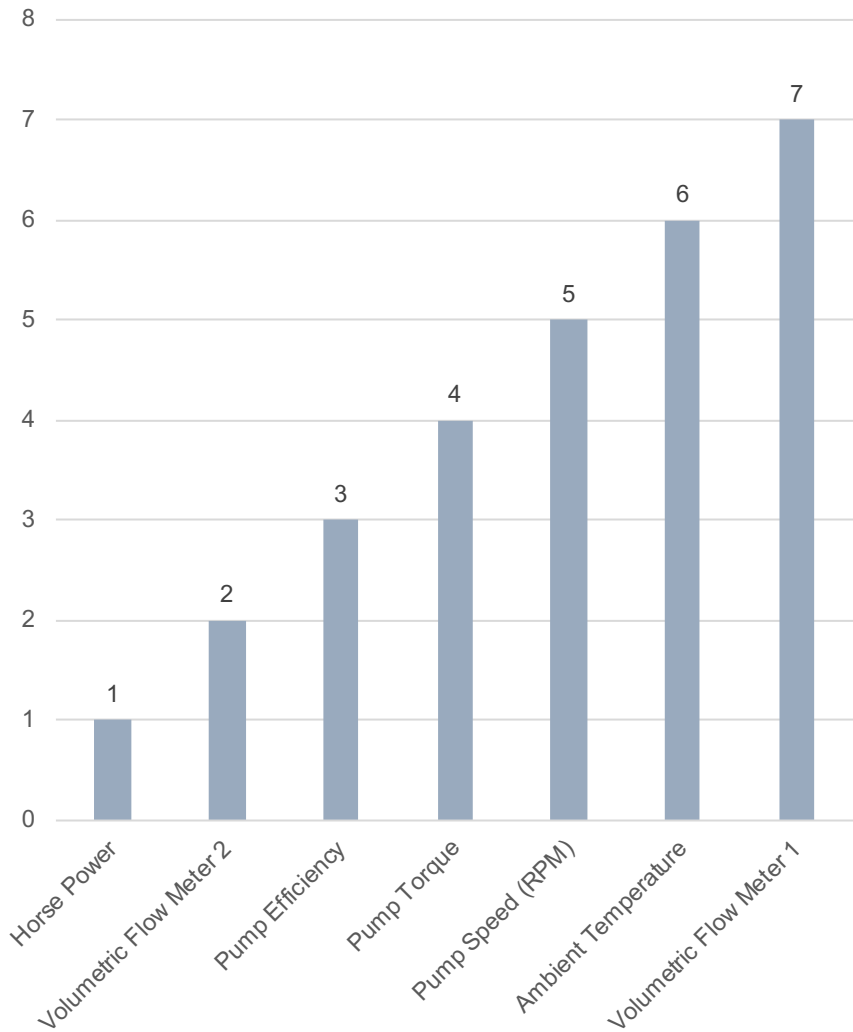
Variable	P-Value Significance
Horse Power	3.5524E-219
Volumetric Flow Meter 2	2.033E-174
Pump Efficiency	2.592E-152
Pump Torque	1.0551E-102
Pump Speed (RPM)	1.68299E-19
Ambient Temperature	4.20516E-09
Volumetric Flow Meter 1	4.01554E-07

*Southern Water Corps Desalination Pump Performance Data from 12/9/14 – 12/10/14