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Attention: REI

July 22, 2016

RE: MIHPT Site Investigation
14267 State Highway 70 West
Lac Du Flambeau, Wisconsin

Dear Dave Larsen,

The following is a summary of site activities performed by Cascade Technical Services, LP at the Tower Standard site in Lac Du Flambeau, Wisconsin.

In addition to the field logs within this report, we have provided guides to assist you in understanding the high resolution data and how the systems work. We recommend that you collect groundwater and / or soil samples to correlate the high resolution data with traditional data. This will provide you with additional evidence to support your development or refinement of your conceptual site model.

We offer 3D modeling of high resolution data and traditional sampling services as well. These would be beneficial for viewing the data within the same area.

If you have any questions about this report or you would like to discuss applying this data to a remedial design at the site, please email me or contact Brad Carlson at 813-731-5916.

Ryan Mulford

Cascade Technical Services, LP

34 Talbot Road
Northborough, MA 01532
410-507-6368 Mobile

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MiHPT Boring Logs (Auto-Scale) ..... Appendix A

MiHPT Boring Logs (Common-Scale) ..... Appendix B

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Personnel:

Mr. Ryan Mulford, Cascade Technical Services (HRSC Specialist)
Mr. Eric Pope, Cascade Technical Services (DPT Operator)

Equipment:

- Geoprobe 7822 Direct Push Drill Rig
- MIP Controller (Nitrogen Flow and Heater)
- Geoprobe FI 6000 Computer
- SRI Gas Chromatograph
- K6300 HPT Controller
- Electrical Conductivity
- XSD (Halogen Specific Detector)
- PID (Photo Ionization Detector) 10.2 eV Lamp
- FID (Flame Ionization Detector)
- 150' MIP/HPT Trunkline
- 1.75" O.D. MIHPT Probe
- 1.75" O.D. Drive Rods
- UHPN (Ultra High Purity Nitrogen)
- UHPH (Ultra High Purity Hydrogen)

MIP System Overview:

The MIP is a direct push tool that produces continuous chemical and physical logs of the vadose and saturated zones. The system detects VOCs in-situ and shows where the contaminants occur relative to the geologic and hydrologic units. Vertical profiles, transects, 3D images and maps can all be produced from the electronic data generated by the MIP logs. The unique capability of providing reliable, real-time information allows for informed and timely decision making in the field. The MIP is a downhole tool that heats the soils and groundwater adjacent to the probe to 120 degrees C. This increases volatility and the vapor phase diffuses across a membrane into a closed, inert gas loop that carries these vapors to a series of detectors housed at the surface. Continuous chemical logs or profiles are generated from each boring. Soil conductivity is also measured and these logs can be compared to the chemical logs to better understand where the VOCs occur. The MIP technology is only appropriate for volatile organic compounds (VOCs). The gas stream can be analyzed with multiple detectors, for example a Halogen Specific detector (XSD) is used to detect halogenated VOC's, and a flame ionization detector is used to detect methane.

Detector Overview:

- XSD – The Halogen Specific Detector converts compounds containing halogens to their oxidation products and free halogen atoms by oxidative pyrolysis. These halogen atoms are adsorbed onto the activated platinum surface of the detector probe assembly resulting in an increase thermionic emission. This emission current provides a corresponding voltage that is measured via an electrometer circuit in the detector controller.
- PID – Photo Ionization Detector sample stream flows through the detector's reaction chamber where it is continuously irradiated with high energy ultraviolet light. When compounds are

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present that have a lower ionization potential than that of the irradiation energy (10.2 electron volts with standard lamp) they are ionized. The ions formed are collected in an electrical field, producing an ion current that is proportional to compound concentration. The ion current is amplified and output by the gas chromatograph's electrometer.

- FID – Flame Ionization Detector consists of a hydrogen / air flame and a collector plate. The effluent from the GC (trunkline) passes through the flame, which breaks down organic molecules and produces ions. The ions are collected on a biased electrode and produce an electric signal.

MIP Data Collection

- Depth - Data is collected from twenty data points per foot. 0.05', 0.10', 0.15', etc...
- Electrical Conductivity - Electrical Conductivity data is measured/collected in milli-siemens per Meter (ms/M). The conductivity of soils is different for each type of media. Finer grained sediments, such as silts or clays, will have a higher EC signal. While coarser grained sediments, sands and gravel, will have a lower EC signal. The coarser grained sediments will allow the migration of contaminants and the finer grained sediments will trap the contaminant.
- Speed / Advancement Rate - Speed data is measured/collected in feet per minute (ft/min). Speed is an indication of the physical advancement rate of the MIP probe. Speed of the MIP probe can vary due to operator advancement and dense soil types. Speed log can provide soil type information which can be correlated with electrical conductivity. Lower advancement speed, correlated with lower conductivity or larger grained soils would more than likely be associated with dense or compacted sands.
- Temperature - Temperature data is measured/collected in Degrees Celsius. Temperature is an indication of the physical temperature of the MIP block. Minimum and Maximum temperature is collected at each vertical interval. Cascade's temperature protocol indicates that the MIP probe temperature shall maintain a minimum temperature of 75 Degrees Celsius.
- Pressure - Pressure data is measured/collected in PSI. Pressure is an indication of the internal pressure of the nitrogen lines located within the trunkline and the pressure behind the membrane. Geoprobe's protocol indicates that the MIP probe pressure shall not exceed 1.5 PSI difference from baseline.
- Detector (XSD, ECD, PID, FID) - Detector responses are measured/collected in micro Volts (uV). Detector responses are an indication of relative contaminant responses. Minimum and Maximum detector responses are collected at each vertical interval.

Response Testing

Response testing is an integral part of ensuring the quality of data from the MIP system. Response testing must be conducted before and after each log. This will ensure the validity of the data and the integrity of the system. Response testing also provides for comparison of data for later MIP logs at a particular site. However, results of the response test may change due to membrane wear from soil contact and abrasion.

Prior to conducting a response test, a response test standard solution is prepared by adding an appropriate volume of stock standard solution to 0.5 liters of clean water in a suitable measuring

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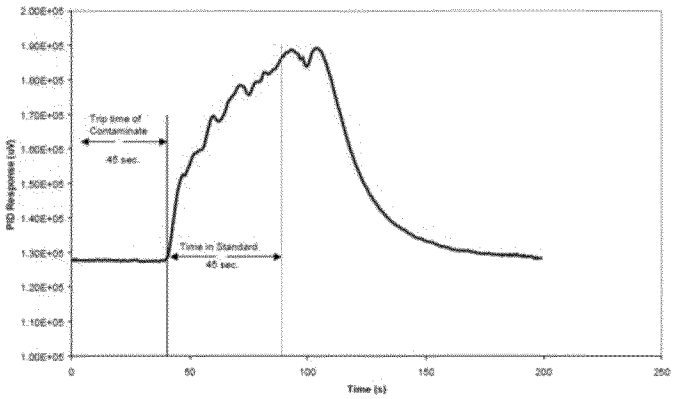
container (beaker or graduated cylinder) to produce a working standard, for example, 10 µL of 50 mg/mL concentration stock standard is added to 0.5 liters of water to yield a 1mg/L working standard. Generally, response test standard solutions are prepared using trichloroethene and toluene. However, response test standard solutions may be prepared based on the specific contaminants of concern at a site of necessary. Also prior to conducting the response test, the MIP is placed in clean water until detector response stabilization has occurred.

The working standard is poured into a 50 mL VOA. Once a stabilized Detector baseline is achieved, the working standard is placed over the Membrane for duration of 30 seconds (Note: in the response test shown below, the MIP was inserted into the working standard for duration of 45 seconds). At the end of 30 seconds the MIP is removed. The working standard cannot be reused after a response test.

The results of the response test are shown on the MIP data acquisition unit (shown below). The trip time is measured by recording the time between the moment when the VOA is placed over the membrane and the response of the detectors, as viewed on the MIP data acquisition unit. The baseline and peak response value are also recorded for comparison with other MIP response tests. The trip time is entered manually into the data acquisition system account for the time it takes for compounds in the subsurface to travel the length of the trunkline during the MIP boring. Per Geoprobe, a passing response test is a response that is double the noise of the detectors.



PID Response Test – 10 ppm Benzene

HPT System Overview

The HPT system is designed to evaluate the hydraulic behavior of unconsolidated materials. As the probe is pushed or hammered at 2cm/s, clean water is injected through a screen on the side of the HPT probe at a flow rate usually less than 300 mL/min. The injection pressure, which is monitored and plotted with depth, is an indication of the hydraulic properties of the soil. A relatively low pressure response indicates a relatively large grain size, and the ability to easily transmit water. However, a relatively high pressure response indicates a relatively small grain size, which correlates with the inability to transmit water.

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Additionally, an EC dipole is integrated into the HPT probe. This allows for the collection soil electrical conductivity (EC) data to interpret the lithology of the subsurface. In general, the higher the electrical conductivity value, the smaller the grain size, the lower the electrical conductivity value, the larger the grain size. However, other factors can affect EC, such as mineralogy and pore water chemistry (brines, extreme pH, contaminants). Conversely, the HPT pressure response is independent of these chemical and mineralogical factors.

There are five primary components of the HPT system (see schematic below): the probe assembly, controller, pump, trunkline, and field instrument. The probe assembly consists of the section that houses the 100 psi pressure transducer, water and electrical connections, and the probe body with the injection screen and electrical conductivity.

Injecting water at a constant rate is integral to system operation. A controller box houses components that monitor and regulate the water injection rate and pressure, as well as pressure transducer signal conditioning electronics. The flow rate, up to 1000 mL/min, is set manually on the front of the controller, and a valve is used to turn on or shut off flow.

A vane pump provides system pressure ensuring adequate flow to the screen. The pump is secured to a frame with an integrated visual flow meter. Water and power are transmitted from the controller to the probe assembly via the trunkline. The probe rods are pre-strung with the trunkline before advancing of the HPT probe begins.

HPT Data Collection

The HPT system collects depth, electrical conductivity, advancement rate, hydraulic pressure, and flow information. Additional detail regarding each of these parameters is provided below.

- Depth - Data is collected from twenty data points per foot. 0.05', 0.10', 0.15', etc...
- Electrical Conductivity - Electrical Conductivity (EC) data is collected in milli-siemens per meter (ms/M). The conductivity of soils is different for each type of media. Finer grained sediments, such as silts or clays, will have a higher EC signal. While coarser grained sediments, sands and gravel, will have a lower EC signal. The coarser grained sediments will allow the migration of contaminants and the finer grained sediments will trap the contaminant.
- Advancement Rate – Advancement rate is collected in units of feet per minute (ft/min). Advancement rate of the HPT probe can vary due to operator advancement and soil types encountered.
- Pressure - Pressure data is collected in pounds per square inch (PSI). Pressure is an indication of hydraulic pressure applied to the subsurface by the HPT system. The system collects both the minimum and maximum pressures over each vertical interval.
- Flow - Flow data is collected in milliliters per minute (mL/min). Flow is an indication of the rate water that is pumped out of the membrane at the HPT probe. The system collects both the minimum and maximum flow over each vertical interval.

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- Estimated Hydraulic Conductivity (est. K) – Hydraulic conductivity, symbolically represented as K, is an in-situ property that describes the ease with which water can move through pore spaces or fractures. It is dependent on the intrinsic permeability of the material and on the degree of saturation. With respect to the HPT system, the estimated K values are only applicable to the saturated portion of the formation. The estimated K value is calculated using the HPT pressure and flow data. It is also necessary to collect HPT response test data before and after each boring. Additionally, it is necessary to conduct at least one pressure dissipation test during the logging operation, below the static water table level.

Site Activities:

Project Dates: July 11th- July 14th, 2016

SCOPE: Cascade Technical Services, LP advanced 17 direct push MIHPT borings from the ground surface to between 20 and 63 feet below ground surface (BGS).

MIHPT Boring	Date	Time	Total Depth (feet)	Dissipation Test Depth(s) (feet)	MIHPT Notes
MiHPT-01	07/11/2016	10:07	52.50	16.73 22.83 35.78 48.78(failed) 52.23	Refusal at 52.50 feet bgs.
MiHPT-02	07/11/2016	13:06	39.00	18.23 24.28(failed) 30.18(failed) 33.23(failed) 36.28 38.73	Refusal at 39.00 feet bgs.
MiHPT-03	7/11/2016	15:15	49.30	19.88 28.83 36.83 44.83	Refusal at 49.30 feet bgs.
MiHPT-04	07/12/2016	07:47	59.25	19.33 29.23 37.28 46.38 58.98	Refusal at 59.25 feet bgs.
MiHPT-05	07/12/2016	10:35	62.15	24.93 29.93 37.28 46.33 58.98	None.
MiHPT-06	07/12/2016	13:58	52.35	19.83 36.83(failed) 46.88	None.

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MIHPT Boring	Date	Time	Total Depth (feet)	Dissipation Test Depth(s) (feet)	MIHPT Notes
MiHPT-07	07/13/2016	08:41	63.35	21.13 27.08 39.23 48.23 63.08	Refusal at 63.35 feet bgs.
MiHPT-08	07/13/2016	11:27	37.25	21.03 31.03 36.98	None.
MiHPT-09	07/13/2016	14:01	27.30	20.23 23.23 27.03	None.
MiHPT-10	07/13/2016	15:31	19:40	19.13	None.
MiHPT-11	07/13/2016	16:39	53.15	20.18 33.23 40.18	None.
MiHPT-12	07/14/2016	07:51	22.15	20.98	None.
MiHPT-13	07/14/2016	09:56	41.75	22.88 32.88 37.88 41.88	Refusal at 41.75 feet bgs.
MiHPT-14	07/14/2016	11:08	59.60	20.18 31.13 39.18 51.13 59.33	Refusal at 59.50 feet bgs.
MiHPT-15	07/14/2016	14:27	34.25	22.93 33.93	None.
MiHPT-16	07/14/2016	16:06	20.50	20.23	None.
MiHPT-17	07/14/2016	17:38	22.30	22.03	None.

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Site Map:

Boring locations are marked using Google Earth.

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MiHPT Boring Logs (Auto-Scale):

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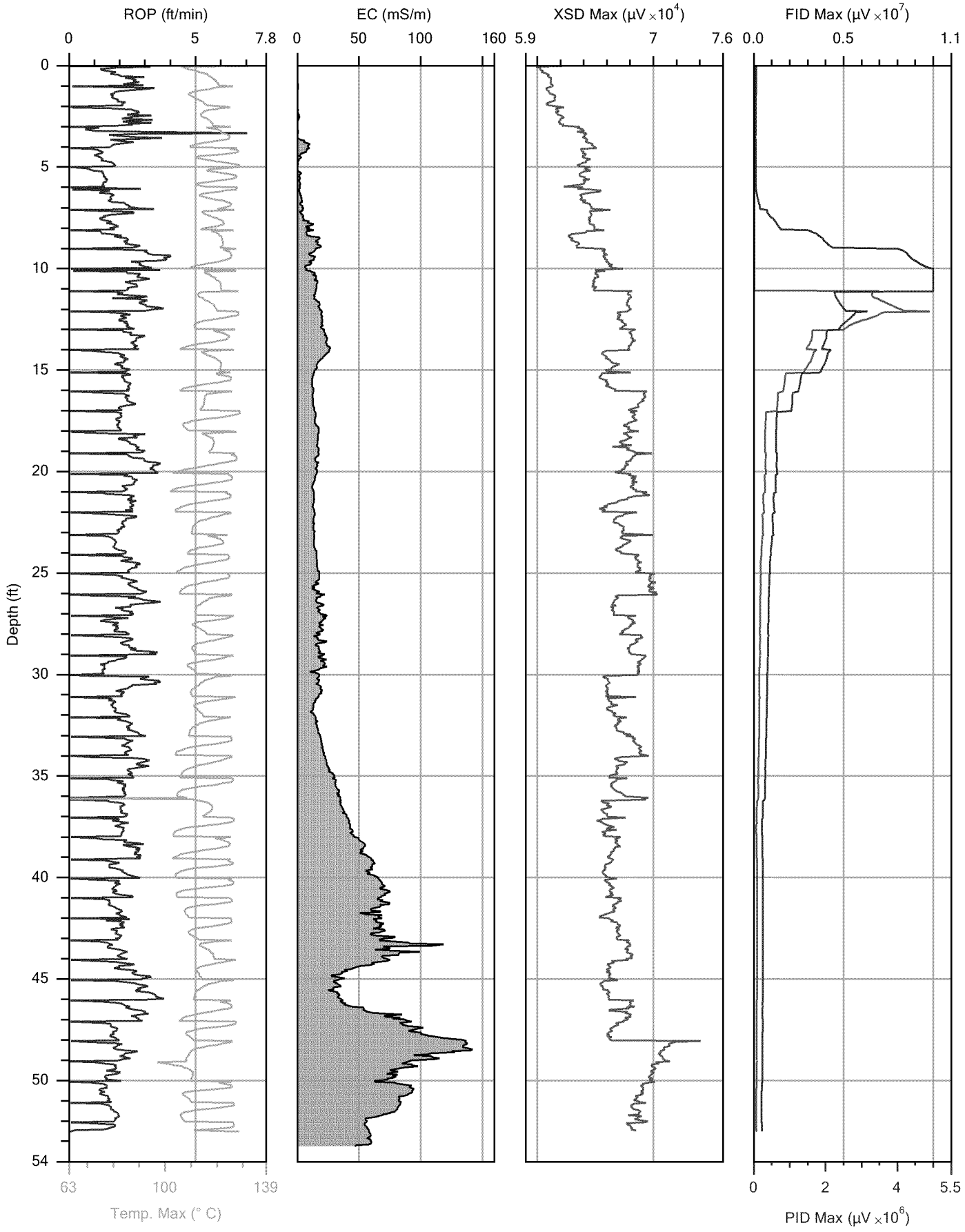

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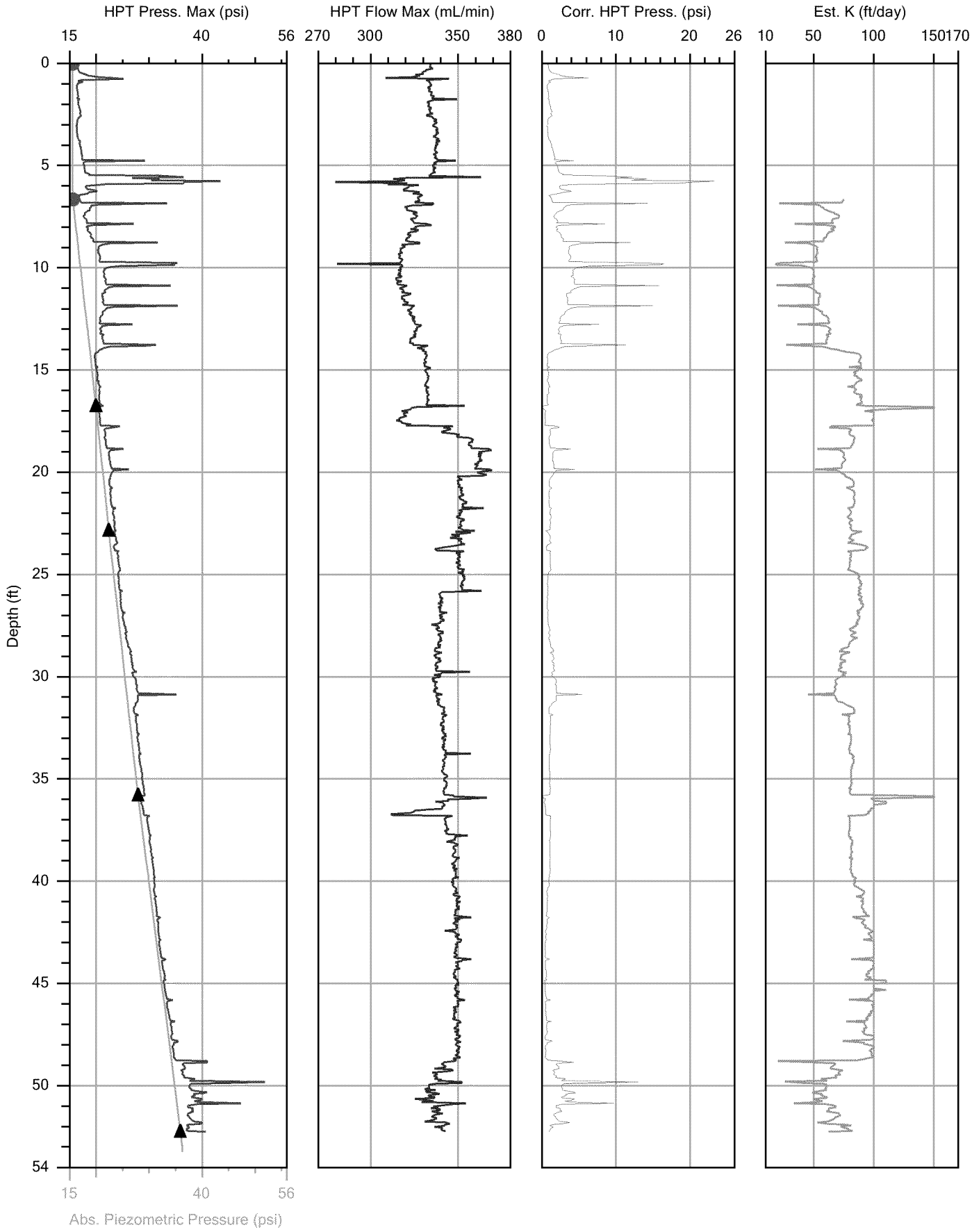

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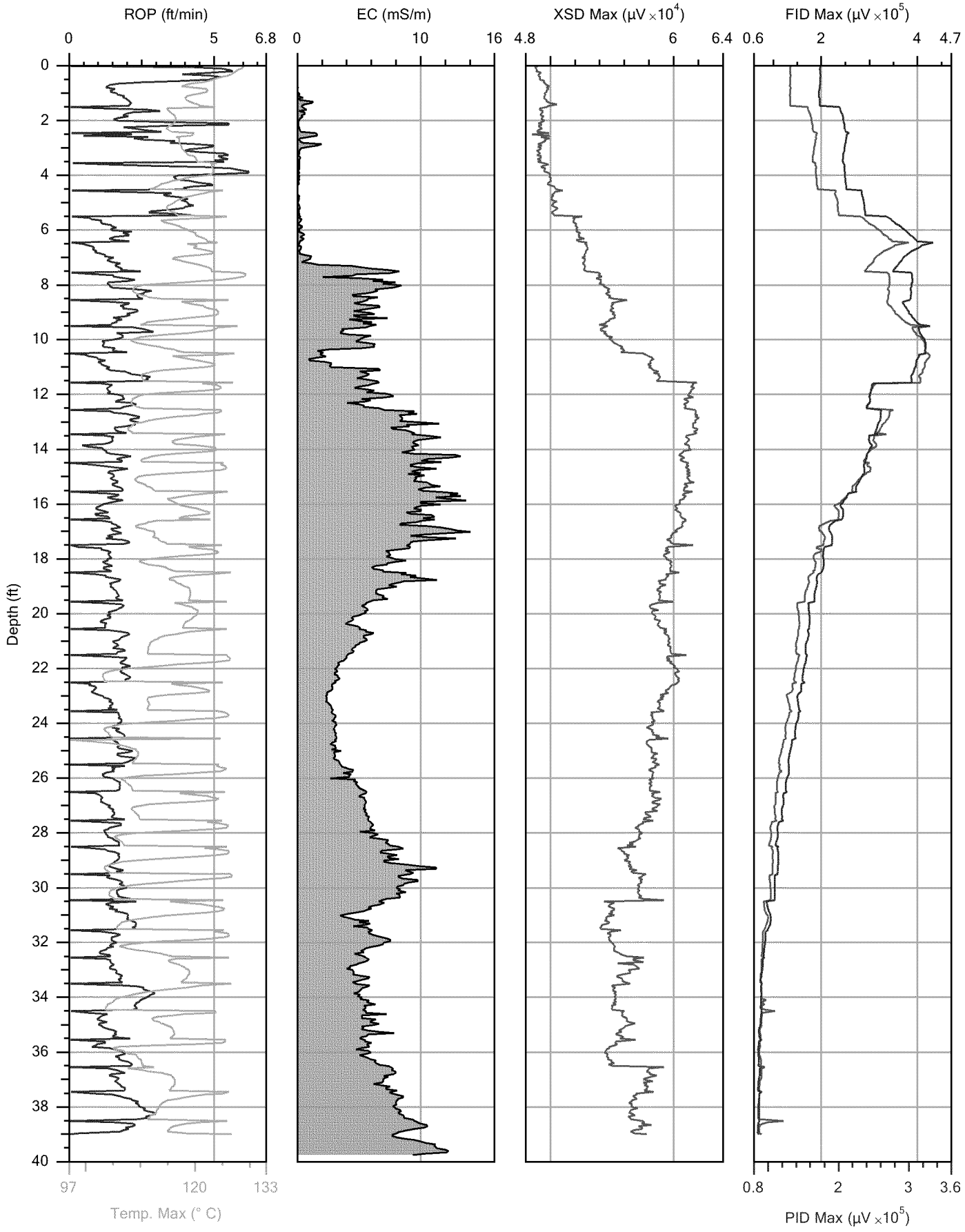

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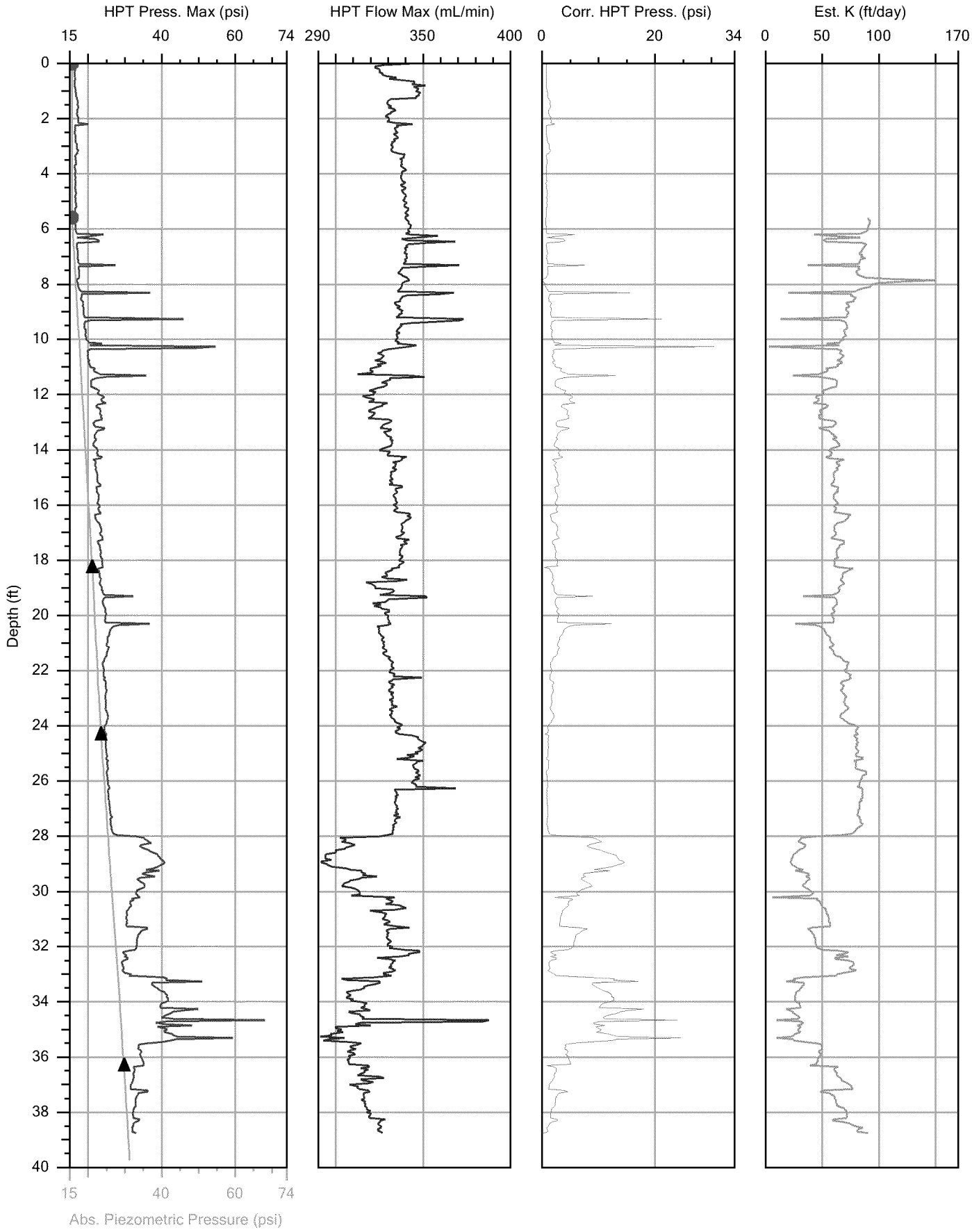

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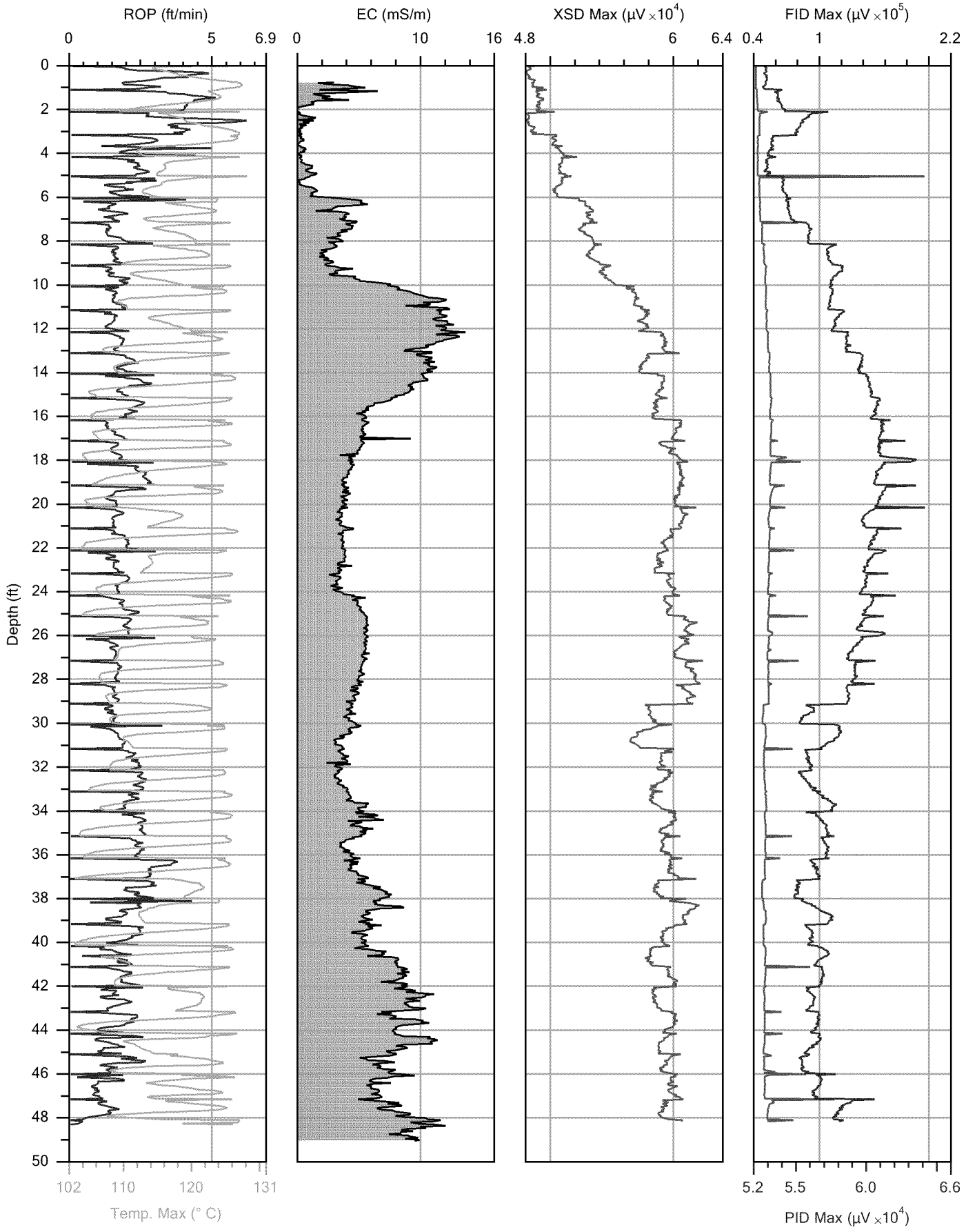

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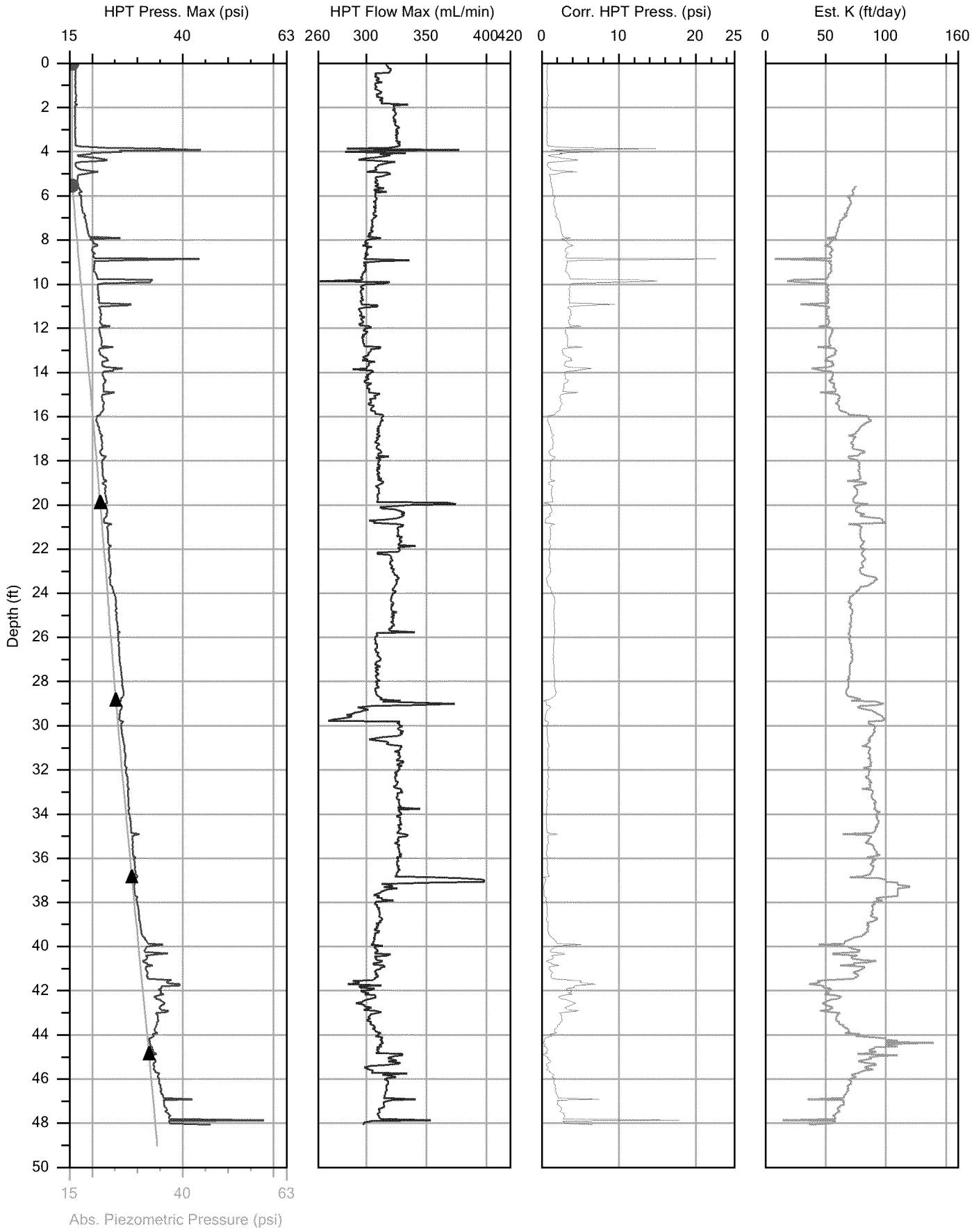

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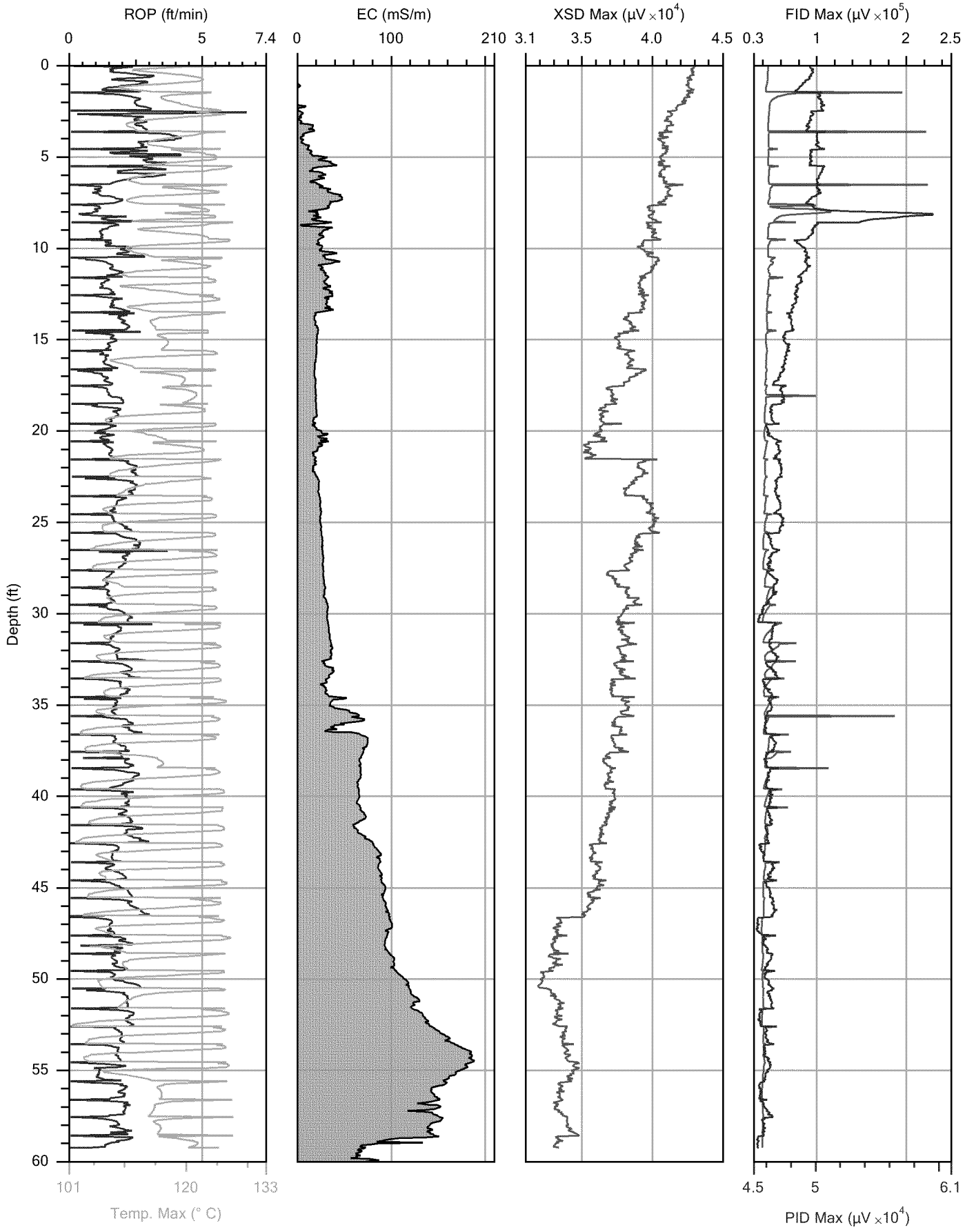

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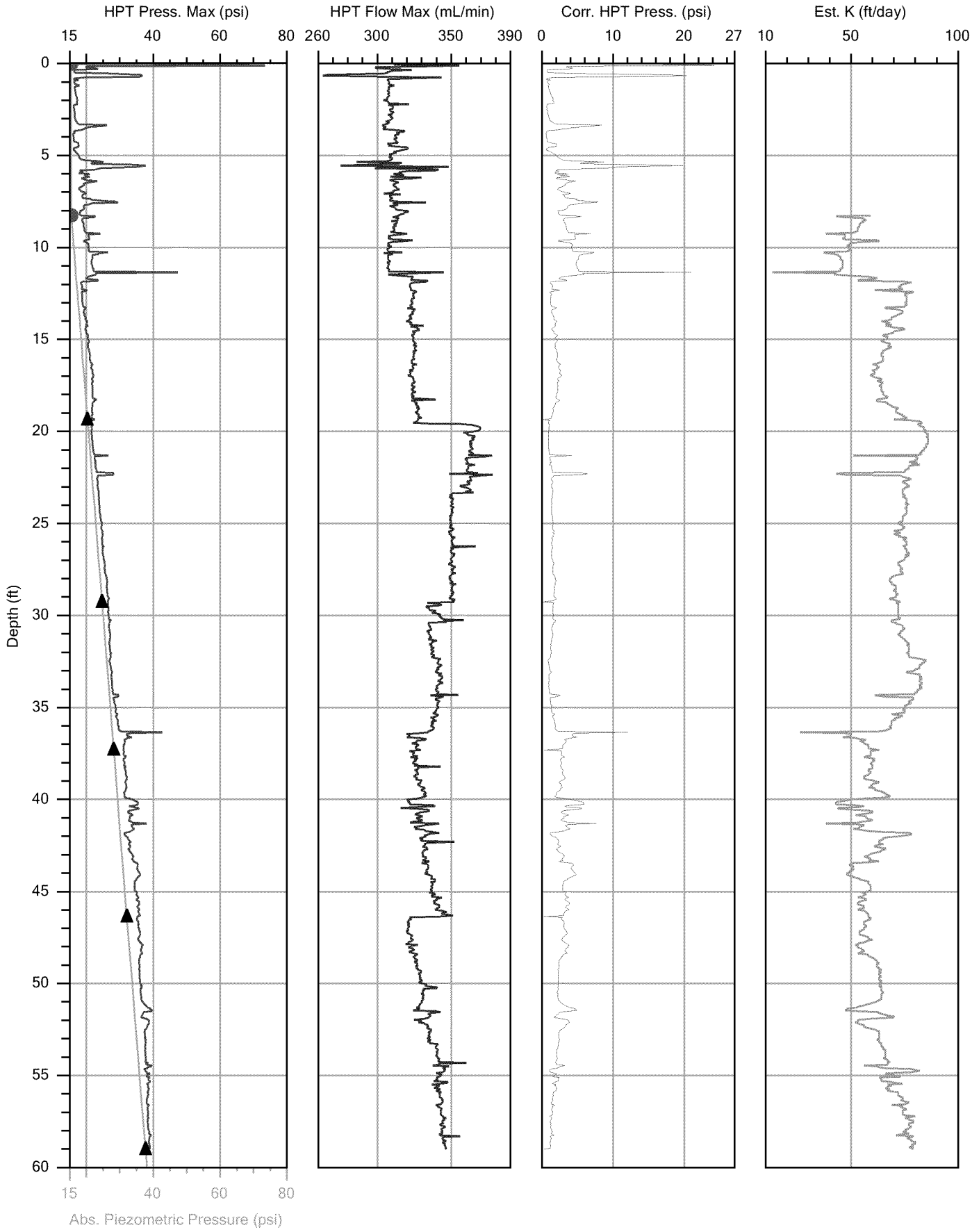

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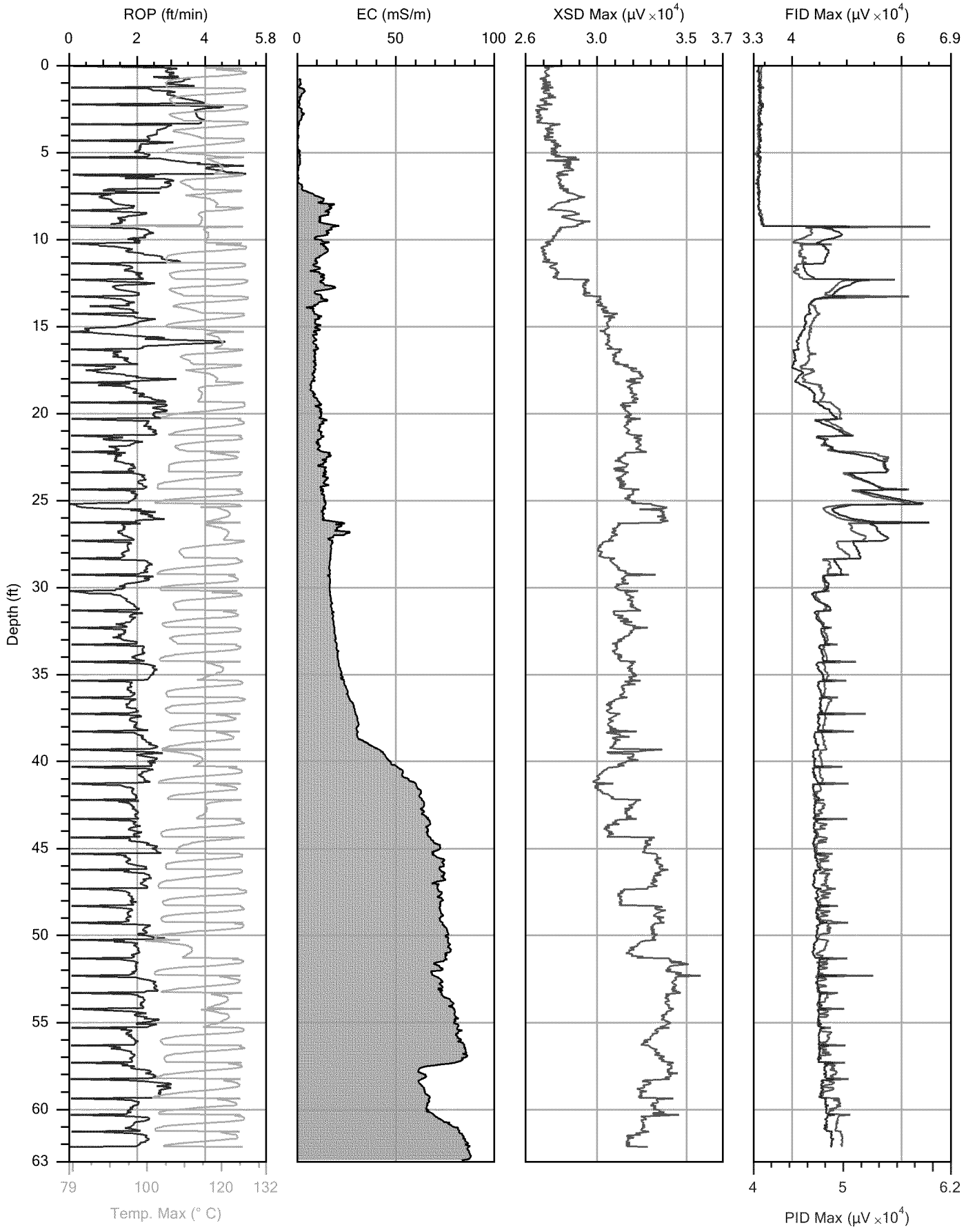

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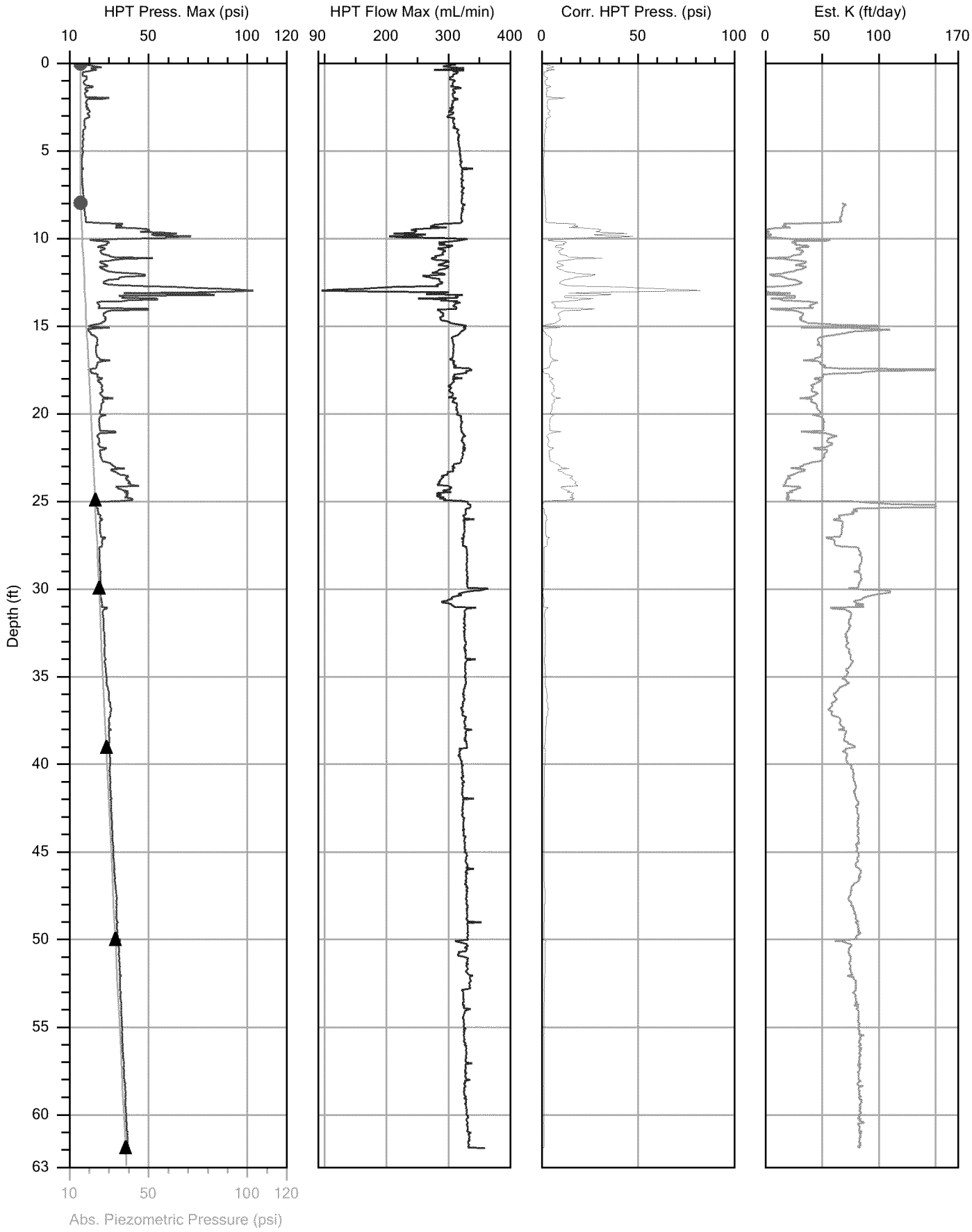

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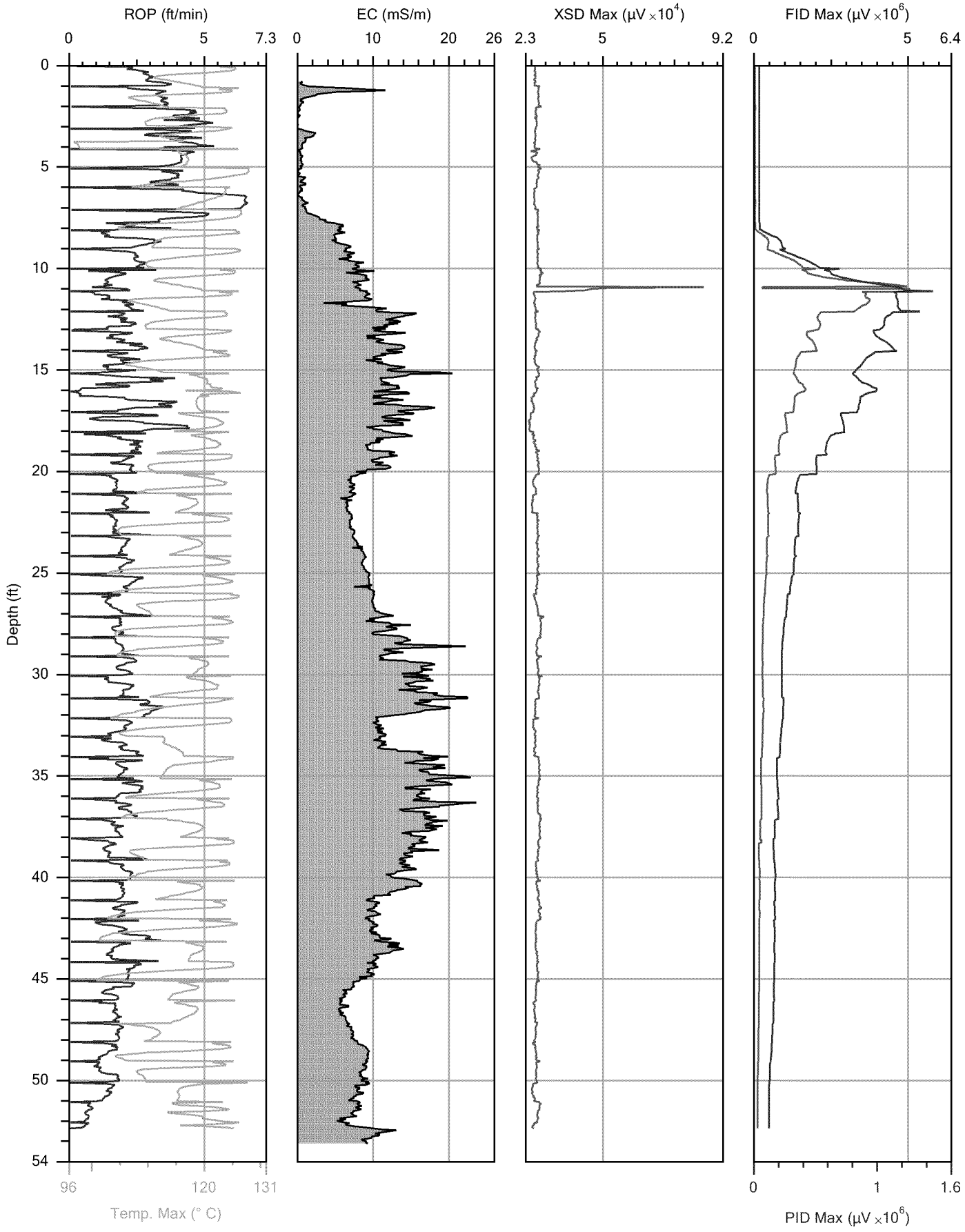

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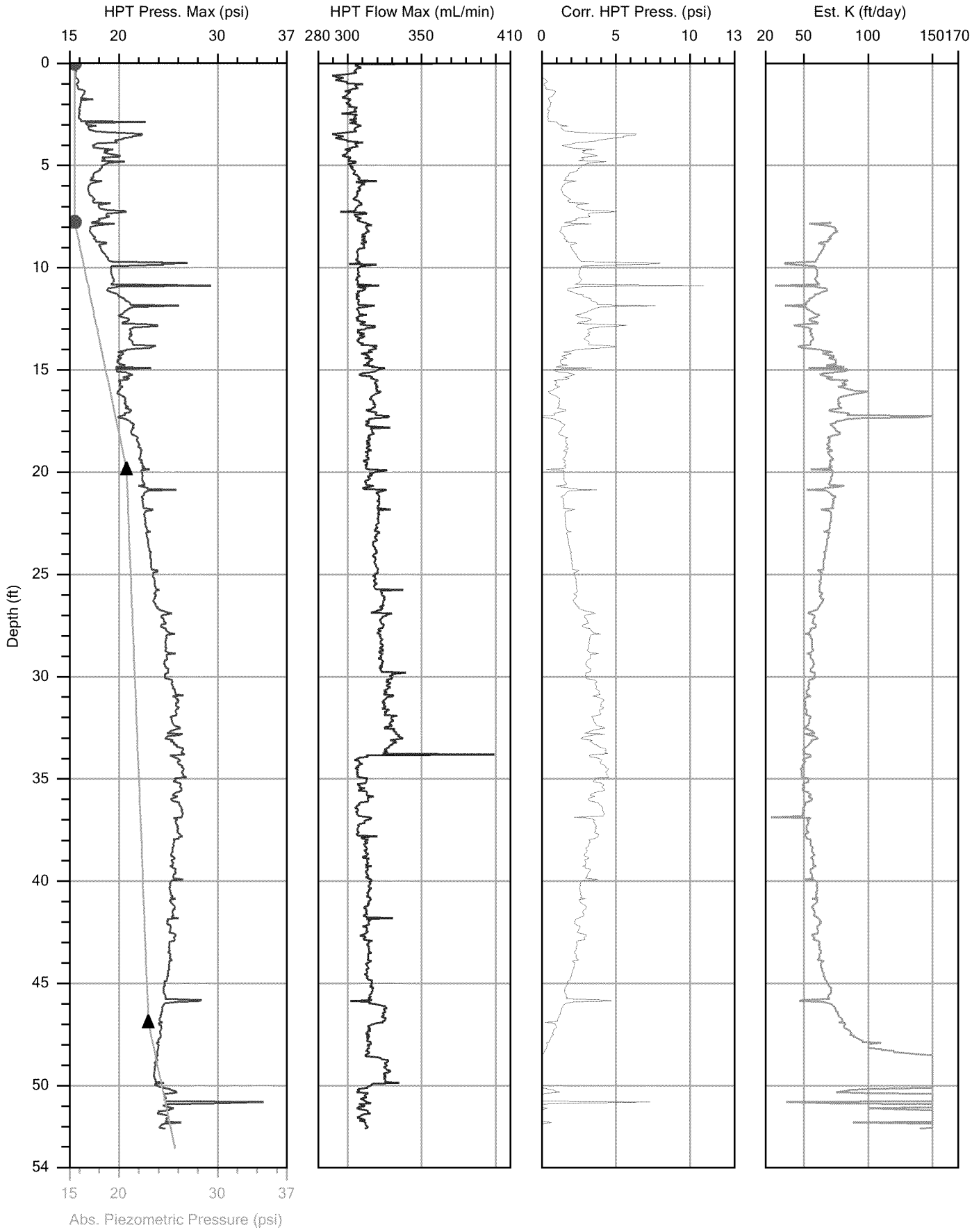

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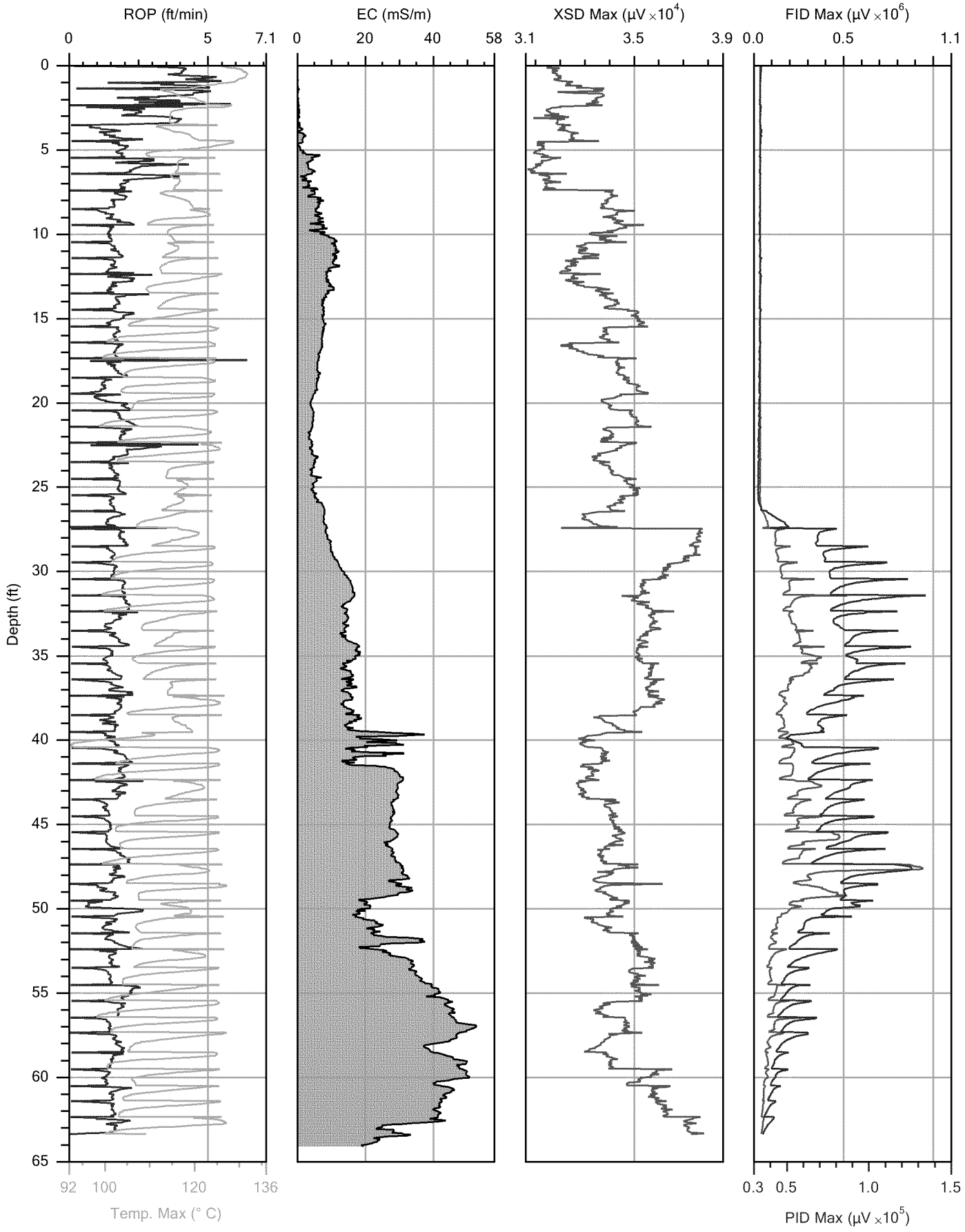

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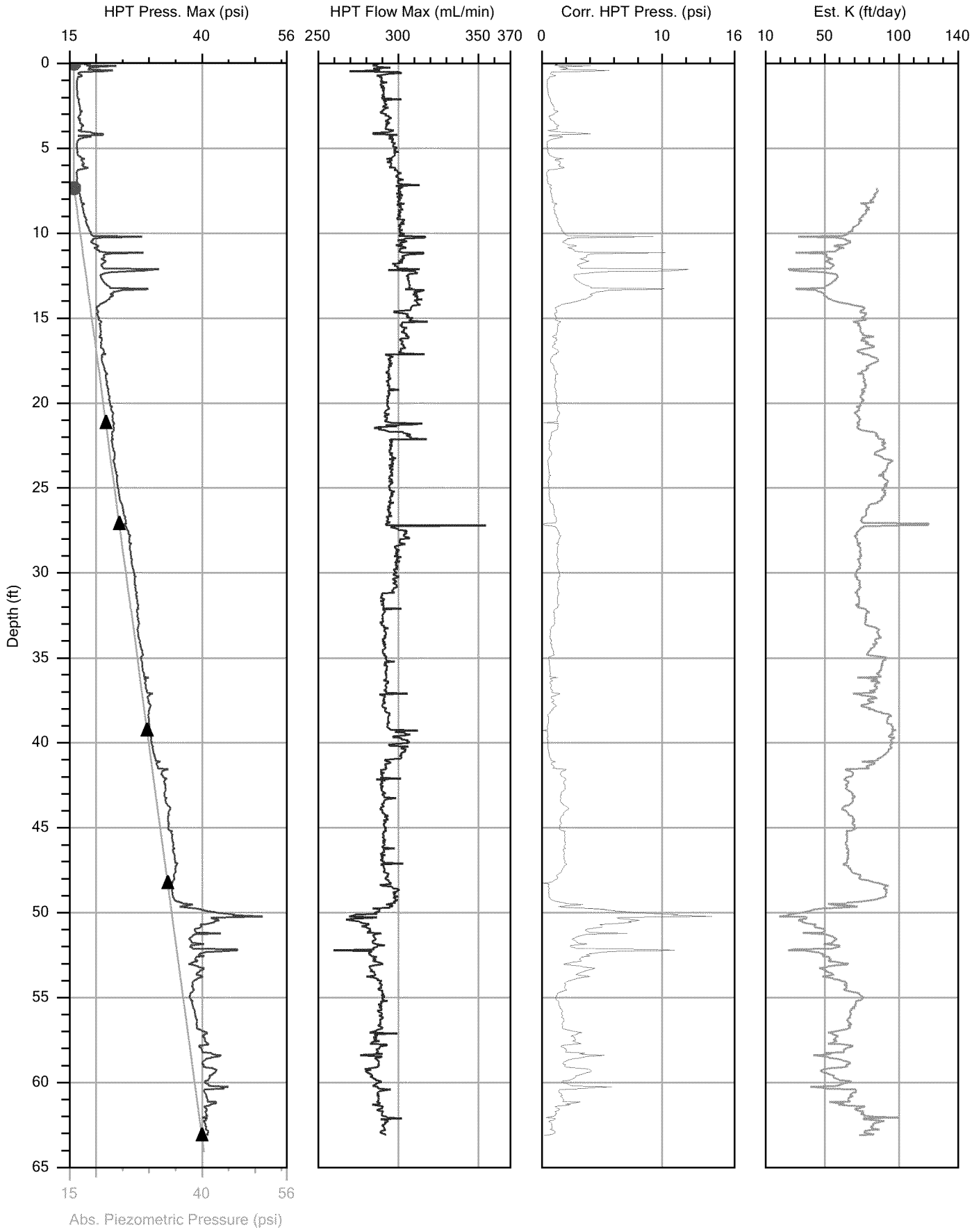

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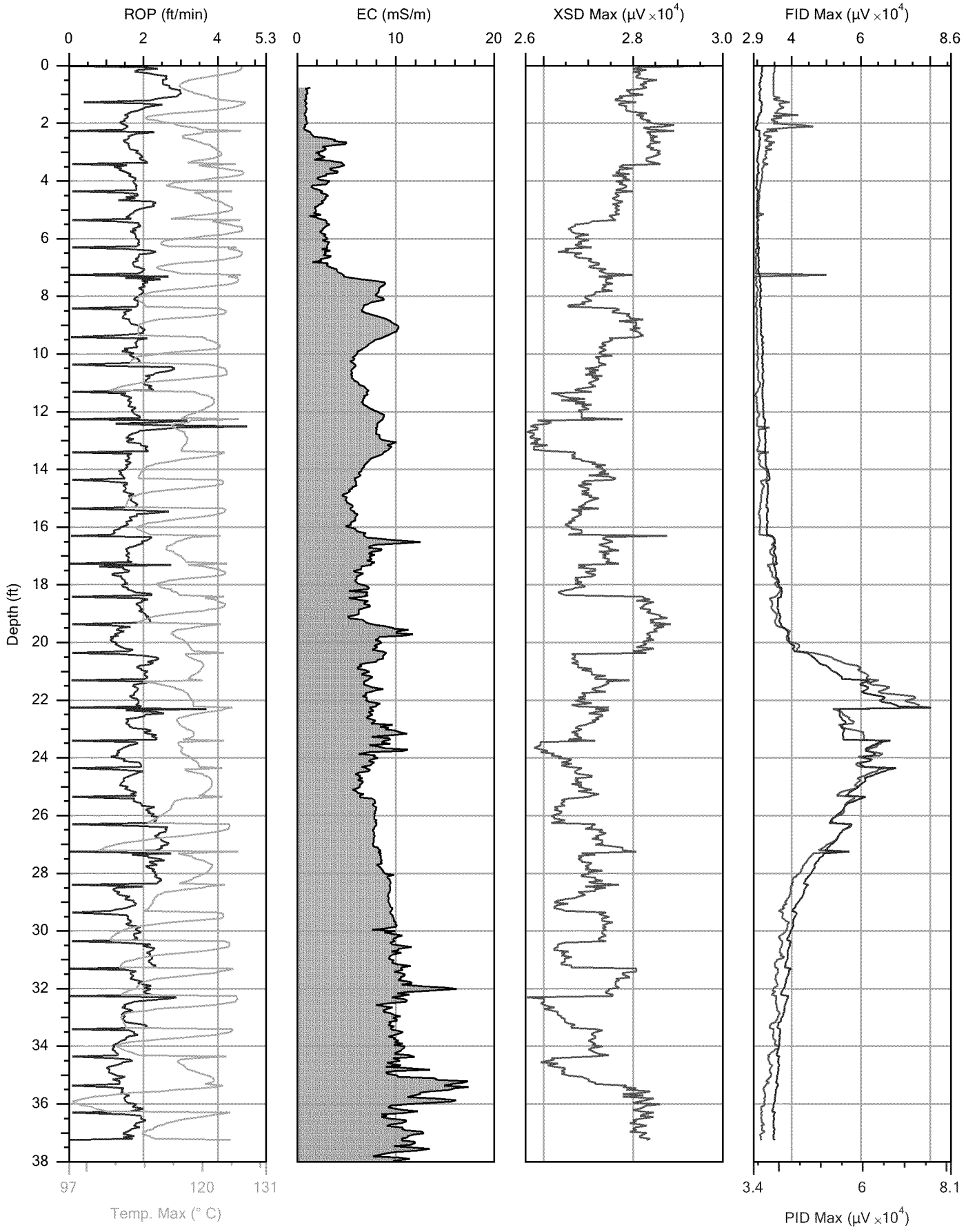

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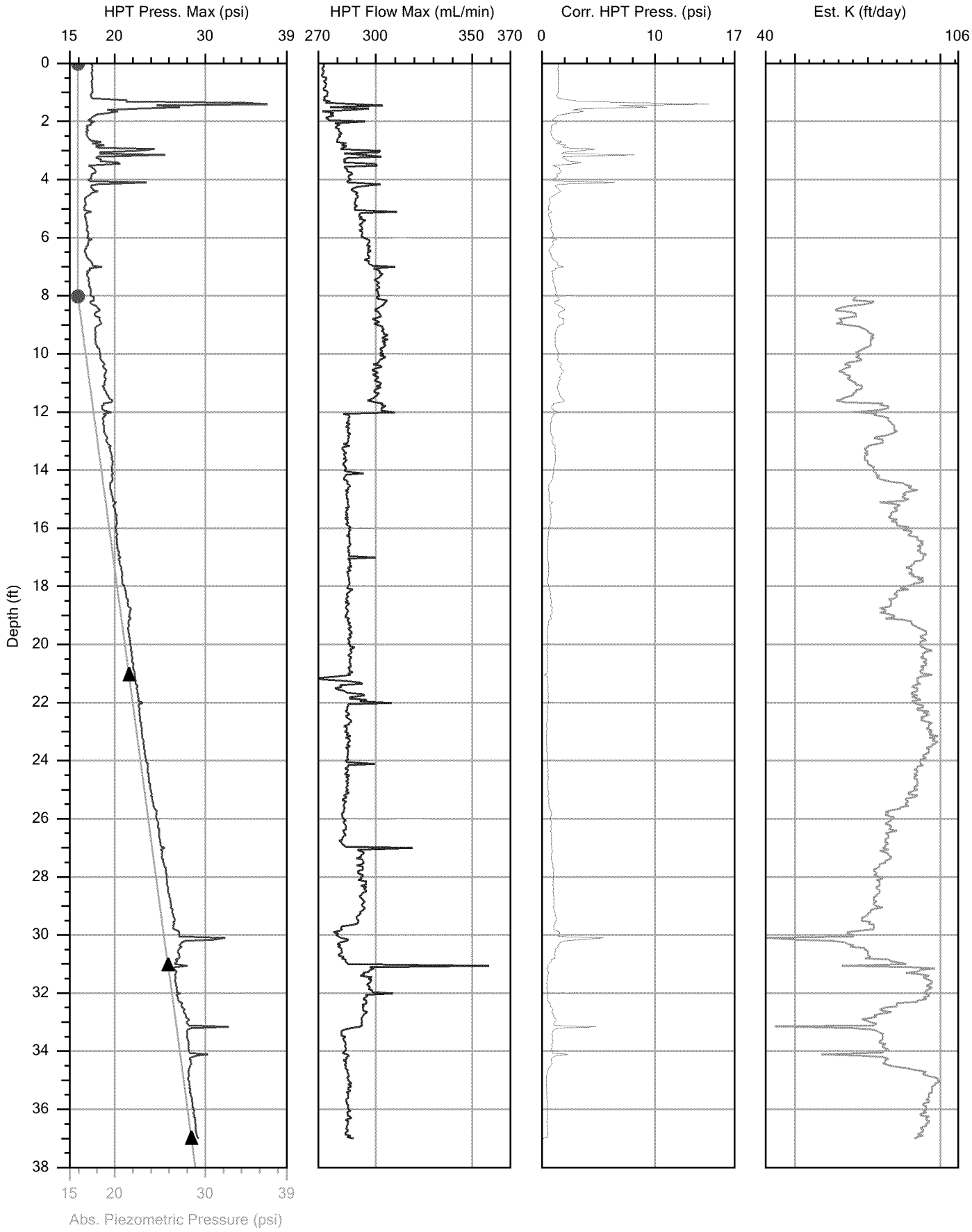

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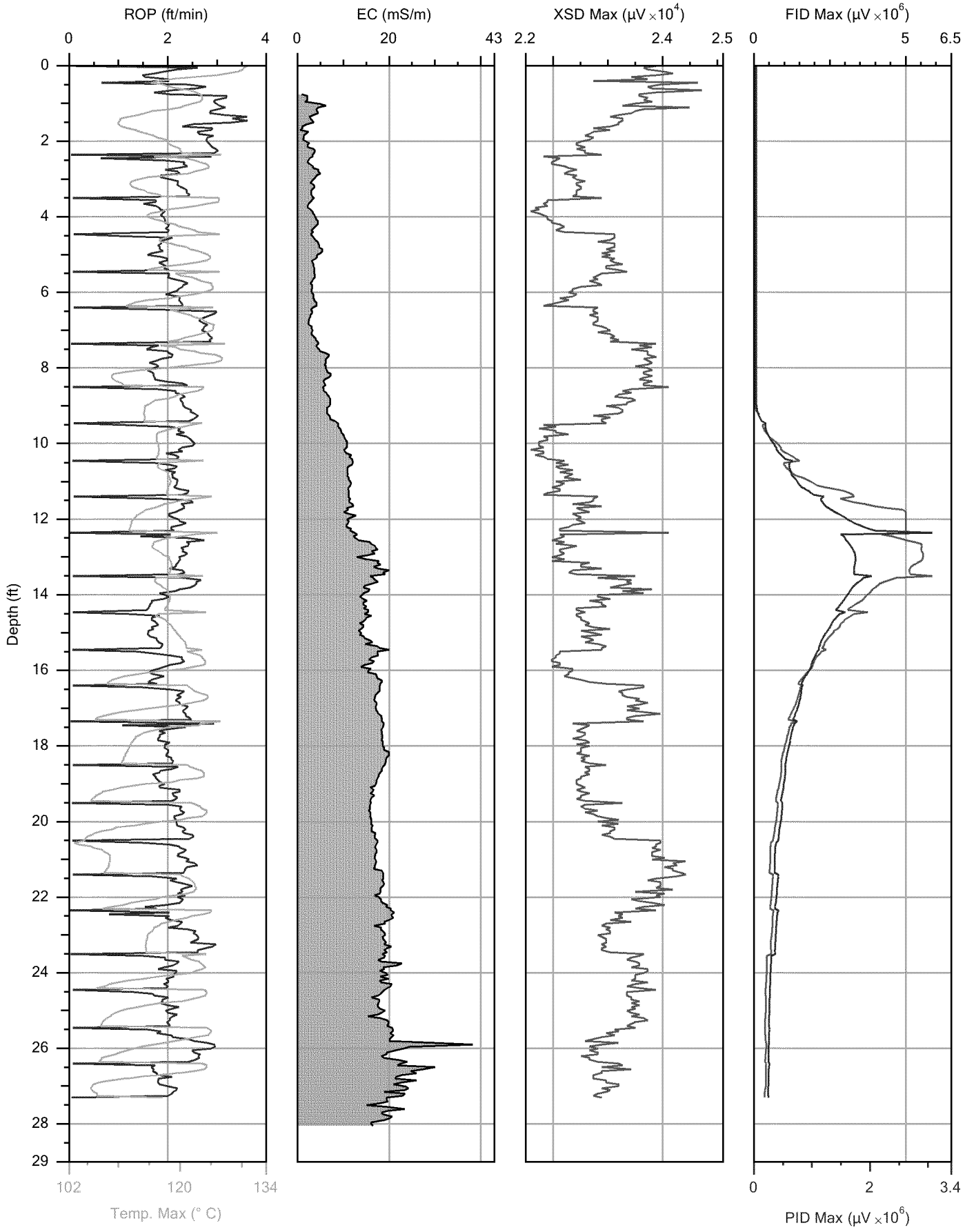

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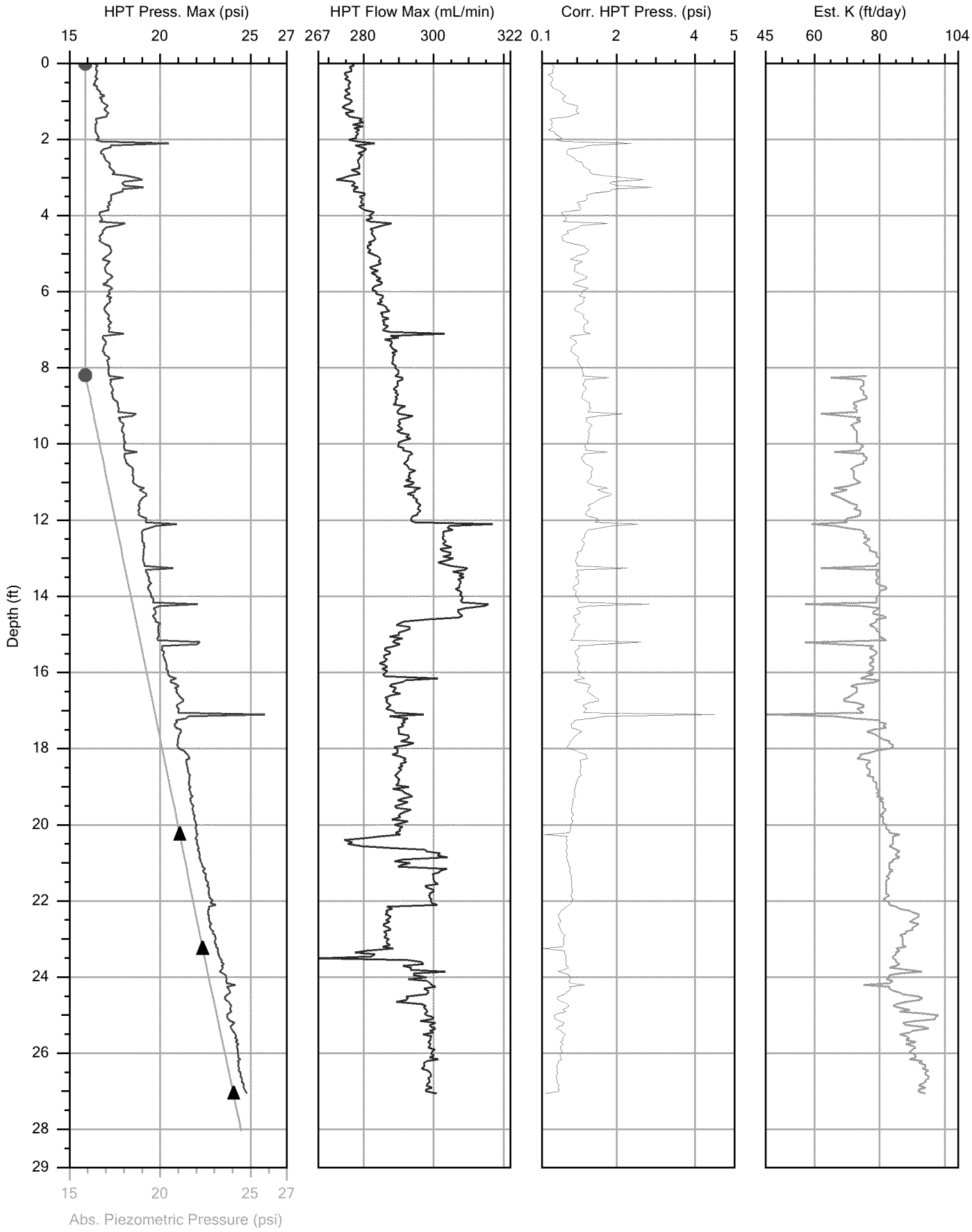

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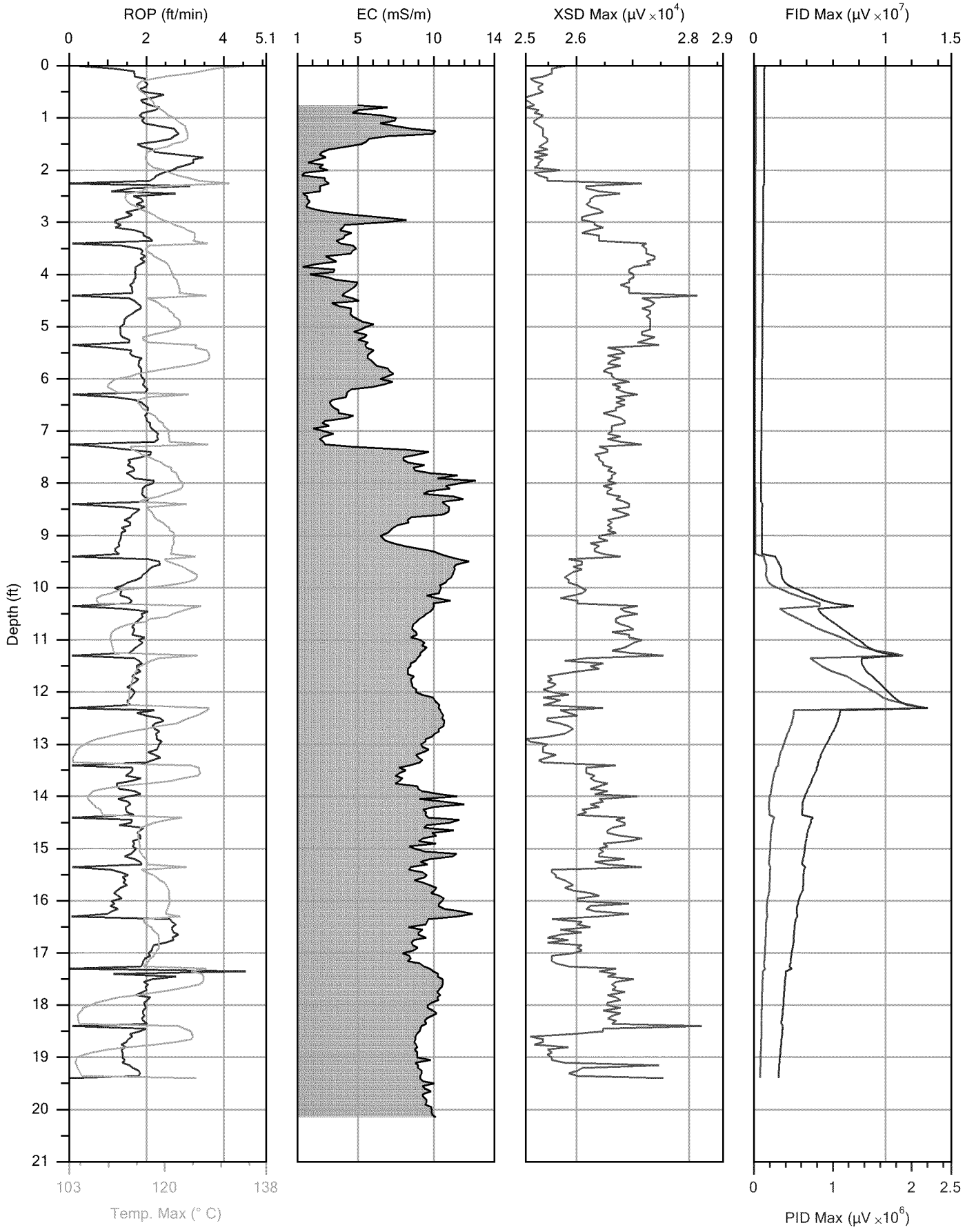

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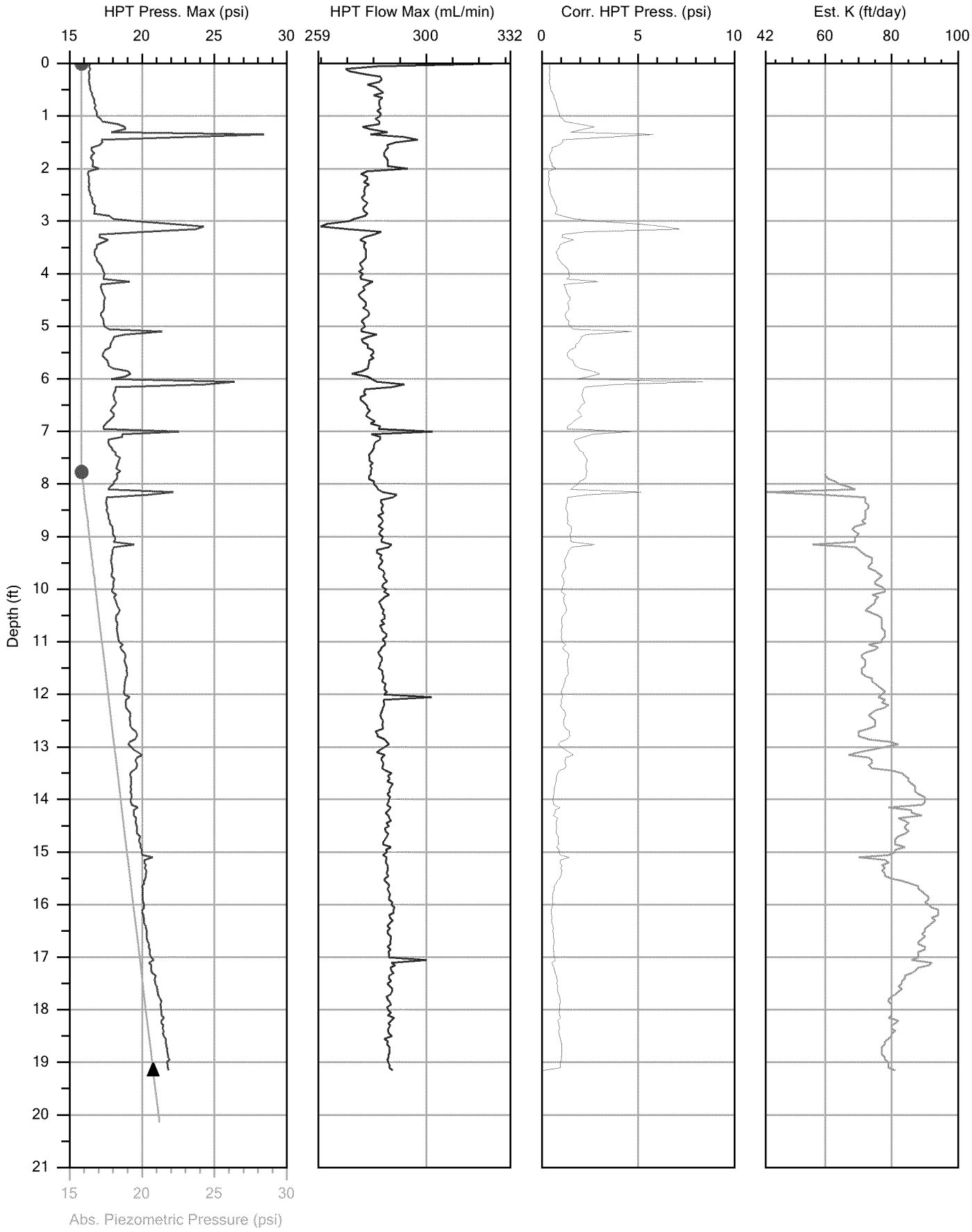

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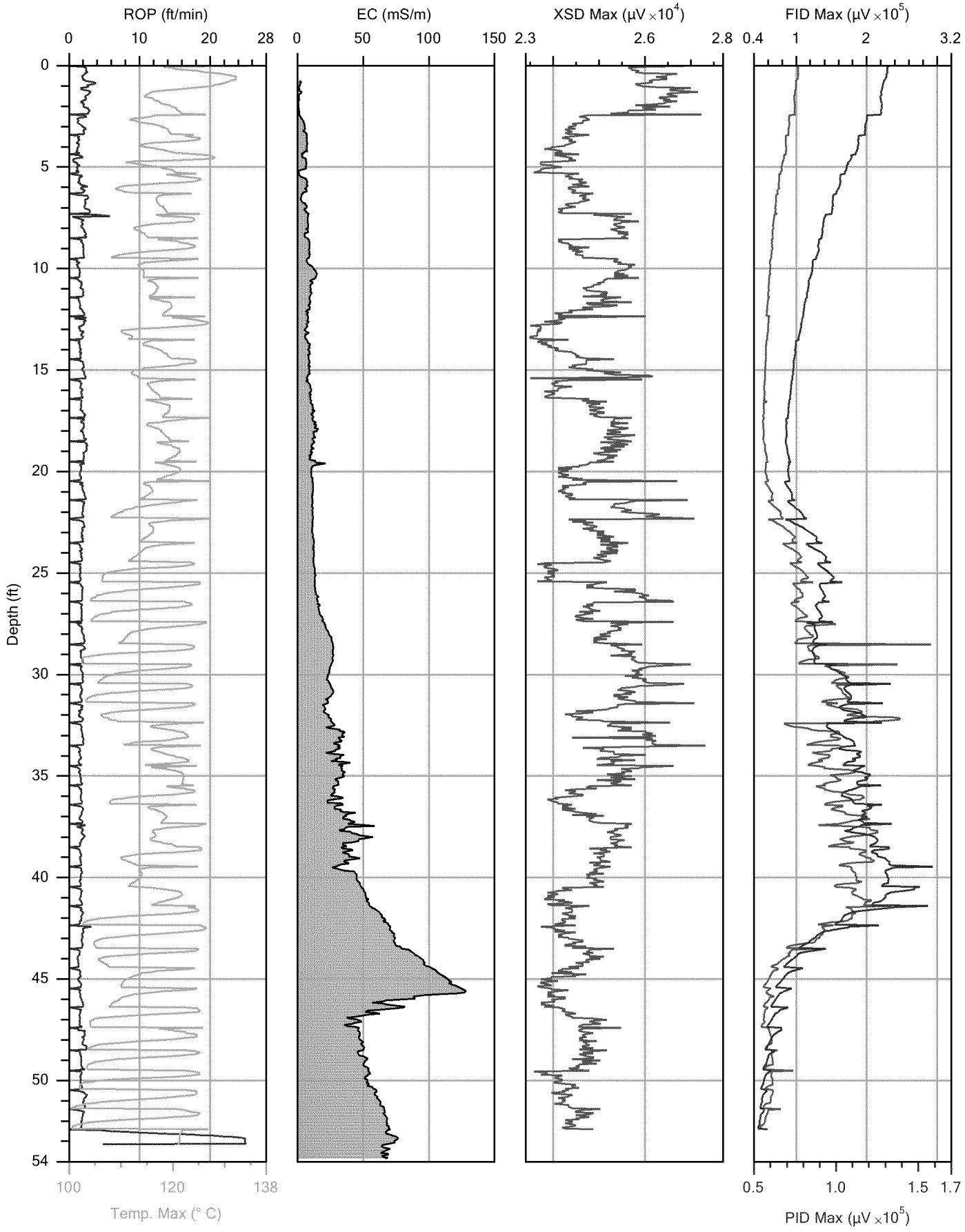

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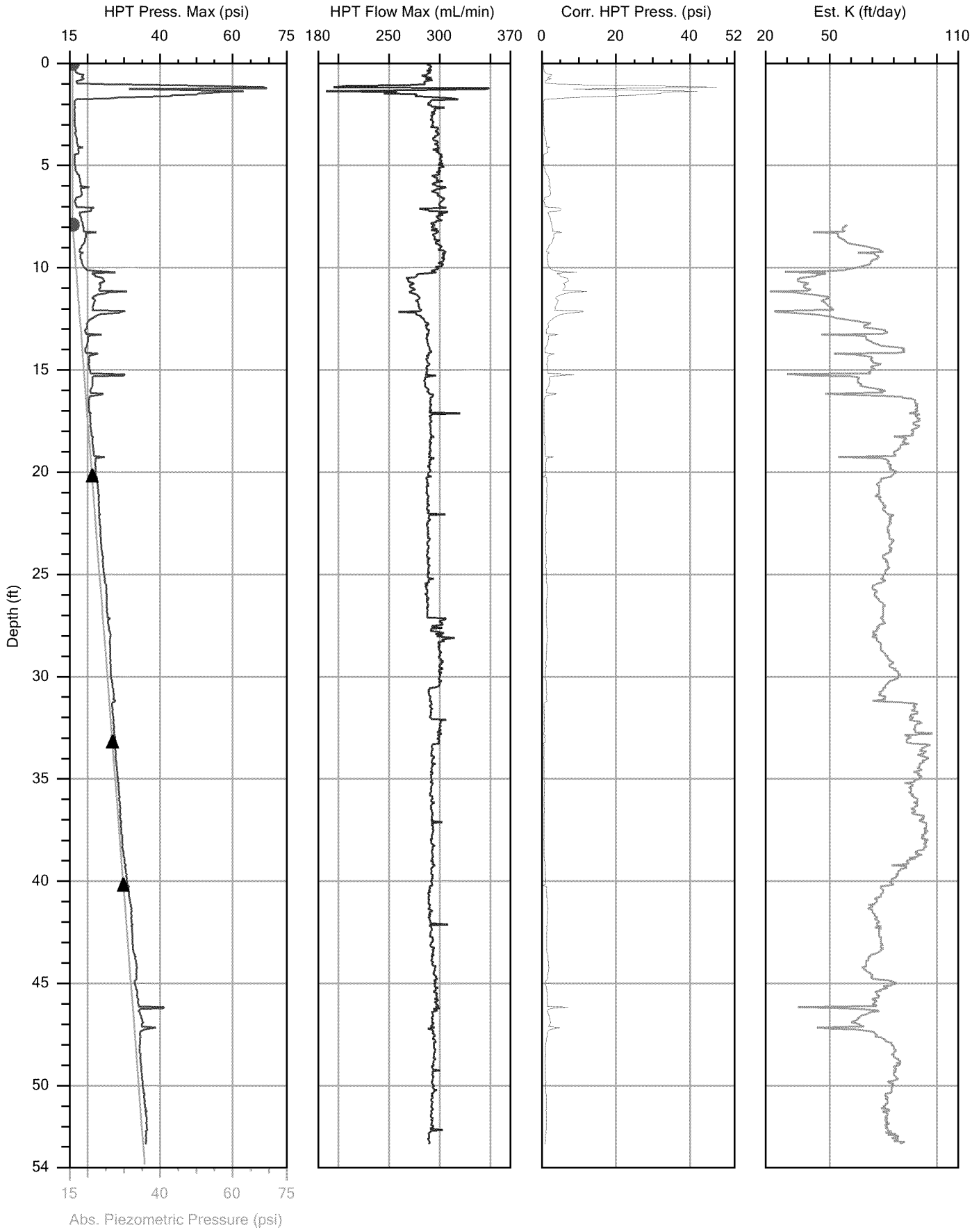
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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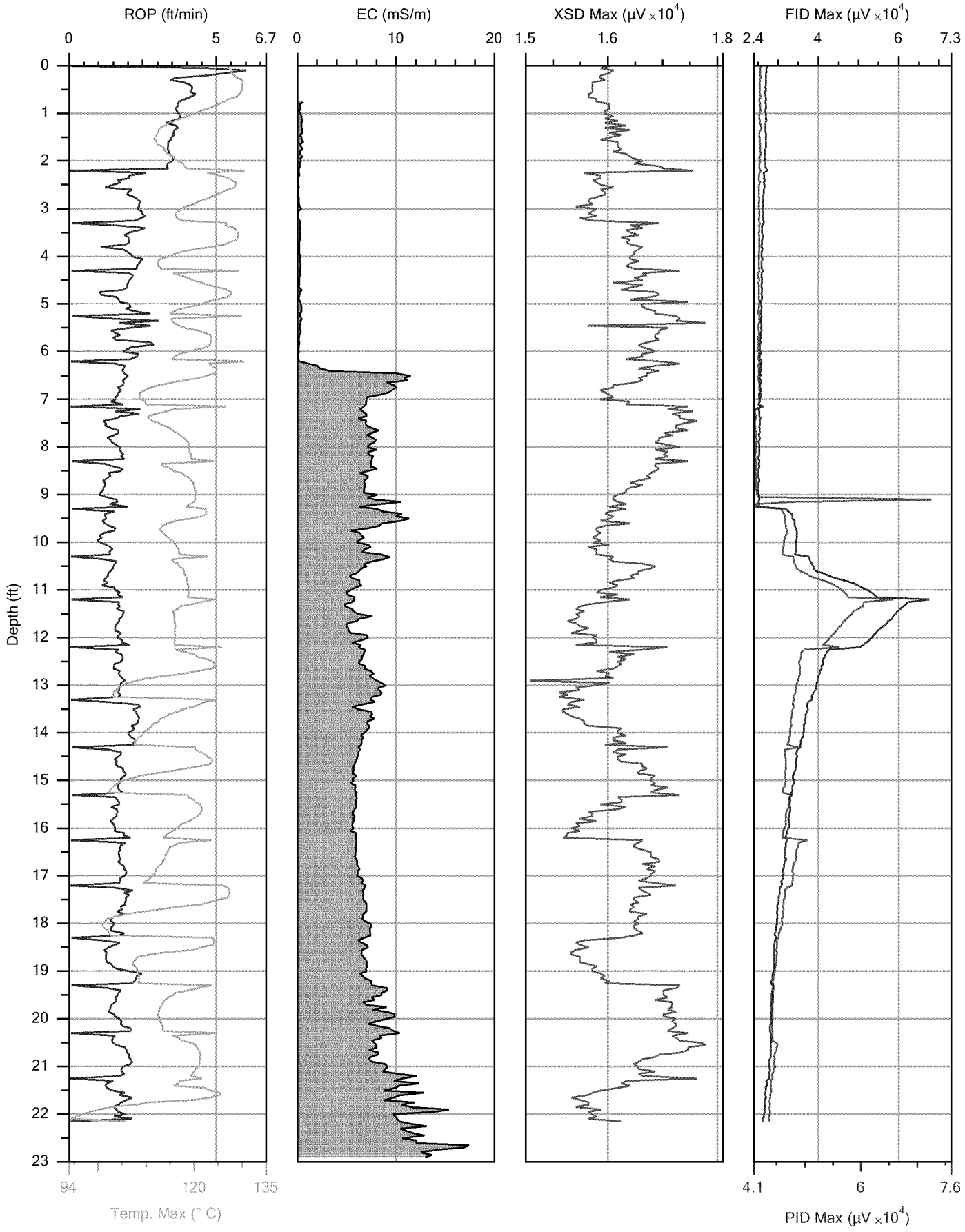
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



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DRILLING | TECHNICAL SERVICES

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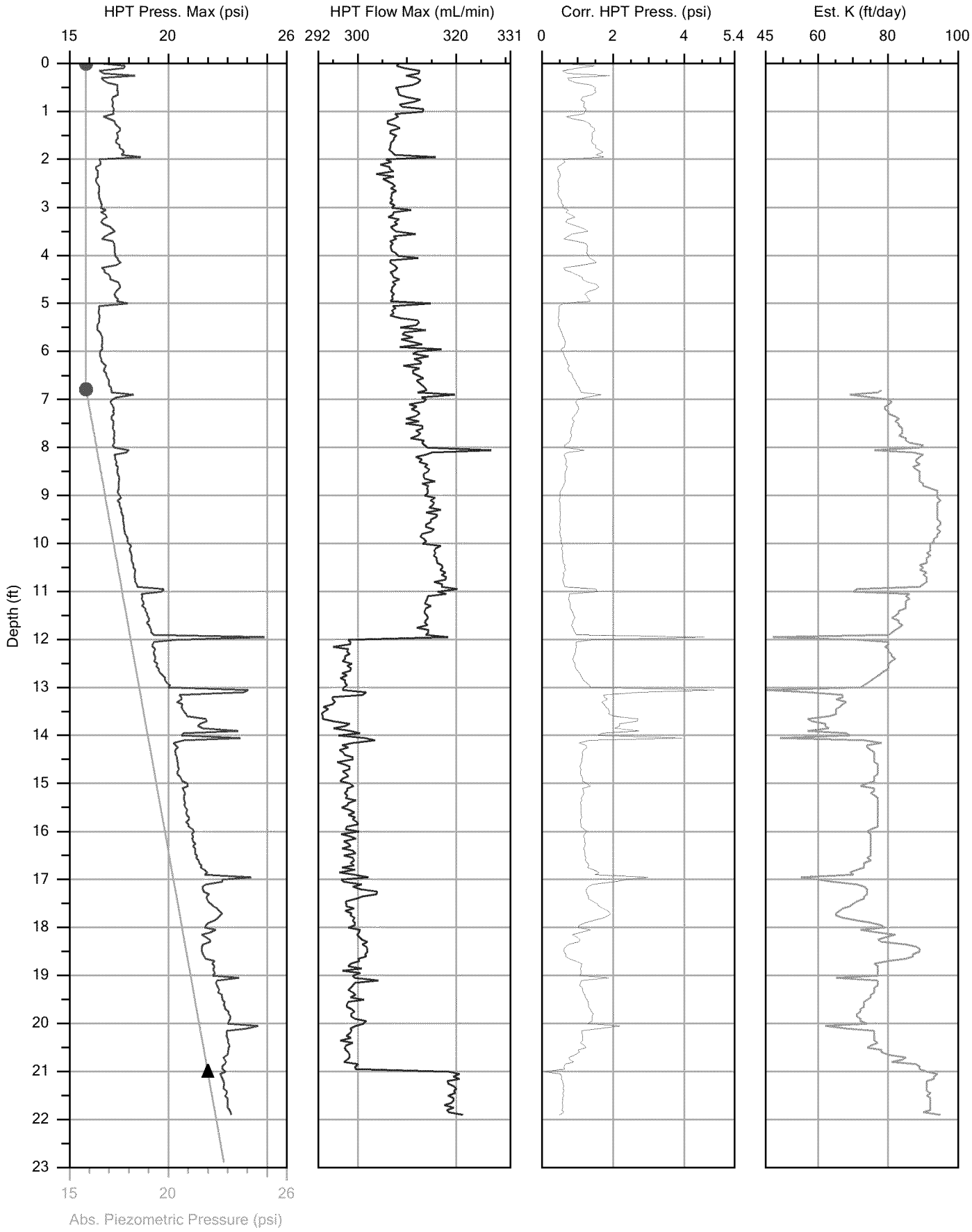
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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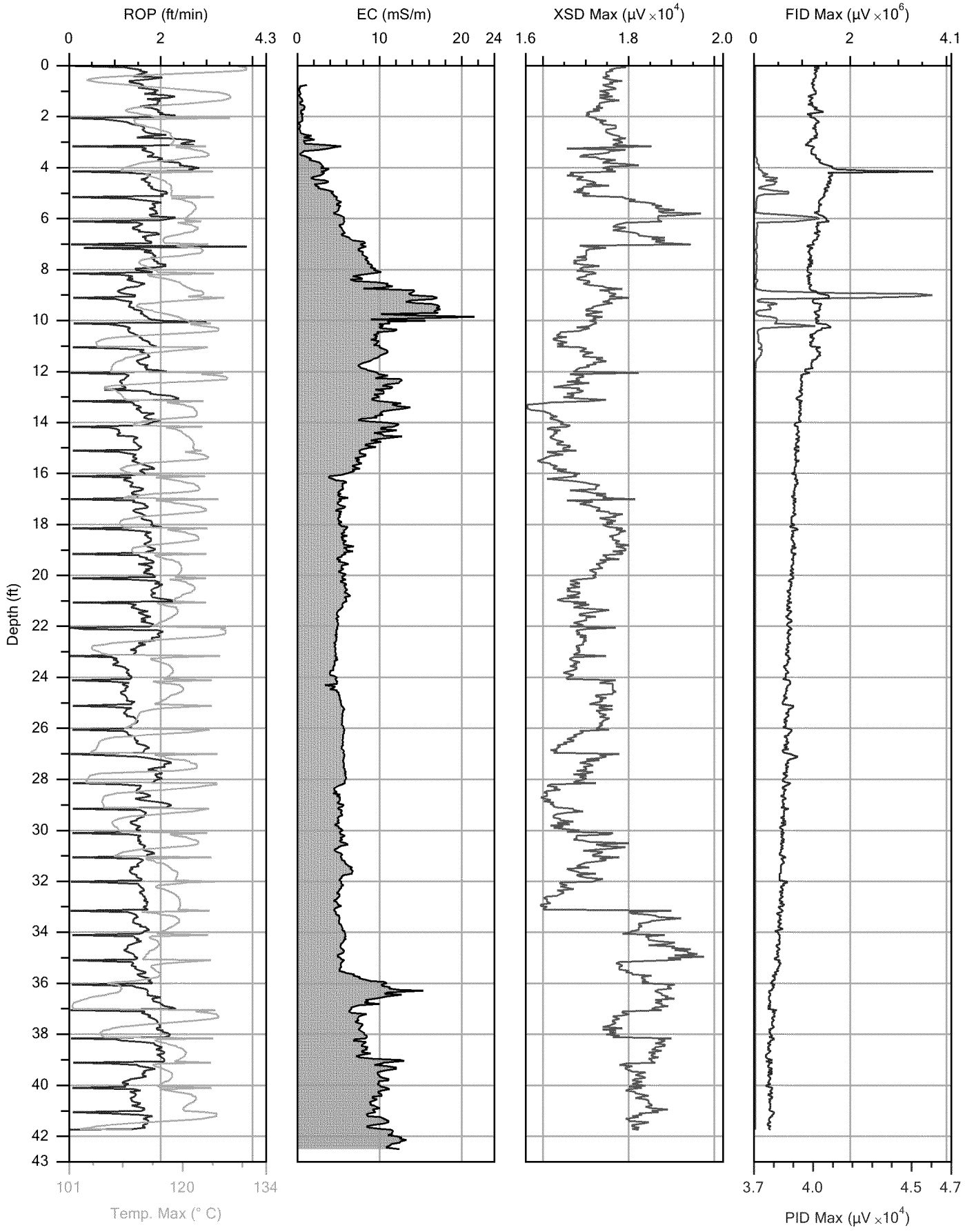
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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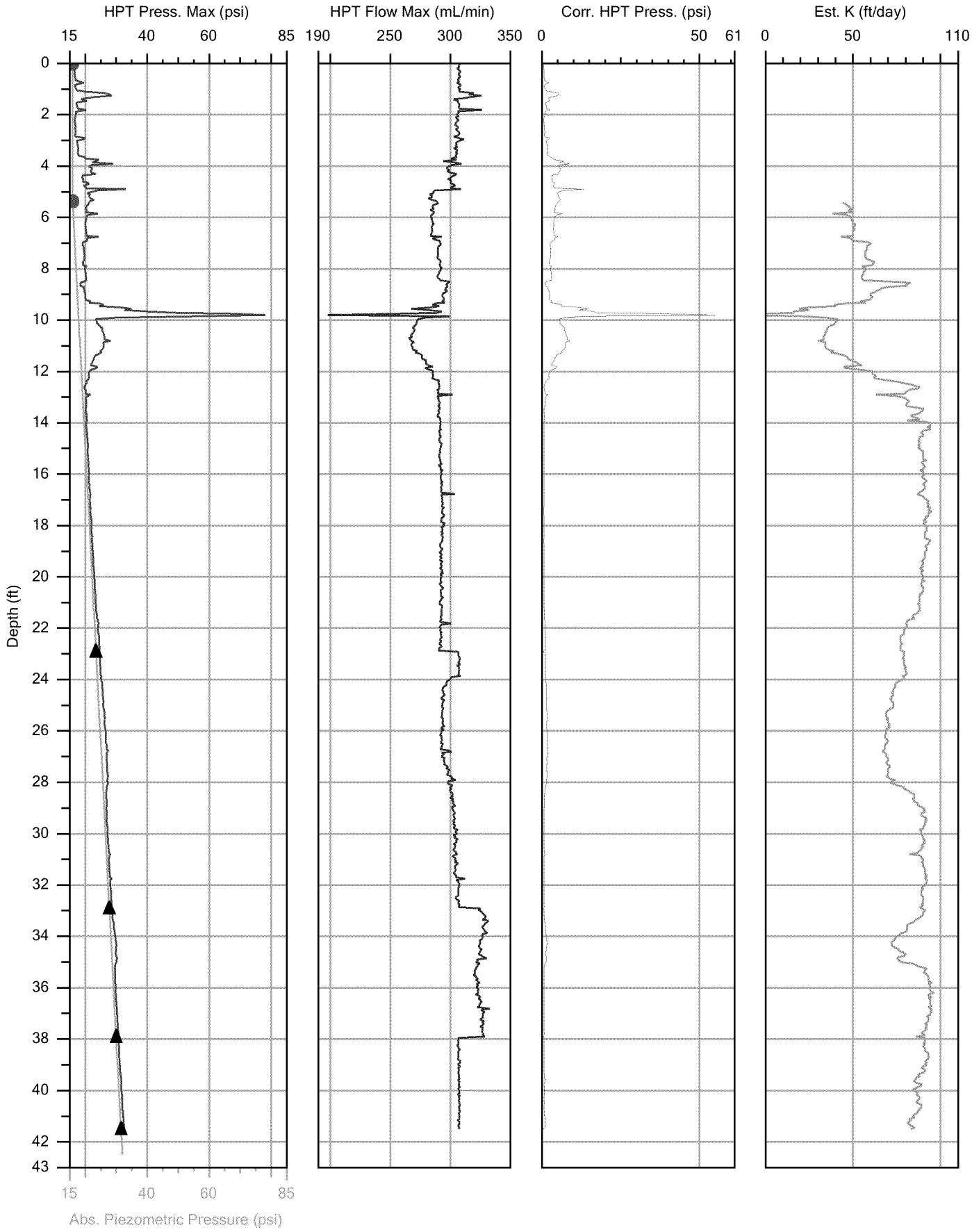
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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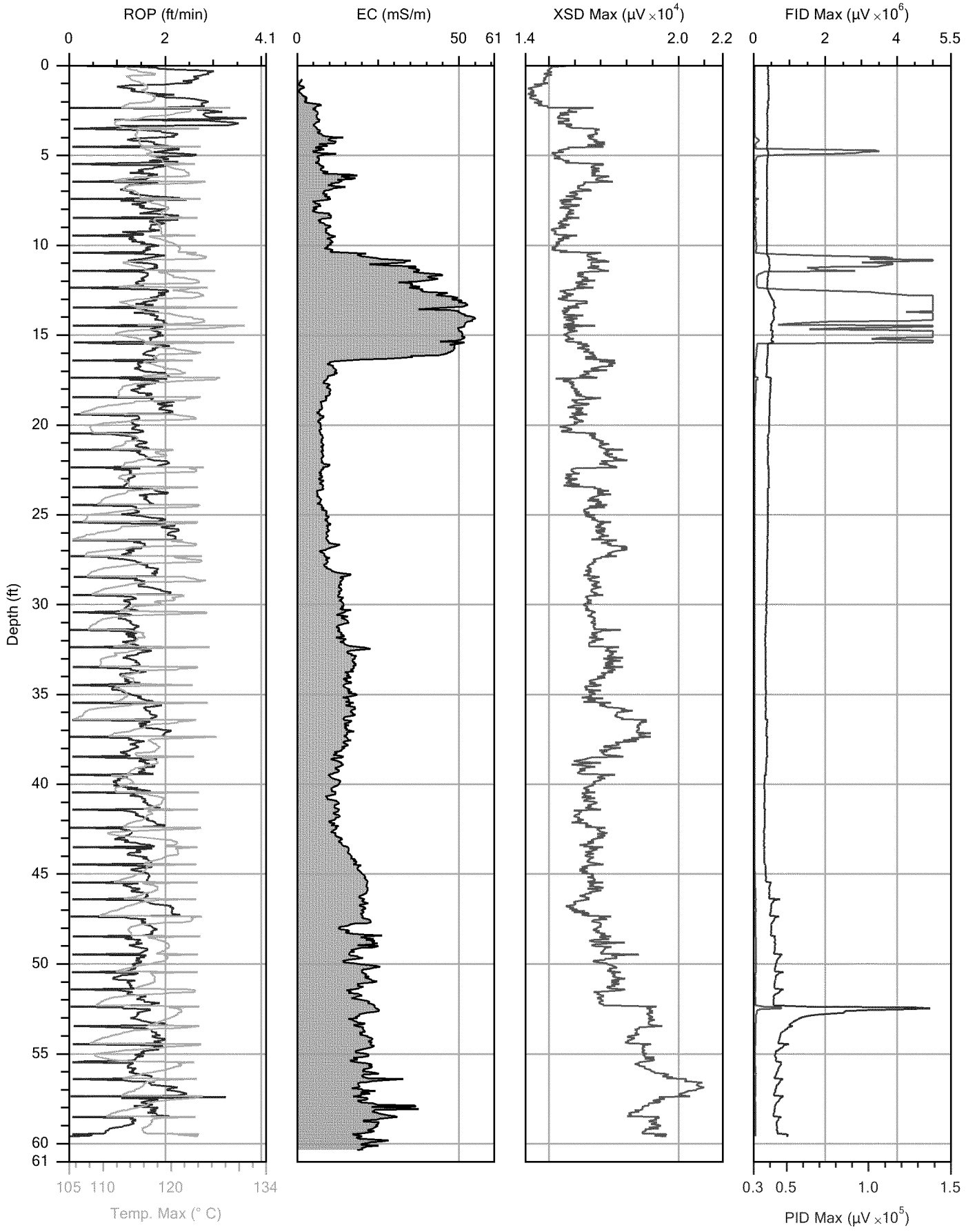
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



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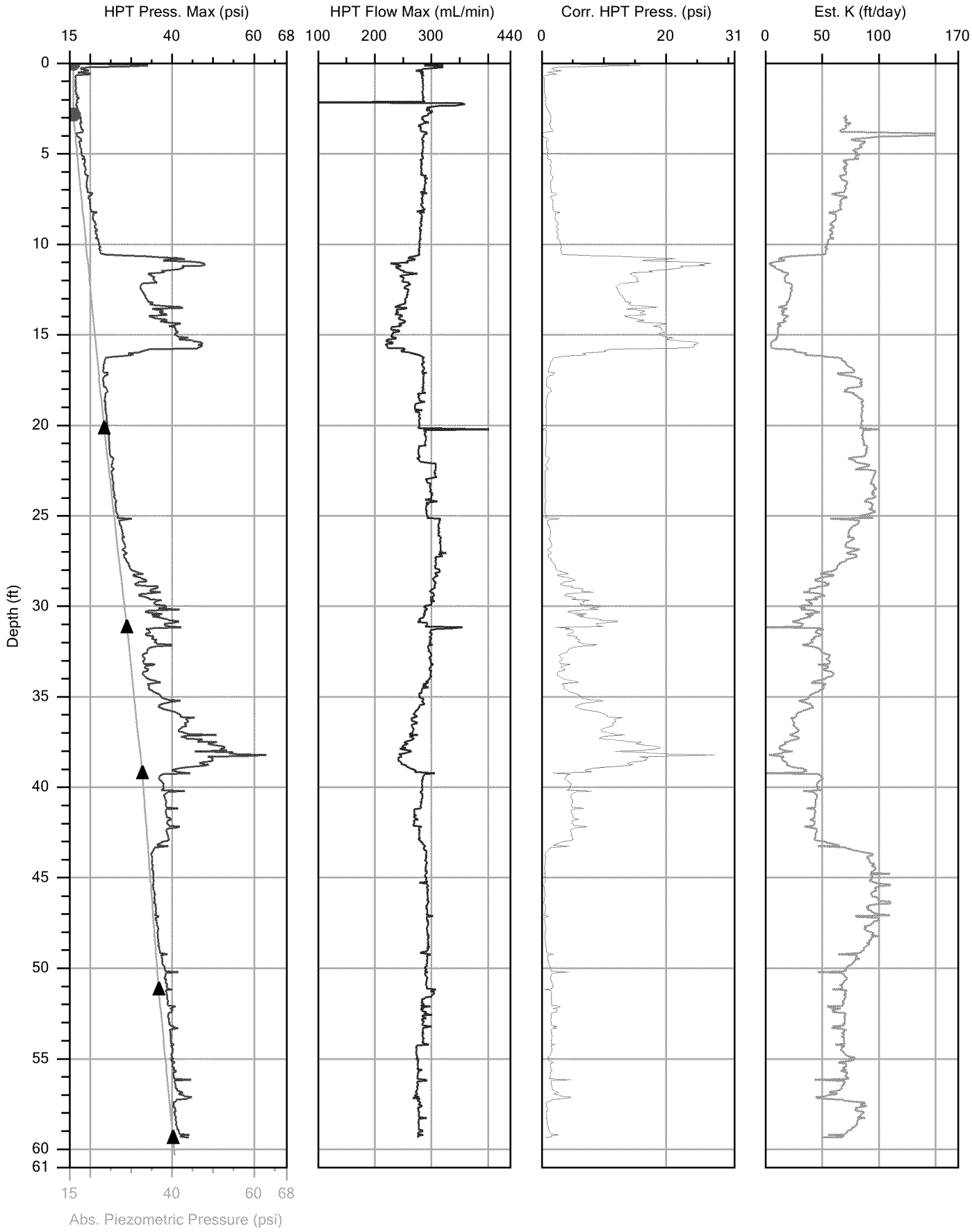
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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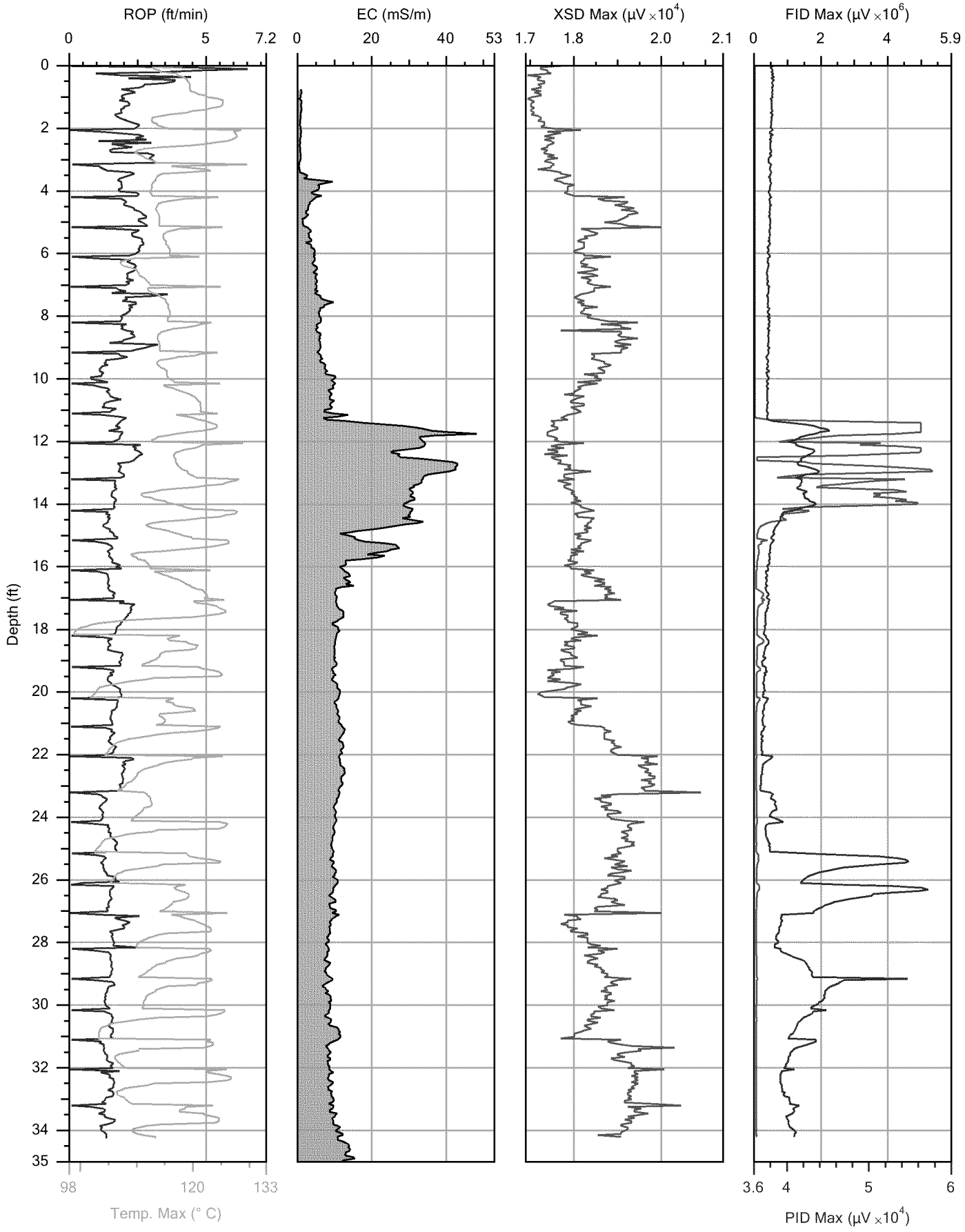
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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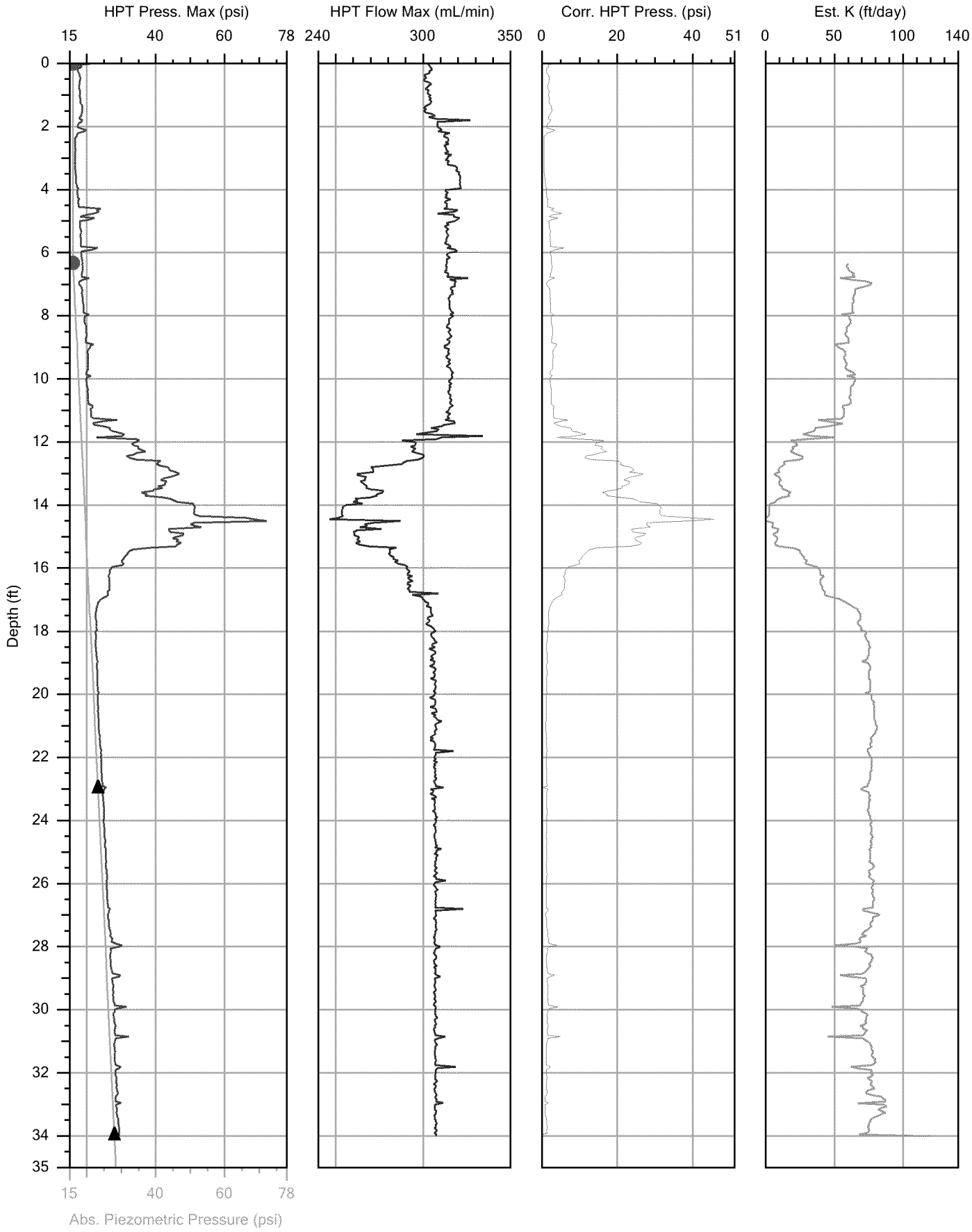
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



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DRILLING | TECHNICAL SERVICES

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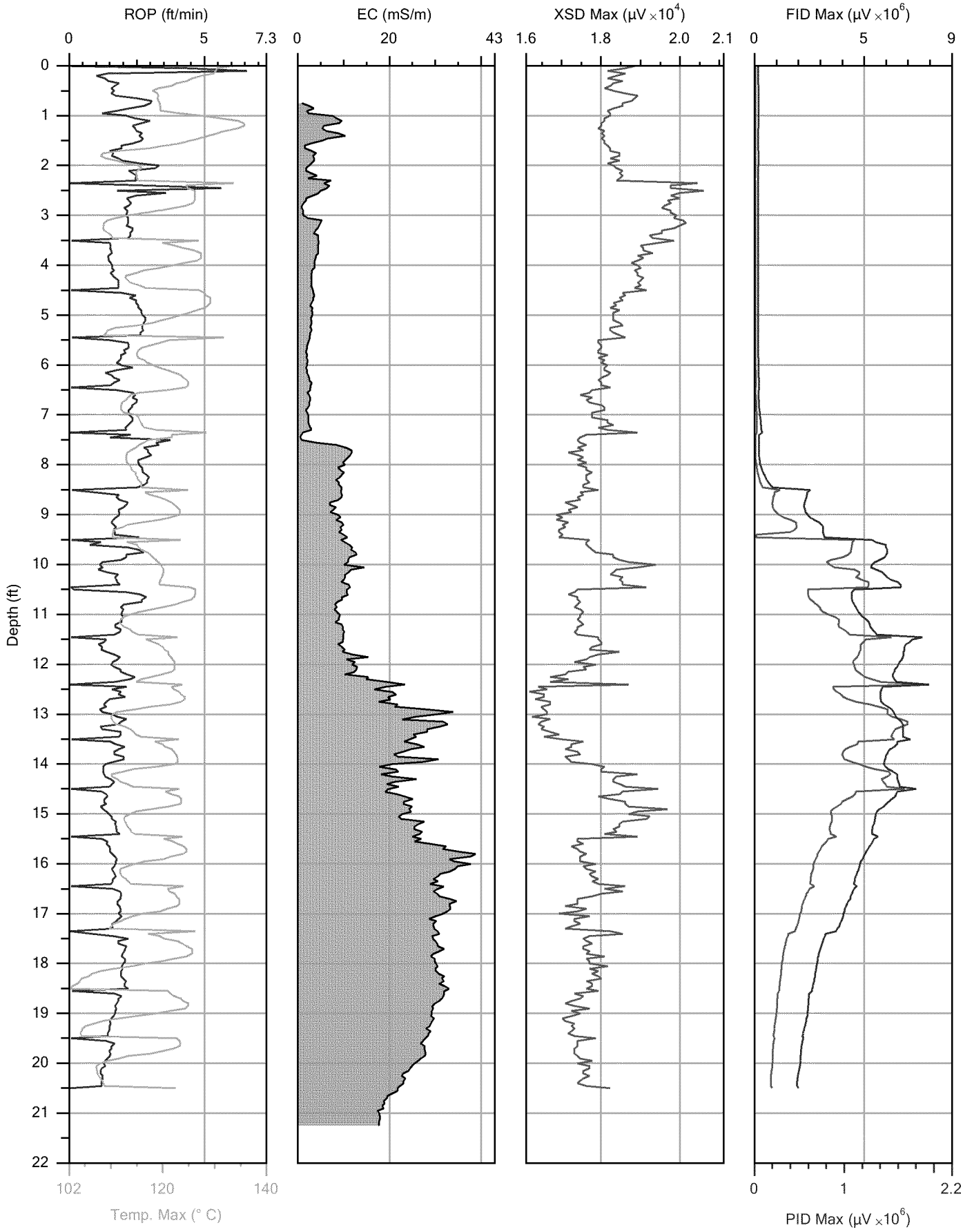
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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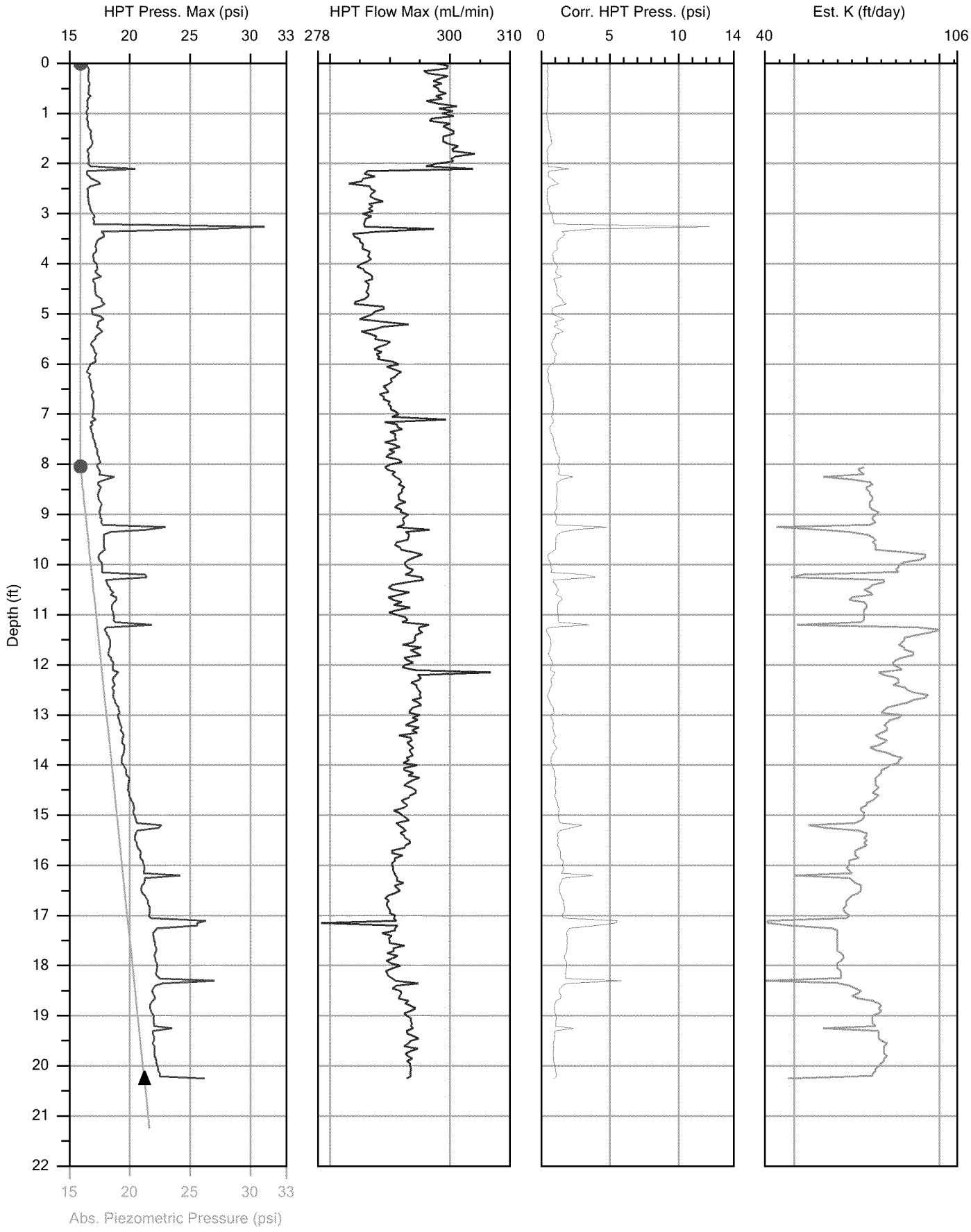
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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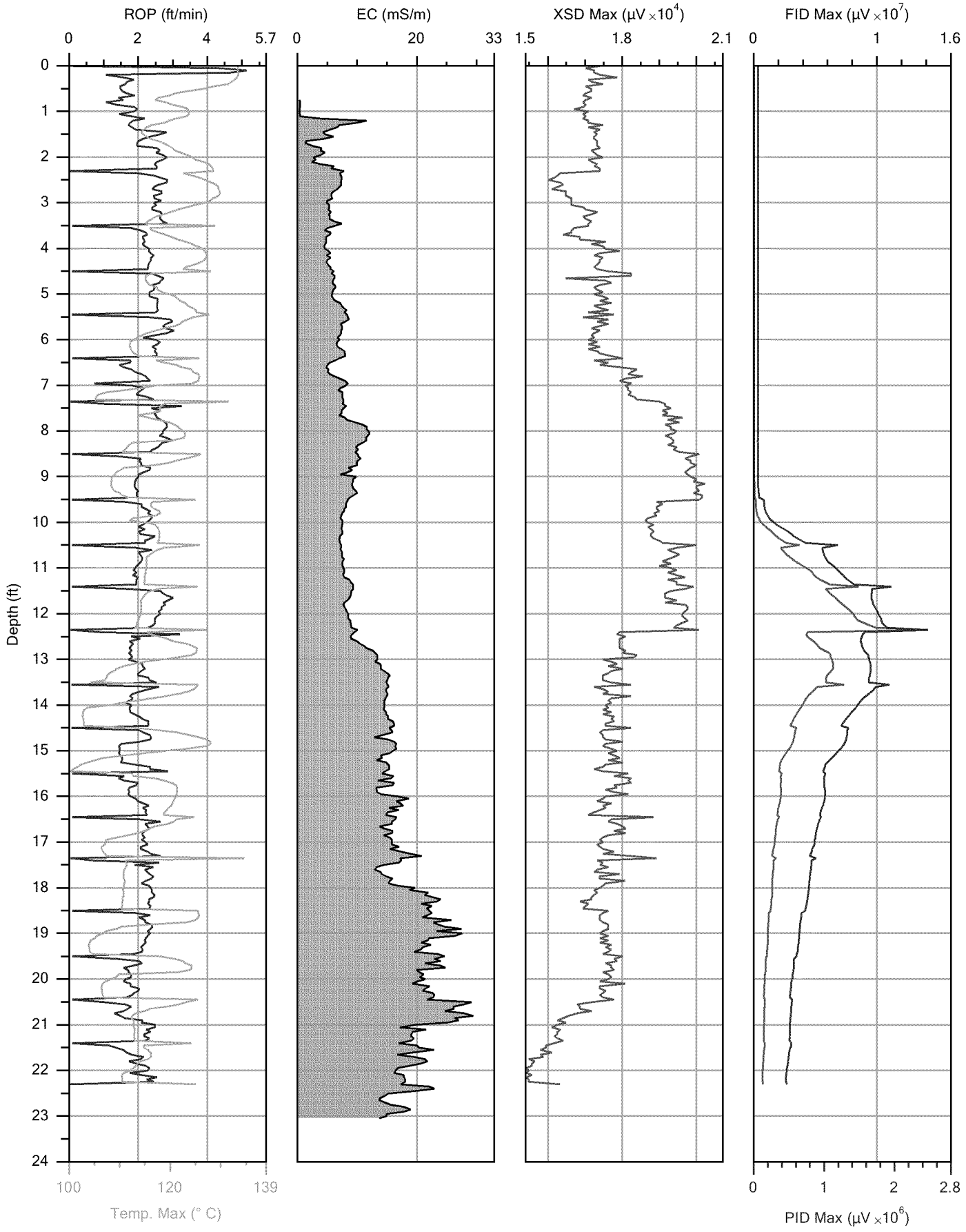
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



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DRILLING | TECHNICAL SERVICES

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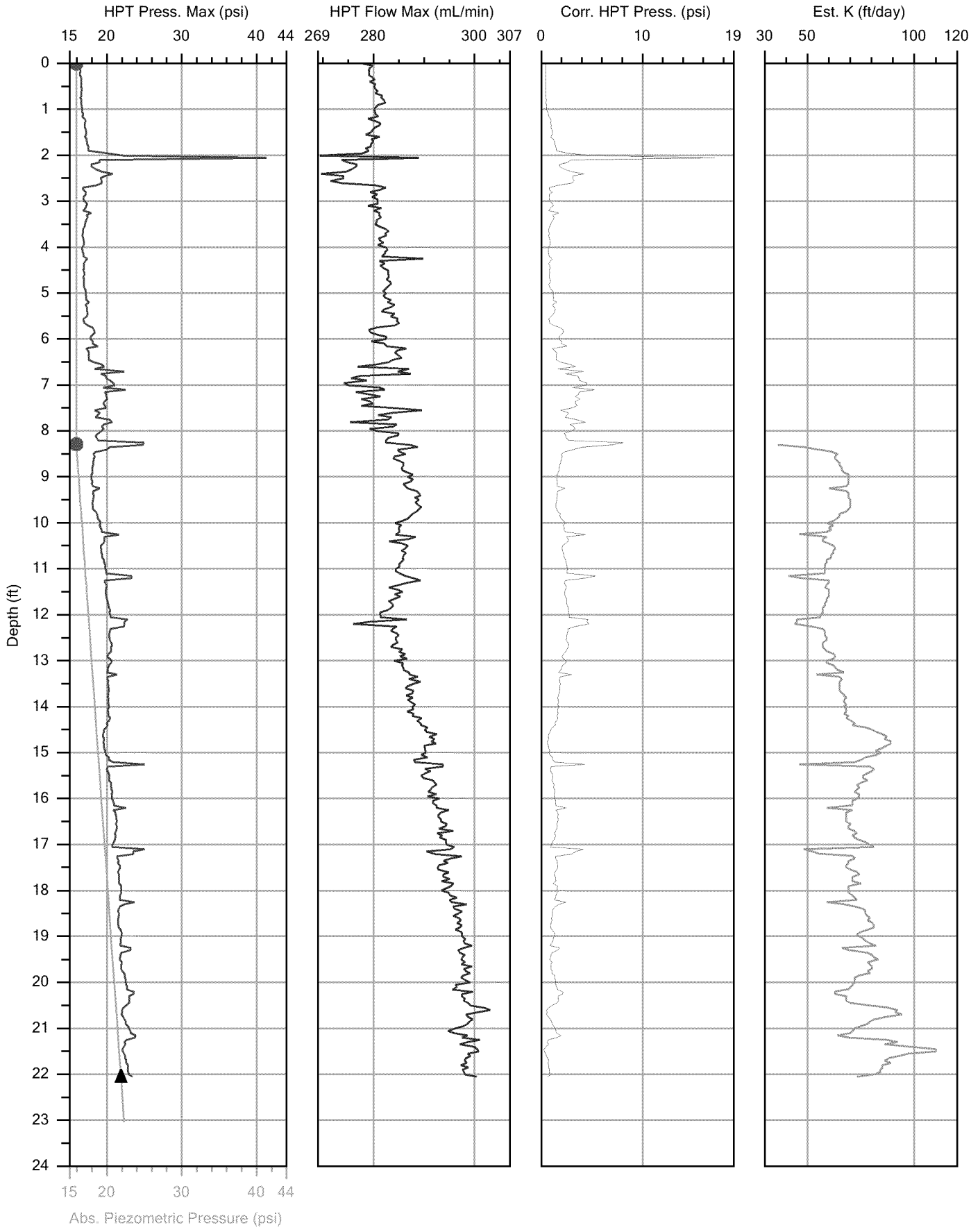
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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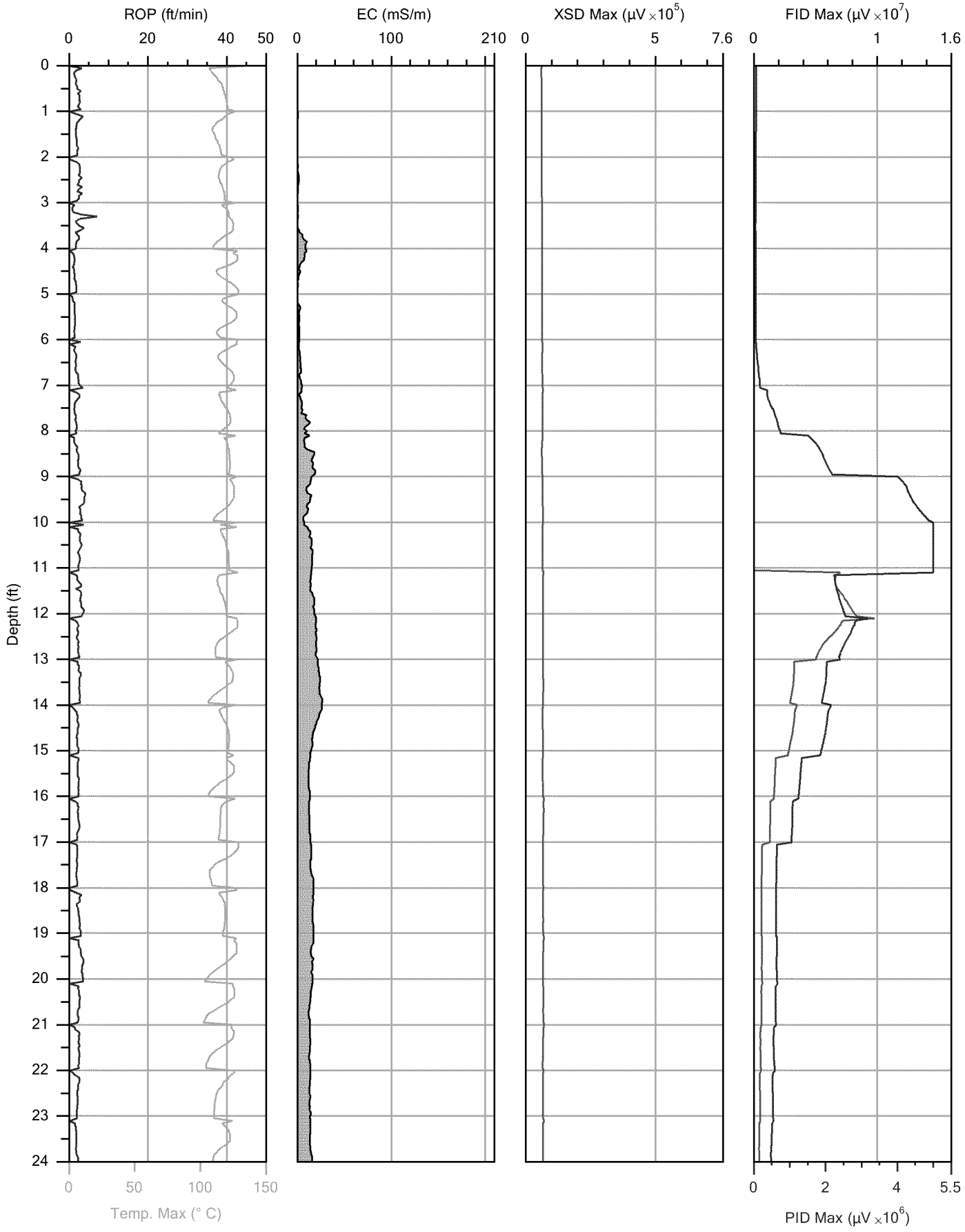
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:

MiHPT Boring Logs (Common-Scale):

EPA-R5-2017-010506_0005590



CASCADE
DRILLING | TECHNICAL SERVICES

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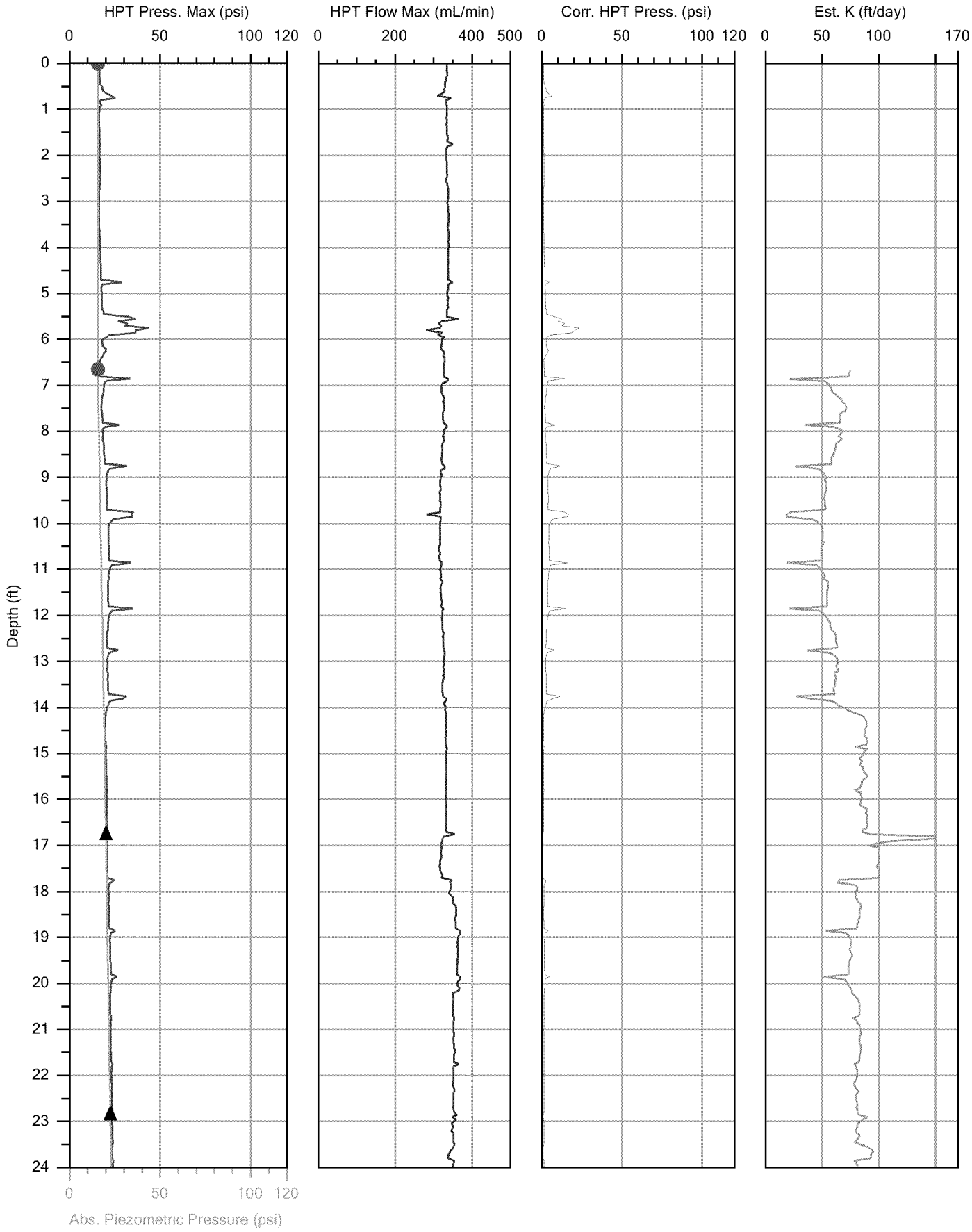
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/11/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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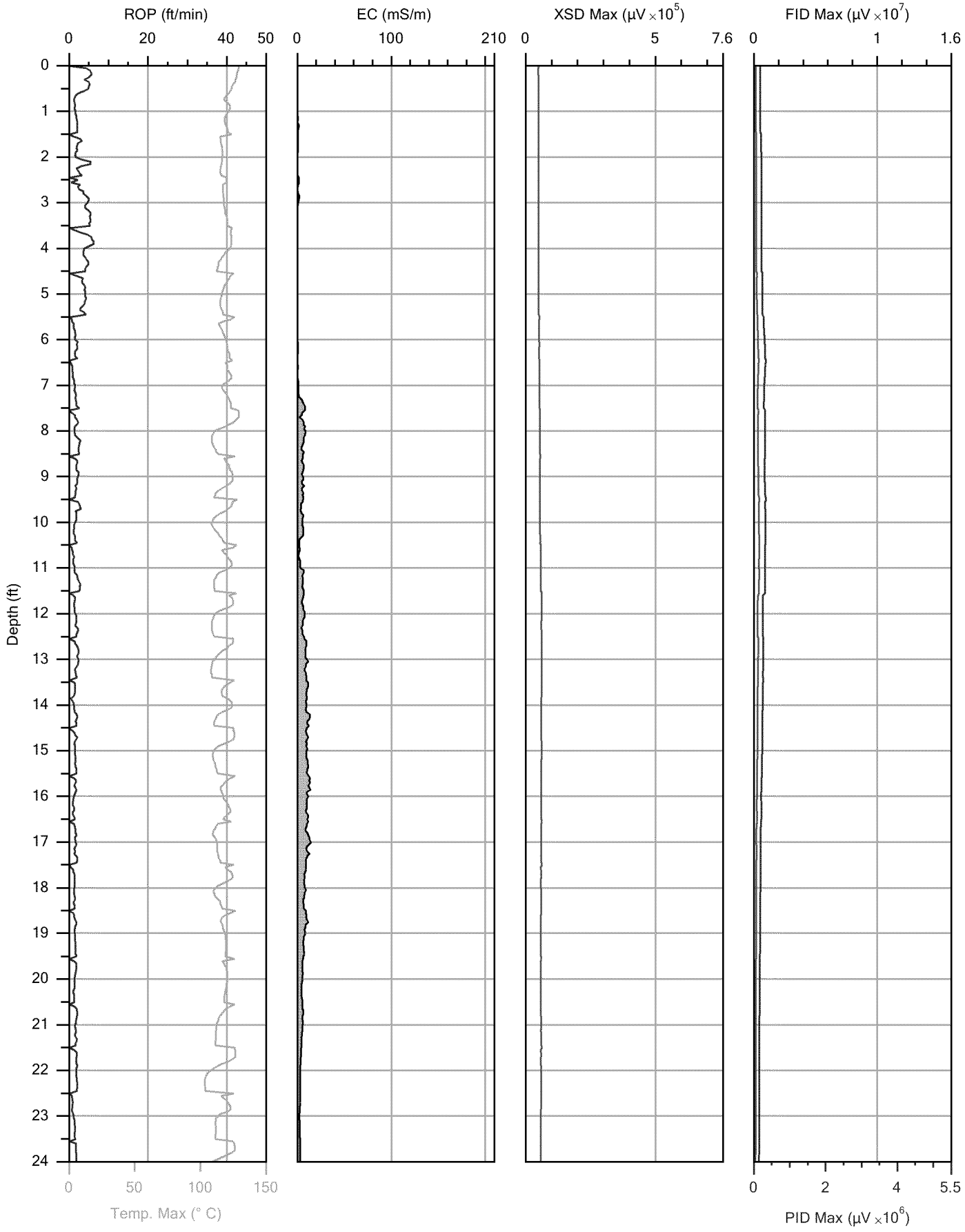
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/11/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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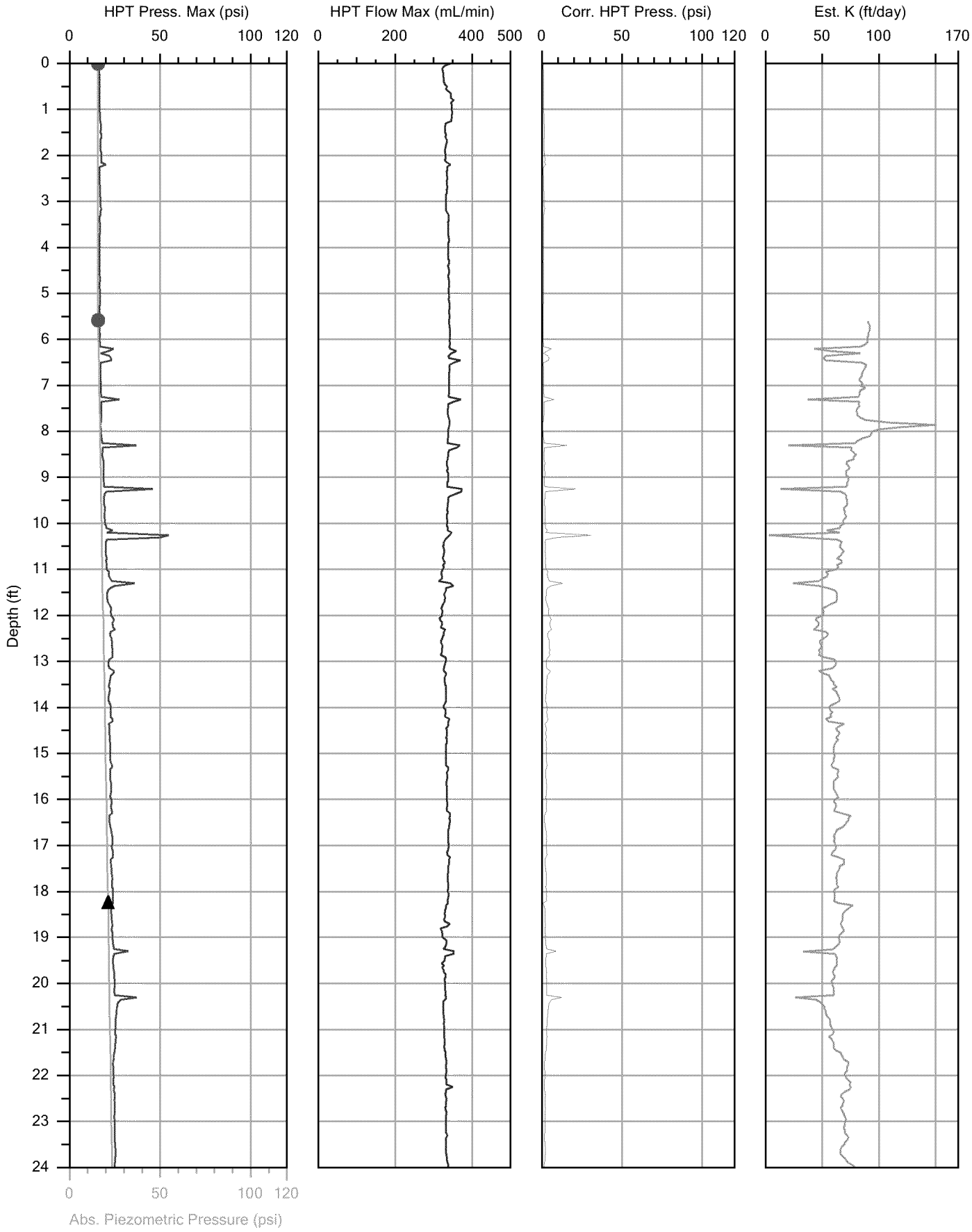
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/11/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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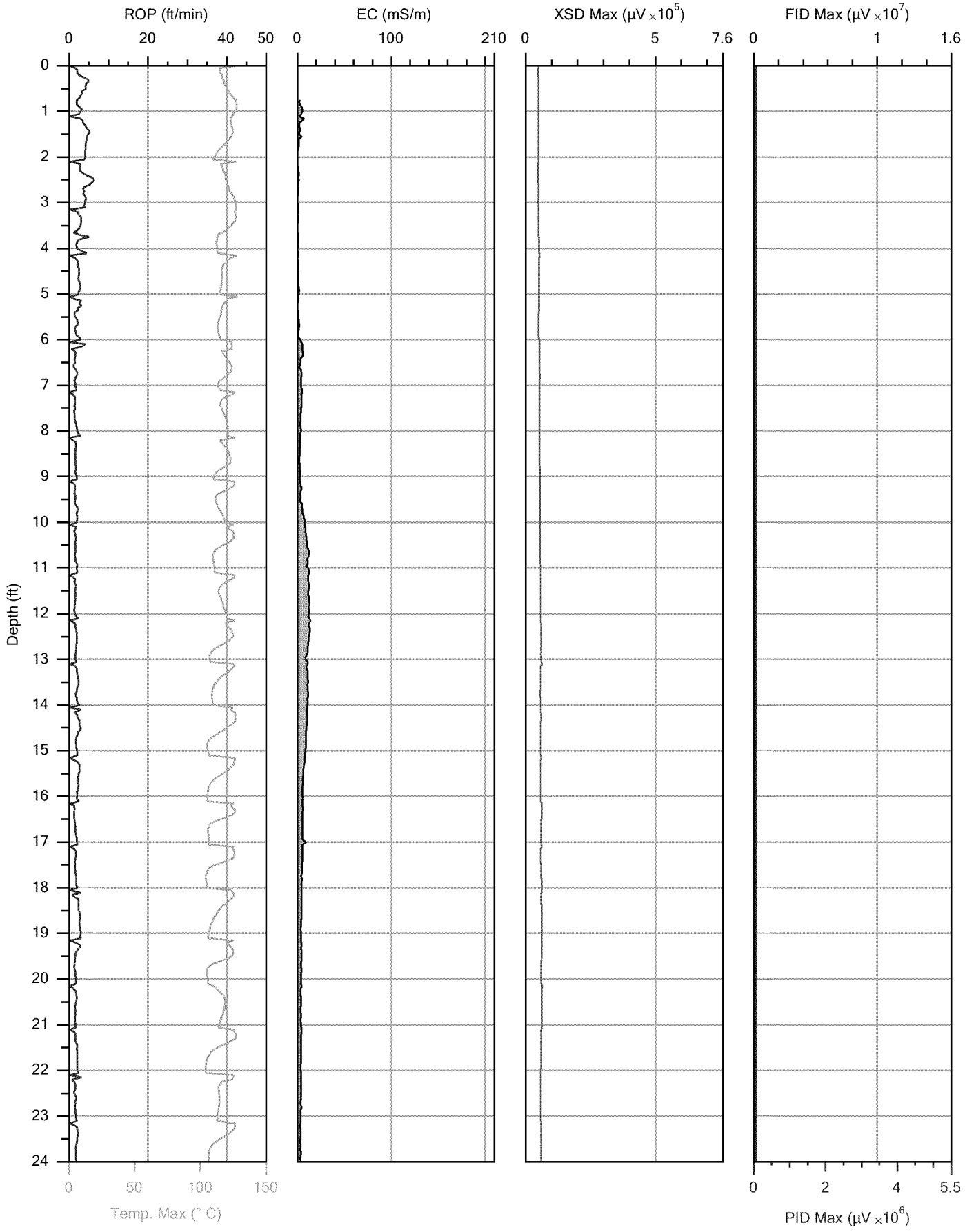
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/11/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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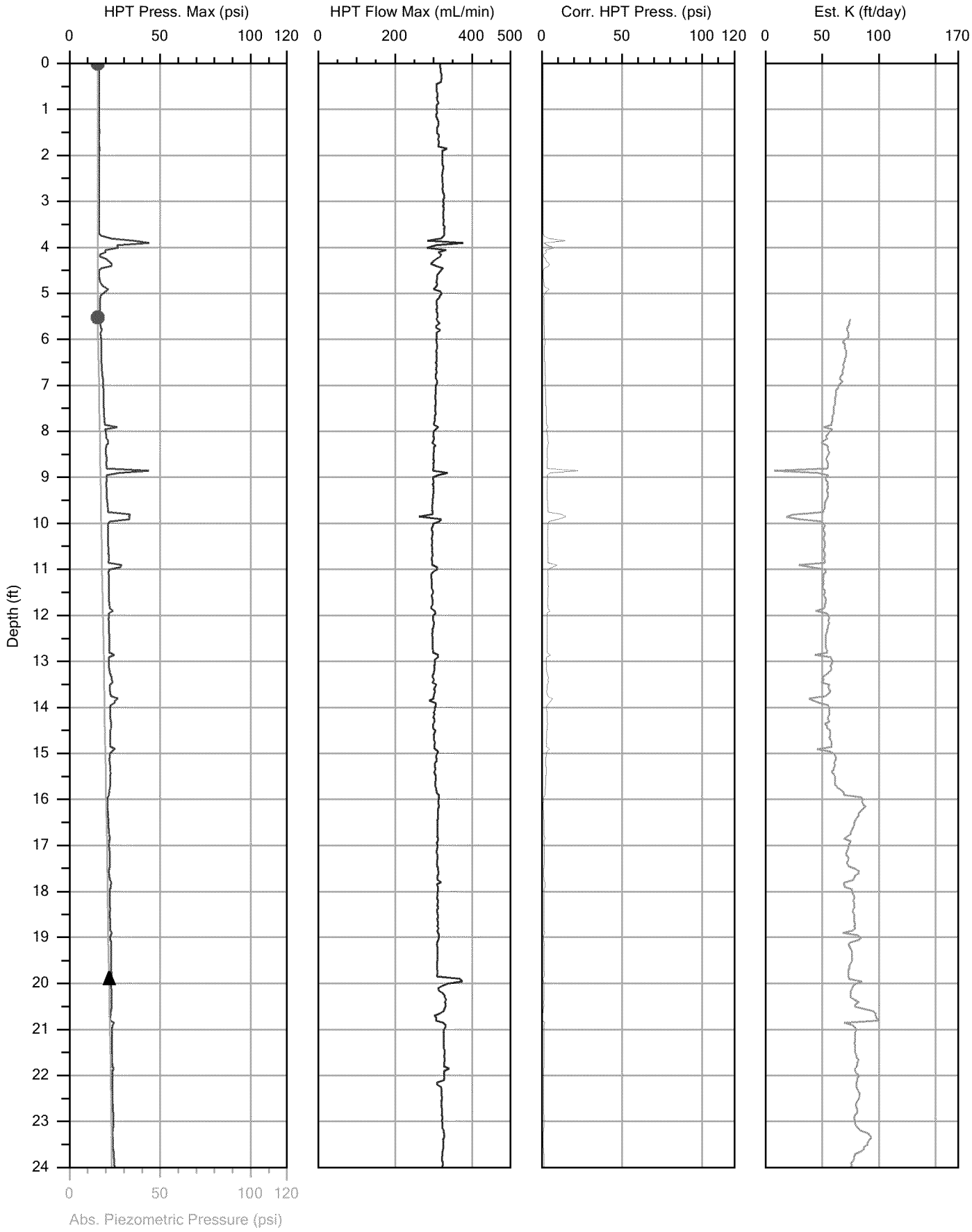
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/11/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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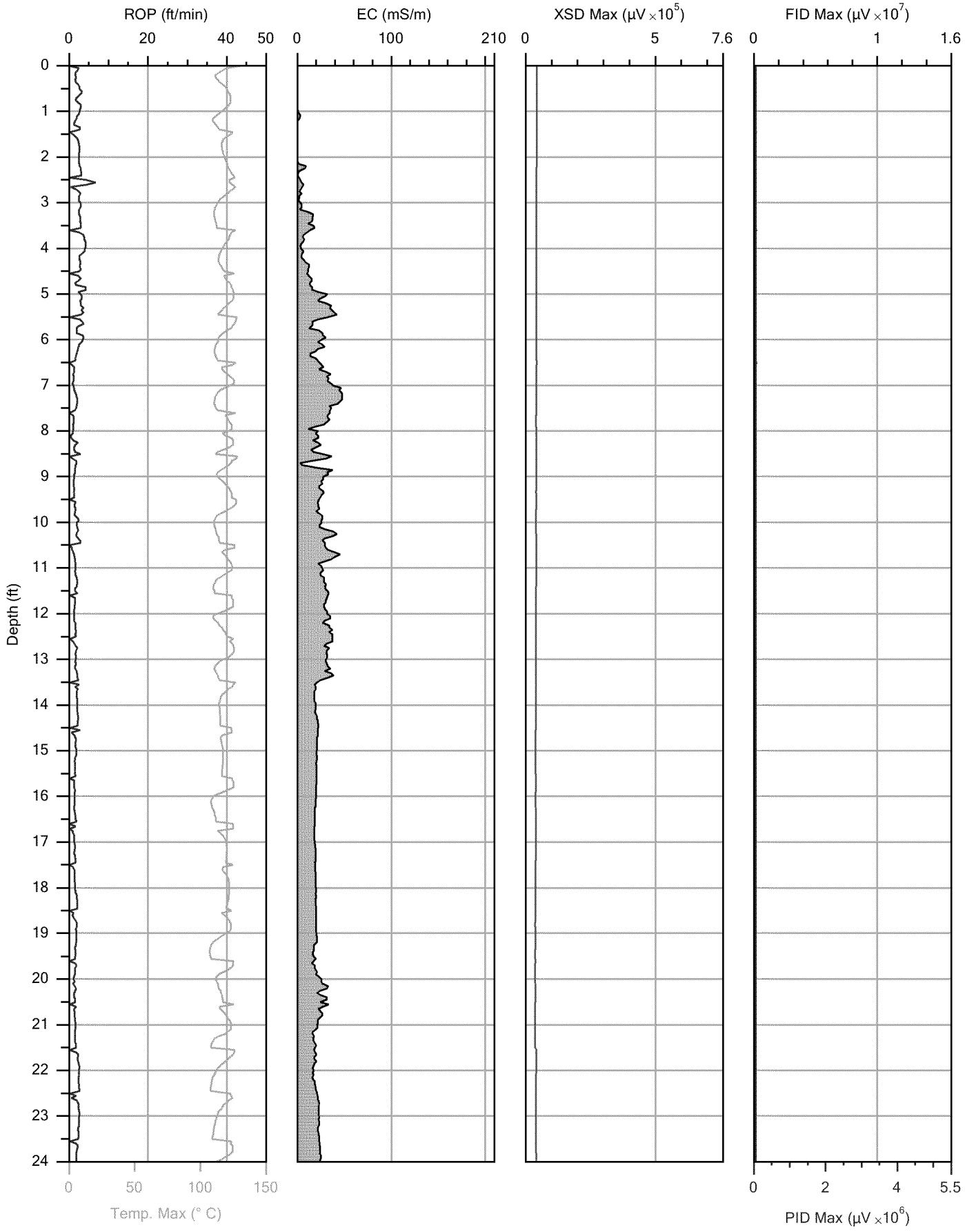
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/11/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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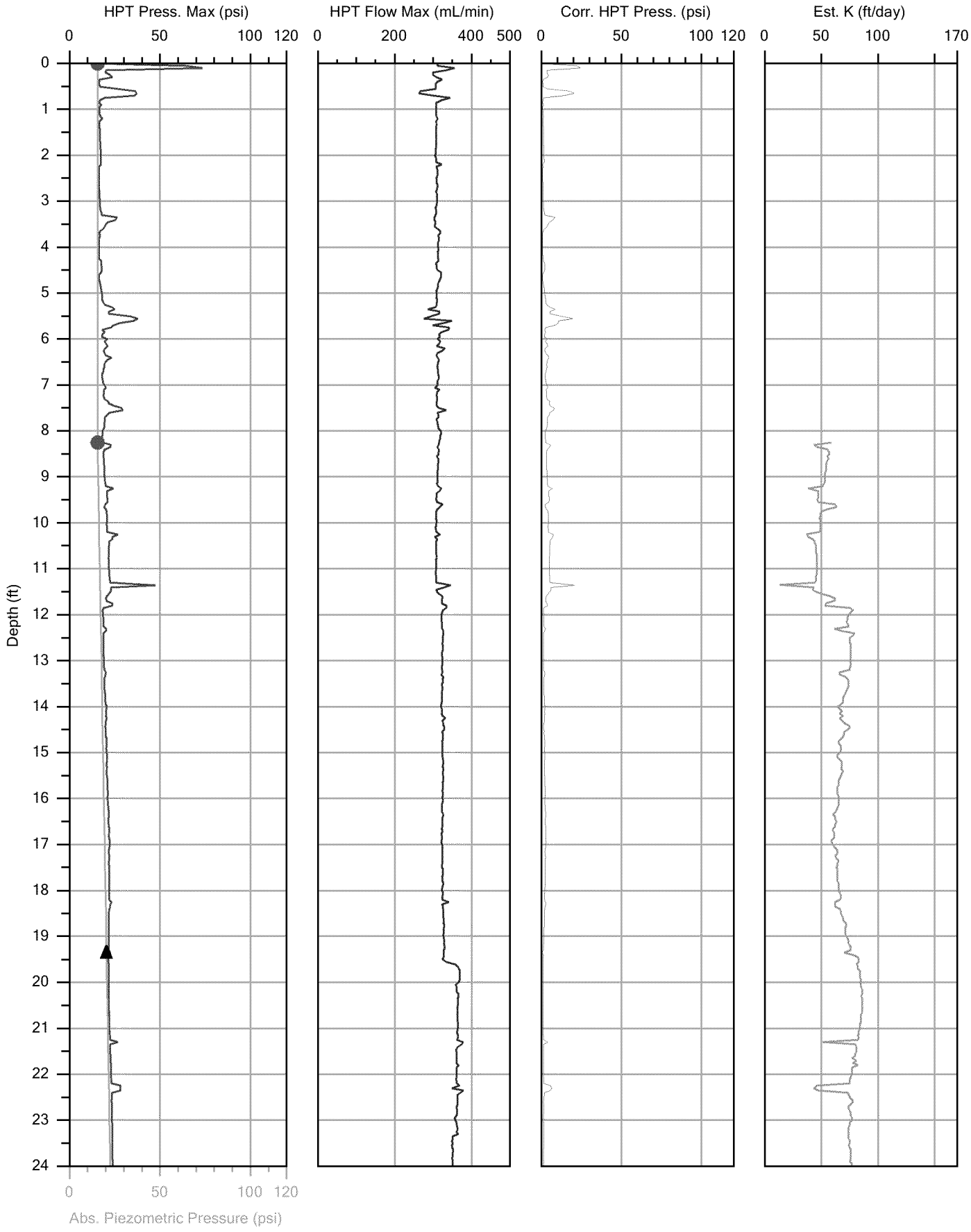
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/12/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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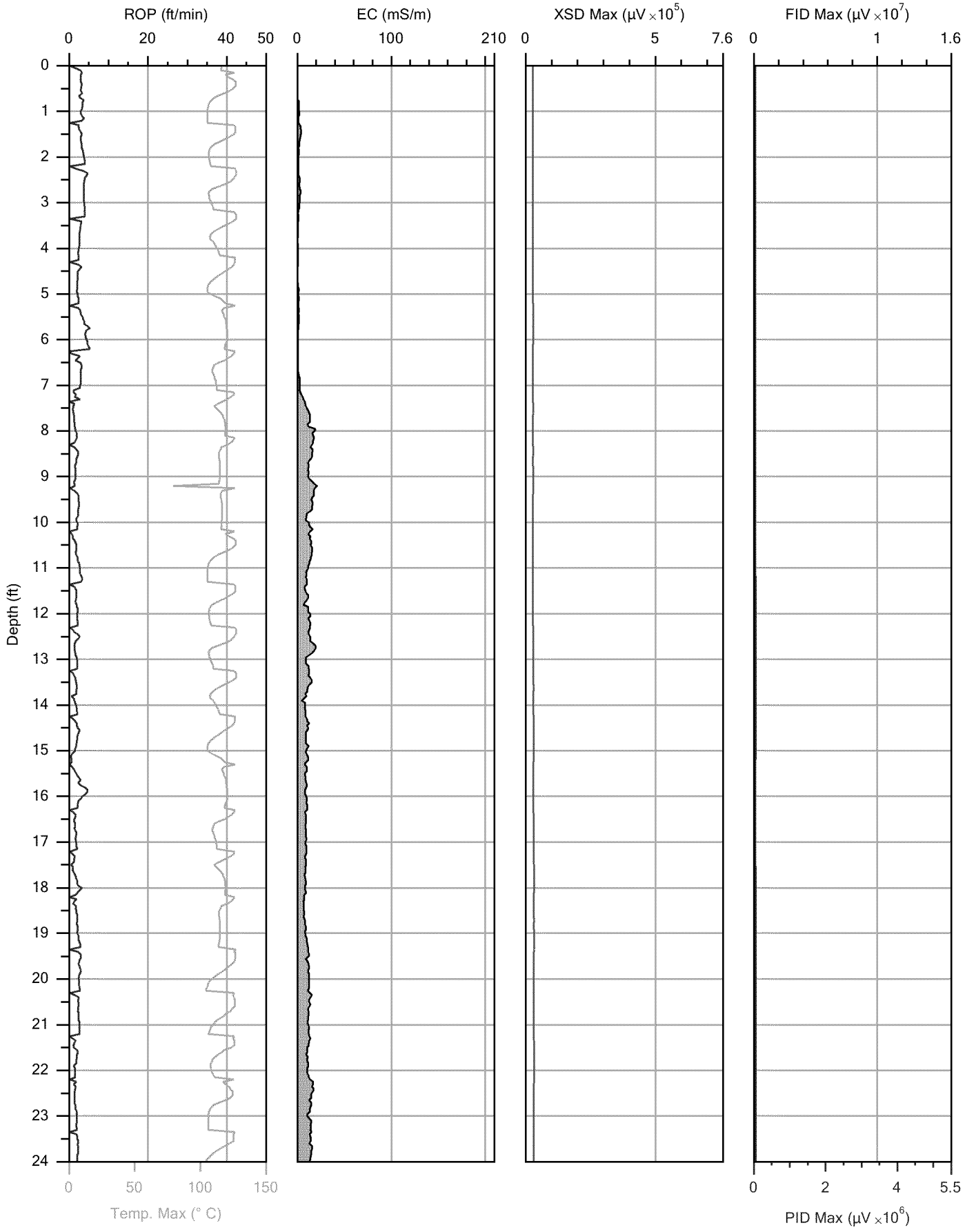
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/12/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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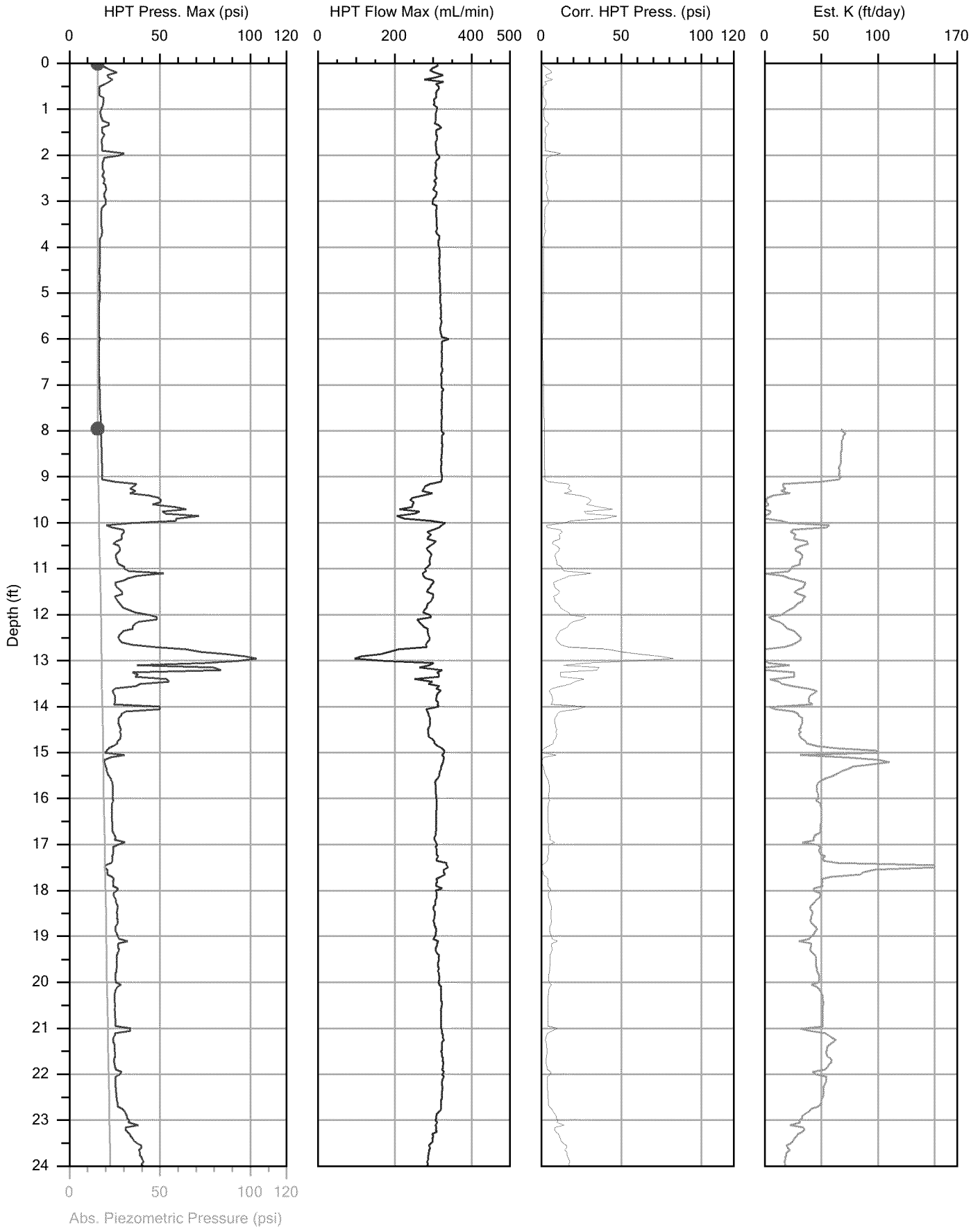
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/12/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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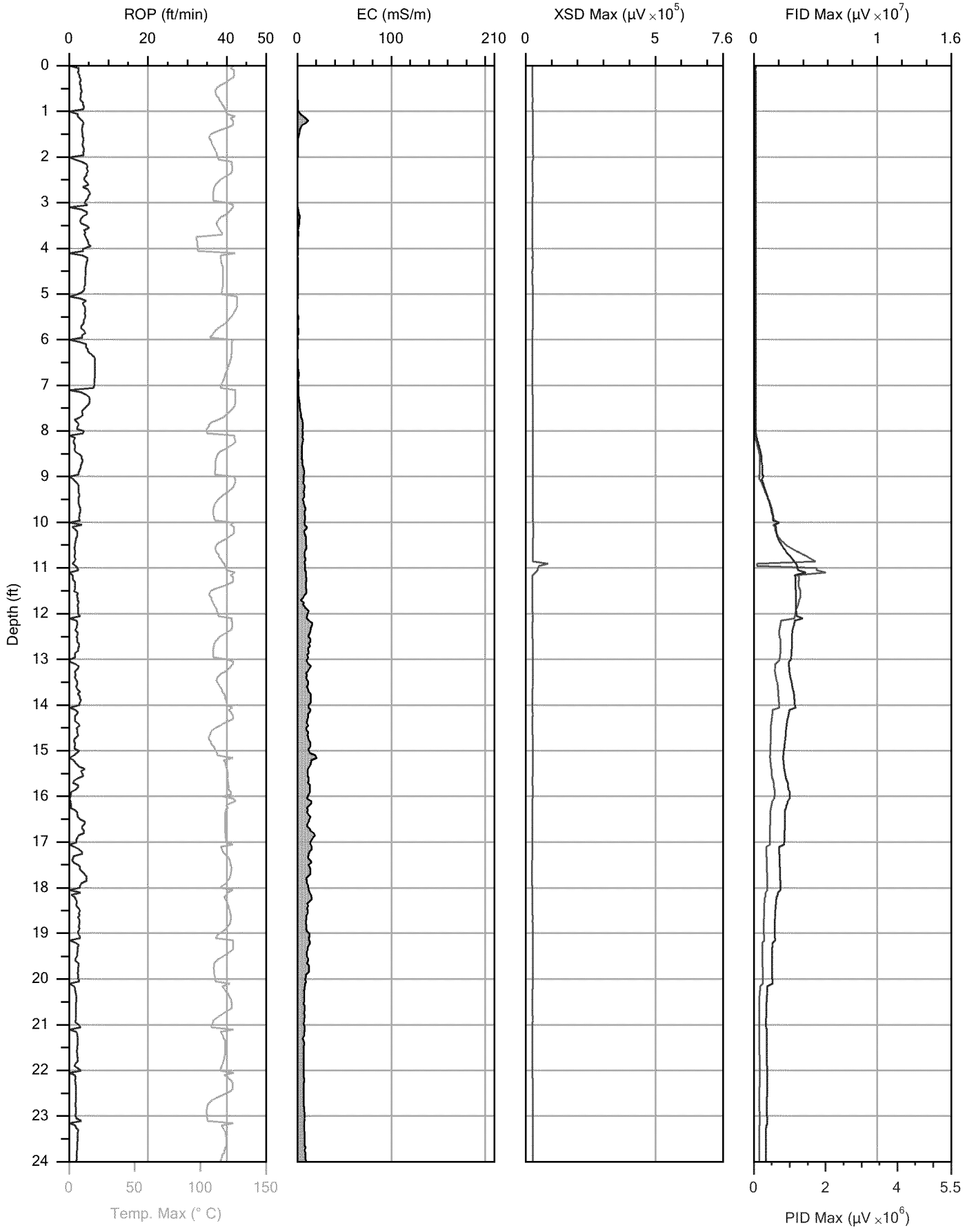
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/12/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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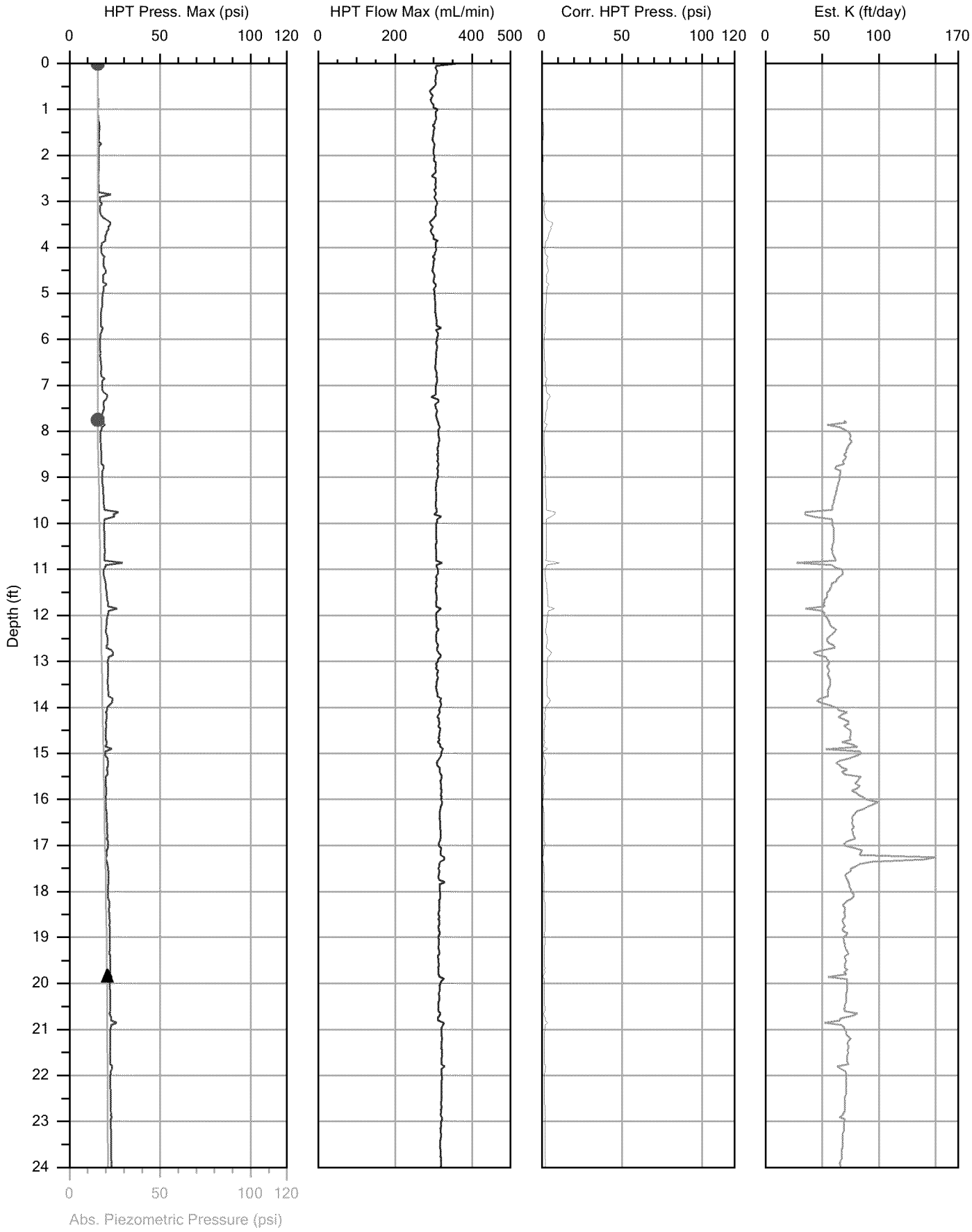
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/12/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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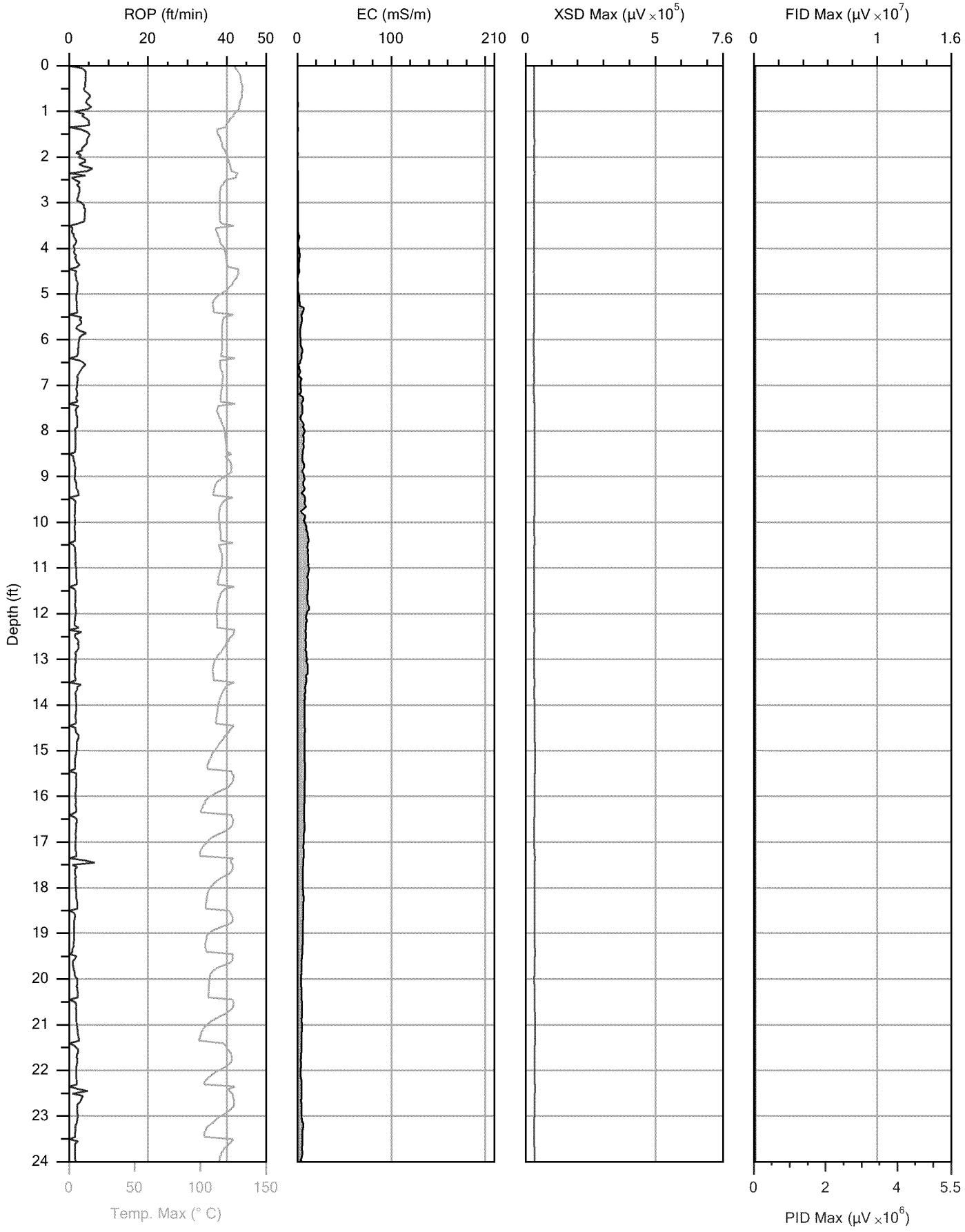
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/12/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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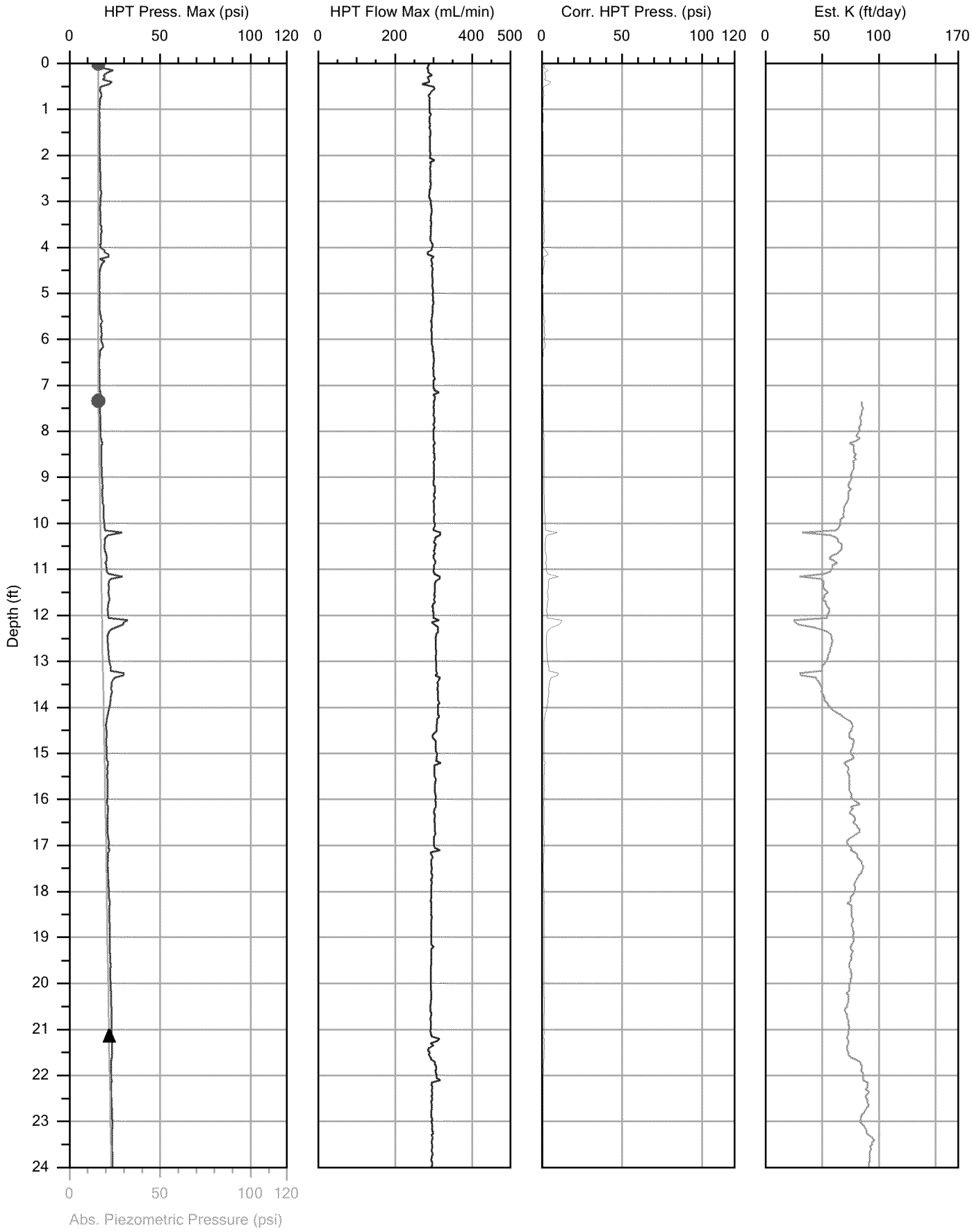
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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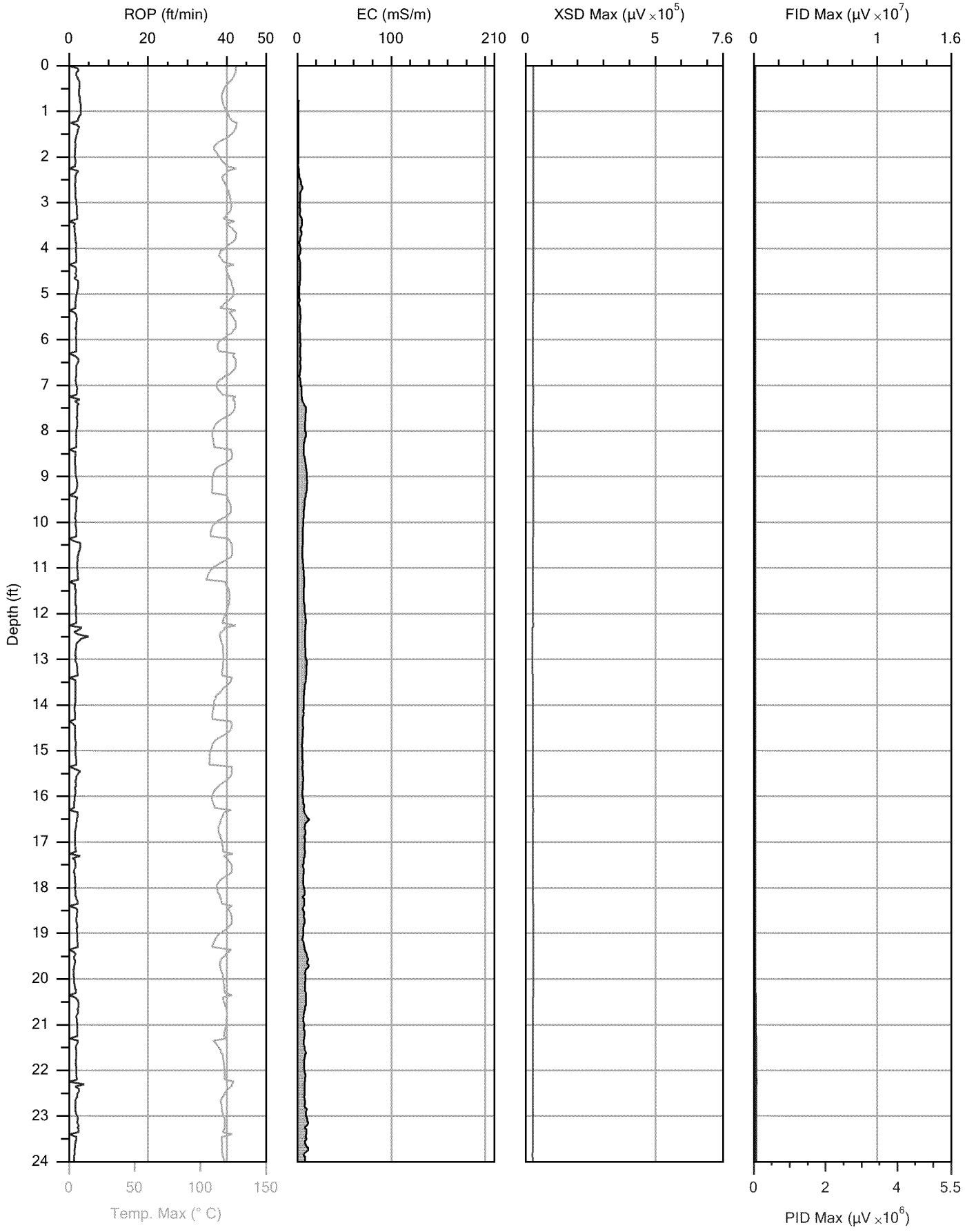
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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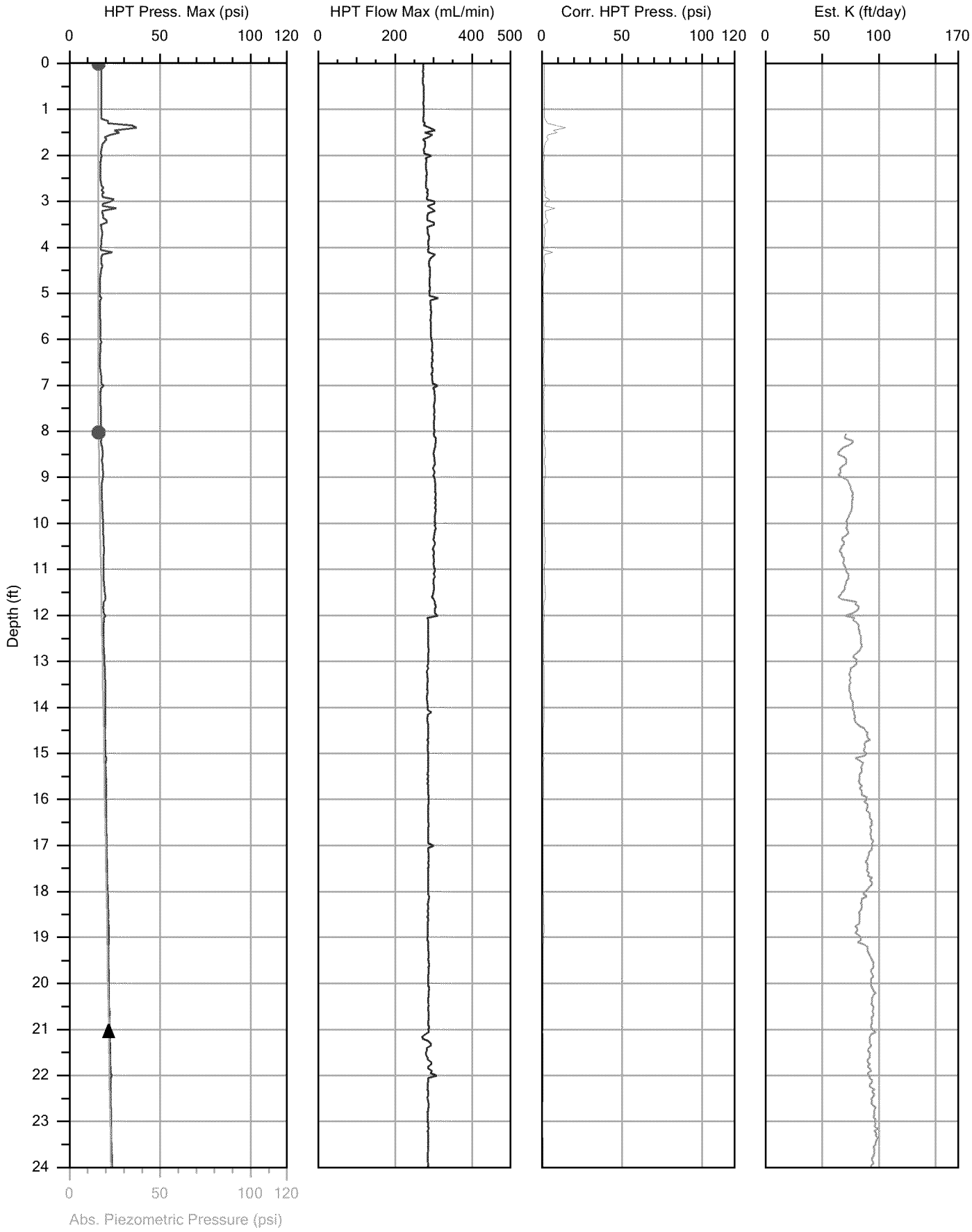
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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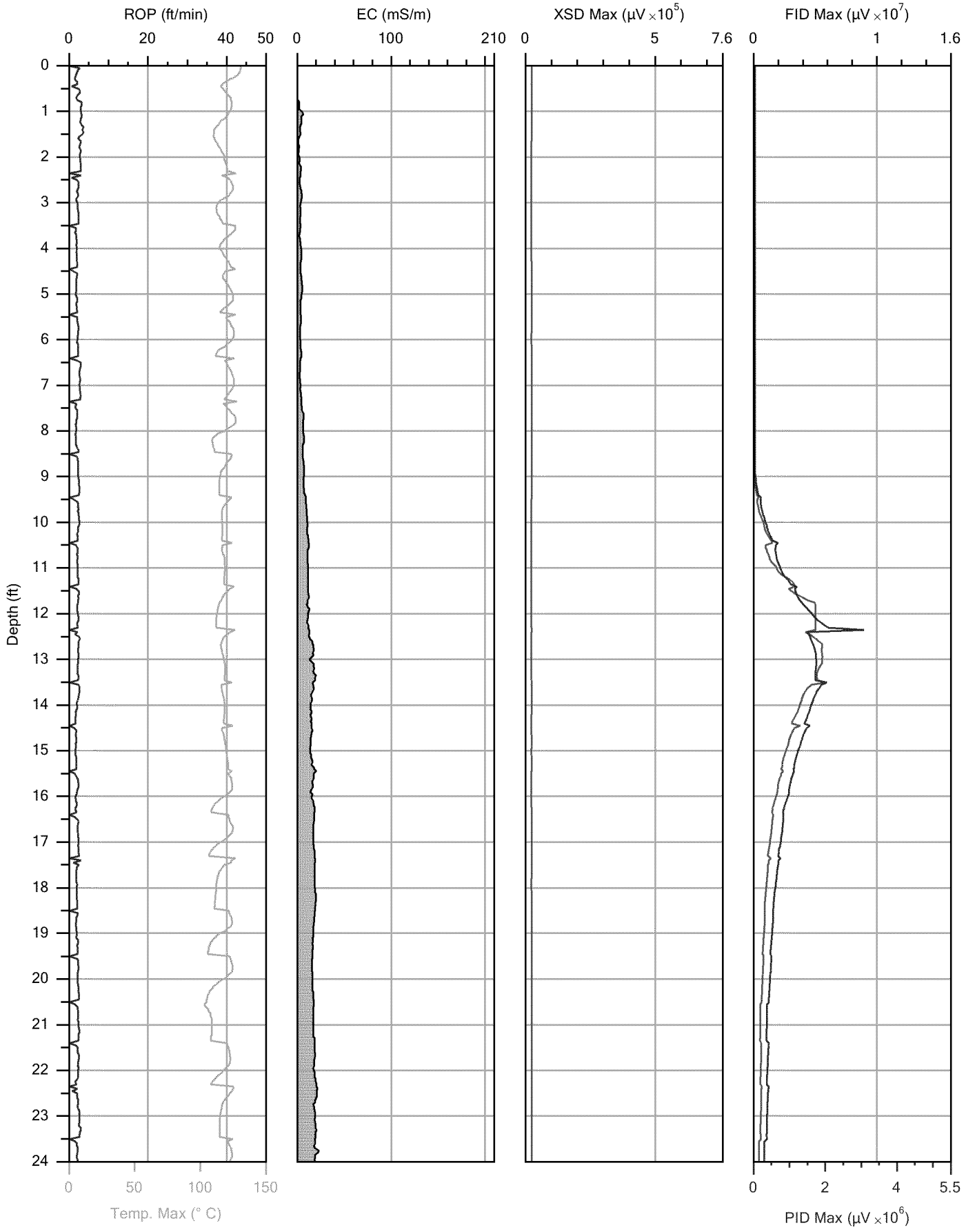
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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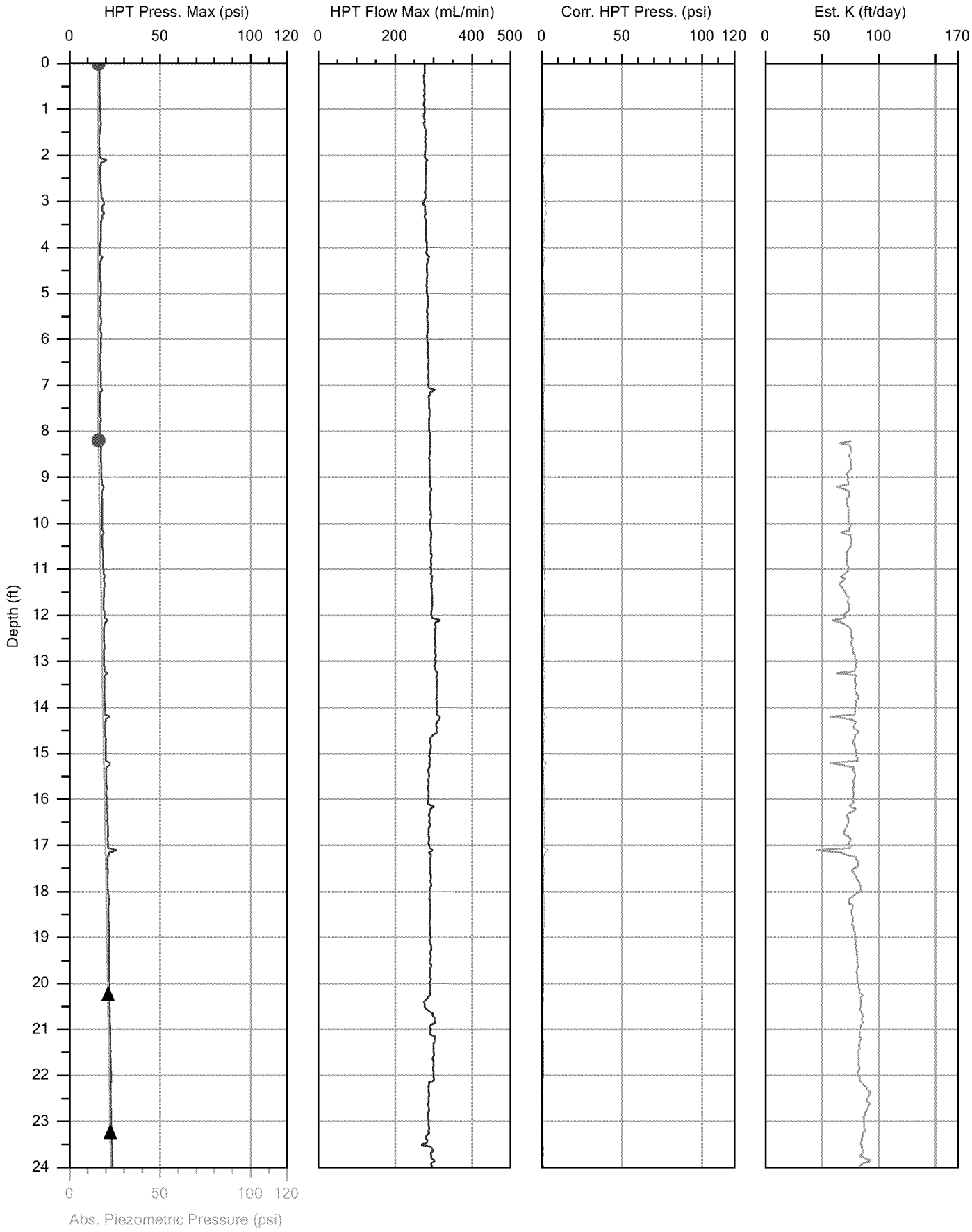
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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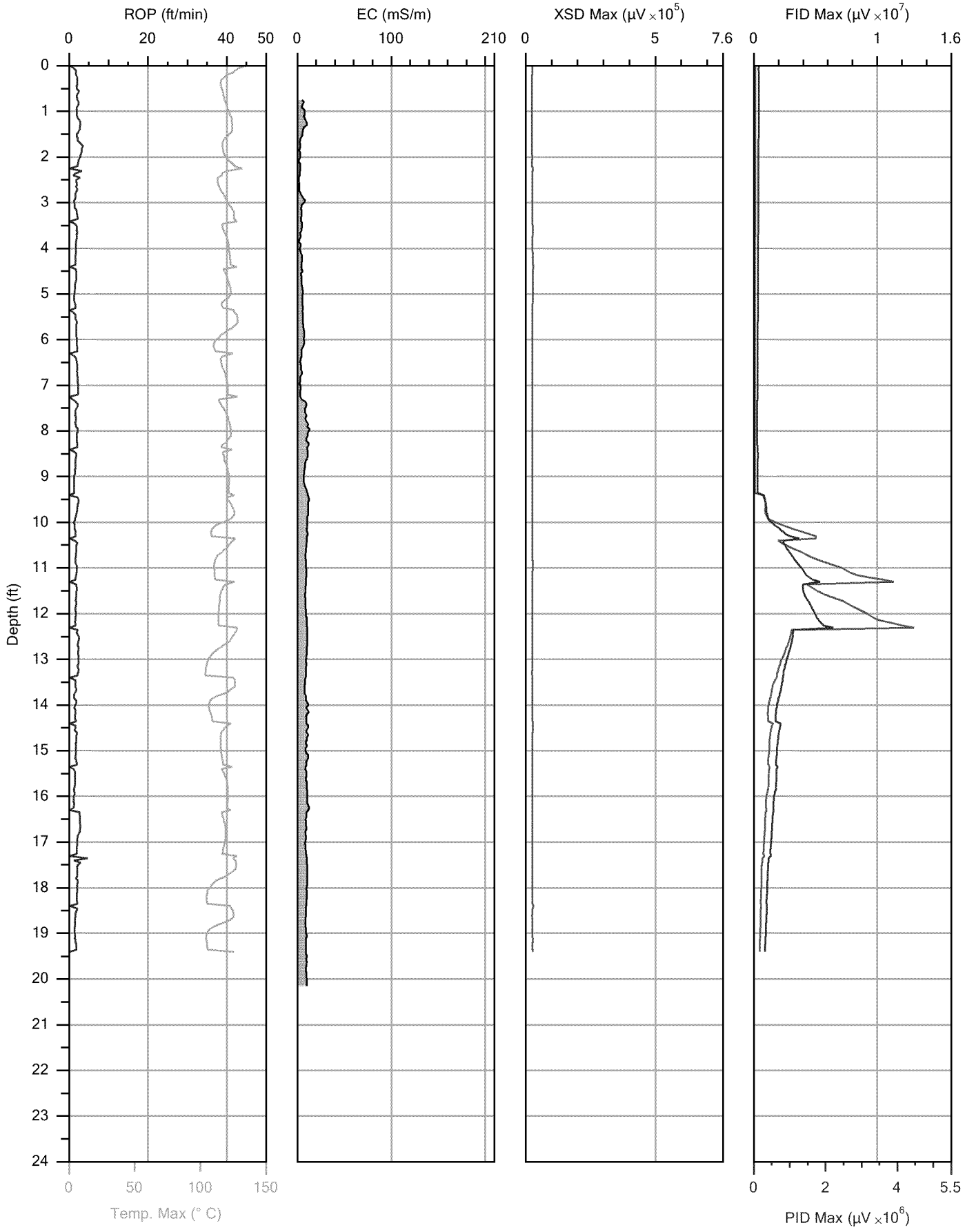
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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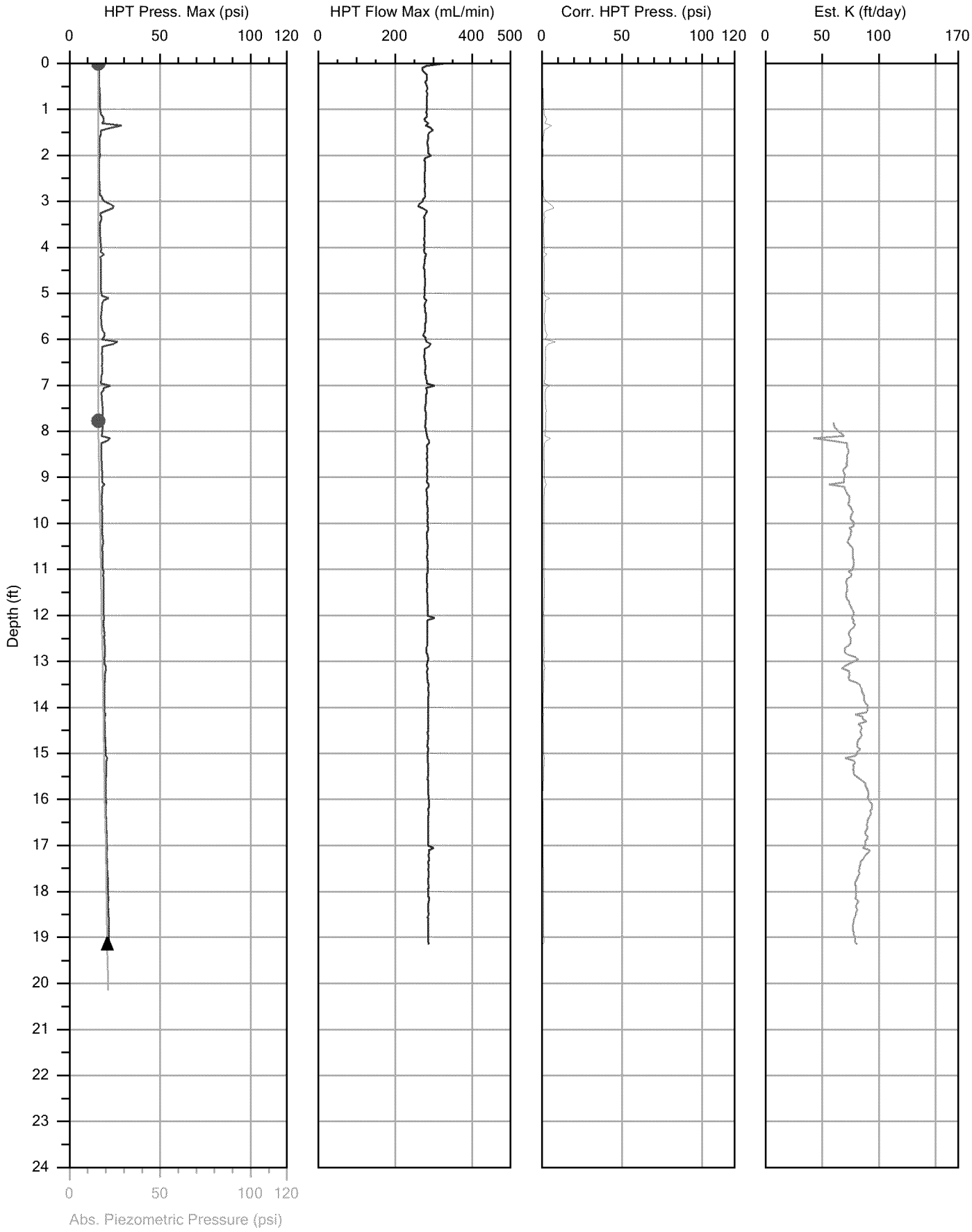
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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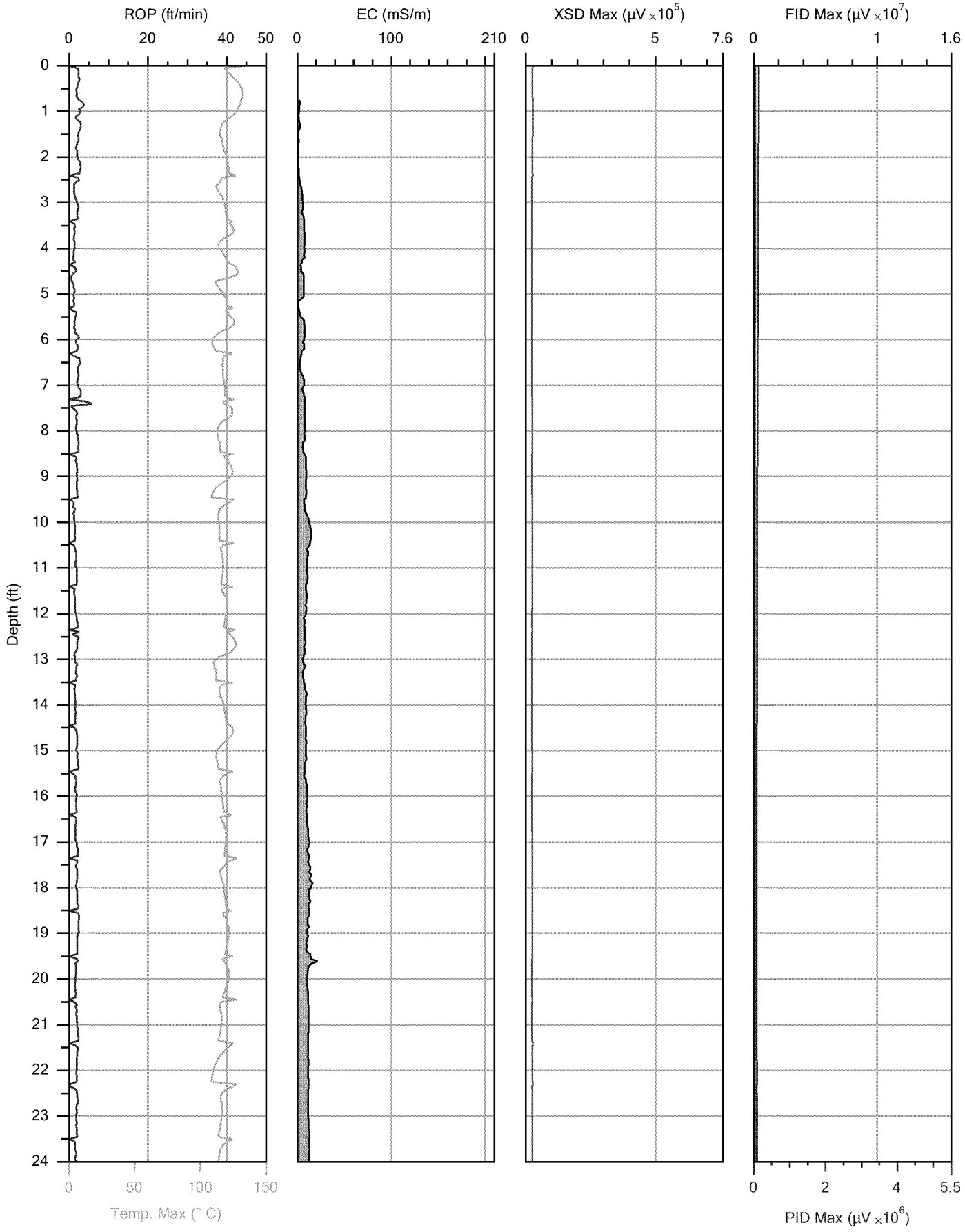
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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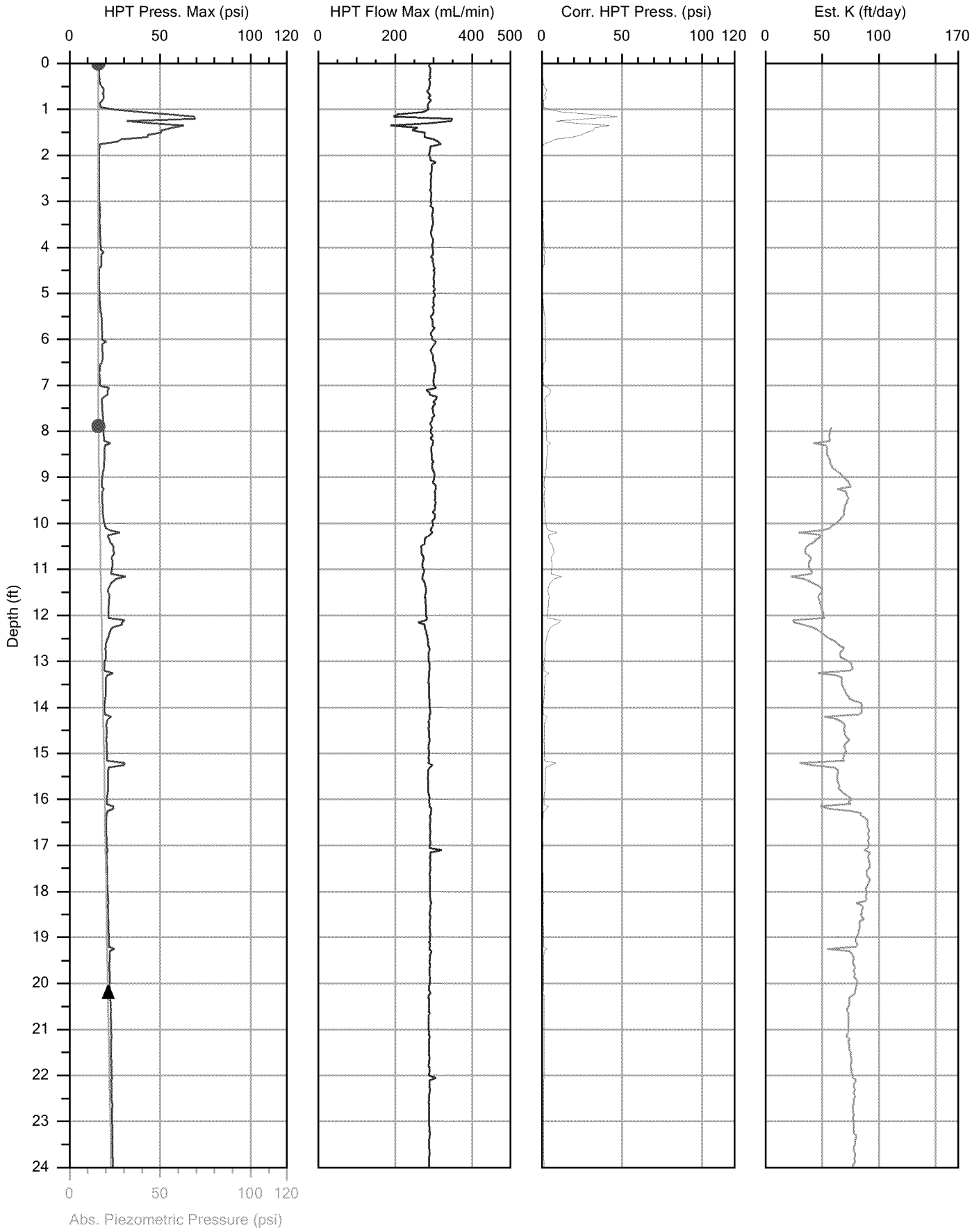
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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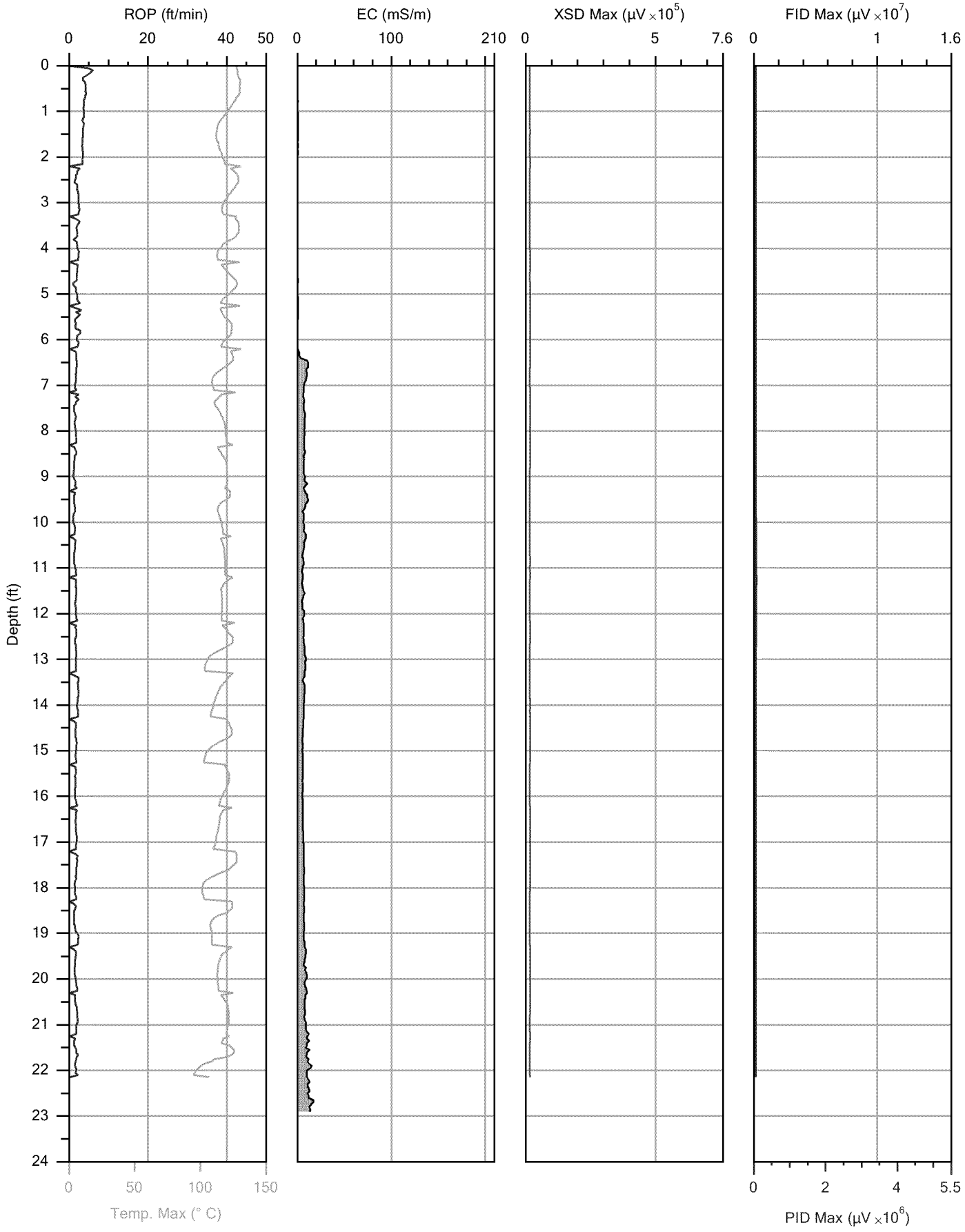
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/13/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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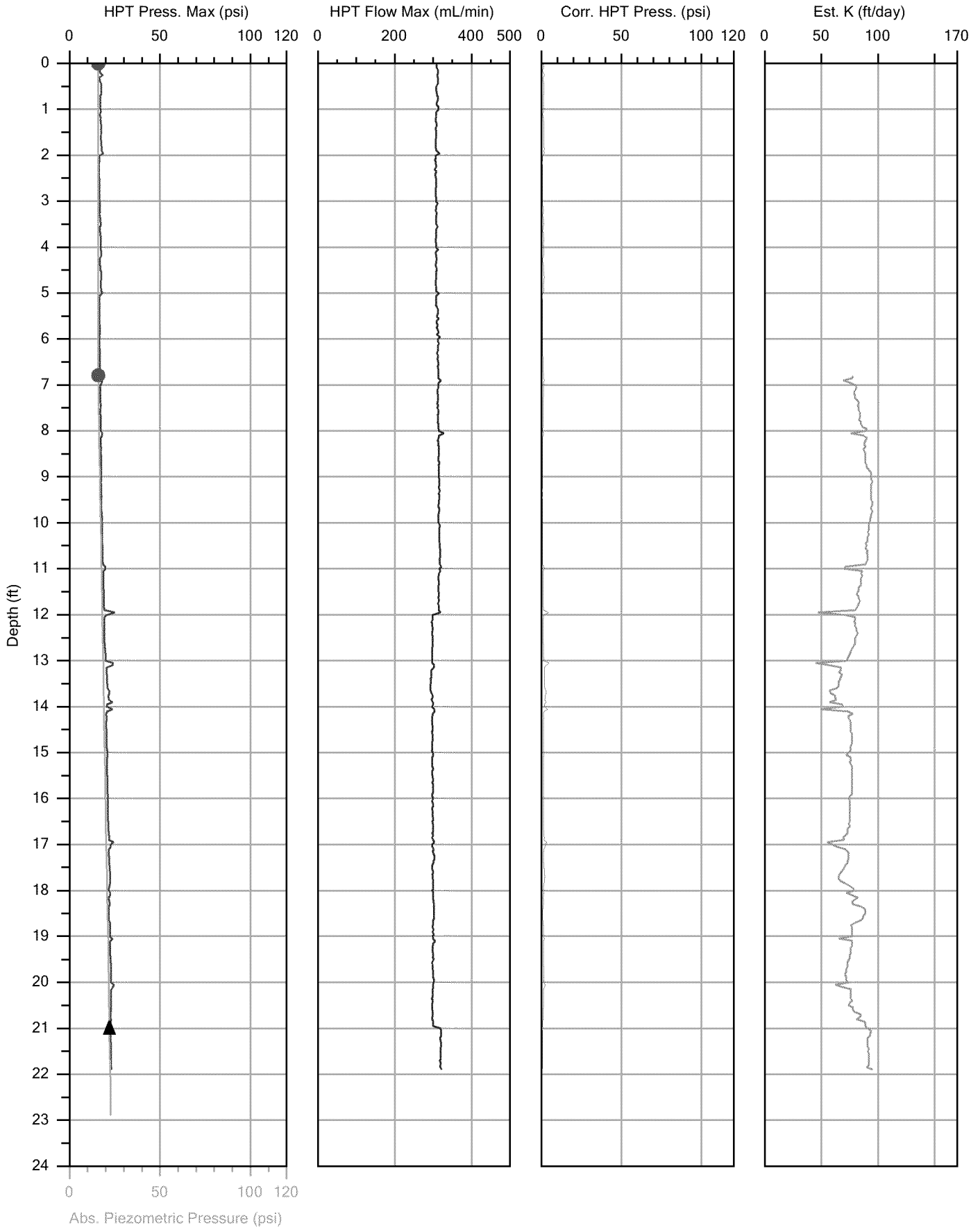
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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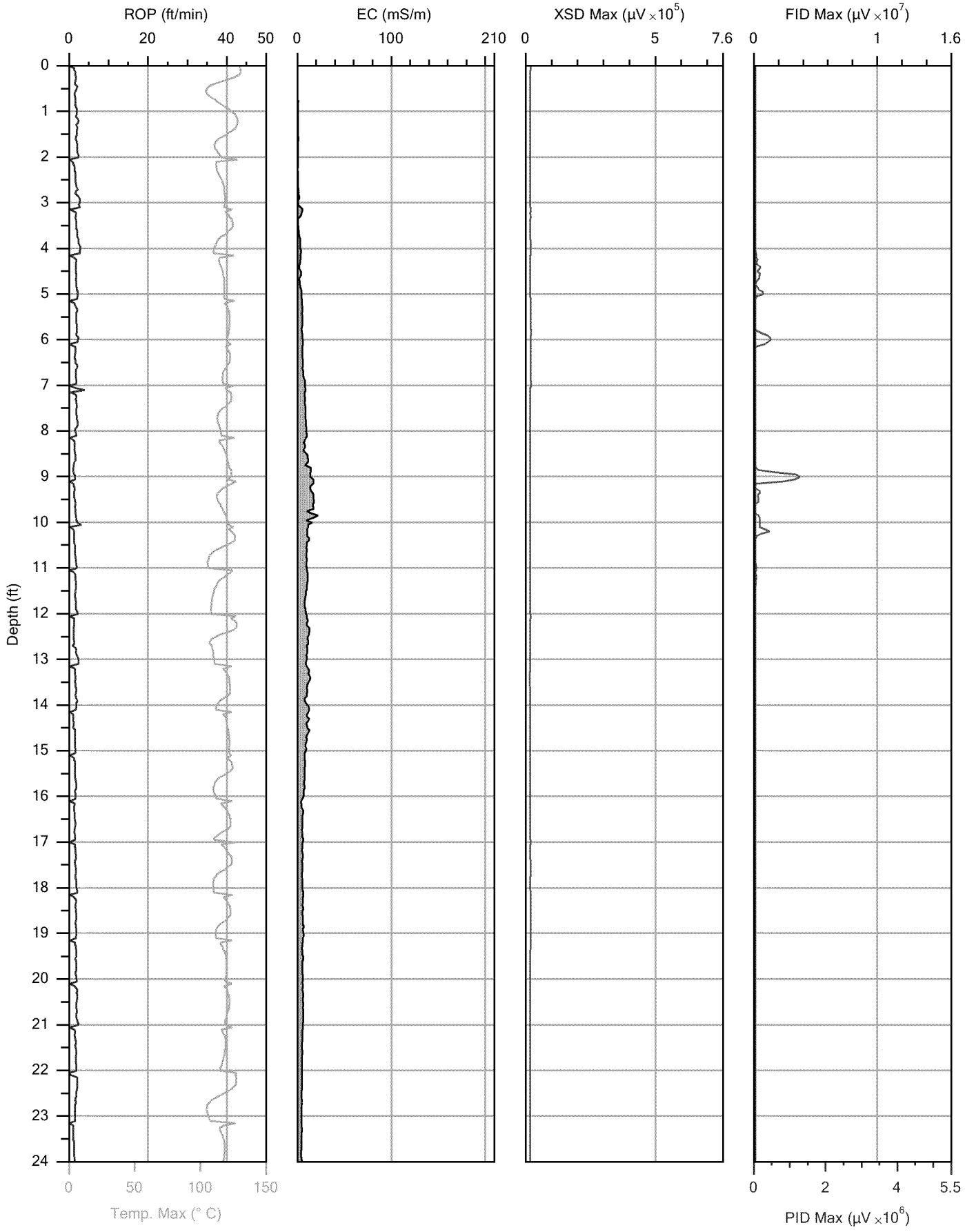
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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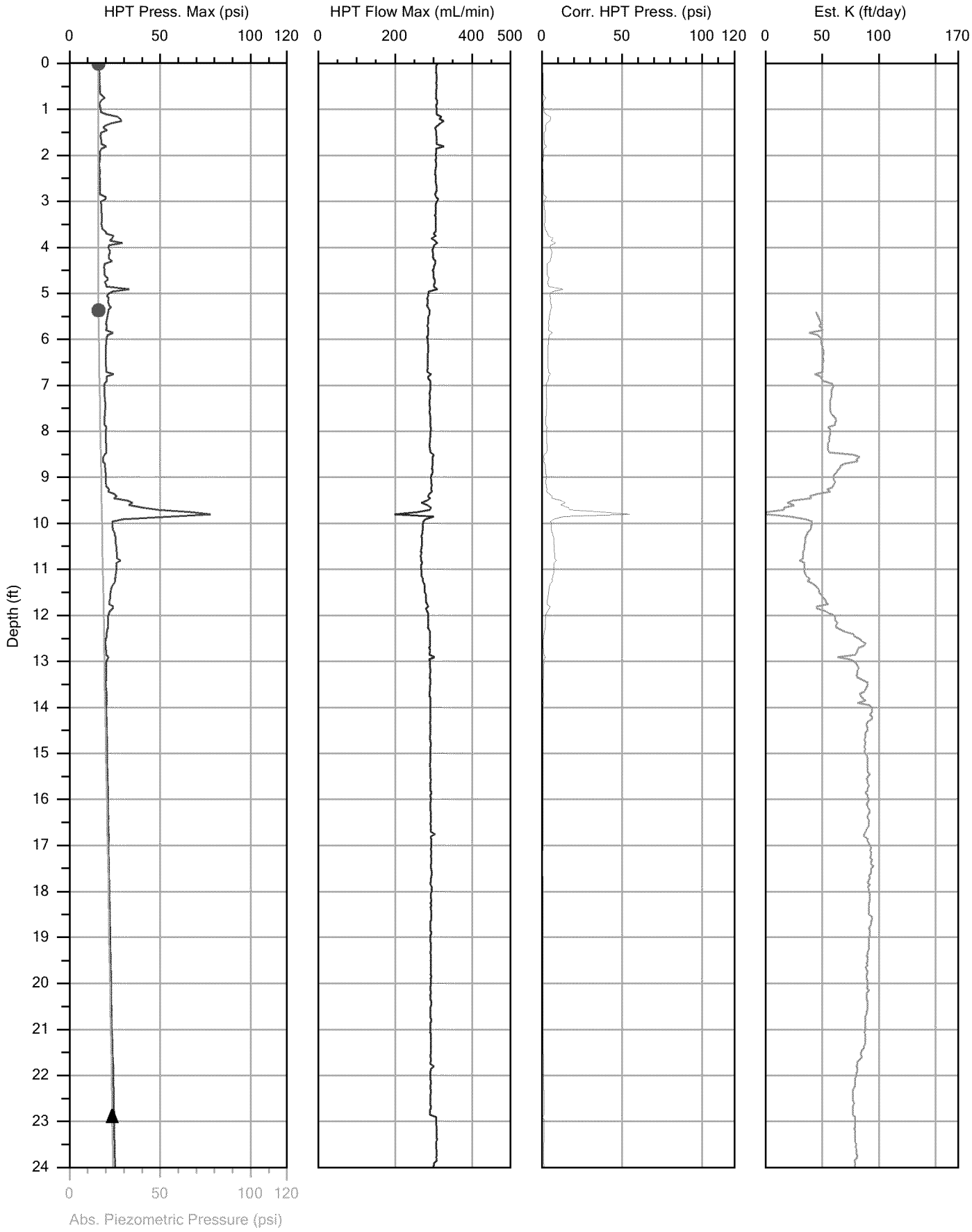

CASCADE
DRILLING | TECHNICAL SERVICES

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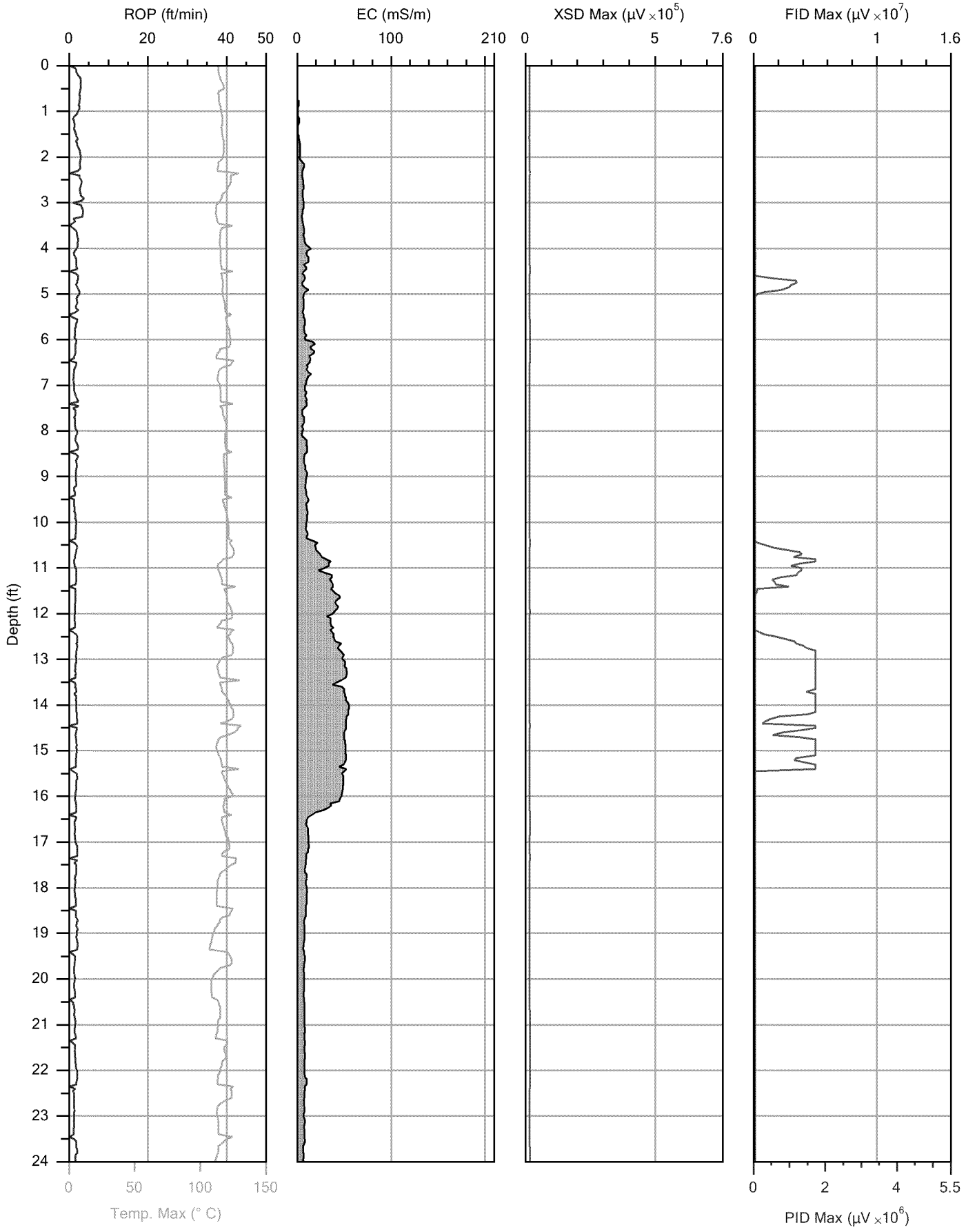
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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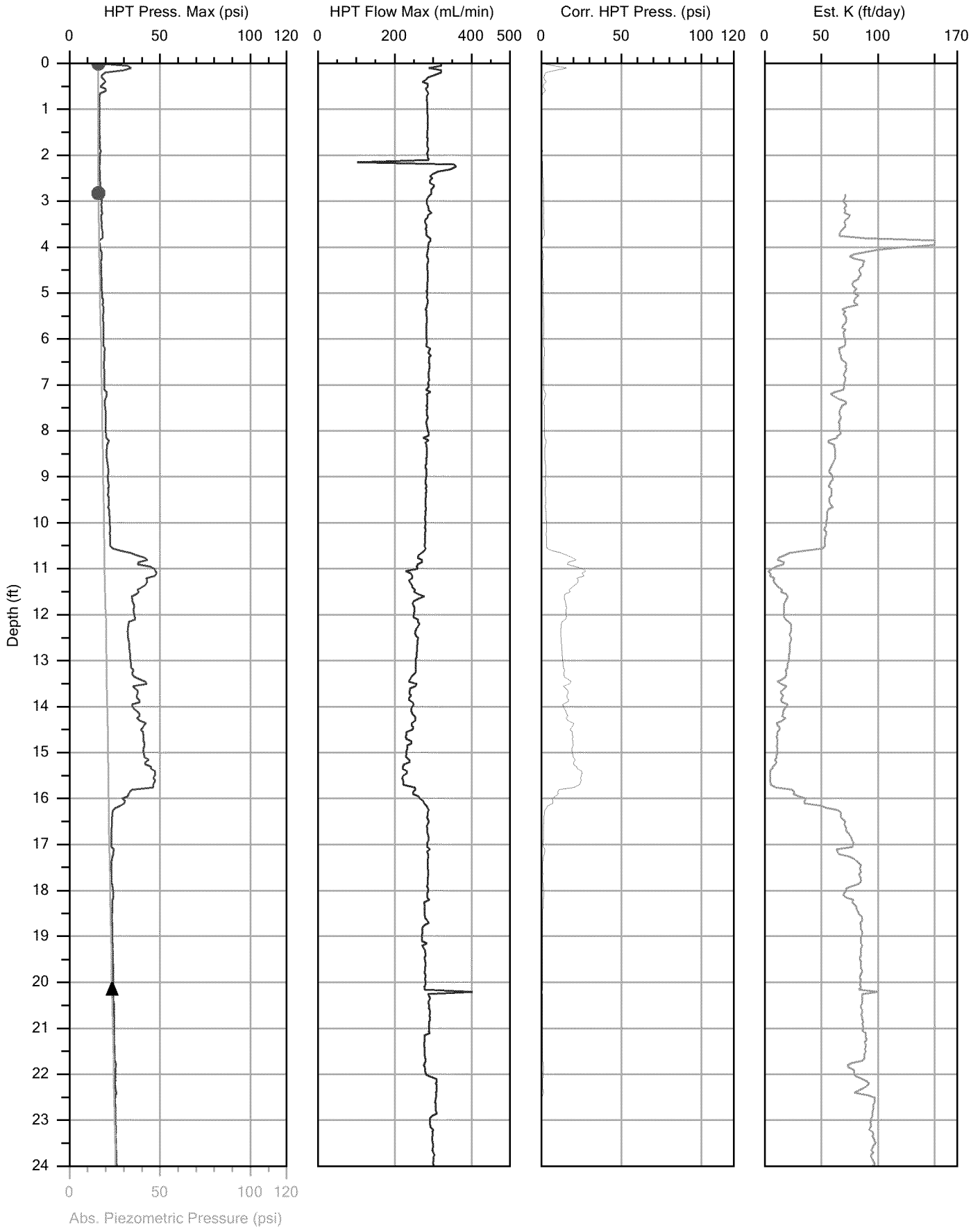
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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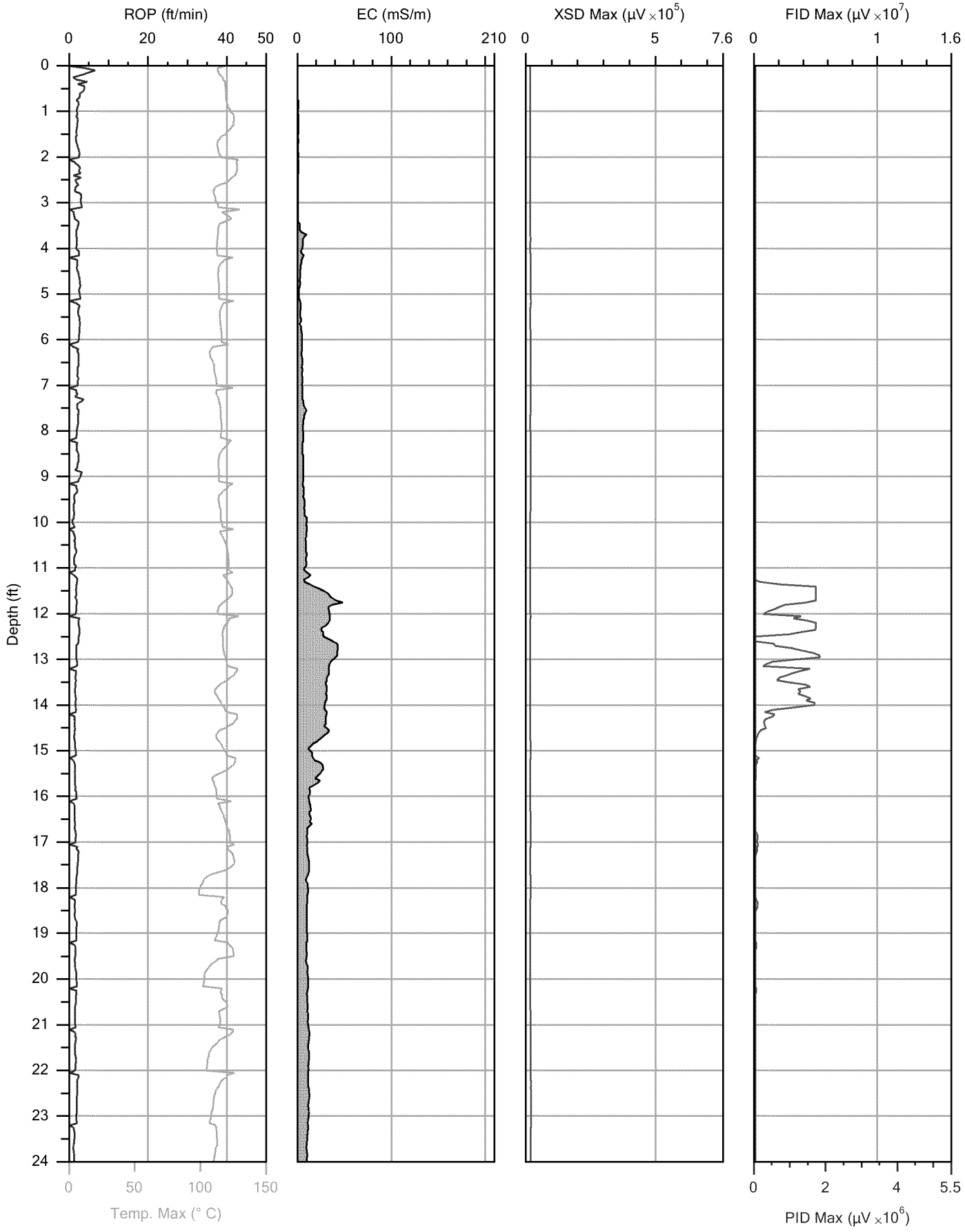
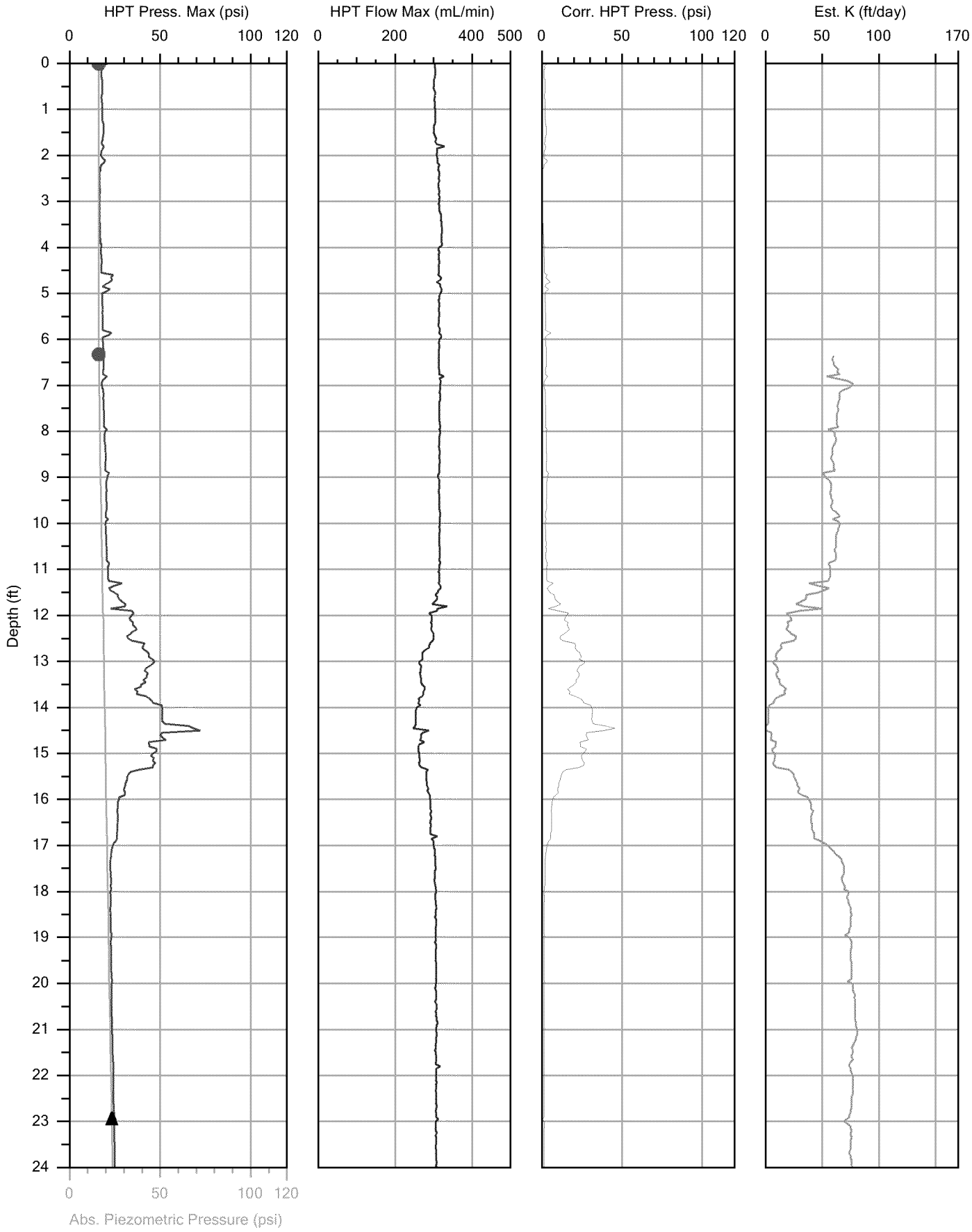
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



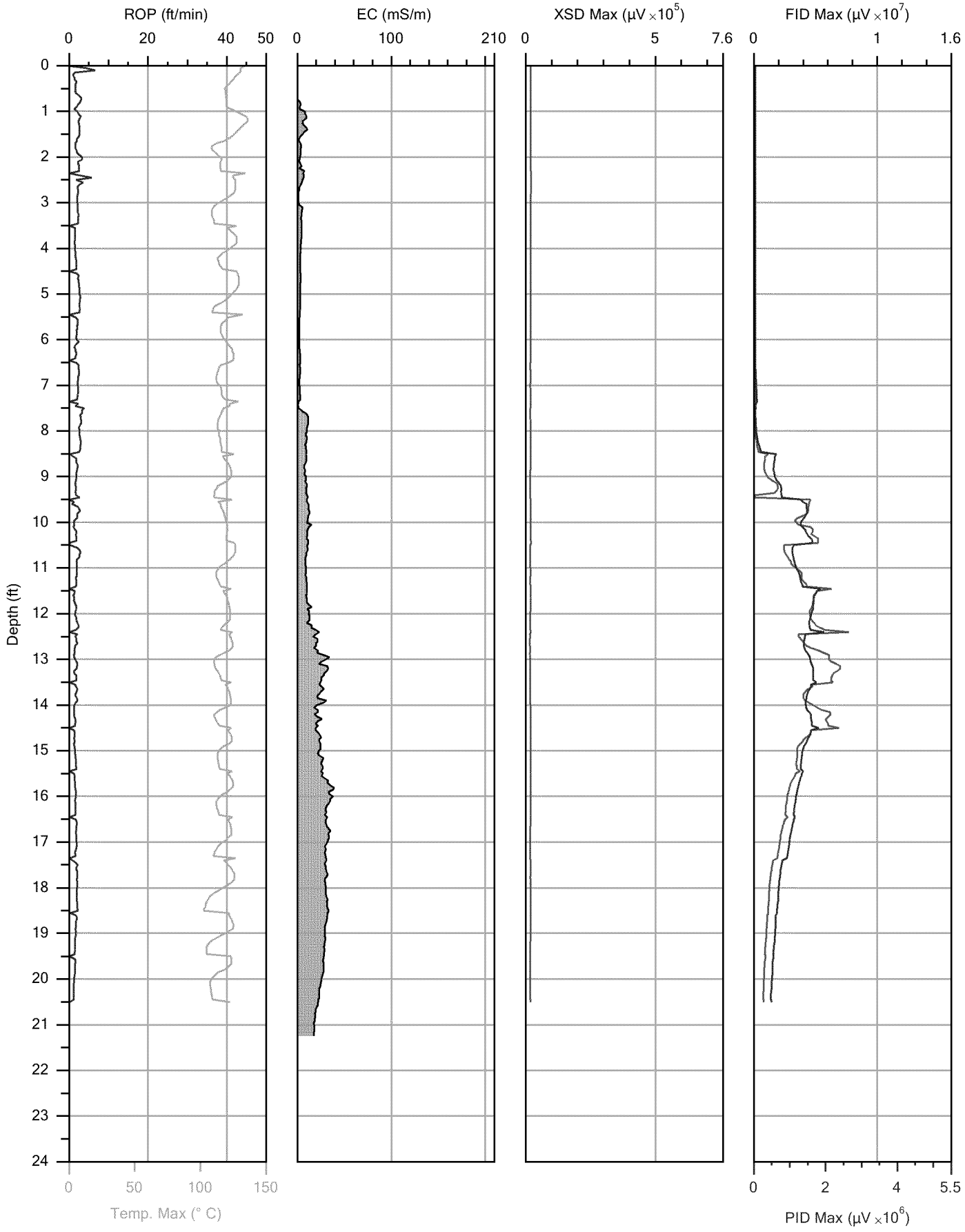
CASCADE
DRILLING | TECHNICAL SERVICES

		File: MIHPT-15.MHP
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

		File: MIHPT-15.MHP
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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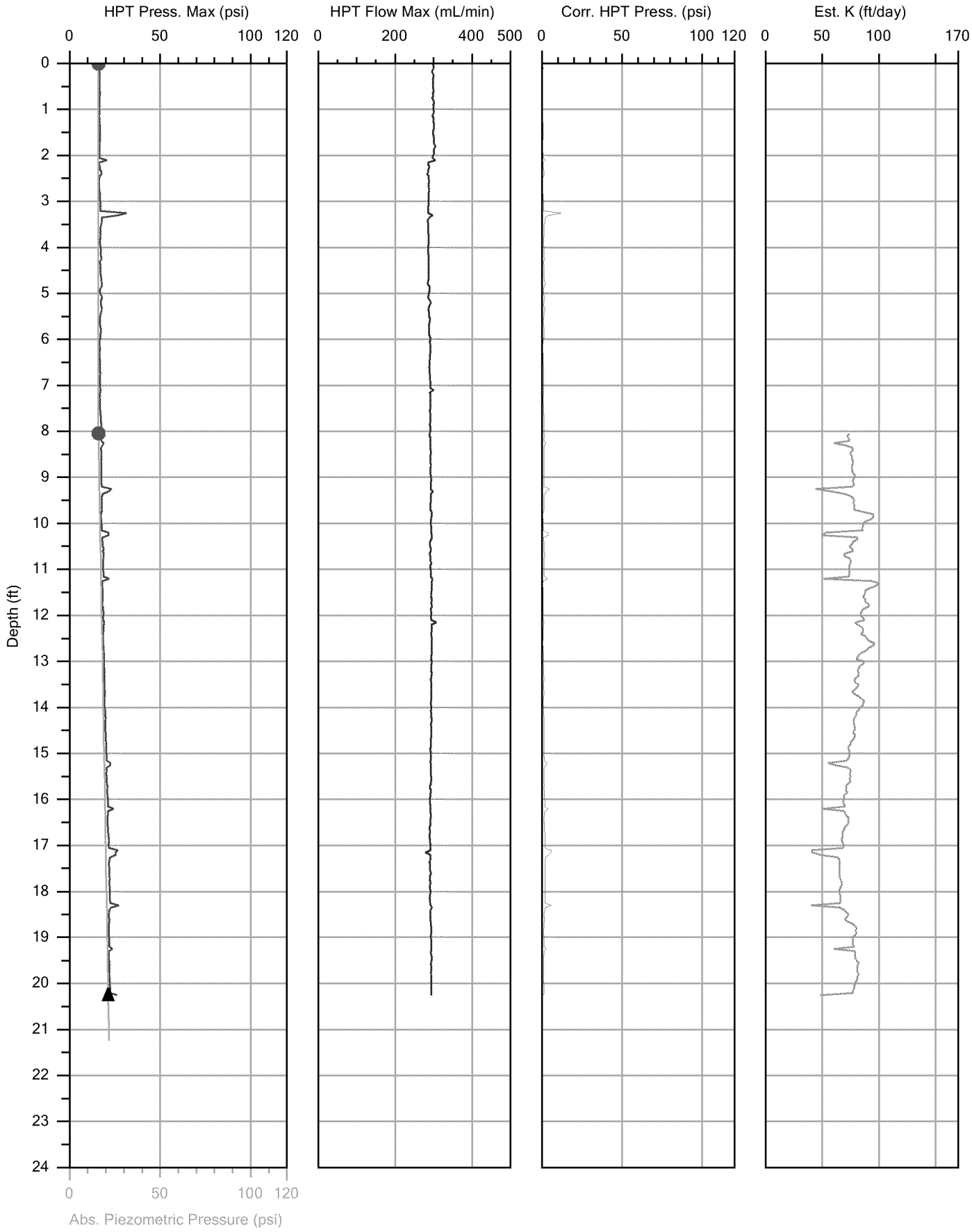
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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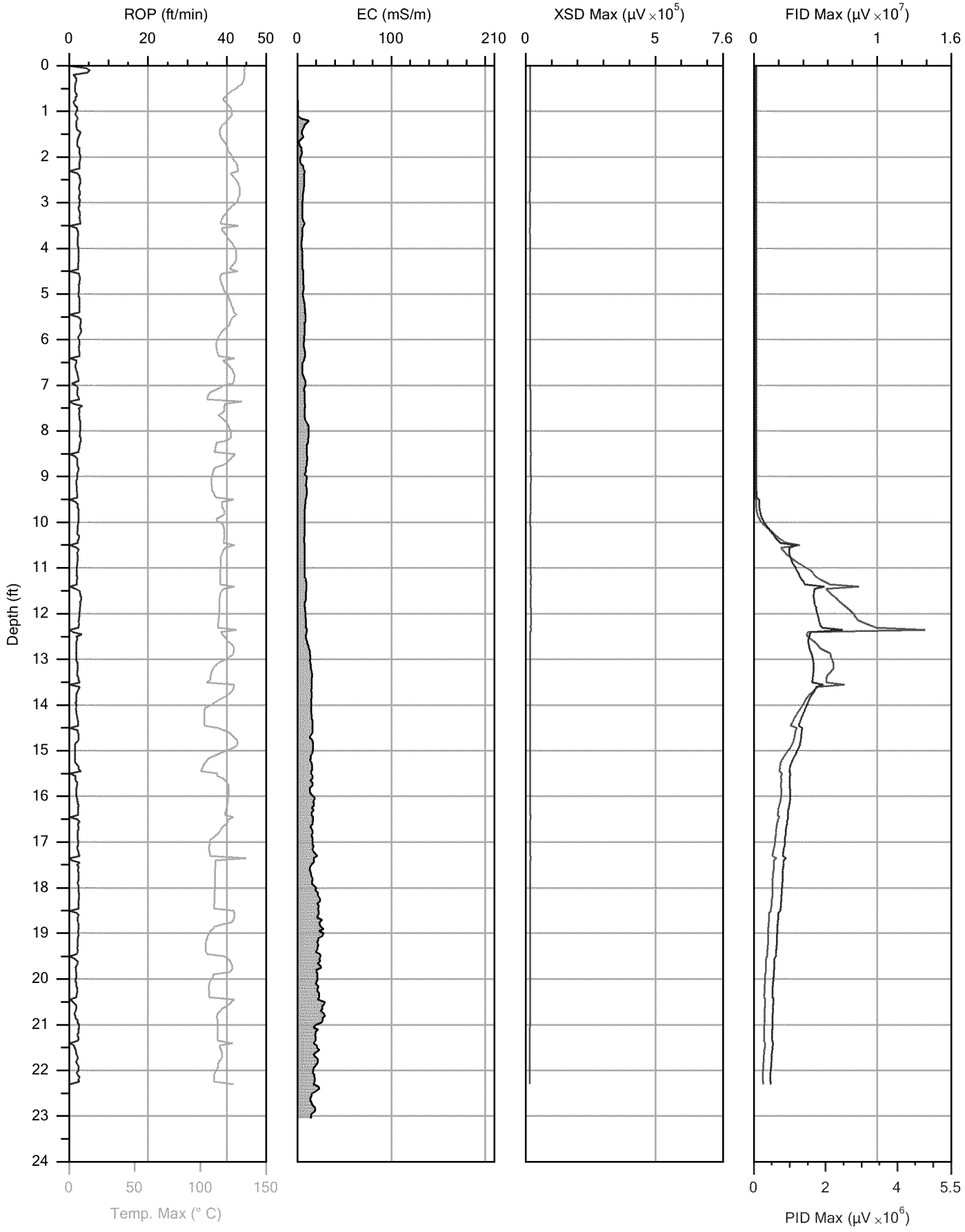
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

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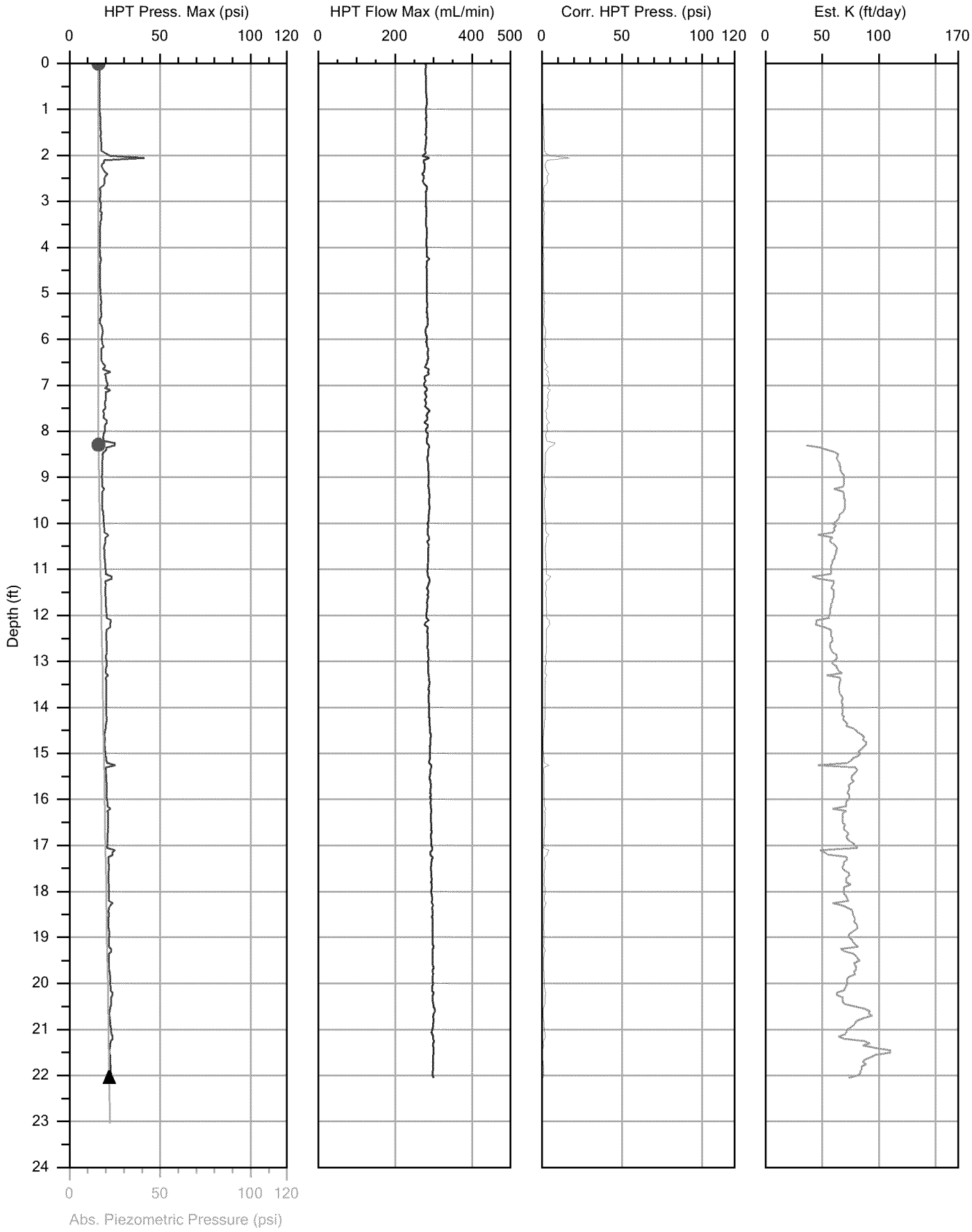
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location:



CASCADE
DRILLING | TECHNICAL SERVICES

		File: MIHPT-17.MHP
Company: Cascade Technical Services	Operator: Ryan Mulford	Date: 7/14/2016
Project ID: Tower Standard	Client: REI	Location: