TECHNICAL MEMORANDUM

SUBJECT: Well MJ-PW3 Evaluation, Middletown-Junction Property, Warren County, Ohio

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DATE: **May 12, 2025**

SUMMARY

Terran Corporation, on behalf of Warren County Water & Sewer Dept. (WCW&SD), submits the following technical memorandum to document the installation and testing of production well MJ-PW3 for final approval by the Ohio Environmental Protection Agency, Southwest District Office (Ohio EPA, SWDO) for use as a Public Water System, Community Water Supply (PWS CWS) well. The production well was designed using the Ohio EPA "green book" as a guide to compliance with rules and procedures governing PWS CWS wells (i.e. Ohio EPA, 2023).

WCW&SD submits for consideration the following details concerning MJ-PW3:

1) MJ-PW3 is a 16-inch diameter, 85-feet deep production well located on the northeast side of the Middletown-Junction property, situated next to the Little Miami River (LMR). The LMR is the primary source water supply for the proposed Middletown Junction Wellfield (Figure 1) .
2) The ODNR well log (#3022156) for MJ-PW3 is provided in Attachment #1.
3) The well's coordinates are: latitude: 39.3637051; longitude: -84.2402975.
4) MJ-PW3 is constructed with a stainless steel, wire-wrapped screen consists of 20-feet of 0.070 slot openings set from 65 to 85 feet below ground surface (ft. bgs) at the bottom of the aquifer. A #4 quartz sand filter pack was constructed around the screen from 55 feet to 85 feet. A bentonite seal was placed over the filter pack followed by cement grout from 54.5 ft. bgs to grade (Figure 7).
5) During the March 2025 24-hour constant rate test (CRT), MJ-PW3 sustained a pumping rate of 1,500 gallons per minute (gpm). WCW&SD is requesting an Ohio EPA approved permanent pump design rating of 1,000 gpm for MJ-PW3.
6) MJ-PW3 CRT analysis of data from the pumping and monitoring wells indicated the aquifer's apparent transmissivity values range from 8,300 to 23,600 feet squared per day (ft^2/day), averaging about 13,650 ft^2/day. Assuming a representative saturated aquifer thickness of 71 feet, calculated hydraulic conductivity values range from 117 to 332 feet per day (ft/day) and averages about 190 ft/day. Aquifer storativity values varied from 2.00×10^{-12} to 1.03×10^{-1} and averaged 2.19×10^{-2}. The range in storativity estimates is consistent with a semi-confined aquifer.

The replacement well's groundwater quality parameters meet Federal Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) with the exception for the per- and polyfluoroalkyl substances (PFAS) constituent Perfluorooctane Sulfonate (PFOS) at 0.0166 µg/L (associated with the surface water quality of the Little Miami River), and the naturally-occurring metals of iron and manganese which are constituents routinely treated at the water treatment facility (Tables 4 and 5).

Coarse cobbled gravel outwash as encountered at production well MJ-PW3.

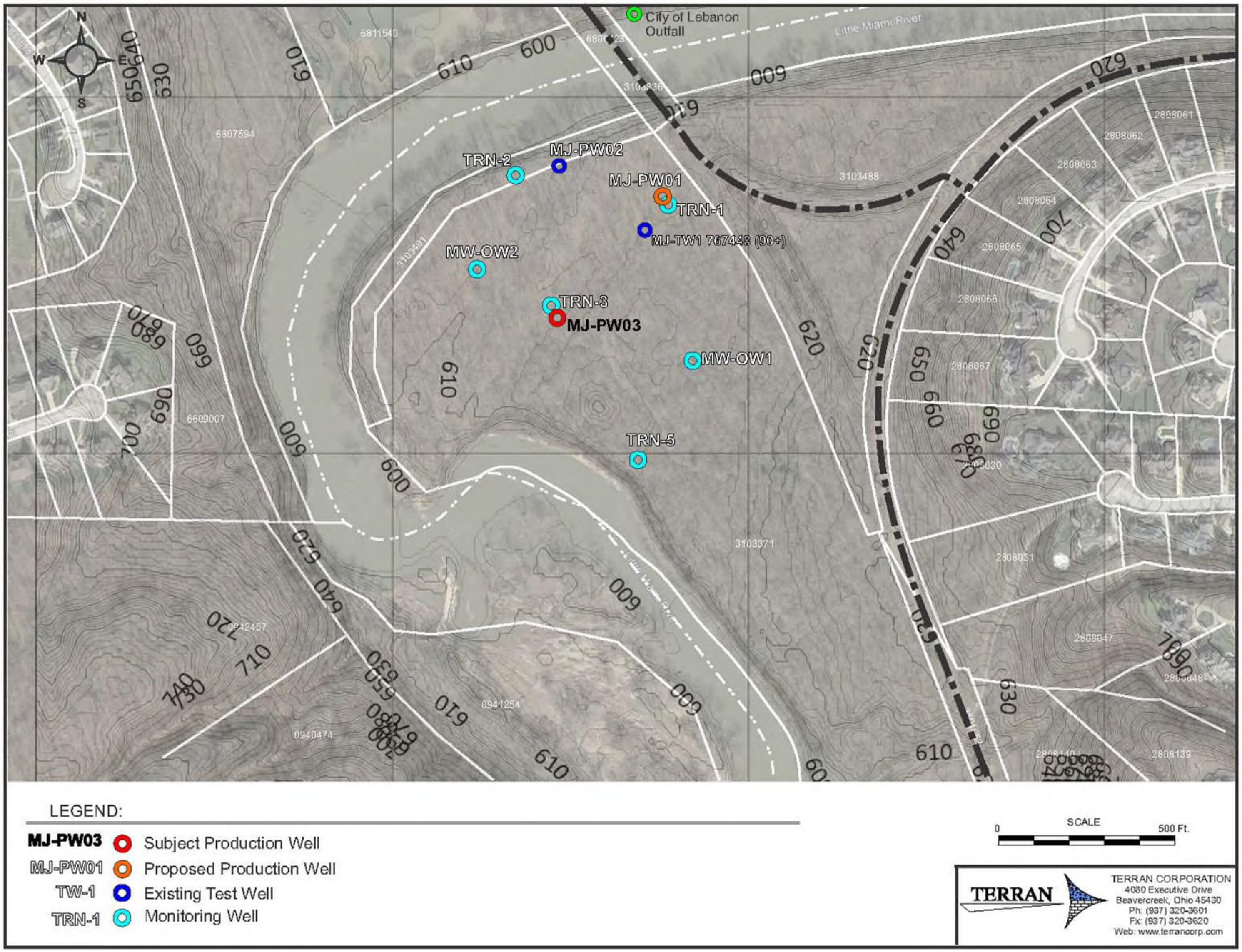


Figure 1. Location of production well MJ-PW3 and monitoring wells at the Middletown-Junction property.

Well Drilling and Construction Description

Drilling of MJ-PW3 was conducted during August 22-2025 with the installation of a 20-inch outer casing using a cable tool rig. National Water Services, LLC (NWS) mobilized a truck-mounted 28-L cable tool rig to the site in late August to set the 24-inch steel casing (Figure 2). The 20-inch casing was driven down and bailed to the bottom of the aquifer, a course sand and gravel outwash deposit (Figure 3), encountering bedrock at 82 feet. The proposed well screen and casing design (Attachment #1) was prepared by NWS based on samples of the formation collected on 5-foot intervals to characterize the aquifer's grain size distribution.

Figure 2. Production well MJ-PW3 under construction at the Middletown-Junction property, August 2024.

Figure 3. Course cobble outwash sand and gravel as found at MJ-PW3, August 2024.

Construction of MJ-PW3 was constructed during January-February 2025. MJ-PW3 was constructed with a 0.070-inch slot, 20-foot length of screen set from 65 to 85 ft. bgs. The 16-inch carbon steel casing sections were welded together including centralizers welded to the exterior casing (Figure 4). These were used to center the well inside the outer casing. The 24-inch casing was then pulled up using hydraulic jacks to expose the well screen and casing as the well was constructed.

A #4 quarry sand filter pack was constructed around the screen from 55 to 85 ft. bgs (Figure 5). A bentonite pellet seal, 0.5-feet in thickness was constructed on top of the filter pack (top of seal 54.5 ft. bgs). The remainder of the casing annular space was grouted shut using 92-bags Portland cement grout to seal the annular space from 54.5 ft. bgs to grade (Figure 6). MJ-PW3 was completed on February 4, 2025 in terms of its screen, casing, filter pack and annular sealing. The "as built" diagram of the well is provided in Figure 7. MJ-PW03 will be completed as a submersible pump operated well (Figure 7).

All of the well's final construction features, such as the pitless adaptor, submersible pump and supporting appurtenances will be installed according to WCW&SD plans at a later date when the well field is constructed under a separate contract and contractor. The proposed pump is an American-Marsh Pump capable of pumping 500 to 1,100 gpm under a total dynamic head pressure of 284 feet. A copy of the proposed pump performance data sheets are provided in Attachment #2 of this memorandum.

Figure 4. **NWS constructing the MJ-PW3 screen and well casing on January 28, 2025.**

Figure 5. No. 4 Parry sand pack being placed around the well screen, January 30, 2025.

Figure 6. NWS using tremie equipment to seal the annular space of well MJ-PW3 with cement grout, February 4, 2025.

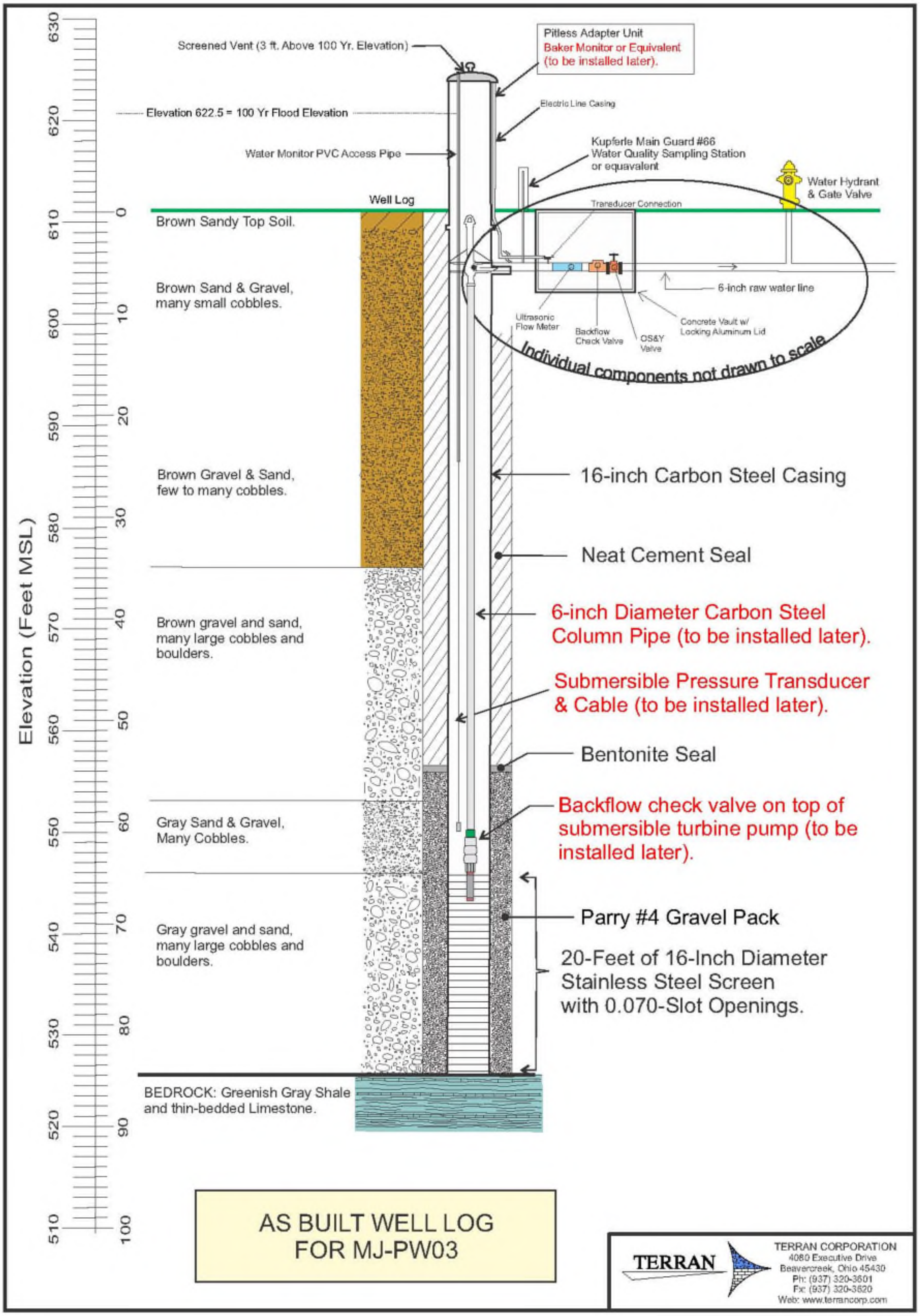


Figure 7. As built diagram for production well MJ-PW3.

Well Development

MJ-PW3 was developed in accordance with OAC 3745-9-09 to remove the native silt and sand of the filter pack. Development was conducted by repeated surging of the well screen while air-lift pumping the water at a rate of approximately 100 gpm to remove the formation fines (Figure 8). Development was conducted during February and March 2025, and effectively removed the silt and sand from around the screen. This was confirmed using a using a Rossum Sand Tester throughout the development process. After completion of development, subsequent measurements of sand accumulation in the tester from well discharge during the SDT and CRT was hardly visible.

Figure 8. Well development of MJ-PW3 during February-March 2025.

Hydrogeologic Setting

The hydrogeologic setting of the subject area was characterized through the drilling of soil borings TRN-1 to TRN-7 with the installation of monitoring wells TRN-1, TRN-2, TRN-3 and TRN-5 (Terran Corp., 2022b). The site hydrogeology consists of stratified glacial outwash comprising a single buried valley aquifer (BVA) contained within a deeply incised bedrock valley (Figure 9). The BVA is primarily a semi-confined aquifer and MJ-PW3 is screened at the bottom of this aquifer at its location.

Depth to groundwater is shallow, ranging from approximately 16 to 24 ft. bgs as measured in the monitoring and test wells (Table 1). Water levels for monitoring wells TRN-1, TRN-2 and TRN-3 located throughout the site (Figure 1) reflect the hydrodynamic activity at the Middletown-Junction property. Water levels in the three wells during March and April 2023 fluctuated on the order of 3 to 4 feet in response to high water events along the Little Miami River as measured at the U.S. Geological Survey (USGS) station 03242050 at South Lebanon (Figure 10).

Groundwater modeling of the Middletown-Junction property was conducted to evaluate the production potential of the proposed well field (Terran Corp., 2022a and 2023). The modeling results indicated a well field capable of producing 2.5 million gallons per day (MGD) is possible through three production wells, pumping between 550 to 600 gpm each. Based on the aquifer testing of the test wells at the property, the model was revised and determined that the aquifer has potential for 3.0 MGD production using two new production wells. The existing 16-inch production test well is designated as a backup well.

During the process for site approval, of the Middletown-Junction property, the Ohio EPA expressed concern regarding the City of Lebanon’s WWTP outfall occurring in proximity to the proposed well field. To address the concern, Terran conducted fate and transport (F&T) modeling of the outfall using chloride as the constituent of concern to evaluate potential long term impact to the well field under 3.0 MGD operation using proposed production wells MJ-PW! and MJ-PW3 (Terran Corp., 2024a). The existing production test well, MJ-TW2, is proposed for use as a backup well MJ-PW2 (Terran Corp., 2024b). Results of the F&T modeling indicated the location of the outfall with respect to the well field and the surface flow of the Little Miami River and the silty nature of the Little Miami River’s bed will sufficiently protect the water quality of the Middletown-Junction well field.

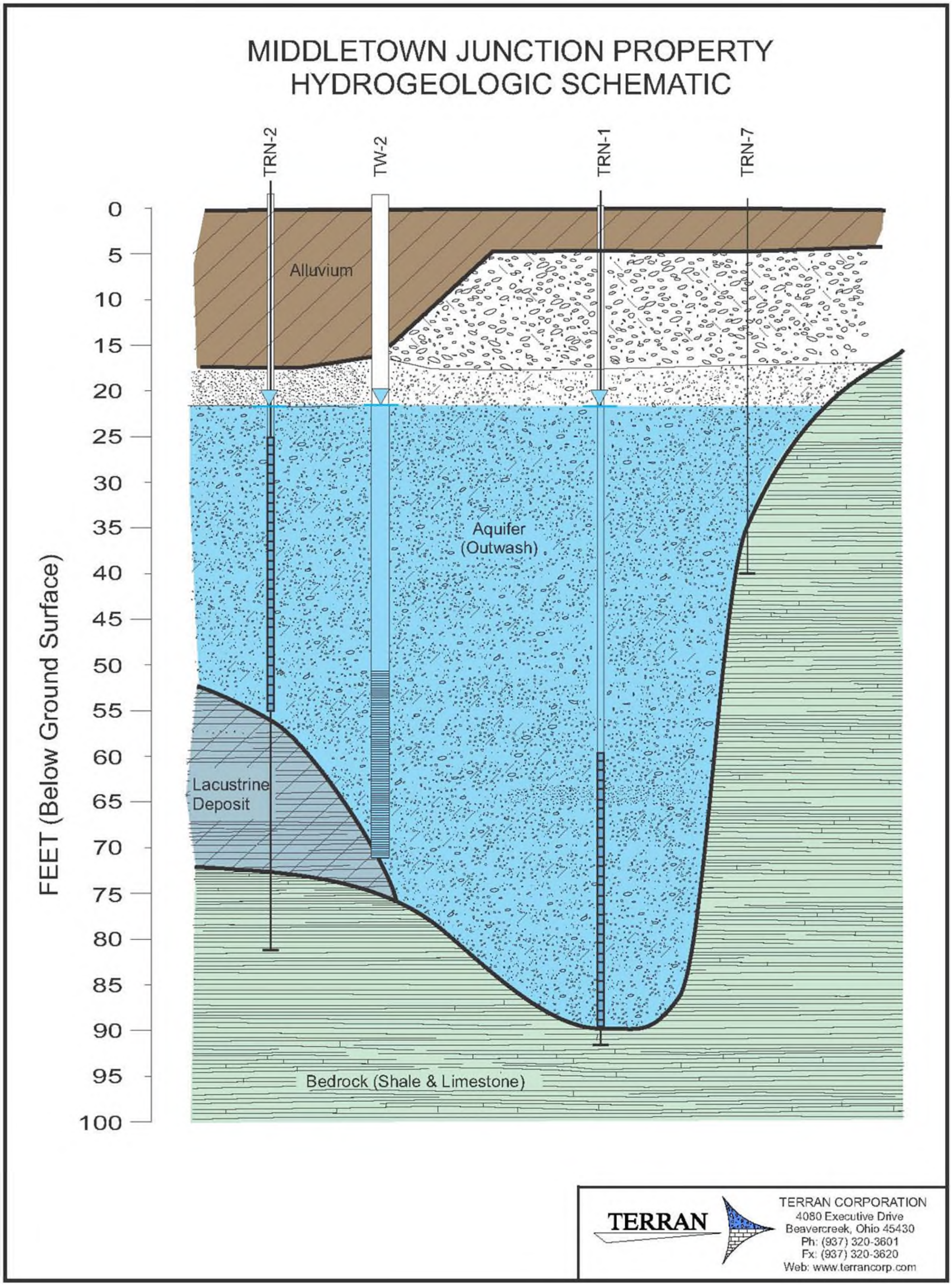


Figure 9. Conceptual hydrogeologic profile of buried valley aquifer at the Middletown-Junction property.

Table 1. Summary of Groundwater Level Measurements at the Middletown-Junction Property.

Date	MJ-TRN1	MJ-TRN2	MJ-TRN3	MJ-TRN5	MJ-OW1	MJ-OW2	MJ-TW1	MJ-TW2
	Depth to Groundwater (Feet below top-of-casing)							
11/14/2022	22.70	22.40	20.02	24.85	---	---	---	---
12/29/2022	22.91	22.65	20.22	---	25.45	---	22.36	19.25
1/4/2023	21.55	21.27	18.83	23.53	24.09	18.82	20.98	17.88
1/10/2023	21.63	21.39	18.99	23.81	24.20	18.97	21.13	18.09
1/11/2023	21.75	21.49	19.09	23.91	24.30	19.10	21.21	18.16
1/18/2023	21.28	21.01	18.59	23.42	23.79	18.60	20.76	17.64
1/27/2023	20.47	20.18	17.73	22.49	22.96	17.75	19.95	16.83
2/2/2023	20.59	20.33	17.93	22.78	23.15	17.94	20.09	16.98
3/1/2023	21.46	21.17	18.74	23.54	23.97	18.79	20.57	17.76
4/11/2023	19.04	18.82	16.48	21.60	21.67	16.44	18.23	15.41
4/12/2023	20.07	19.78	17.41	22.33	22.60	17.36	19.68	16.39
5/2/2023	21.30	21.04	18.61	23.31	23.84	18.61	20.48	17.67
5/18/2023	21.30	21.03	18.66	---	23.84	18.75	20.48	17.65
5/24/2023	21.87	21.62	19.19	24.06	24.44	19.25	21.34	17.94
6/1/2023	22.52	22.28	19.87	24.68	25.09	19.87	22.00	22.28
12/11/2024	22.40	22.43	20.00	24.80	25.22	-----	21.84	20.01
12/17/2024	22.58	22.03	19.59	24.22	24.81	19.58	21.44	18.61
2/25/2025	19.71	19.63	16.95	-----	-----	17.21	18.70	16.12
3/7/2025	20.99	20.75	18.34	23.20	23.55	18.32	20.15	17.40
3/14/2025	22.41	22.12	19.70	24.40	24.91	19.72	21.57	18.76
3/18/2025	19.43	19.20	17.12	21.47	21.67	16.77	19.43	15.84

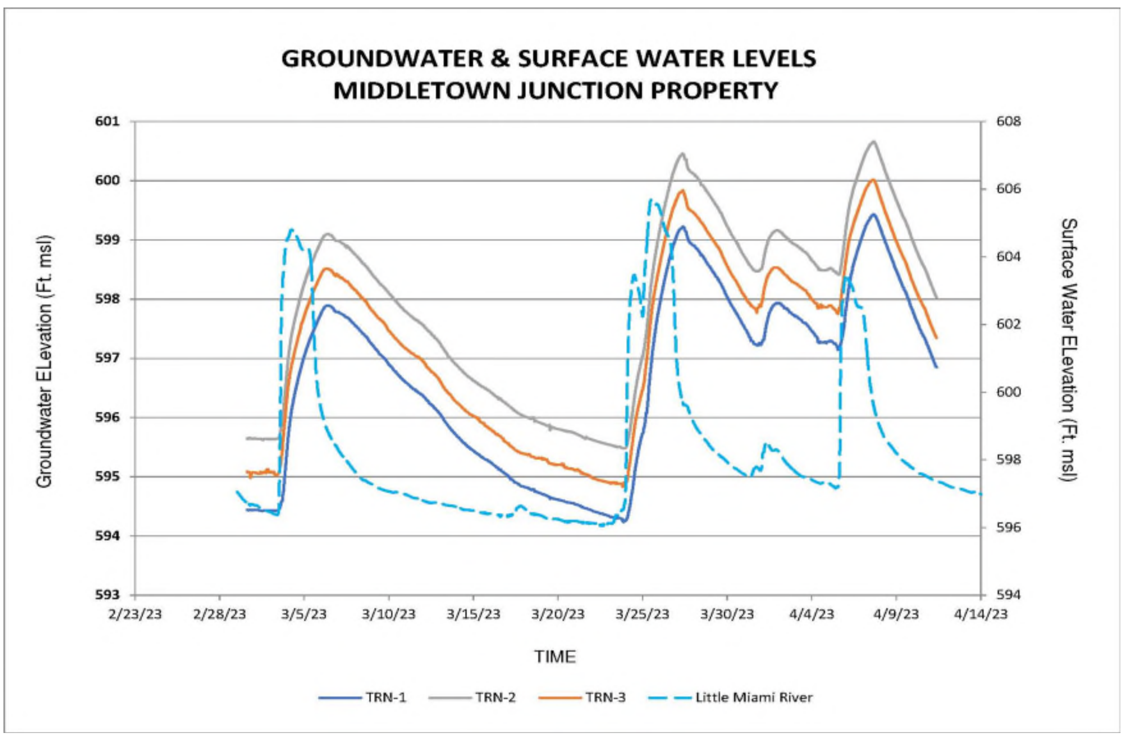


Figure 10. Groundwater level trends in monitoring wells TRN-1 to TRN-3 and Little Miami River stage elevations, March 1-April 11, 2023.

Well Testing

As required by OAC 3745-9-09(B), the aquifer and well performance at the MJ-PW3 wellsite were characterized through the conduct of a Step-Drawdown Test (SDT), a 24-hour Constant Rate Test (CRT) and a 12-hour Recovery Test (RT). These tests were successfully completed from March 10-13, 2025. Test data was used for aquifer characterization to determine the sustainable yield and potential drawdown of the well at its rated design capacity. In addition to estimates of sustainable yield and drawdown, the tests were also evaluated to determine representative values of key aquifer coefficients; transmissivity, hydraulic conductivity, storativity and diffusivity. These newly acquired well and aquifer parameters are used to update the Middletown-Junction property conceptual, analytical and numerical groundwater models. The Ohio EPA required SDT and CRT field forms are provided in Attachment #3.

Step Drawdown Test (SDT) Description

The SDT of MJ-PW3 started at 10:00 hours on March 10, 2025. Four 120-minute-long steps were completed at pumping rates of 750, 1,104, 1,525 and 1,750 gpm. MJ-PW3 was tested using a submersible test pump and portable generator. At the wellhead, a 90-degree elbow, pressure gauge and controlling gate valve were installed to regulate discharge. Also installed at the pumping well were a transducer/datalogger and fixed electronic tape to monitor water levels manually and electronically (Figure 11).

Approximately 460 feet of 8-inch flexible discharge line extended the test pump discharge away from MJ-PW3 to the southwest, connecting to a 10x7-inch orifice meter and manometer (Figure 12). Water levels in MJ-PW3 at the wellhead were monitored using both pressure transducer/datalogger and manual measurements. The transducer/data logger combination was programmed to record water level changes to a hundredth (0.01) of a foot every minute. A pressure transducer/datalogger was also installed on the discharge pipe manometer to record changes in discharge every minute (Figure 12).

Figure 13 graphically summarizes the drawdown measured in the pumping well as a function of SDT elapse time. These data are used to calculate the well performance parameters and aquifer hydraulic characteristics at and near the production well.

Figure 11. MJ-PW3 wellhead monitoring and flow control for SDT, CRT and RT.

Figure 12. SDT & CRT discharge pipe, orifice and manometer to measure discharge.

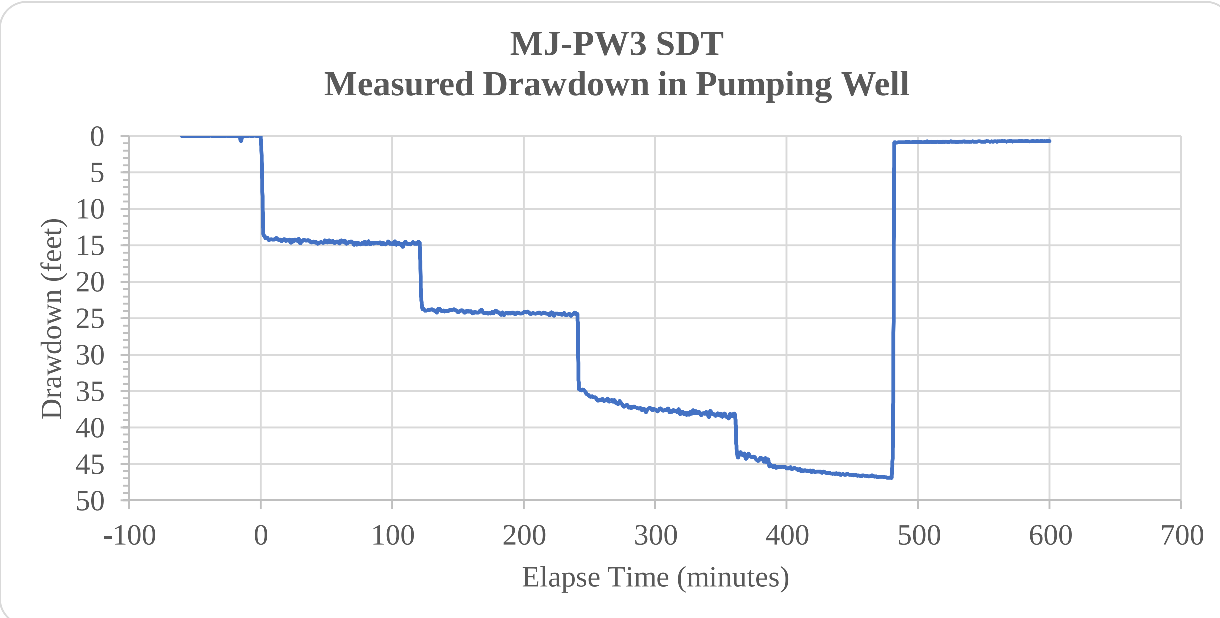


Figure 13. Graphical summary of drawdown vs. SDT elapse time at MJ-PW3.

Step Drawdown Test Results

The step test data was analyzed using various analytical techniques including those developed by Rorabaugh (1953), Kasenow (2001) and Bierschenk (1964). Analysis results are summarized in Figure 13. MJ-PW3 total in-well water level drawdown predictably decreases as pumping rates increase. This is graphically shown by the increase in the pumping well water level drawdown (Figure 14, 1st panel, dark blue line) as the discharge rate increased. Since all three of the SDT analysis methods provided virtually the same resulting total drawdown measured in the pumping well during the SDT, the various head loss components can be calculated with some certainty. This allows us to establish benchmark values for these individual head loss components of MJ-PW3 in its current condition as a newly constructed production well. These benchmark values represent the baseline or near optimal conditions to compare future well performance tests of MJ-PW3.

About 25 percent of the total drawdown in MJ-PW3 is attributed to natural flow restrictions within the aquifer and through the well filter pack. This is graphically depicted as the red line in panels 2, 3 and 4 of Figure 14. Commonly described as aquifer loss or laminar well loss, this head loss component considers the rate at which laminar flow contributes to the pumped well total drawdown. Aquifer loss is calculated using the aquifer loss coefficient “B”. As determined from March 10, 2025 SDT, the benchmark B coefficient value for MJ-PW3 was measured to be 0.0138 ft./gpm.

Depending upon pumping rate, well loss or turbulent flow loss, as measured by the well loss coefficient "C", causes about 21percent of the total drawdown in MJ-PW3 (green line in panels 2, 3 and 4, Figure 14). In its current state as new construction, a production well benchmark C coefficient value for MJ-PW3 of $6.72E^{-06}$ ft./gpm^2 was determined from the SDT results. This qualitatively suggests the well was properly designed and developed (Walton, 1962; Bierschenk, 1964).

A third head loss component affecting total drawdown in a well is partial penetration of the well screen within the aquifer. As shown by the light blue line in panels 2, 3 and 4 of Figure 14, partial penetration effects accounted for approximately 54 percent of the total drawdown in MJ-PW3. This was anticipated. Only a portion of the aquifer was screened for this production well to minimize effects of well interference and maintain sufficient available drawdown during seasonal variations of the groundwater piezometric levels.

From March 2025 SDT data, near-well aquifer transmissivity was estimated to be about 83,100 ft^2/day. Assuming an 79-foot aquifer thickness at MJ-PW3, an apparent hydraulic conductivity value 118 ft./day was calculated using the near-well transmissivity estimate (Figure 14). This K value assumes known hydraulic barrier boundaries were encountered within the short pumping duration of the SDT developing radius of influence.

A common technique to judge production well performance is to calculate the well's specific capacity at various discharge rates. Figure 15 graphically summarizes the changes in specific capacity and drawdown observed at MJ-PW3 during the March 2025 SDT.

Step Drawdown Test Analysis for Well MJ-PW3

Test Completed: March 10, 2025 (NWS & Terran)

Calculated Well-loss Coefficient Summary

Coefficient	B[2]	C[2]	n[2]	r_e[2]	L_p[3]
Method	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	(percent)
Rorabaugh[1]	0.0069	1.125E-06	2.13	2.40	58
Rorabaugh	0.0141	6.567E-06	2.00	0.00	55
Kasenow	0.0139	6.700E-06	2.00	0.01	54
Bierschenk	0.0140	6.652E-06	2.00	0.00	55
Jacob	0.0134	6.962E-06	2.00	0.01	52
Average	*0.0138*	*6.720E-06*	*2.00*	*0.01*	*54*

[1] Rorabaugh with best fit n & corrected for partial penetration
[2] Average all values not corrected for partial penetration
[3] Calculated using highest SDT discharge

Calculated Well Drawdown Summary

Not corrected for partial penetration - All Methods

Field	Jacob	Rorabaugh	Kasenow	Bierschenk	Field
Measured	Calculated total drawdown $s_{Tc} = BQ_n + CQ^n$				Measured
Q_n	s_{Tc}	s_{Tc}	s_{Tc}	s_{Tc}	s_{Tm}
(gpm)	(feet)	(feet)	(feet)	(feet)	(feet)
750	13.98	14.26	14.16	14.24	14.27
1104	23.30	23.57	23.47	23.57	23.52
1525	36.66	36.81	36.72	36.82	36.77
1750	44.81	44.85	44.78	44.88	44.95

Corrected for partial penetration - Rorabaugh Method

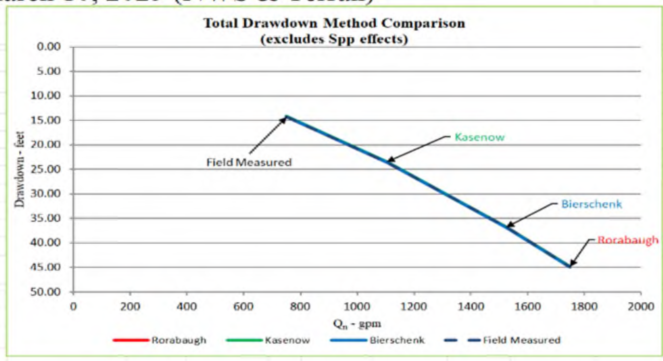
Coefficient	B	C	n	r_e	
	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	
Field	0.0069	1.125E-06	2.13	2.40	Field
Measured	Calculated $s_{Tc} = s_{pp} + s_a + s_w$				Measured
Q_n	s_{pp}	s_a	s_w	s_{Tc}	s_{Tm}
(gpm)	(feet)	(feet)	(feet)	(feet)	(feet)
750	7.65	5.17	1.45	14.27	14.27
1104	12.60	7.61	3.30	23.52	23.52
1525	19.71	10.52	6.56	36.78	36.77
1750	24.09	12.07	8.79	44.94	44.95

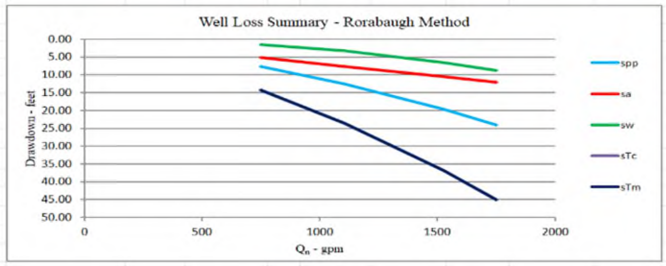
Corrected for partial penetration - Kasenow Method

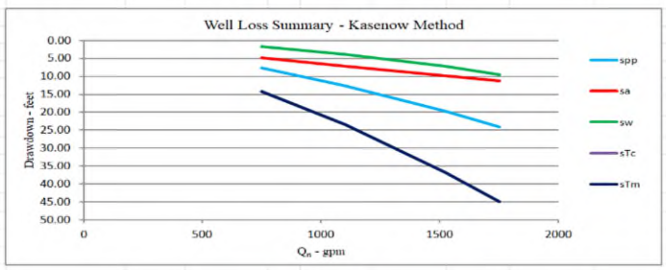
Coefficient	B	C	n	r_e	
	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	
Field	0.0064	3.109E-06	2.00	3.59	Field
Measured	Calculated $s_{Tc} = s_{pp} + s_a + s_w$				Measured
Q_n	s_{pp}	s_a	s_w	s_{Tc}	s_{Tm}
(gpm)	(feet)	(feet)	(feet)	(feet)	(feet)
750	7.65	4.82	1.75	14.22	14.27
1104	12.60	7.10	3.79	23.50	23.52
1525	19.71	9.81	7.23	36.75	36.77
1750	24.09	11.26	9.52	44.87	44.95

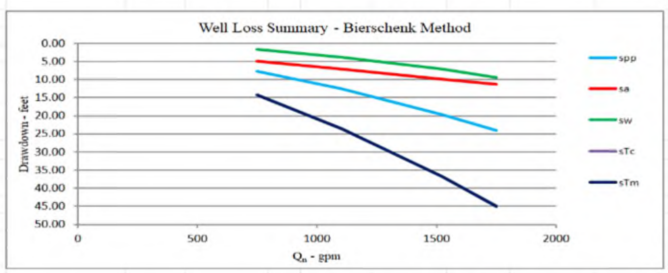
Corrected for partial penetration - Bierschenk Method

Coefficient	B	C	n	r_e	
	(ft/gpm)	(ft/gpm^2)	(unitless)	(feet)	
Field	0.0065	3.087E-06	2.00	3.39	Field
Measured	Calculated $s_{Tc} = s_{pp} + s_a + s_w$				Measured
Q_n	s_{pp}	s_a	s_w	s_{Tc}	s_{Tm}
(gpm)	(feet)	(feet)	(feet)	(feet)	(feet)
750	7.65	4.87	1.74	14.26	14.27
1104	12.60	7.17	3.76	23.54	23.52
1525	19.71	9.91	7.18	36.79	36.77
1750	24.09	11.37	9.45	44.92	44.95









Variables:

$Q =$	pumping rate	$s_T =$	total production well drawdown
$T =$	transmissivity	$s_{Tm} =$	total production well drawdown measured in the field
$S =$	storage coefficient	$s_{Tc} =$	calculated or modeled total production well drawdown
$t =$	pumping time	$s_{pp} =$	drawdown due to well screen partial penetration in aquifer
$r_w =$	pumping well radius		drawdown due to aquifer loss during pumping
$B =$	aquifer loss coefficient		drawdown due to well loss during pumping
$C =$	well loss coefficient	$Ro =$	radius of influence; distance to 0.01 ft drawdown
$s_c =$	specific capacity	$r_c =$	critical radius from well center into filter zone (turbulent/laminar flow)
$Vs =$	screen entrance velocity	$Se =$	estimated added head loss due to skin effect using Ro, r_w & r_e
$r_e =$	pumping well effective radius		
$L_p =$	laminar head loss ratio		
$Se =$	head loss due to skin effect		
Note:	Adjustment in Q needed		

CalcT Range	T ft^2/day	K ft/day	T gal/day ft	K gal/day/ft^2
Theis - s_{Tm}	11,110	118	83,101	886
B&R - s_{pp}	35,990	456	269,207	3,408

Estimated Ro using B =	966	feet	
Sc using 4th step Q =	38.9	gpm/ft	
Vs using 4th step Q =	0.113	ft/sec	(goal < 0.10 ft/sec)
Estimated filter zone r_c using B	30.2	inches	
Estimated Se using B results	4.77	feet	(goal Se <= 0 feet)

Walton/Sheahan Index Coefficient (C* - in ft/gpm^2) 6.73E-06

$C^* < 2.5 \times 10^{-5}$	=	properly designed & developed
$2.5\times10^{-5} > C^* < 5\times10^{-5}$	=	mild deterioration or clogging
$5\times10^{-5} > C^* < 2\times10^{-4}$	=	severe deterioration or clogging
$C^* > 2\times10^{-4}$	=	difficult to restore to original capacity

Bierschenk Development Factor (DF) = 0.05

DF < 0.1 = very effective (excellent) development
0.1 > DF < 0.5 = effective (good) development
0.5 > DF < 1.0 = fairly effective (fair) development
DF > 1.0 = poorly effective (poor) development

Figure 14. Summary graphic of step-drawdown test analysis for MJ-PW3.

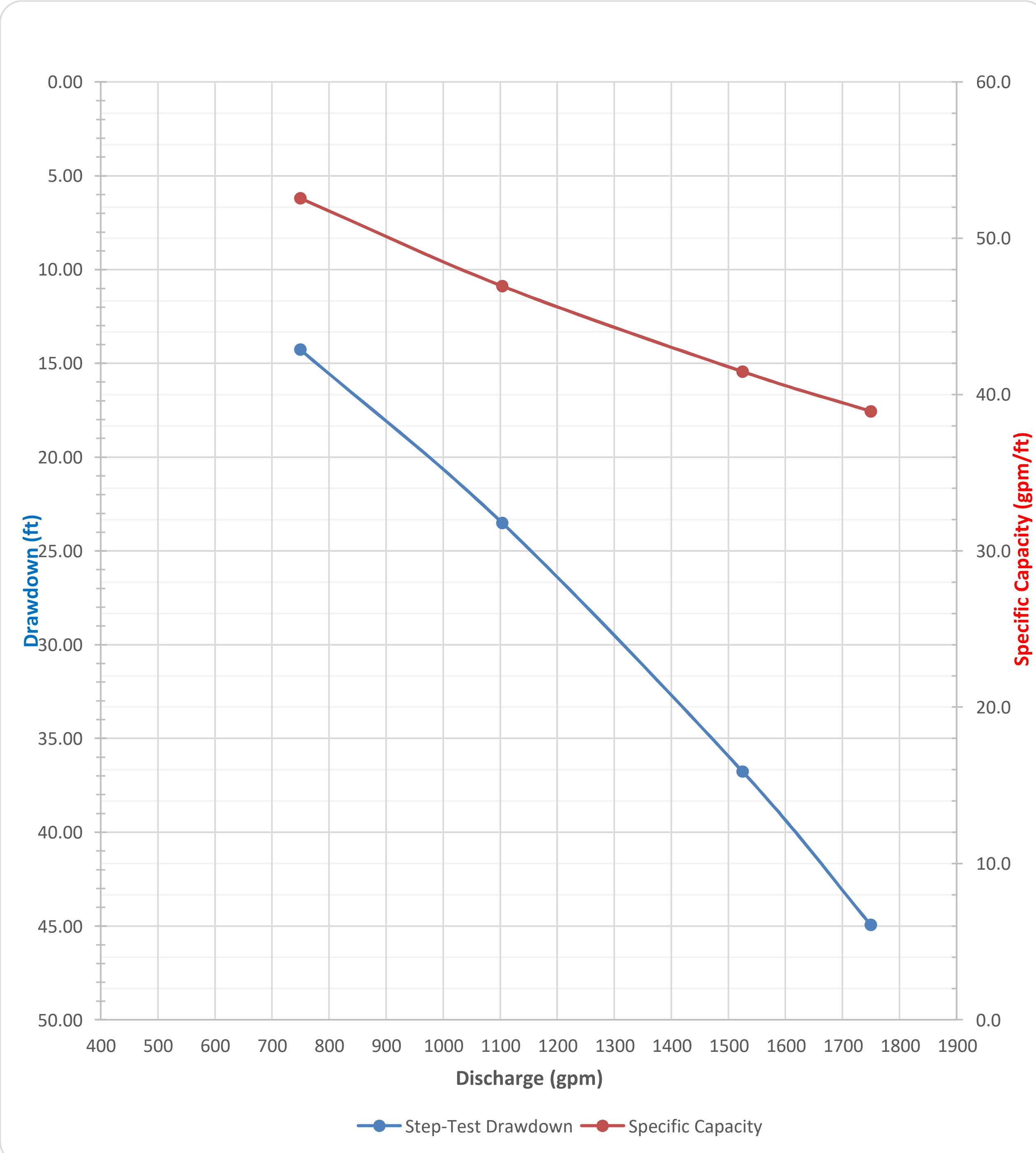


Figure 15. Changes in drawdown and specific capacity in MJ-PW3 during March 10, 2025 SDT.

Constant Rate Test Description

Beginning March 11th and concluding March 12, 2025, a 24-hour CRT and nominal 12-hour RT was completed by Terran and National Water Services at MJ-PW3. The pumping portion of the CRT began at 10:00 hours on March 11th and continued until March 12th at 10:10 hours. Discharge remained stable throughout the duration of the CRT, averaging 1,500 gpm. During the 1,450-minute pumping phase of the test, approximately 2.25 million gallons of water (2.25 MGD) were extracted.

Recording of water levels in the pumping and monitoring wells for the recovery phase of the CRT began immediately on March 12th at 10:10 hours and continued until 10:00 hours on March 13th. The aquifer water levels recovered at MJ-PW3 to 90% of the pre-pumping static water level in just a couple minutes of the pump shutdown (Figure 16). Hydraulically, MJ-PW3 response to the CRT pumping stress suggests confined aquifer conditions at this location.

Approximately 460 feet of 8-inch flexible discharge line extended the test pump discharge away from MJ-PW3 to the southwest, connecting to a 10x7-inch orifice meter and manometer (Figures 11 and 12). Water levels in MJ-PW3 at the wellhead were monitored using both pressure transducer/datalogger and manual measurements. The transducer/data logger combination was programmed to record water level changes to a hundredth (0.01) of a foot using a one-minute sampling schedule. A pressure transducer/datalogger was also installed on the discharge pipe manometer to record changes in discharge every minute (Figure 12).

Figure 16 graphically summarizes the drawdown and recovery measured in the pumping well as the function of CRT elapse time. Figure 17 is a corresponding graphical summary of discharge changes recorded at the manometer with elapse time. These data are used to calculate the well performance parameters and aquifer hydraulic characteristics at and near the production well.

In addition to collecting water level measurements manually and electronically at the pumping well, six additional locations were monitored using transducers and dataloggers: TW-1, OW-1, OW-2, MJ-PW1, TRN-3, and TRN-5. (Figure 1). Table 2 provides specific details of each monitoring location as it pertains to their use in the CRT analysis.

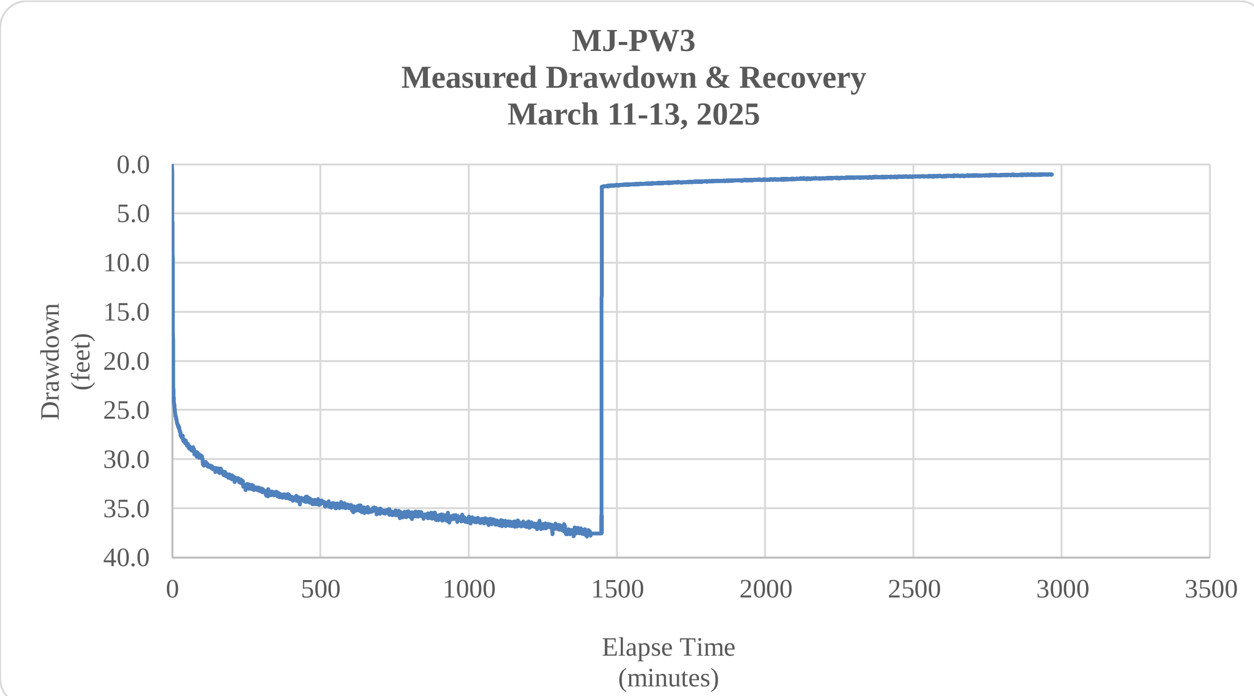


Figure 16. Graphical summary of drawdown and recovery vs. CRT elapse time at MJ-PW3.

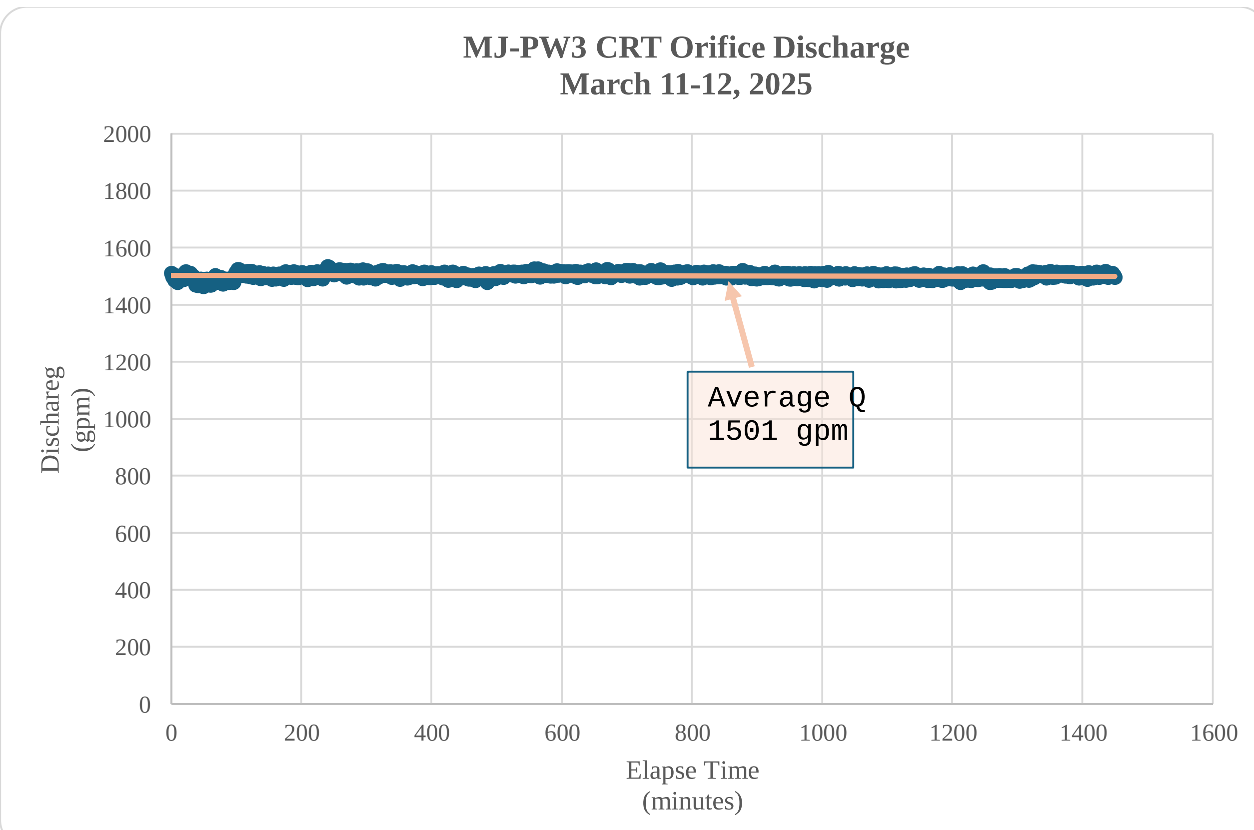


Figure 17. Graphical summary of discharge vs. elapse time during MJ-PW3 CRT pumping phase.

Table 2. Pumping and monitoring wells utilized in March 2025 MJ-PW3 SDT & CRT.

Well ID	Location		Ground Elevation (ft MSL)	Casing Stickup (feet)	Meas. Pt. Elevation (ft MSL)	Screen Diameter (inches)	Screen Length (feet)	Distance to Pump Well (feet)
	Northing/Y (feet)	Easting/X (feet)						
MJ-PW1	501775	1476820	613	3.5	~616	16	20	457
MJ-PW3	501446	1476503	612	3.6	~616	16	20	0
MJ-TW2	501809	1476503	610.2	2.2	612.4	16	20	405
MJ-TW1	501658	1476750	613.1	2.5	615.6	8	20	325
MJ-OW2	501531	1476298	611	3.5	613.81	2	15	223
MJ-OW1	501282	1476876	612.4	3	619.03	2	15	408
MJ-TRN3	501427	1476458	612.7	2.8	613.79	2	20	49
MJ-TRN5	500995	1476740	612	3.0	618.45	2	20	505

Note: Measuring point elevations are estimated for MJ-PW1, MJ-PW3, TW-1 and TW-2.

Constant Rate Test Results

Transmissivity and storativity may be estimated using the change in drawdown as a function of the production well discharge with time and distance to an observation well. Many aquifer analysis techniques have been developed for the evaluation of time-drawdown data. For the MJ-PW3 CRT, several of these techniques were used to determine key aquifer coefficients. The computer program AQTESOLV™ was used to apply the analytical methods of Moench-Prickett (1972), Theis (1935), Cooper-Jacob (1946), Papadopulos-Cooper (1967) and others to evaluate the CRT data. A representative analysis graph is shown in Figure 18 using the drawdown data from the pumping well and the 2-inch diameter observation well OW-1 about 408 feet distal of MJ-PW3. To provide an area-weighted estimate of transmissivity, Figure 19 presents residual drawdown curves of production and monitoring wells superimposed upon MJ-PW3 recovery data. A representative estimate of apparent transmissivity from this analysis would be about 100,000 gal/day/ft (13,400 ft^2/day). This value compares favorably with the CRT transmissivity and storativity values calculated using applicable analytical models for the pumped and observation wells (Table 3).

Analyses of water level data obtained during the CRT confirm the outwash aquifer in the study area behaves as a semi-confined hydrologic unit. In the vicinity of MJ-PW3 CRT and extending outward to the monitoring wells in the pumping well radius of influence, the induced flow regime appeared to start as linear moving to radial at test end. A representative apparent transmissivity value for the portion of the Middle-Junction property affected during the MJ-PW3 CRT would be ± 13,650 ft^2/day. Assuming the aquifer saturated thickness is 71 feet, a representative hydraulic conductivity would be ± 190 ft./day (Table 2).

Storativity is the measure of the volume of water retained in or released from storage in the aquifer, expressed as a function of surface area and change in head. The smaller the value for storativity, typically the more confined the aquifer. As shown in Table 3, once the cone-of-depression(s) extends beyond the immediate area of MJ-PW3, a representative calculated late-time storage value from the CRT would be 0.022 (2.19×10^{-2}).

Groundwater Production Potential at Middletown-Junction Property

The current groundwater conceptual site model of the Middletown-Junction property suggests the underlying aquifer consists of coarse outwash materials deposited in an erosional channel bounded by shale bedrock walls (Figure 9, Terran Corp., 2022a,b). This type of aquifer formation is commonly referred to as strip, channel or buried-valley aquifer. Groundwater flow in strip aquifers is strongly influenced by boundaries, usually resulting in an unexpectedly large drawdown of groundwater levels over large distances. When developing a wellfield in a strip aquifer, the underestimation of drawdowns can result in an overestimation of sustainable yields.

To determine representative values for transmissivity (T) and hydraulic conductivity (K) of the aquifer beneath Middletown-Junction, SDTs and CRTs were completed using MJ-PW1 and MJ-PW3 as individually pumped wells while measuring water level drawdown in available monitoring wells. Depending upon the pumping rate and duration of each test, the cone of depression may or may not encounter the aquifer boundaries. If no-flow or barrier boundaries are not reached during the pumping process of a test, the calculated T and K values will be higher and drawdown less than results for tests that are affected by boundaries.

We will use current and historical pumping tests at TW-1 and TW-2 to illustrate the effects of barrier boundaries at the Middletown Junction property. In 1993, a 2-hour SDT was completed at TW-1 using 3-steps of 300, 600 and 715 gpm discharge rates. Calculated test results for T and K were 60,800 ft^2/day and 822 ft./day, respectively. This SDT was followed by a 2880-minute CRT pumping at 700 gpm. Data from this test resulted in a calculated T value of 51,500 ft^2/day and 757 ft./day for hydraulic conductivity. A 2023 CRT pumped TW-1 at 222 gpm for 1,560 minutes. Results for T were 50,800 ft^2/day and 747 ft./day for K. It was noted that in the interpretation of these tests, the cone of depression did not extend sufficiently far to encounter significant barrier boundaries.

The geometric mean for these TW-1 pump tests results would be 54,200 ft^2/day for transmissivity and 775 ft./day for hydraulic conductivity. These mean aquifer coefficient values are used to estimate the theoretical water level drawdown in TW-1 if stressed at a higher pumping rate for a longer pumping duration. Using appropriate analytical equations, if TW-1 could be pumped at 1,700 gpm for ten days, about 9.3 feet of drawdown in the pumping well would be realized in the absences of barrier boundaries.

For comparison, in 2023 a 3-hour SDT was completed at TW-2 using 3-steps of 409, 557 and 730 gpm discharge rates. Calculated test results for T and K were 56,600 ft^2/day and 922 ft/day, respectively. Corrected for aquifer thickness, T and K values from the SDTs at TW-1 and TW-2 are very similar if not the same. Specific capacity for the TW-1 SDT 3rd step was 268 gpd/ft compared to TW-2 SDT 3rd step of 266 gpm/ft. This is to be expected since both wells are completed in the same strip aquifer spaced only 310 feet apart.

In 1994, a CRT using well TW-2 pumping at 1,700 for ten days was performed. The total drawdown in this test production well at the end of ten days pumping was 26 feet. The cause for the unusually large drawdown response appears to be barrier boundaries. The 1994 CRT sufficiently stressed the aquifer over the ten-day period to reduce the apparent or effective transmissivity from 56,600 ft^2/day to 15,400 ft^2/day. Effective hydraulic conductivity was lowered from about 901 ft./day to 250 ft./day (Figures 21 and 22).

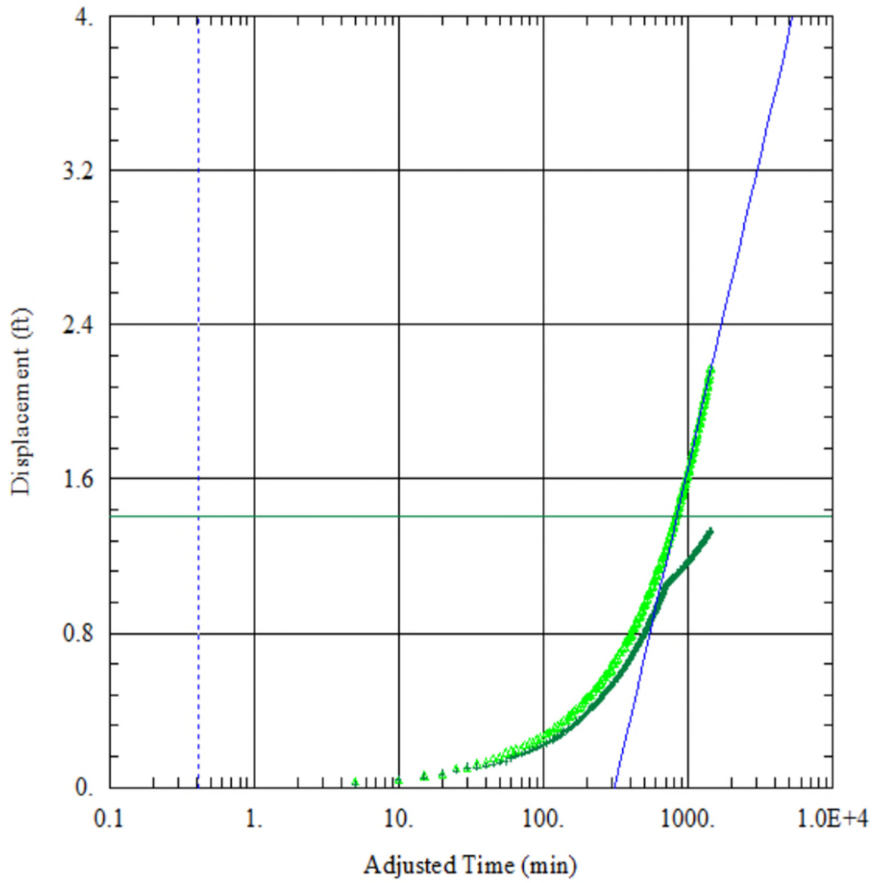
The recently completed SDT and CRT at MJ-PW3 provided ample stress to the aquifer to measure the effects of barrier boundaries on water level drawdowns in the pumping and monitoring wells. Figures 14 and 24 summarize a portion of this data to determine representative T and K values throughout the aquifer when MJ-PW3 pumping stresses invoke barrier boundary effects. This information is used to update and utilize the numerical groundwater model for the Middletown-Junction property in assessing production well(s) performance along with estimating sustainable production potential.

Table 3. Calculated aquifer transmissivity and storativity values for MJ-PW3 and selected monitoring wells.

Pumping Well	Obs. Well	Test Type	Solution Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)[1]	Storativity (unitless)
MJ-PW3	MJ-PW3	Step-Drawdown	Theis	9,360	118	NA
MJ-PW3	MJ-PW3	Step-Drawdown	Bradbury & Rothschild	35,990	456	NA
MJ-PW3	MJ-PW3	Constant Rate	Specific Capacity	9,590	121	NA
			Geometeric Mean	***14,783***	***187***	
MJ-PW3	MJ-PW3	Constant Rate	Cooper-Jacob	8,730	123	NA
MJ-PW3	MJ-PW3	Recovery	Theis (Recovery)	23,580	332	NA
			Geometeric Mean	***14,348***	***202***	
MJ-PW3	MJ-PW1	Constant Rate	Neuman	12,100	170	2.00E-08
MJ-PW3	MJ-PW1	Constant Rate	Cooper-Jacob	14,130	199	3.67E-02
MJ-PW3	MJ-PW1	Constant Rate	Moench (Case 2)	8,290	117	2.00E-12
MJ-PW3	MJ-PW1	Recovery	Theis (Recovery)	16,100	227	NA
			Geometeric Mean	***12,291***	***173***	***1.14E-07***
MJ-PW3	MJ-TW1	Constant Rate	Cooper-Jacob	13,780	194	6.48E-02
MJ-PW3	MJ-TW1	Constant Rate	Moench-Prickett	12,330	174	1.03E-01
MJ-PW3	MJ-TW1	Constant Rate	Neuman	13,060	184	8.66E-02
MJ-PW3	MJ-TW1	Recovery	Theis (Recovery)	13,440	189	NA
			Geometeric Mean	***13,141***	***185***	***8.33E-02***
MJ-PW3	MJ-TRN3	Constant Rate	Cooper-Jacob	16,600	234	2.80E-02
MJ-PW3	MJ-TRN3	Constant Rate	Cooley-Case	16,220	228	4.27E-06
MJ-PW3	MJ-TRN3	Constant Rate	Moench (Case 2)	12,500	176	2.50E-01
			Geometeric Mean	***14,986***	***211***	***3.10E-03***
MJ-PW3	MJ-TRN5	Constant Rate	Cooper-Jacob	18,780	265	3.47E-02
MJ-PW3	MJ-TRN5	Constant Rate	Moench (Case 2)	9,200	130	2.17E-05
MJ-PW3	MJ-TRN5	Constant Rate	Neuman	9,030	127	5.64E-03
MJ-PW3	MJ-TRN5	Recovery	Theis (Recovery)	16,900	238	NA
			Geometeric Mean	***12,743***	***179***	***1.62E-03***
MJ-PW3	MJ-OW1	Constant Rate	Cooper-Jacob	16,320	230	4.73E-02
MJ-PW3	MJ-OW1	Constant Rate	Neuman	12,800	180	1.23E-02
MJ-PW3	MJ-OW1	Constant Rate	Moench-Prickett	11,200	158	7.41E-03
MJ-PW3	MJ-OW1	Recovery	Theis (Recovery)	17,130	241	NA
			Geometeric Mean	***14,149***	***199***	***1.63E-02***
MJ-PW3	MJ-OW2	Constant Rate	Cooper-Jacob	13,110	185	1.52E-01
MJ-PW3	MJ-OW2	Constant Rate	Papadopulos-Cooper	13,850	195	1.81E-01
MJ-PW3	MJ-OW2	Constant Rate	Moench (Case 2)	12,130	171	7.46E-04
MJ-PW3	MJ-OW2	Recovery	Theis (Recovery)	16,925	238	NA
			Geometeric Mean	***13,895***	***196***	***2.74E-02***

Note [1]: Normalized hydraulic conductivity calculated using 71 feet as a saturated aquifer thickness

Notes: NA = Calculation method does not provide estimates of this variable



AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (Kz/Kr): 0.1072

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MJ-PW3	1476502.8	501445.9

Observation Wells

Well Name	X (ft)	Y (ft)
MJ-OW1	1476876	501282

SOLUTION

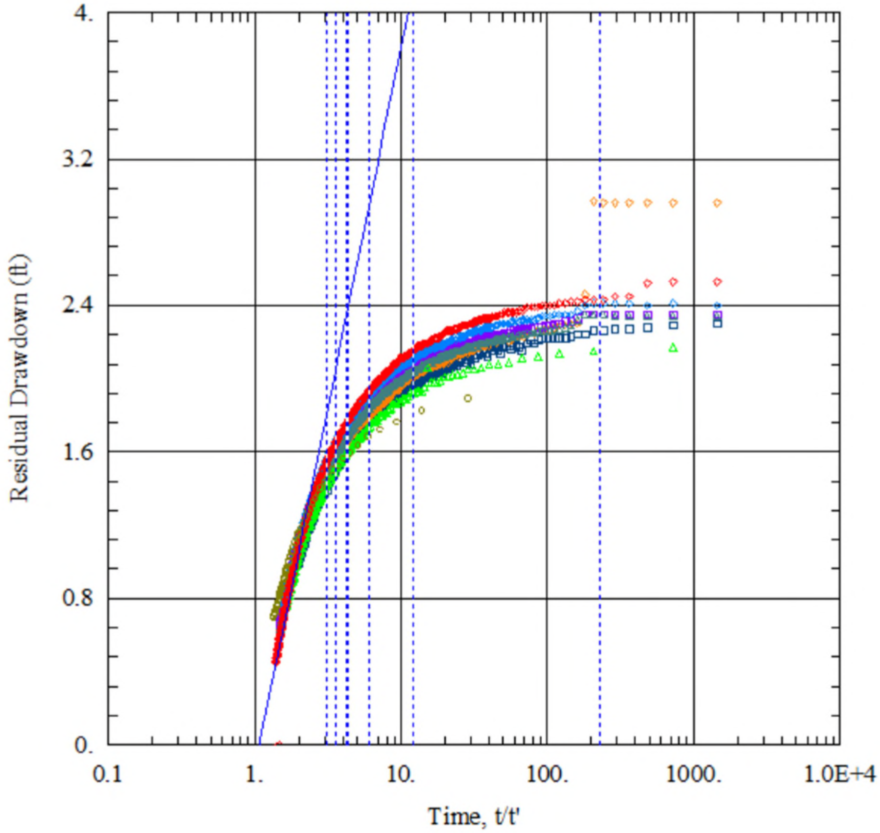
Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 1.221E+5 gal/day/ft

S = 0.04732

Figure 18. Example analysis hydrograph of drawdown in monitoring well MJ-OW1 for the March 2025 MJ-PW3 CRT.



AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (Kz/Kr): 0.9999

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MJ-PW3	1476502.8	501445.9

Observation Wells

Well Name	X (ft)	Y (ft)
MJ-PW3	1476502.8	501445.9
MJ-TRN3	1476458	501427
MJ-PW1	1476819.7	501774.6
MJ-TW2	1476507	501851
MJ-OW1	1476876	501282
MJ-OW2	1476298	501531
MJ-TW1	1476749.5	501657.9
MJ-TRN-5	1476753.7	501007.5

SOLUTION

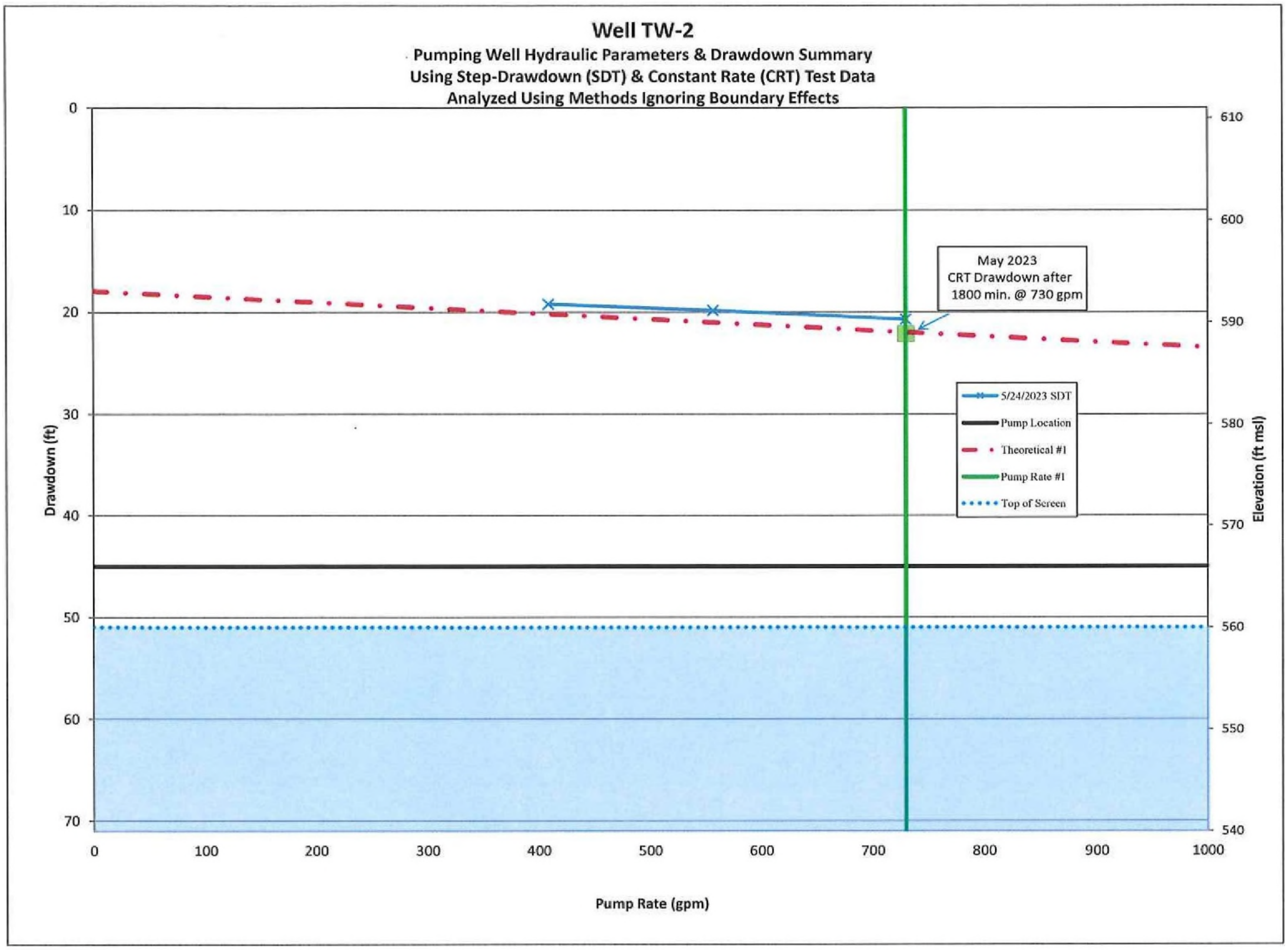
Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1.005E+5 gal/day/ft

S/S' = 1.079

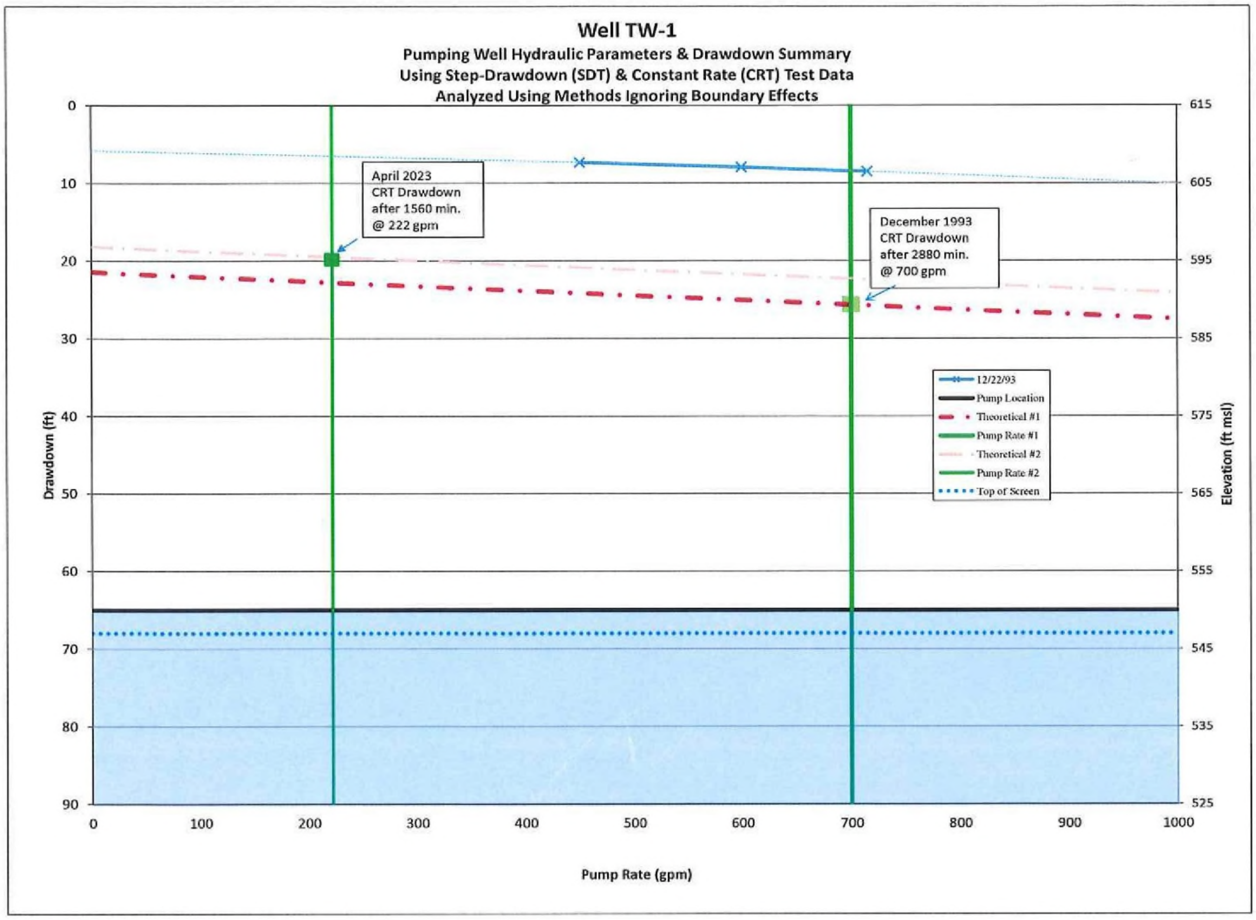
Figure 19. Composite residual recovery analysis of March 2025 MJ-PW3 CRT.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	Highest Pumping Stress (gpm)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients: Aquifer B (ft/gpm)	Loss Coefficients: Well C (ft/gpm^2)	Near-Well Aquifer Parameters: T (gal/day/ft)	K (ft/d)	S (unitless)	S_y (unitless)	Comments
5/24/2023	SDT	180	730	60	3	0.0021	2.27E-06	423,000	992			B & C - four analysis methods; T & K by Theis; b=53 ft
5/24/2023	Spc. Cap.	180	730					399,600	937			Driscoll unconfined method; b=53 ft
5/25-26/2023	CRT	1800	730					380,000	958			Theis method; b=53 feet
5/25-26/2023	CRT	1800	730					376,500	950			Theis recovery method; b=53 ft.
5/25-26/2023	CRT	1800	730					383,000	966			Cooper-Jacob method; b=53 ft.
5/25-26/2023	Obs	1800	730					291,000	734		0.109	Jaeger method using TW-1; b=53 ft
5/25-26/2023	Obs	1800	730					311,800	787		0.118	Jaeger method using TRN-2; b=53 ft
5/25-26/2023	D-D	1800	730					363,500	917	0.002		Kasenow method of D-D using TW-1; b=53 ft
Existing data analysis representative well/aquifer coefficients:						**0.0021**	**2.27E-06**	**363,600**	**901**	**0.002**	**0.113**	

Notes:
- SDT are Step-Drawdown Tests
- Spc. Cap. are analyses techniques to calculated T & K values using Specific Capacity values
- CRT are Constant Rate Tests
- D-D are Distance Drawdown analyses methods
- Obs are Observation well analysis methods. The pumping well being evaluated was used as an observation well during a nearby well pump or aquifer test.
- due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

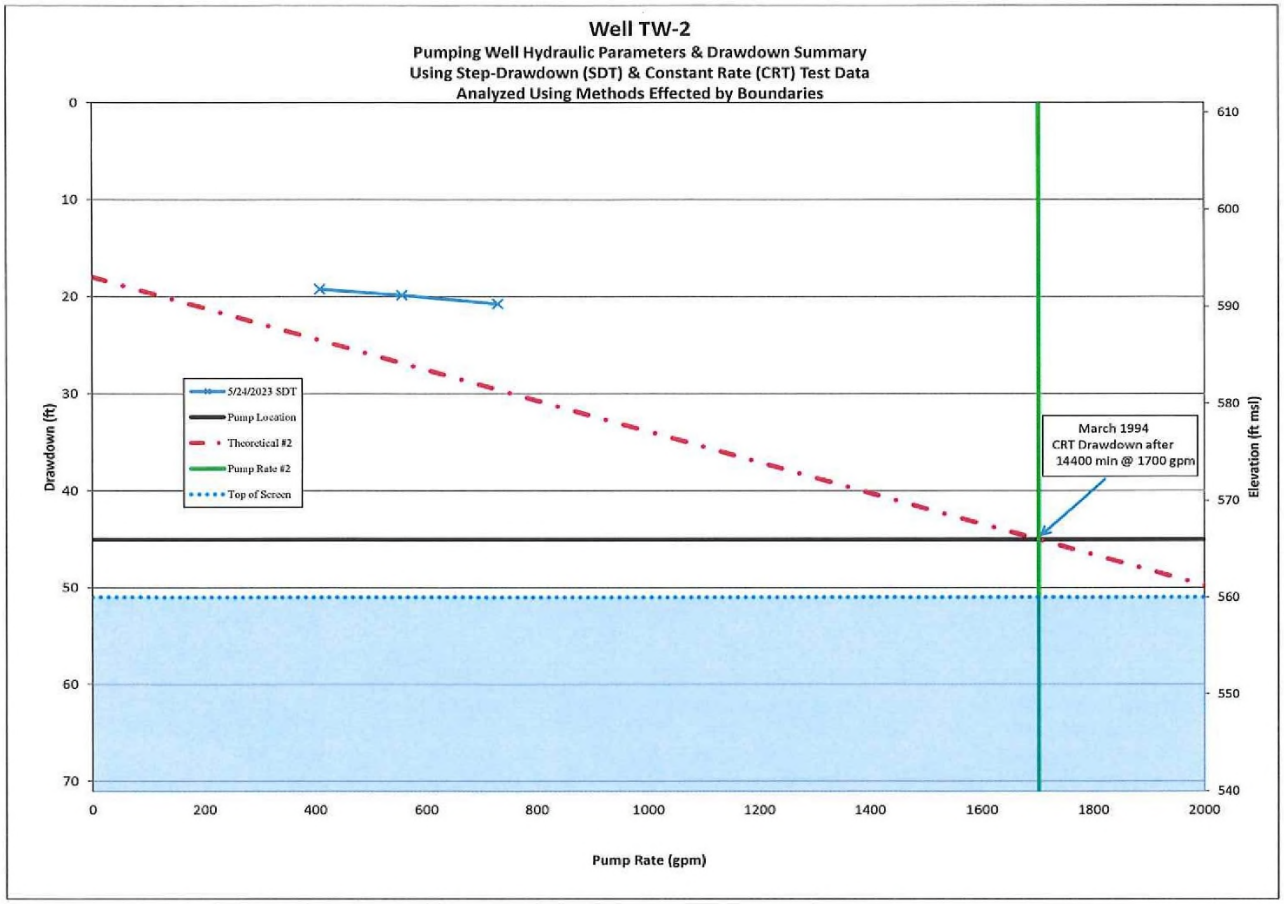
Figure 20. Summary graphic illustrating aquifer coefficients calculated for TW-2 ignoring boundaries.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	Highest Pumping Stress (gpm)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients: Aquifer B (ft/gpm)	Loss Coefficients: Well C (ft/gpm^2)	Near-Well Aquifer Parameters: T (gal/day/ft)	K (ft/d)	S (unitless)	S_y (unitless)	Comments
12/22/1993	SDT	360	715	120	3	0.0025	1.77E-06	509,040	920			B & C - four analysis methods; T & K by Theis; b=68 ft
12/27-28/1993	CRT	2880	700					385,000	757			Theis method; b=68 feet
12/27-28/1993	CRT	2880	700					542,900	1067			Theis recovery method; b=68 ft.
12/27-28/1993	CRT	2880	700					477,200	938			Cooper-Jacob method; b=68 ft.
12/27-28/1993	Obs	2880	700					449,900	885	0.0015	0.278	Neuman method using MJ-P1 by CEC; b=68 ft
12/27-28/1993	Spc. Cap.	2880	700					283,600	722			GeoMean T & K from six unconfined methods; b=53 ft
4/11-12/2023	CRT	1560	222					380,000	747			Theis method; b=68 feet
4/11-12/2023	CRT	1560	222					514,200	923			Cooper-Jacob method; b=68 ft.
4/11-12/2023	Obs	1560	222					451,600	888			Theis recovery method using TRN-1; b=68 ft.
4/11-12/2023	Obs	1560	222					275,300	541			Cooper-Jacob method using TRN-1 & boundaries; b= 68 ft
4/11-12/2023	Obs	1560	222					493,200	969	0.0025	0.102	Tartakovsky-Neuman method using TRN-1; b=68 ft.
4/11-12/2023	Obs	1560	222					298,900	588	0.0020	0.162	Neuman method using TRN-1; b=68 ft.
4/11-12/2023	Spc. Cap.	1560	222					256,200	614			GeoMean T & K from six unconfined methods; b=56 ft
Existing data analysis representative well/aquifer coefficients:						**0.0025**	**1.77E-06**	**396,282**	**796**	**0.0020**	**0.166**	

Notes:
- SDT are Step-Drawdown Tests
- Spc. Cap. are analyses techniques to calculated T & K values using Specific Capacity values
- CRT are Constant Rate Tests
- D-D are Distance Drawdown analyses methods
- Obs are Observation well analysis methods. The pumping well being evaluated was used as an observation well during a nearby well pump or aquifer test.
- due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

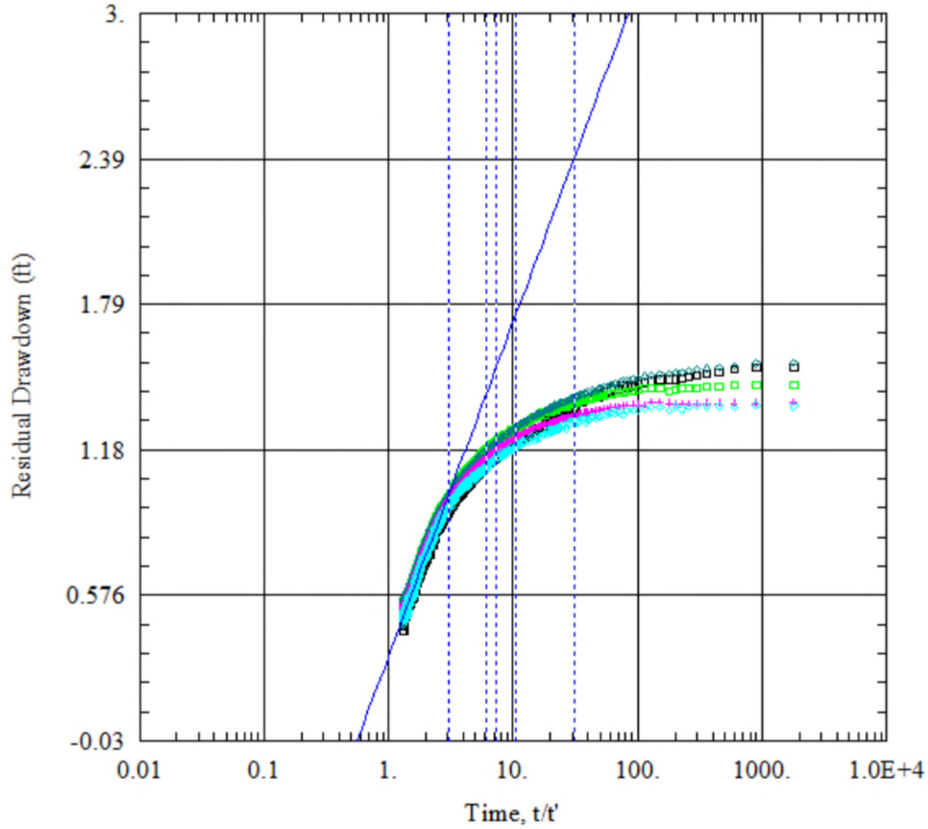
Figure 21. Summary graphic illustrating aquifer coefficients calculated for TW-1 ignoring boundaries.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	Highest Pumping Stress (gpm)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients: Aquifer B (ft/gpm)	Loss Coefficients: Well C (ft/gpm^2)	Near-Well Aquifer Parameters: T (gal/day/ft)	K (ft/d)	S (unitless)	S_y (unitless)	Comments
4/18-28/1994	CRT	14400	1702					120,000	303			Theis method; b=53 feet
4/18-28/1994	Spc. Cap.	14400	1702					125,800	295			GeoMean T & K from six unconfined methods; b=53 ft
5/25-26/2023	Obs	1800	730					85,700	216	0.0005	0.114	Neuman/Agarwal unconfined method using TRN-1: b=53 ft.
5/25-26/2023	Obs	1800	730					80,500	203	0.0005	0.114	Tart/Neu/Agarwal unconfined method using TRN-1: b=53 ft.
5/25-26/2023	Obs	1800	730					89,800	226	0.0005	0.391	Neuman/Agarwal unconfined method using TRN-2: b=53 ft.
5/25-26/2023	Obs	1800	730					86,800	219	0.0005	0.392	Tart/Neu/Agarwal unconfined method using TRN-2: b=53 ft.
5/25-26/2023	Obs	1800	730					80,700	206	0.0005	0.14	Neuman/Agarwal unconfined method using TW-1: b=53 ft.
5/25-26/2023	Obs	1800	730					76,900	194	0.0005	0.141	Tart/Neu/Agarwal unconfined method using TW-1: b=53 ft.
5/25-26/2023	Obs	1800	730					123,900	313	0.0005	0.391	Neuman/Agarwal unconfined method using TRN-5: b=53 ft.
5/25-26/2023	Obs	1800	730					117,400	296	0.0004	0.03	Tart/Neu/Agarwal unconfined method using TRN-5: b=53 ft.
5/25-26/2023	Obs	1800	730					132,700	335		0.013	Cooper-Jacob method for TRN-5; b=53 ft.
5/25-26/2023	Obs	1800	730					119,600	302		0.049	Cooper-Jacob method for TRN-1; b=53 ft.
5/25-26/2023	Obs	1800	730					115,600	292		0.033	Cooper-Jacob method for TRN-3; b=53 ft.
Existing data analysis representative well/aquifer coefficients:								**98,952**	**250**	**0.0005**	**0.100**	

Notes:
- SDT are Step-Drawdown Tests
- Spc. Cap. are analyses techniques to calculated T & K values using Specific Capacity values
- CRT are Constant Rate Tests
- D-D are Distance Drawdown analyses methods
- Obs are Observation well analysis methods. The pumping well being evaluated was used as an observation well during a nearby well pump or aquifer test.
- due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

Figure 22. Summary graphic illustrating aquifer coefficients calculated for TW-2 that includes boundary effects.



WELL TEST ANALYSIS

AQUIFER DATA

Saturated Thickness: 57. ft

Anisotropy Ratio (Kz/Kr): 0.3831

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
TW-2	1476507	501851

Observation Wells

Well Name	X (ft)	Y (ft)
TW-2	1476507	501851
TW-1	1476749	501657
TRN-2	1476342	501796
TRN-3	1476473	501426
OW-2	1476266	501550

SOLUTION

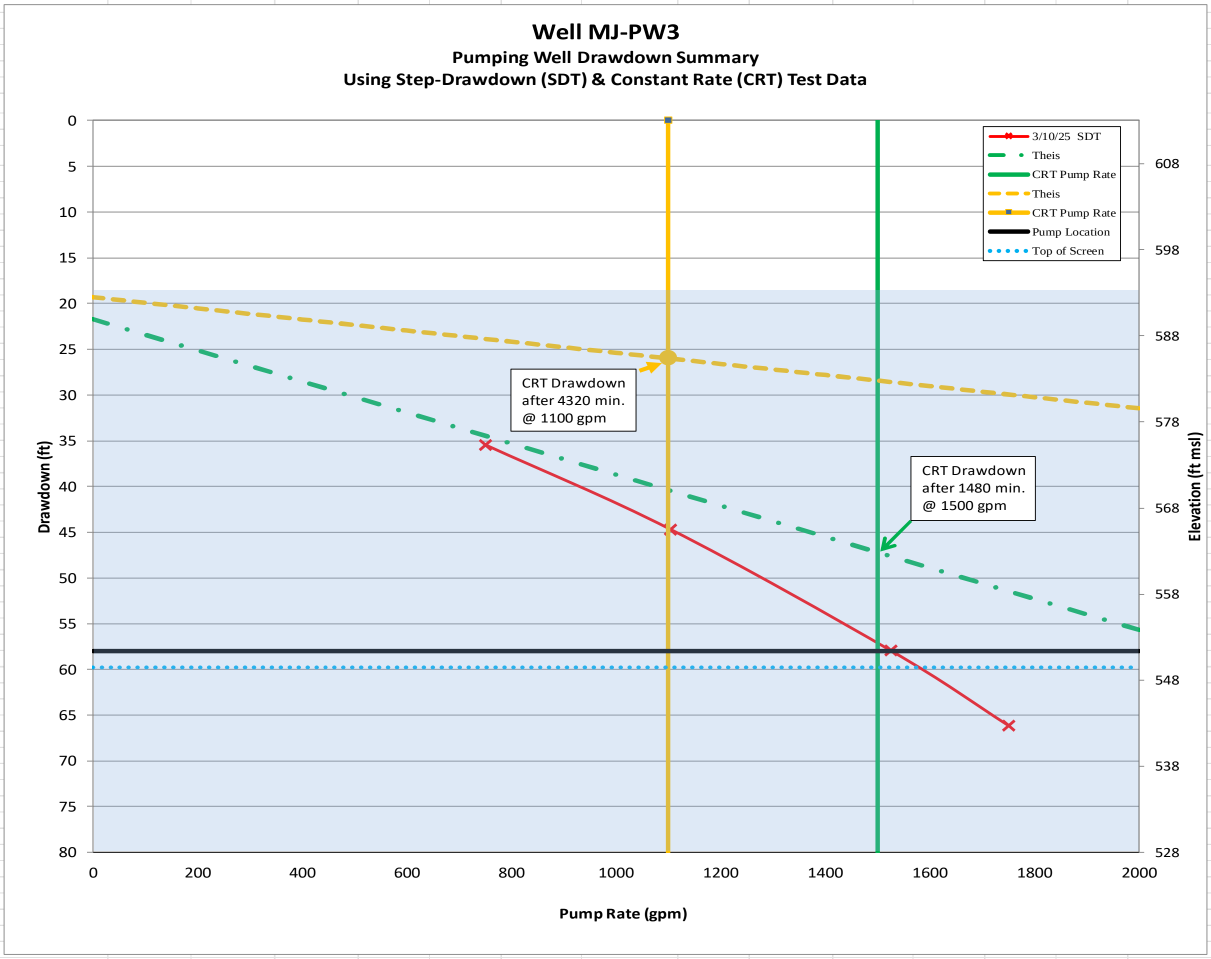
Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1.849E+4 ft^2/day

S/S' = 0.589

Figure 23. Monitoring well composite residual drawdown curves used in the TW-2 CRT analysis including the effects of barrier boundaries.



Test Date	Test Analysis Type	Total Pumping Duration (minutes)	SDT Step Duration (minutes)	SDT Step Events (each)	Loss Coefficients Aquifer B (ft/gpm)	Loss Coefficients Well C (ft/gpm^2)	Near-Well Aquifer Parameters T (ft^2/day)	Near-Well Aquifer Parameters K (ft/d)	Near-Well Aquifer Parameters S/S_y (unitless)	Comments
3/10/2025	SDT	480	120	4	0.0138	6.72E-06	9,360	132		Theis method; b=71 ft.; leaky confined conditions
3/11-12/2025	CRT	1450					13,370	188		Theis method; b=71 ft.; leaky confined conditions
3/11-12/2025	CRT	1450					8,730	123		Cooper-Jacob method; b=71 ft.
3/11-12/2025	CRT	1450					23,580	332		Theis Recovery method; b=71 feet
3/11-12/2025	CRT	1450					11,200	158	0.00741	Paired w/MJ-OW1, Moench-Prickett ; r=408 ft.
3/11-12/2025	CRT	1450					12,330	174	0.01030	Paired w/MJ-TW1, Moench-Prickett method; r=325 ft.
3/11-12/2025	CRT	1450					12,130	171	0.00075	Paired w/MJ-OW2, Moench (Case 2) method; r=223 ft.
3/11-12/2025	CRT	1450					9,200	130	0.00002	Paired w/MJ-TRN5, Moench (Case 2) method; r=505 ft.
3/11-12/2025	CRT	1450					14,130	199	0.00367	Paired w/MJ-PW1. Cooper-Jacob; r=457 ft.
3/11-12/2025	CRT	1450					12,500	176	0.02500	Paired w/MJ-TRN3, Moench (Case 2) method; r=49 ft.
Existing data analysis representative well/aquifer coefficients:					**0.0138**	**6.72E-06**	**12,150**	**171**	**0.00220**	*(Using geometric means)*

Notes:	SDT	are Step-Drawdown Tests
	Spc. Cap.	are analyses techniques to calculated T & K values using Specific Capacity values
	CRT	are Constant Rate Tests
	D-D	are Distance Draw-down analyses methods
		due to the test data not meeting the analysis method assumptions or boundaries, these values are incorrect and should not be considered representative

Figure 24. Summary graphic illustrating aquifer coefficients calculated for MJ-PW3 that includes boundary effects.

Groundwater Quality Results

A groundwater sample was collected from test well MJ-PW3 on March 12, 2025. The sample was collected at the conclusion of the 24-hour constant rate test from a metal sample port located off the pump casing. The lab results for a groundwater samples from test wells TW-1 and TW-2 are also provided for comparison purposes (Tables 4 and 5). A copy of the MJ-PW3 lab results is provided in Attachment #4 of this technical memorandum.

Groundwater samples from MJ-PW3 were analyzed for the water quality parameters of volatile organic compounds (VOCs), synthetic organic compounds (SOCs), total metals (Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Hg, Pb, Mg, Mn, Ni, Se, Ag, Na, Tl and Zn), fluoride, chloride, total dissolved solids (TDS), alkalinity, pH, sulfate, nitrate, nitrate, cyanide and Polyfluoroalkyl Substances (PFAS) (Tables 4 and 5).

The inorganic metal constituents reported for MJ-PW3 included arsenic (0.002J), barium (0.128 mg/L), calcium (93.1 mg/L), copper (0.010J mg/L), lead (0.005J mg/L), magnesium (24.0 mg/L), manganese (0.015J mg/L), sodium (42.3 mg/L) and zinc (0.0195 mg/L). General chemistry parameters included total alkalinity (275 mg/L), chloride (91.3 mg/L), fluoride (0.20 mg/L), pH (6.0 s.u.), TDS (476 mg/L), nitrate (0.45J mg/L), nitrite (0.01J) and sulfate (49.5 mg/L) (Tables 4 and 5).

All of the reported inorganic constituents are of a natural occurrence, commonly found in soil and groundwater. Of the reported inorganic levels in MJ-PW3, none of the common constituents have exceeded their respective U.S. EPA Maximum Contaminant Levels (MCLs); however, the constituents of iron did exceed its Secondary Maximum Contaminant Level (SMCL) (Tables 4 and 5).

Organic constituents analyzed included VOCs, SOCs and PFAS constituents (Tables 4 and 5). No detectable concentrations of VOCs or SOCs were reported for MJ-PW3. The PFAS constituent of perfluorooctane sulfonate (PFOS) was reported at 0.0839 µg/L, exceeding the MCL of 0.004 µg/L. Two other PFAS constituents reported included Perfluorobutane sulfonate (PFBS) at 0.00209 µg/L and Perfluorooctanoic acid (PFOA) at 0.00272 µg/L; both PFAS constituents are reported at concentrations below federal action levels.

Two total coliform bacteria water samples were also collected, respectively at 9:45 and 10:15 a.m. at the conclusion of the MJ-PW3 24-hour CRT pump test; both sample results tested negative for total coliform (Tables 4 and 5).

Table 4. Summary of Analytical Results for Ground Water Samples from MJ-PW3 (and test wells TW-1 and TW-2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	TW-1*	TW-2	MJ-PW3	MCL	SMCL
Inorganic Parameters					
Alkalinity, total (as $CaCO_3$) (mg/l)	344	311	275	NA	NA
Antimony, total (mg/l)	ND	<0.005	<0.003	0.006	
Arsenic, total (mg/l)	ND	<0.010	0.002 J	0.010	
Barium, total (mg/l)	0.216	0.127	0.128	2	
Beryllium, total (mg/l)	ND	<0.001	<0.001	0.004	
Cadmium, total (mg/l)	0.71	<0.002	<0.001	0.005	
Calcium, total (mg/l)	109	114	93.1		
Chloride (mg/l)	43.3	52.1	91.3		250
Chromium, total (mg/l)	ND	<0.005	<0.005	0.1	
Copper, total (mg/l)	ND	<0.005	0.010 J	1.3	1.0
Cyanide, total (mg/l)	ND	<0.0050	0.000734 J	0.2	
Fluoride (mg/l)	ND	0.24	0.20	4	2
Iron, total (mg/l)	**2.44**	<0.2	**0.579**		0.3
Lead, total (mg/l)	ND	<0.005	0.0005J	0.015	
Magnesium, total (mg/l)	29.8	28.2	24.0		
Manganese, total (mg/l)	**0.365**	<0.100	0.015J		0.05
Mercury, total (mg/l)	ND	NA	<0.0005	0.002	
Nickel, total (mg/l)	ND	<0.005	<0.010		
Nitrate-N as NO3-N (mg/l)	ND	0.59	0.45 J	10	
Nitrite-N as NO2-N (mg/l)	ND	NA	0.01 J	1	
pH (s.u.)	7	8.1	6.0		6.5-8.5
Total Dissolved Solids (mg/l)	**529**	360	476		500
Selenium, total (mg/l)	ND	<0.010	<0.005	0.05	
Silver, total (mg/l)	ND	<0.002	<0.010		0.1
Sodium, total (mg/l)	20.7	28.0	42.3		
Sulfate (mg/l)	53.9	39.5	49.5		250
Thallium, total (mg/l)	ND	<0.050	<0.001	0.002	
Zinc, total (mg/l)	ND	<0.160	0.0195		5
Volatile Organic Chemicals (VOCs)					
Benzene (µg/l)	ND	<1.0	<0.5	5	
Bromobenzene (µg/l)	ND	<1.0	NA		
Bromochloromethane (µg/l)	ND	<1.0	NA		
Bromodichloromethane (µg/l)	ND	<1.0	NA		
Bromoform (µg/l)	ND	<1.0	NA		
Bromomethane (µg/l)	ND	<1.0	NA		
n-Butylbenzene (µg/l)	ND	<1.0	NA		
sec-Butylbenzene (µg/l)	ND	<1.0	NA		

** Sample results from Tetra Tech (2007)*

Table 4. Summary of Analytical Results for Ground Water Samples from MJ-PW3 (and test wells TW-1 and TW-2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	TW-1	TW-2	MJ-PW3	MCL	SMCL
Volatile Organic Chemicals (VOCs) (Continued)					
tert-Butylbenzene (µg/l)	ND	<1.0	NA		
Carbon Tetrachloride (µg/l)	ND	<1.0	<0.5	5	
Chlorobenzene (µg/l)	ND	<1.0	<0.5	100	
Chloroethane (µg/l)	ND	<1.0	NA		
Chloroform (µg/l)	ND	<1.0	NA		
Chloromethane (µg/l)	ND	<1.0	NA		
2-Chlorotoluene (µg/l)	ND	<1.0	NA		
4-Chlorotoluene (µg/l)	ND	<1.0	NA		
Dibromochloromethane (µg/l)	ND	<1.0	NA		
Dibromomethane (µg/l)	ND	<1.0	NA		
1,2-Dichlorobenzene (µg/l)	ND	<1.0	<0.5	600	
1,3-Dichlorobenzene (µg/l)	ND	<1.0	NA		
1,4-Dichlorobenzene (µg/l)	ND	<1.0	<0.5	75	
Dichlorodifluoromethane (µg/l)	ND	<1.0	NA		
1,1-Dichloroethane (µg/l)	ND	<1.0	NA		
1,2-Dichloroethane (µg/l)	ND	<1.0	<0.5	5	
1,1-Dichloroethene (µg/l)	ND	<1.0	<0.5	7	
cis-1,2-Dichloroethene (µg/l)	ND	<1.0	<0.5	70	
trans-1,2-Dichloroethene (µg/l)	ND	<1.0	<0.5	100	
Dichloromethane (methylene chloride) (µg/l)	0.94	<1.0	<0.5	5	
1,2-Dichloropropane (µg/l)	ND	<1.0	<0.5	5	
1,3-Dichloropropane (µg/l)	ND	<1.0	NA		
2,2-Dichloropropane (µg/l)	ND	<1.0	NA		
1,1-Dichloropropene (µg/l)	ND	<1.0	NA		
1,3-Dichloropropene (cis & trans) (µg/l)	ND	<1.0	NA		
1,2-Dibromo-3-chloropropane (µg/l)	ND	<5.0	NA		
1,2-Dibromoethane (EDB) (µg/l)	ND	<1.0	NA		
Ethylbenzene (µg/l)	ND	<1.0	<0.5	700	
Fluorotrichloromethane (µg/l)	ND	<1.0	NA		
Hexachlorobutadiene (µg/l)	ND	<1.0	NA		
Isopropylbenzene (µg/l)	ND	<1.0	NA		
p-Isopropyltoluene (µg/l)	ND	<1.0	NA		
Naphthalene (µg/l)	ND	<1.0	NA		
n-Propylbenzene (µg/l)	ND	<1.0	NA		
Styrene (µg/l)	ND	<1.0	<0.5	100	
1,1,1,2-Tetrachloroethane (µg/l)	ND	<1.0	NA		
1,1,2,2-Tetrachloroethane (µg/l)	ND	<1.0	NA		
Tetrachloroethene (µg/l)	ND	<1.0	<0.5	5	
Toluene (µg/l)	ND	<1.0	<0.5	1000	
1,2,3-Trichlorobenzene (µg/l)	ND	<1.0	NA		

Table 4. Summary of Analytical Results for Ground Water Samples from MJ-PW3 (and test wells TW-1 and TW-2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	TW-1	TW-2	MJ-PW3	MCL	SMCL
Volatile Organic Chemicals (VOCs) (Continued)					
1,2,4-Trichlorobenzene (µg/l)	ND	<1.0	<0.5	70	
1,1,1-Trichloroethane (µg/l)	ND	<1.0	<0.5	200	
1,1,2-Trichloroethane (µg/l)	ND	<1.0	<0.5	5	
Trichloroethylene (µg/l)	ND	<1.0	<0.5	5	
1,2,3-Trichloropropane (µg/l)	ND	<1.0	NA		
1,2,4-Trimethylbenzene (µg/l)	ND	<1.0	NA		
1,3,5-Trimethylbenzene (µg/l)	ND	<1.0	NA		
Vinyl Chloride (µg/l)	ND	<1.0	<0.5	2	
Xylenes, total (µg/l)	ND	<1.0	<0.5	10,000	

** Sample results from Tetra Tech (2007)*

Table 5. Summary of Analytical Results for Ground Water Samples from MJ-PW3 (and test wells TW-1 and TW-2 for comparison), Middletown-Junction Property, Ohio.

PARAMETER	TW-1*	TW-2	MJ-PW3	MCL	SMCL
Synthetic Organic Chemicals (SOCs)					
Alachlor (mg/l)	<0.000020	NA	<0.00020	0.002	
Atrazine (mg/l)	<0.000030	NA	<0.00030	0.003	
Simazine (mg/l)	<0.000040	NA	<0.00035	0.004	
Radiological Parameters					
Gross Alpha (pCi/L)	<3	NA	<3		
Gross Beta (pCi/L)	NA	NA	<4		
Radium-226 and Radium-228 (Combined)	3	NA	<1	*5 pCi/L*	
Uranium	NA	NA	NA	*30 pCi/L*	
Per and Polyfluoroalkyl Substances (PFAS)					
Perfluorooctanoic acid (PFOA) (µg/L)	NA	<0.0044	0.00272	0.004	
Perfluorooctane sulfonate (PFOS) (µg/l)	NA	**0.014**	**0.0839**	0.004	
Perfluorononanoic acid (PFNA) (µg/L)	NA	<0.0046	<0.00173	1.0*	
Perfluorobutane sulfonate (PFBS) (µg/L)	NA	<0.0044	0.00209		
Perfluorohexane sulfonate (PFHxS) (µg/L)	NA	<0.0044	<0.00173		
Hexafluoropropylene oxide dimer acid (HFPO-DA) (µg/L)	NA	<0.0023	<0.00173		
Biological Parameters					
Total Coliform	Negative	NA	Negative		
Fecal Coliform	Negative	NA	Negative		
Indicator Parameters					
Redox Potential (Eh)	NA	-206.1 mV	NA		
Dissolved Oxygen	NA	5.24 mg/L	NA		
Temperature	NA	14.62˚C	NA		
Specific Conductance	NA	820 µmhos/cm	NA		
pH (field)	NA	6.82 s.u.	NA		
Turbidity	NA	0.30 NTU	NA		

Note: Highlighted Results exceed either MCL or SMCL levels.

BDL – Below Detection Limit
MCL – Maximum Contaminant Level
SMCL – Secondary Maximum Contaminant Level
NTU – Nephelometric Turbidity Units* Hazard Index (Unitless)
** Sample results from Tetra Tech (2007)*

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Terran Corporation, 2023, Technical Memorandum for Test Well TW-2 Evaluation, Middletown-Junction Property, Warren County, Ohio: Consultant report, August 4, 2023, prepared for the Warren County Water & Sewer Dept., 82p.

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ATTACHMENT #1

ODNR WELL LOG
AND WELL DESIGN SHOP DRAWINGS
FOR
PRODUCTION WELL MJ-PW03

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Geological Survey, 2045 Morse Road, Columbus, Ohio 43229-6605
Phone (614) 265-6576

Well Log Number 3022156

WELL LOCATION

County WARREN Township HAMILTON

Owner/Builder: WARREN CO. WATER & SEWER DISTRICT

Address of Well Location: 406 JUSTICE DR

City LEBANON Zip Code +4 45036

Permit No. Section; and or Lot No.

Use of Well MUNICIPAL

Coordinates of Well (Use only one of the below coordinate systems)

Latitude, Longitude Coordinates

Latitude: 39.363705 Longitude: -84.240297

Elevation of Well in feet: +/- ft.

Datum Plane: ☐ NAD27 ☐ NAD83 Elevation Source DIGITAL MAP

Source of Coordinates: GPS

Well location written description:

Near the intersection of the Little Miami Scenic Bike Trail and the Lebanon Countryside Trail

Comments on water quality/quantity and well construction:

WELL TEST *

Pre-Pumping Static Level 21.69 ft. Date 3/11/2025

Measured from TOP OF CASING

Pumping test method PUMPING

Test Rate 1500 gpm Duration of Test 24 hrs.

Feet of Drawdown 59.3 ft. Sustainable Yield gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump Capacity gpm

Pump set at ft. Pitless Type

Pump installed by

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm NATIONAL WATER SERVICES (DAYT)

Address 3949 DAYTON PARK DR

City, State, Zip DAYTON OH 45414

Signed JOSH GAVIN (Filed Electronically) Date 4/30/2025

ODH Registration Number 003318 Last Revised on 5/1/2025

CONSTRUCTION DETAILS

Drilling Method: CABLE TOOL

BOREHOLE/CASING (Measured from ground surface)

1. Borehole Diameter 24 inches Depth 85 ft.
   Casing Diameter in. Length ft. Thickness in.
2. Borehole Diameter 16 inches Depth 85 ft.
   Casing Diameter 16 in. Length 65 ft. Thickness 0.5 in.

Casing Height Above Ground 3 ft.

Type 1: 2: STEEL

Joints 1: 2: WELDED

SCREEN

Diameter 16 in. Slot Size 0.7 in. Screen Length 20 ft.

Type CONTINUOUS WIRE WOUND Material STAINLESS STEEL

Set Between 65 ft. and 85 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Vol/Wt. Used 6,750 LBS

Method of Installation POURED (GRAVITY)

Depth: Placed From: 55 ft. To: 85 ft.

GROUT

Material NEAT CEMENT Vol/Wt. Used 11,875 LBS

Method of Installation PUMPED WITH TREMIE PIPE

Depth: Placed From: 3 ft. To: 55 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BROWN	SANDY	SOIL	0	2
TAN	COBBLES	SAND & GRAVEL	2	18
BROWN		SAND & GRAVEL	18	25
BROWN		SAND & GRAVEL	25	31
BROWN	COARSE	GRAVEL	31	35
BROWN	LARGE	GRAVEL	35	40
BROWN	LARGE	SAND/GRAVEL/BOULI	40	50
BROWN	LARGE	GRAVEL & BOULDER!	50	58
BROWN	LARGE	GRAVEL	58	60
BROWN	LARGE	SAND & GRAVEL	60	65
BROWN	LARGE	GRAVEL & BOULDER!	65	80
BROWN	LARGE	GRAVEL	80	85
BLUE		SHALE	85	86
		WATER AT	22	85

Aquifer Type (Formation producing the most water.) GRAVEL & BOULDERS

Date of Well Completion 03/11/2025 Total Depth of Well 85 ft.

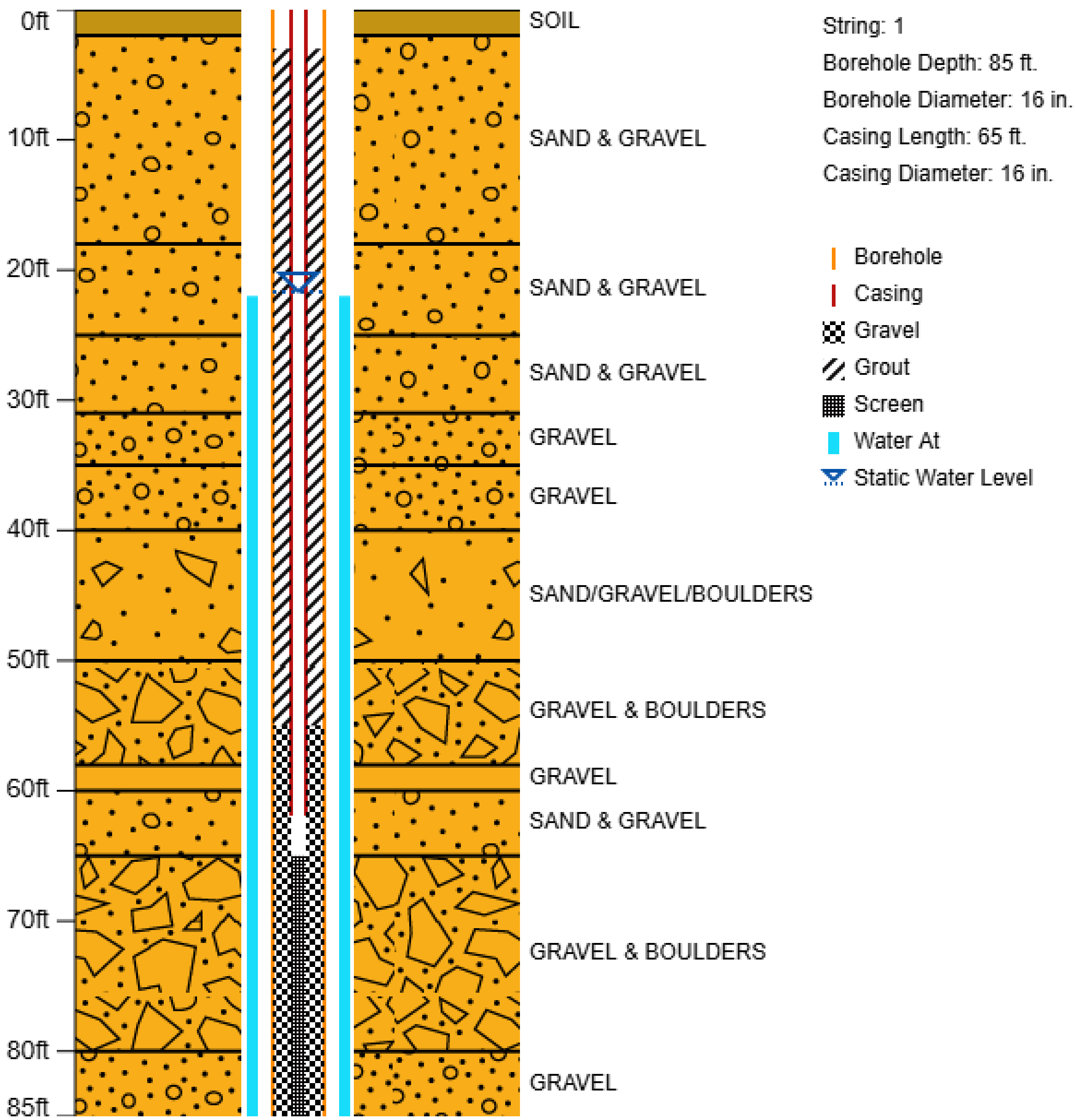
Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number
3022156



SUBMITTAL FORM

To: Terran Corporation Attn: Kelly Smith 4080 Executive Drive Beavercreek, OH 45430 (937) 320-3601	**Originator:** National Water Services, LLC Donnie Williams P.O. Box 230 Paoli, IN 47454 (812) 723-2108
Engineers Contract No.:	**Project Name:** Warren County Water & Sewer Department Middletown Junction Production Well Drilling
NWS Project No.: 8666	**Submittal #: WAR-002**
__X__ **For Approval** ______ **For Information**	_____ **Resubmittal** __X__ **As Specified** _____ **Exception**

Qty.	Drawing / Specification Section Reference	Description of Item
	Spec Section 33.21.00 Water Supply Wells	Recommended Well Design

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

Contractor: National Water Services, LLC

Submitted By: *Donnie Williams* **Date:** 10/13/2024

Senior Estimator

Work may proceed	Revise and resubmit - Work may proceed Subject to Incorporation of changes indicated.	Revise and resubmit - Work may not proceed	Review not required - Work may proceed
X			

(Please mark the box below the appropriate review and add any applicable notes in space provided below.)

Notes:

Submittal Reviewed By: Kelly C Smith **Date:** 10/14/2024

NATIONAL WATER SERVICES
WATER SUPPLY SPECIALISTS

Owner
Warren County Water & Sewer Department

Contact Person

City/State
Lebanon, OH

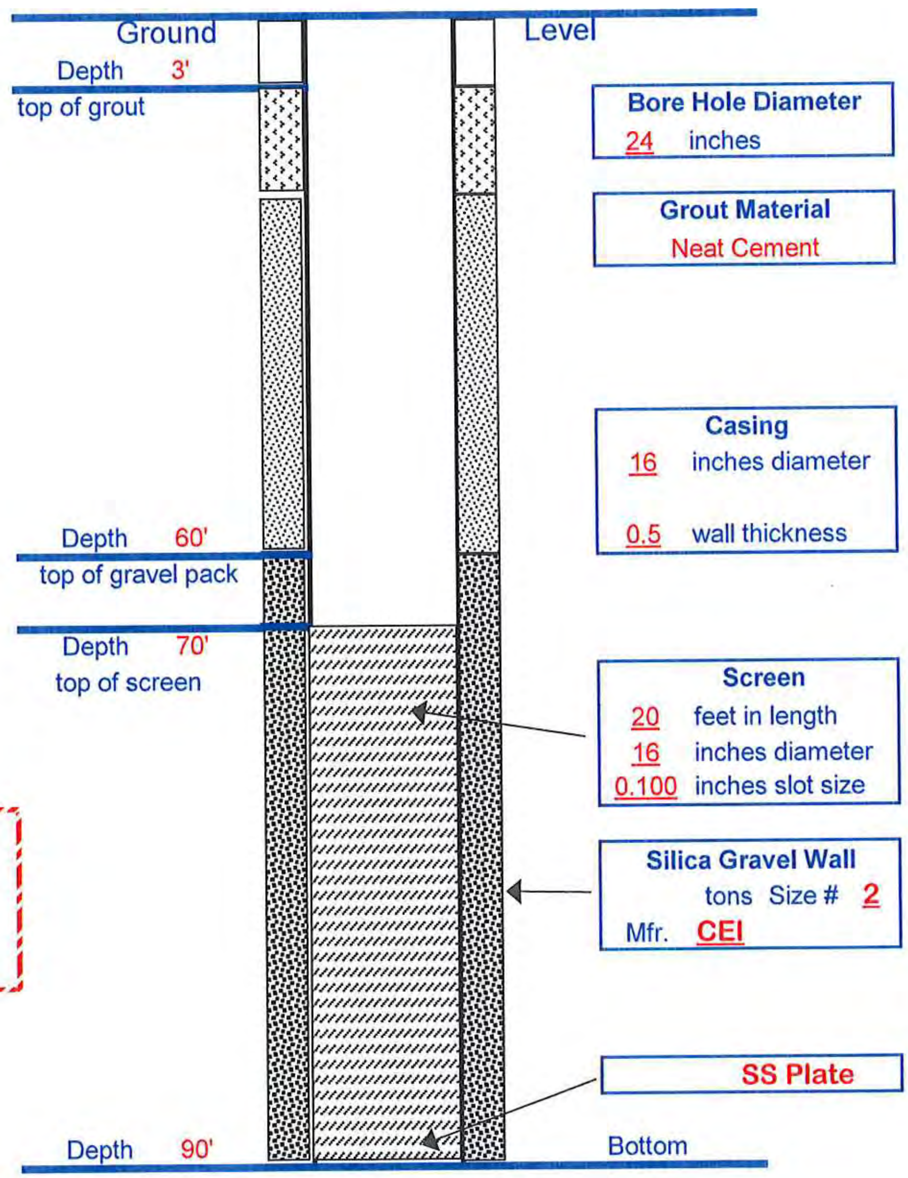
Phone Number

Date
10/13/2024

Well Location
Middletown Junction

Well Number
PW-1

Casing extends 2' above ground level.



Not to Scale
Please note that all depths measured from ground level are not to scale.

Static Level	
Type of Rig	**Cable Tool**
Driller	**Grant Herron**
Date Completed	

Pumped G.P.M. at feet
pumping level after hours

Special Notes

FIELD BORING LOG

Date 9/18/2024
County Warren County
Project 2 Production Wells
Phone No.
Location

Township
Job# #8666
Boring No. PW-1
Foreman Grant Herron

Drilling Methods: HSA ____ CFA ____ ROTARY ____ ROCK CORING ____ CABLE TOOL X

DEPTH, FT				Sample		
FROM	TO	DESCRIPTION	Type	Depth, FT	Recovery	SPT Blows N/6"
7	20	Tan sand & gravel hard compacted				
20	30	Sand & gravel 1"--2" gravel				
30	41	Pea gravel with some sand, mixed brown				
41	51	Larger gray gravel with cobbles up to 6"				
51	61	Sand & gravel, pea gravel, sand more prominent, gravel iron stained				
61	71	Majority pea gravel, coarse sand. Very iron stained, some larger gravel 1"				
71	81	Very brown iron stained coarse sand & gravel majority pea gravel				
81	85	Gray sand & gravel with some cobbles up to 6" dirty				
85	90	Gray finer sand mixed with gravel, some cobbles with broken limestone chips, dirty				
90		Pipe refusal--pipe would not drive past 90'				

WATER LEVEL OBSERVATIONS

DURING DRILLING

AT COMPLETION

AFTER ____ HRS ____
AFTER ____ HRS ____
AFTER ____ HRS ____

NOTES: 24" base hole

PIEZOMETER INSTALLED:
YES ____ NO ____

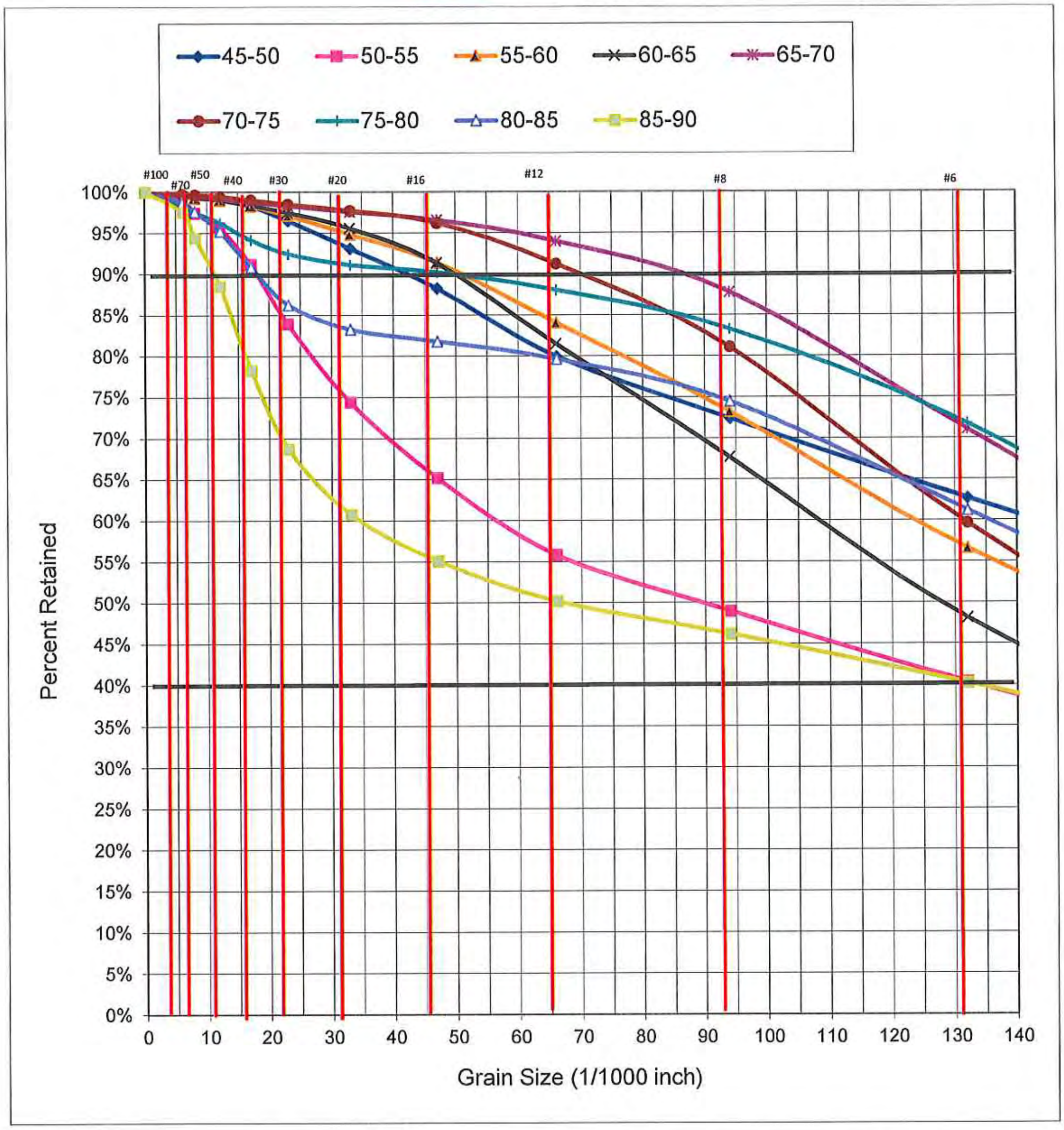
DEPTH ____ CASING ____

Grout: ____ Grout Depth: ____
Installation: ____ No. Bags: ____
GPM: ____

Johnson Screens
651-636-3900

Johnson Screens

SAND ANALYSIS



Job Name Middletown Junction PW -1
Location Warren County, OH
Driller NWS

Sample ID Middletown Junction PW -1
Analyzed by: Duvall, Steven
Date: 10/11/2024

Casing ϕ 16 in
Screen ϕ 16 in

Desired Yield 1,000 GPM
SWL (ft) N/A ft

Recommended Slot Size: 100 slot (0.100") screen from 70' to 90' bgs.
Recommended Gravel Pack: CEI 3/16" x #10

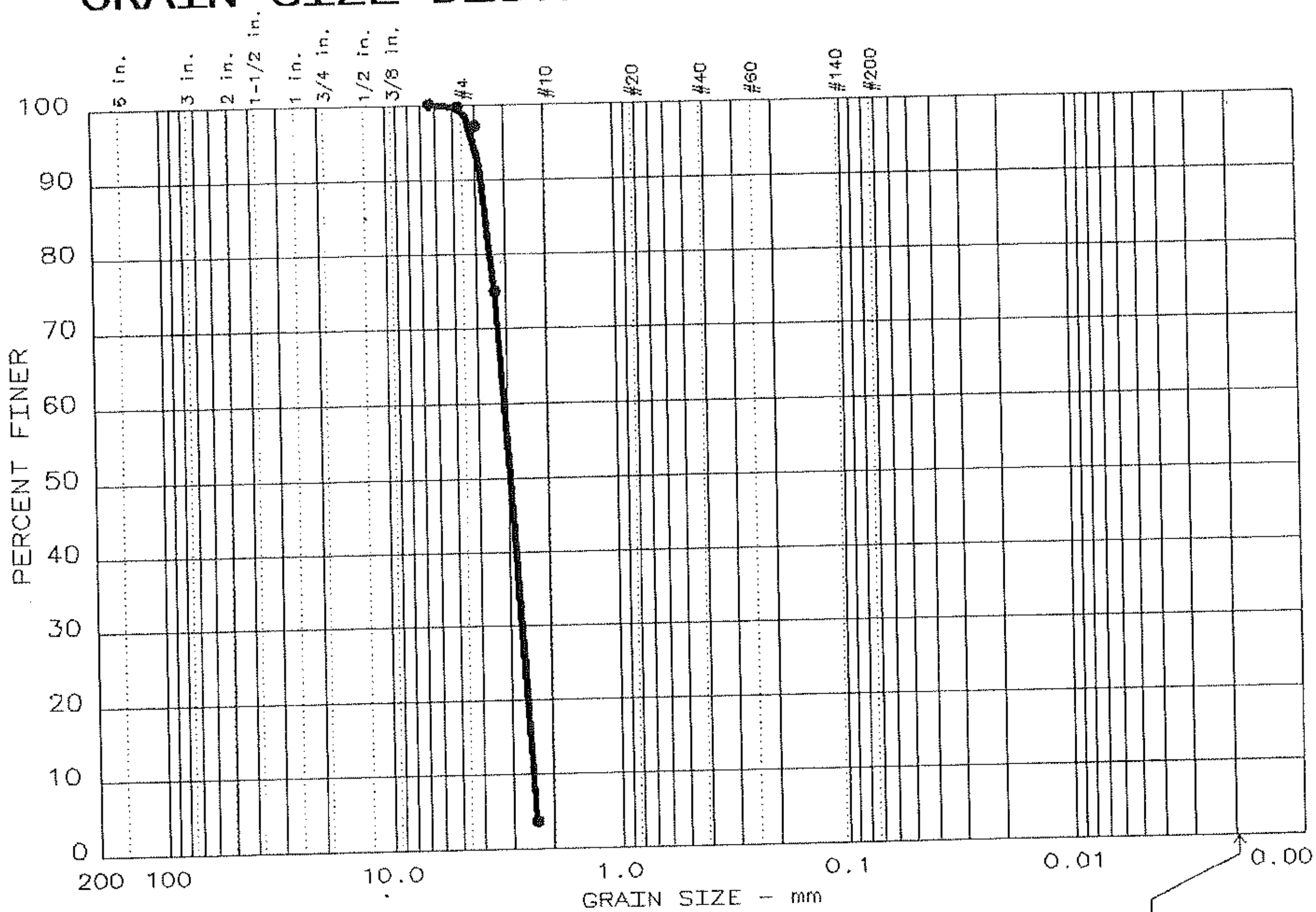
Based exclusively on the samples provided by the contractor, a sieve analysis graph and suggested screen slot size is provided as requested. Since numerous construction considerations and site circumstances influence successful well completion, Johnson Screens assumes no responsibility for final well performance nor awareness of local regulations pertaining to well installations.

Prepared by:Meyer, Wayne

Send Samples to 1950 Old Highway 8, New Brighton, MN 55112

FILE NO.: A06060X12
REPORT NO.: 0030

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	15	0.0	100.0	0.0		

	LL	PI	D_{90}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			3.77	3.08	2.93	2.66	2.48	2.43	0.95	1.3

MATERIAL DESCRIPTION	USCS	AASHTO
● Gravel (3/16"x3/32") #2 well pack		

Project No.: A06060x12
Project: CEI -
● Location: CEI

Date: 8/17/06

Remarks:

GRAIN SIZE DISTRIBUTION TEST REPORT
SOLAR TESTING LABORATORIES

Fig. No.: ______

10/11/2024

Johnson Screens

WELL SCREEN SUBMITTAL DATA

CLIENT: 250' HIQ CONSTRUCTION
PROJECT:

Material	304 Stainless			
Nom Size	16	PS	*410*	*mm*
Top x Bottom Fitting Configuration	WR x WR W/PB			
Estimated Total Well Depth	90	ft	*27*	*meters*
Estimated Feet of Screen	20	ft	*6*	*meters*
Design Slot Size	0.100	in	*2.5*	*mm*
Approx. Outside Diameter	16.10	in	*409*	*mm*
Screen Barrel Inside Diameter	15.39	in	*391*	*mm*
Approx. Clear ID at Fittings	15.06	in	*382*	*mm*
Approx. Weight Per Ft	23	lbs	*11*	*kg*
Wire Width	0.130	in	*3.3*	*mm*
Wire Height	0.250	in	*6.4*	*mm*
Calc. Collapse Strength *	76	PSI	*5*	*kg/sq.cm*
Open Area	43.5%			
Intake Area	264	sq.in./ft	*5,585*	*sq.cm./meter*
Transmitting Capacity-at 0.1 ft/sec	82	gpm/ft	*17*	*lps/meter*
Support Rod Diam	0.161	in	*4.1*	*mm*
No Rods	70			
Cross Sectional Rod Area	1.43	sq.in.	*9.21*	*sq.cm.*
Design Yield Strength	30,000	PSI	*2,109*	*kg/sq.cm*
Calc.Tensile Strength *	36,400	lbs	*16,500*	*kg*
Max.Recomended Hang Wt. *	18,200	lbs	*8,300*	*kg*
Column Load *	33,800	lbs	*15,300*	*kg*

* A broad range of site conditions and completion methods can impact the physical strength requirements (collapse, tensile, hang weight and column strengths) for a successful screen installation. Consult a Johnson Screens technical representative with questions regarding the parameters presented above as they may relate to your specific site requirements. Final design parameters should be reviewed and confirmed by the customer and his third-party consultants.

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www.johnsonscreens.com/water-wells

Nominal Pipe Size		Outside Diameter (Inch)	Nominal Wall Thickness Schedule (Inch)																
NPS	DN	OD	SCH 5s	SCH l0s	SCH 10	SCH 20	SCH 30	SCH 40s	SCH STD	SCH 40	SCH 60	SCH 80s	SCH XS	SCH 80	SCH 100	SCH 120	SCH 140	SCH 160	SCH XXS
1/8	6	0.405		1.240				0.068	0.068	0.068		0.095	0.095	0.095					
1/4	8	0.540		1.650				0.088	0.088	0.088		0.119	0.119	0.119					
3/8	10	0.675		1.650				0.091	0.091	0.091		0.126	0.126	0.126					
1/2	15	0.840	0.065	2.110				0.109	0.109	0.109		0.147	0.147	0.147				0.188	0.294
3/4	20	1.050	0.065	2.110				0.113	0.113	0.113		0.154	0.154	0.154				0.219	0.308
1	25	1.315	0.065	2.770				0.133	0.133	0.133		0.179	0.179	0.179				0.250	0.358
1 1/4	32	1.660	0.065	2.770				0.140	0.140	0.140		0.191	0.191	0.191				0.250	0.382
1 1/2	40	1.900	0.065	2.770				0.145	0.145	0.145		0.200	0.200	0.200				0.281	0.400
2	50	2.375	0.065	2.770				0.154	0.154	0.154		0.218	0.218	0.218				0.344	0.436
2 1/2	65	2.875	0.083	3.050				0.203	0.203	0.203		0.276	0.276	0.276				0.375	0.552
3	80	3.500	0.083	3.050				0.216	0.216	0.216		0.300	0.300	0.300				0.438	0.600
3 1/2	90	4.000	0.083	3.050				0.226	0.226	0.226		0.318	0.318	0.318					
4	100	4.500	0.083	3.050				0.237	0.237	0.237		0.337	0.337	0.337		0.438		0.531	0.674
5	125	5.563	0.109	3.400				0.258	0.258	0.258		0.375	0.375	0.375		0.500		0.625	0.750
6	150	6.625	0.109	3.400				0.280	0.280	0.280		0.432	0.432	0.432		0.562		0.719	0.864
8	200	8.625	0.109	3.760		0.250	0.277	0.322	0.322	0.322	0.406	0.500	0.500	0.500	0.594	0.719	0.812	0.906	0.875
10	250	10.750	0.134	4.190		0.250	0.307	0.365	0.365	0.365	0.500	0.500	0.500	0.594	0.719	0.844	1.000	1.125	1.000
12	300	12.750	0.156	4.570		0.250	0.330	0.375	0.375	0.406	0.562	0.500	0.500	0.688	0.844	1.000	1.125	1.312	1.000
14	350	14.000	0.156	4.780	0.250	0.312	0.375		0.375	0.438	0.594		0.500	0.750	0.938	1.094	1.250	1.406	
16	400	16.000	0.165	4.780	0.250	0.312	0.375		0.375	0.500	0.656		0.500	0.844	1.031	1.219	1.438	1.594	
18	450	18.000	0.165	4.780	0.250	0.312	0.438		0.375	0.562	0.750		0.500	0.938	1.156	1.375	1.562	1.781	
20	500	20.000	0.188	5.540	0.250	0.375	0.500		0.375	0.594	0.812		0.500	1.031	1.281	1.500	1.750	1.969	
22		22.000	0.188	5.540	0.250	0.375	0.500		0.375		0.875		0.500	1.125	1.375	1.625	1.875	2.125	
24	600	24.000	0.218	6.350	0.250	0.375	0.562		0.375	0.688	0.969		0.500	1.219	1.531	1.812	2.062	2.344	
26		26.000			0.312	0.500	0.000		0.375				0.500						
28	700	28.000			0.312	0.500	0.625		0.375				0.500						
30		30.000	0.250	7.920	0.312	0.500	0.625		0.375				0.500						
32	800	32.000			0.312	0.500	0.625		0.375	0.688			0.500						
34		34.000			0.312	0.500	0.625		0.375	0.688			0.500						
36	900	36.000			0.312	0.500	0.625		0.375	0.750			0.500						
38		38.000							0.375				0.500						
40	1000	40.000						0.375											
42		42.000							0.375				0.500						
44	1100	44.000							0.375				0.500						
46		46.000							0.375				0.500						
48	1200	48.000							0.375			0.500							

ATTACHMENT #2

MW-PW03 SUBMERSIBLE PUMP PERFORMANCE SHOP DRAWINGS DOCUMENTS

Pump Performance Datasheet

American-Marsh Pumps Quotation System 24.6.5

Item number	: 001	Size	: 12KC
Service	:	Stages	: 5
Quantity	: 1	Based on curve number	: 12KC
Quote number	: 2501008	Basic model number	: -
		Date last saved	: 26 Mar 2025 1:19 PM

Operating Conditions

Flow, rated	: 1,000.0 USgpm
Differential head / pressure, rated (requested)	: 284.0 ft
Differential head / pressure, rated (actual)	: 288.7 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Site Supply Frequency	: 60 Hz

Performance

Speed criteria	: Synchronous
Speed, rated	: 1750 rpm
Impeller diameter, rated	: 8.75 in
Impeller diameter, maximum	: 9.31 in
Impeller diameter, minimum	: 7.94 in
Efficiency (bowl / pump)	: 82.01 / 80.60 %
PEI (CL)	: -
NPSH required / margin required	: 9.59 / 0.50 ft
Ns (total flow) / Nss (imp. eye flow)	: 2,012 / 11,358 US Units
MCSF	: 516.7 USgpm
Head, maximum, rated diameter	: 358.6 ft
Head rise to shutoff (bowl / pump)	: 24.09 / 25.89 %
Flow, best eff. point (bowl / pump)	: 862.9 / 848.7 USgpm
Flow ratio, rated / BEP (bowl / pump)	: 115.88 / 117.82 %
Diameter ratio (rated / max)	: 93.95 %
Head ratio (rated dia / max dia)	: 80.39 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Temperature, max	: 68.00 deg F
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Vapor pressure, rated	: 0.34 psi.a

Material

Material selected	: Cast iron - Standard

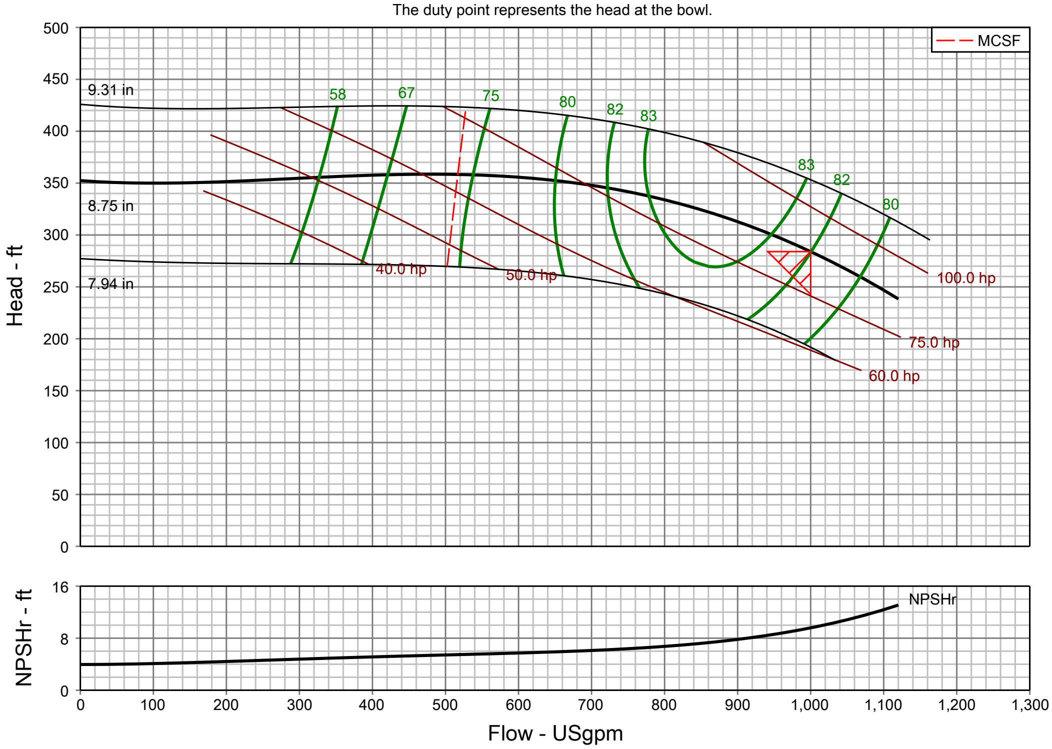
Pressure Data

Maximum working pressure	: See the Additional Data page
Maximum allowable working pressure	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data (@Max density)

Driver sizing specification	: Maximum power
Margin over specification	: 0.00 %
Service factor	: 1.15
Power, hydraulic	: 71.70 hp
Power (bowl / pump)	: 87.43 / 87.68 hp
Power, maximum, rated diameter	: 87.90 hp
Minimum recommended motor rating	: 100 hp / 74.57 kW

Bowl performance. Adjusted for construction and viscosity.
The duty point represents the head at the bowl.



Item number	: 001	Size	: 12KC
Service	:	Stages	: 5
Quantity	: 1	Speed, rated	: 1750 rpm
Quote number	: 2501008	Intellicode	:
		Date last saved	: 26 Mar 2025 1:19 PM

Performance Data

Head, maximum diameter, rated flow	: 353.3 ft
Head, minimum diameter, rated flow	: 191.9 ft
Head, maximum, rated diameter	: 358.6 ft
Efficiency adjustment factor, total	: 1.00
Power adjustment, total	: 0.00 hp
Head adjustment factor, total	: 1.00
Flow adjustment factor, total	: 1.00
NPSHR adjustment factor, total	: 1.00
User applied performance adjustment comments	:
NPSH margin dictated by pump supplier	: 0.50 ft
NPSH margin dictated by user	: 0.00 ft
NPSH margin used (added to 'required' values)	: 0.50 ft

Mechanical Limits

Torque, rated power, rated speed	: 5.01 hp/100 rpm
Torque, maximum power, rated speed	: 5.02 hp/100 rpm
Torque, driver power, full load speed	: 5.62 hp/100 rpm
Torque, driver power, rated speed	: 5.62 hp/100 rpm
Torque, pump shaft limit	: 18.14 hp/100 rpm
Radial load, worst case	: -
Radial load limit	: -
Impeller peripheral speed, rated	: -
Impeller peripheral speed limit	: -

Stage, Speed and Solids Limits

Stages, maximum	: 22
Stages, minimum	: 1
Pump speed limit, maximum	: 3000 rpm
Pump speed limit, minimum	: 800 rpm
Curve speed limit, maximum	: 3000 rpm
Curve speed limit, minimum	: 300 rpm
Variable speed limit, maximum	: -
Variable speed limit, minimum	: 100 rpm
Solids diameter limit	: 0.63 in

Energy Indexes

Bare pump model number	: 12KC
Basic model number	: -
PEI CL/VL	: - / -
ER CL/VL	: - / -

Typical Driver Data

Driver speed, full load	: 1780 rpm
Driver speed, rated load	: 1782 rpm
Driver efficiency, 100% load	: N/A
Driver efficiency, 75% load	: N/A
Driver efficiency, 50% load	: N/A

Various Performance Data	**Flow (USgpm)**	**Head (ft)**	**Efficiency (%)**	**NPSHr (ft)**	**Power (hp)**
Shutoff, rated	0.00	352.4	-	-	34.02
Shutoff, maximum	0.00	425.9	-	-	46.27
MCSF	516.7	358.3	73.79	5.47	63.35
Rated flow, minimum	1,000.0	191.9	79.66	-	60.82
Rated flow, maximum	1,000.0	353.3	82.90	-	108
BEP flow, rated	862.9	321.5	83.56	7.35	83.83
120% rated flow, rated	1,200.0	201.2	73.20	16.55	83.28
End of curve, rated	1,120.1	238.4	77.80	13.09	86.65
End of curve, minimum	1,034.1	179.2	78.06	0.00	59.92
End of curve, maximum	1,163.4	295.1	77.79	14.84	111
Maximum value, rated	-	358.6	83.56	-	87.90
Maximum value, maximum	-	-	83.94	-	111

System differential pressure	**@ Density, rated**	**@ Density, max**
Differential pressure, rated flow, rated (psi)	122.9	122.9
Differential pressure, shutoff, rated (psi)	152.5	152.5
Differential pressure, shutoff, maximum (psi)	184.3	184.3

Discharge pressure	**@ Suction pressure, rated**	**@ Suction pressure, max**	**@ Suction pressure, rated**	**@ Suction pressure, max**
Discharge pressure, rated flow, rated (psi.g)	122.9	122.9	122.9	122.9
Discharge pressure, shutoff, rated (psi.g)	152.5	152.5	152.5	152.5
Discharge pressure, shutoff, maximum (psi.g)	184.3	184.3	184.3	184.3

Ratios

Maximum flow / rated flow, rated	: 112.01 %	Head rated diameter / head minimum diameter, rated flow	: 147.99 %

Pump Performance - Additional Data

Mixed Stage Performance	Set #1	Set #2	Set #3	Set #4	Alternate First Stage
Size	12KC	-	-	-	-
Stages	5	-	-	-	-
Based on curve number	12KC	-	-	-	-
Impeller diameter, rated	8.75 in	-	-	-	-
Impeller diameter, maximum	9.31 in	-	-	-	-
Impeller diameter, minimum	7.94 in	-	-	-	-

Head and Power Losses

Friction loss rate, column	: 6.15 %
Friction loss, column	: 1.23 ft
Friction loss, discharge head	: 2.40 ft
Friction loss, can/barrel	: -
Friction loss, suction bell and strainer	: 0.00 ft
Friction loss, bowl/column adaptor	: 0.43 ft
Friction loss, total	: 4.06 ft
Power loss, lineshaft bearings	: -
Power loss, thrust bearing	: 0.26 hp
Power loss, total	: 0.26 hp

Bowl vs. Pump Performance

Head (bowl / pump)	: 284.0 ft / 279.9 ft
Efficiency (bowl / pump)	: 82.01 % / 80.60 %
Power (bowl / pump)	: 87.43 hp / 87.68 hp
NPSH required at first stage impeller eye	: 9.59 ft

Weights and Down Thrust

Weight, lineshaft	: -
Weight, bowl assembly rotating element	: 111.7 lb
Thrust factor	: 6.50 lb/ft
Thrust, hydraulic (rated / max)	: 1,842.9 / 2,326.8 lbf
Thrust, bowl shaft end (rated / max)	: 0.00 / 0.00 lbf
Thrust, shaft step (rated / max)	: 0.00 / 0.00 lbf
Thrust, stuffing box sleeve (rated / max)	: - / -
Thrust, total (rated / max)	: 1,954.5 / 2,438.4 lbf
Thrust Limit	: -

* Rated thrust @ rated head, density, and suction pressure where applicable
* Max thrust @ max head, density, and suction pressure where applicable

Pressure Data	Maximum working pressure (psi.g)	Maximum allowable working pressure (psi.g)	Hydrostatic test pressure (psi.g)
Bowl	155.2	263.0	394.5
Column	155.2	1,200.0	-
Discharge head	155.2	275.0	-
Can/Barrel	-	-	-

Torque Limits

Torque, lineshaft limit	: -

Dimensions

Minimum clearance below suction bell lip/case	: 0.00 in
Minimum well diameter	: 0.00 in
Suction nozzle centerline height	: -
Bowl assembly length, first stage	: 23.06 in
Bowl assembly length, upper stage	: 10.00 in
Bowl assembly length, total	: 63.06 in
Suction bearing hub length	: 0.00 in
Strainer length	: 0.00 in
Bowl to column adaptor length	: 0.00 in
Discharge head stick-down	: 0.28 in
Submersible motor adaptor length	: 17.00 in
Submersible motor length	: 70.00 in
Column length	: 20.00 ft
Total pump length	: 32.53 ft
Can / barrel length	: -
Stuffing box sleeve diameter	: -
Suction bell diameter	: -
Minimum submergence to prevent vortexing	: 30.00 in
Actual submergence (based on LLL)	: 390 in
Discharge head height	: 26.00 in
Discharge nozzle centerline height	: 9.00 in
Min distance discharge nozzle centerline to suction bell	: 0.00
Lineshaft length	: -
Bowl shaft diameter	: 1.69 in
Bowl diameter, outside	: 11.50 in
Bowl diameter, exit	: 8.16 in
Column diameter, inside	: 6.07 in
Column internal obstruction diameter	: -
Can/barrel diameter, inside	: -
Can/barrel obstruction diameter	

NPSH

NPSH at bowl (available / required)	: Ample / 9.59 ft
NPSH at low liquid level (available / required)	: Ample / -
NPSH at suction flange (available / required)	: - / -

Liquid Velocities

Column liquid velocity	: 11.09 ft/s
Discharge head liquid velocity	: 11.35 ft/s
Can liquid velocity	: -
Suction nozzle liquid velocity	: -

Additional Design Conditions

NSF/ANSI/CAN 61 & 372 Certification Required	: NO	Pump Length Definition	: Column length (Setting)
		Length Value	: 20.00 ft
Pump Design	: Submersible	Well Inside Diameter	: in
Impeller Type	: Enclosed Impeller	Pumping Level (From Bottom of Head to Liquid)	: ft
Driver Type	: Submersible Motor		
Head Measurement Location	: Top of bowl	NPSH Measurement Location	: Bowl

Bowl Options

Impeller Fastener	: Collet	Bowl Suction Connection Size	: Submersible
Bowl Shaft Material	: 416ss	Bowl Suction Type	: Submersible
Bolting	: Standard Bolting	Submersible Motor Adaptor Size	: 10" Motor Bracket
Bowl Discharge Type	: Threaded		

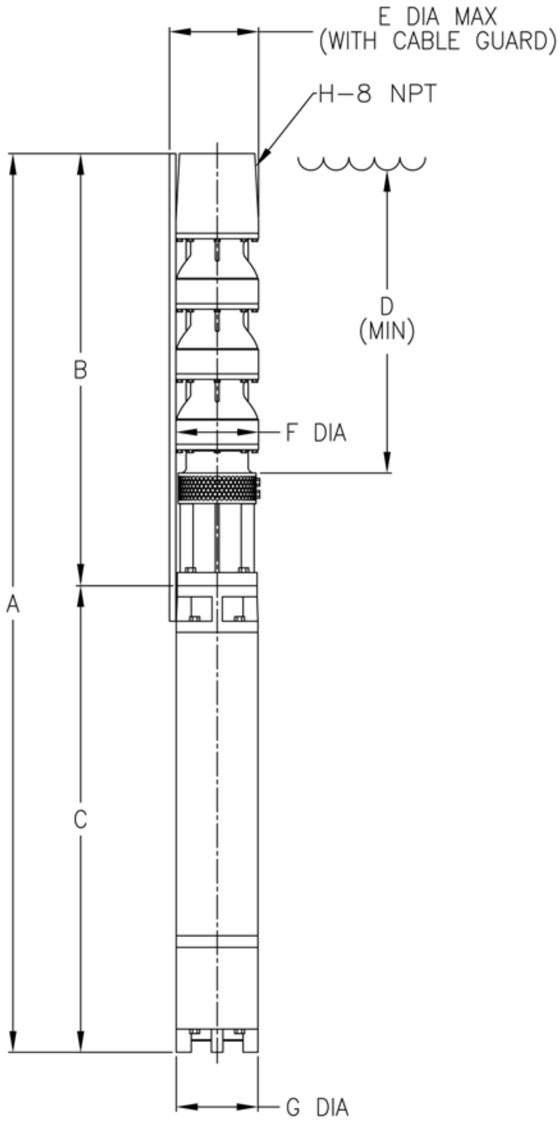
Column Options

Column Diameter	: 6 inch	Column Type	: Threaded

Discharge Head Options

Discharge Head Type	: Fabricated Steel	Discharge Head Flange Rating	: Class 150
Larger Head Diameter Required	: No	Discharge Head Column Connection	: Threaded
Discharge Head Size	: 6" Discharge		

GENERAL ARRANGEMENT DRAWINGS



DISCHARGE HEAD

Not Required

FOUNDATION PLATE

Not Required

STRAINER DETAIL

Not Required

All Dimensions Are In inches ± 0.38 in
Not For Construction Unless Certified By Engineering
Drawings Represent General Construction

A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
149.7	80.06	69.68	30.00	11.44	11.25	8.52	6"	---	---	---	---	---	---	---

S	H2	H3	H4	H5	F1	F2	F3	F4	P1	P2	P3	P4	S1	S2
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Vertical Turbine Pump			
480 SERIES VT			
Submersible Pump			
GENERAL DATA			
FLOW	1,000.0 USgpm	HEAD	284.0 ft
LIQUID	Water	SG	1.000 SG
LIQUID TEMP	68.00 deg F	VISCOSITY	1.00 cP
PUMP DATA			
BOWL MODEL	12KC	STAGES	5
BOWL SFT DIA	1.69 in	LINESHAFT DIA	---
IMPELLER CONN. TYPE	Collet	COLUMN SIZE	6.00 in
COLUMN CONN. TYPE	Threaded	COL WALL / COL SCH	0.28 in
TOTAL RATED THRUST	1,954.5 lbf		
MECHANICAL SEAL DATA			
MFGR	---	TYPE	-
SIZE	-	API CODE	-
PUMP MATERIAL DATA			
BOWL	Cast Iron	IMPELLER	Standard
BOWL WR	None	IMP WR	None
BOWL SHAFT	416 SS	LINESHAFT	-
STRAINER	300 SS	COL PIPE	Steel
DISCHARGE HEAD	Steel	COL CPLG	Steel
-			
MFR.	-	-	-
HP	-	-	-
-	-	-	-
-	-	ROTATION	-
TYPE	Solid Shaft	ENCLOSURE	-
WEIGHTS			
EST. PUMP WT.	735.0 lb	-	-

CERTIFICATION CONTENT	
CUSTOMER	National Water Service
SERVICE	-
ITEM NUMBER	001
P.O. NUMBER	-
QUOTE NO.	2501008
DATE	26 Mar 2025 1:07 PM
CERTIFIED FOR	-
CERTIFIED BY	-

WARNING

DO NOT OPERATE THIS MACHINE WITH OUT PROTECTIVE GUARD IN PLACE. ANY OPERATION OF THIS MACHINE WITHOUTPROTECTIVE GUARD CAN RESULT IN SEVERE BODILY INJURY

Vertical Turbine - 12KC - 5 Stage

PLEUGER

Submersible Motors
Ranges 6" - 16"

60 Hz

Highest Reliability & Durability
Energy Efficiencies up to

95%

PLEUGER. Reliable. Always.

Table of Content

About PLEUGER

PLEUGER is an international manufacturer and supplier of submersible motors, pumps, thrusters and plunger pumps and related services with headquarters in Hamburg, Germany. Renowned worldwide across the energy, mining, water, industrial processing and the oil & gas industries for absolute reliability and outstanding longevity, our products are designed, engineered and manufactured to solve some of the toughest applications in the most challenging and harshest environments. With over 90 years experience we are experts in electric submersible motors and pumps for various applications in the Water and General Industry, including Mining and Oil & Gas market sector. With German engineering know-how and many years of industry experience, PLEUGER meets the demands of customers worldwide for performance, durability, energy efficiency and total cost of ownership.

PLEUGER CRAFTSMANSHIP

PLEUGER stands for true craftsmanship, combining vision, precision and attention to detail.

From our unique manufacturing processes for stators, to our unrivalled winding capabilities for submersible motors, each element is part of our journey to absolute perfection.

Nothing is more important to us than the reliability and durability of our products.

DESIGN & ENGINEERING

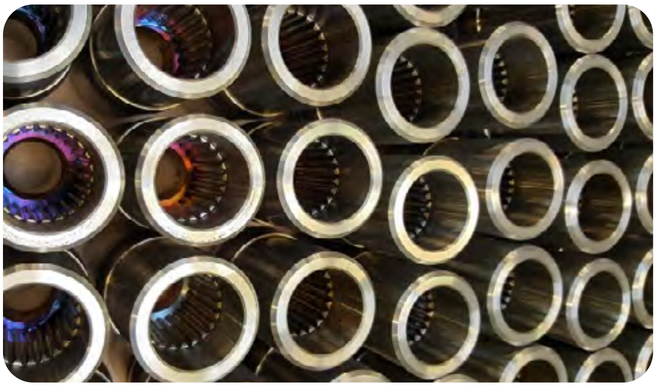
PLEUGER believes in total reliability and the very best quality. We achieve this through precision design and engineering. Proven throughout our decades of experience in consulting, engineering and manufacturing for the most demanding applications around the world.

We offer you the best fit for your submersible pump solution. Engineered for performance. Built to last.

TECHNOLOGIES

Our design engineers, production engineers and data analysts are always investigating how new technologies, materials and approaches can enhance what we do, to maximise performance and reliability and minimize energy consumption.

PLEUGER submersible pump units keep critical systems running across the world in energy, drinking water, industrial processes, dewatering and geothermal heating applications.



PLEUGER SUBMERSIBLE PUMPS

Best-in-class submersible pumps built for reliability and performance.

PLEUGER Submersible Motors — Made in Germany

As a manufacturer of world-class submersible motors, every PLEUGER product is designed, engineered and manufactured to the highest standards for efficiency, corrosion protection, and an extended power range.

Standard Motors

- 6" to 50"
- Induction motor, Asynchronous motor
- Power output: 5.5 kW to 5 MW (7.4 HP to 6,705 HP)
- Operating speed: 200 to 3600 rpm – 2,4,6,8 pole designs
- 200 V to 6.6 kV / 50 and 60 Hz

PMM Motors

- 6" to 8"
- Synchronous motor
- Power output: 4.0 to 165 kW (5.36 to 221 HP), 200 kW (268 HP) on request
- Operating speed: 2100 to 3600 rpm (max 3800 rpm) 4 pole design
- Driven by Variable Frequency Drive (VFD)
- VFD input voltage 400 to 500 V / 70 and 120 Hz

Key Features

- Water-filled motors as standard
- Oil-filled motors on request
- Rewindable
- Operating temperatures: -20°C to +50°C / -4°F to +122°F, on request -30°C to +85°C / +22°F to +185°F
- Suitable for VFD operation

International Design Standards

Design Standards: ANSI / ASTM / DIN / ISO / Hydraulic Institute / CE / API 610

Hydraulic Standards: ANSI/HI / EN ISO / API610 / NFPA20

Electrical Standards: NEMA / IEC / IEEE

Certifications: DNV GL / ABS / CSA / ATEX/ NSF61

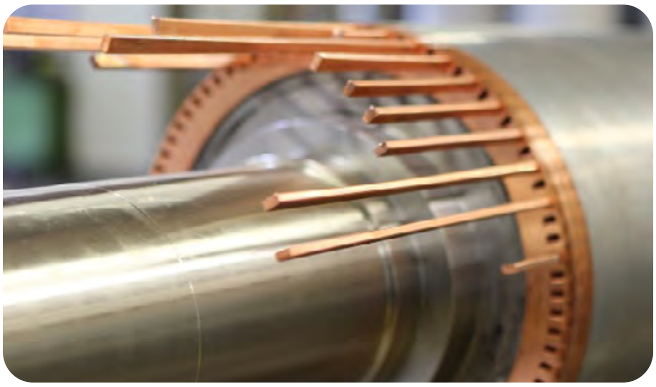
Approvals: ISO 9001

NSF

Made in Germany

Significant savings in energy costs

High-performance pumps with increased efficiency of up to 85% (average η opt > 83%) available



PLEUGER PMM Motors

Our engineers and analysts are always investigating how new technologies, materials and approaches can enhance what we do, to maximise performance and reliability and minimize energy consumption.

PLEUGER PMM motors are rewindable, synchronous electric motors with significant Increase of Motor Efficiency (up to 95%) and Power Output.

Available from 4 kW (5.4 HP) to 165 kW (to 221 HP), 200 kW (268 HP) on request with efficiencies up to 94%

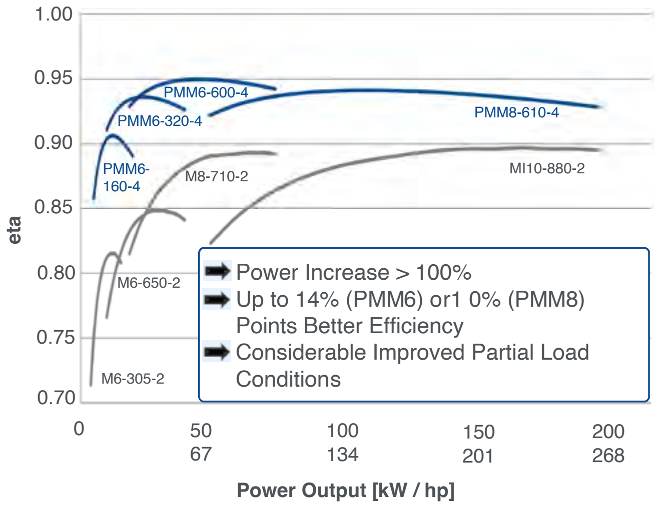
- Designed to minimize life cycle costs
- Design based on the reliable PLEUGER asynchronous / induction motor
- Operated via variable frequency drive (VFD) ensures most efficient operation
- PLEUGER offers the complete system of pump, motor and VFD

PLEUGER PMM Motors

Designed for increased performance and reduced life-cycle costs.

Features and Benefits

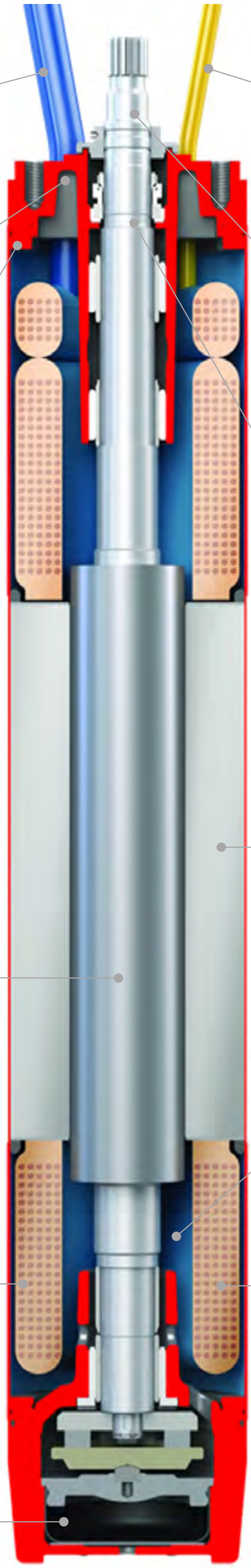
- Up to 14 percent points better efficiency than asynchronous motors
- Increased power output of more than 100%, motors allow smaller unit sizes with reduced installation costs
- Wide efficiency curves drastically reduce number of motor sizes and simplify storage
- No special VFD required; standard VFDs from various manufacturers can be used
- No sinus filter or du/dt filter required, reduce investment and energy cost



Motor Type	Power Output * kW (HP)	Current * A	Efficiency * %	Cos Phi *	Length, L mm (inch)	Diameter, D mm (inch)	Weight kg (lb)	Maximum Permissible Thrust kN (lbf) Down	Up
PMM6-160-4	4.0 (5.4)	8.2	87.0%	0.995	696 (27.40)	144 (5.669)	46 (101)	27.5 (6100)	6 (1350)
	5.5 (7.4)	11.0	89.0%	0.990					
	9.2 (12.3)	17.9	91.0%	0.975					
	11.0 (14.3)	21.5	91.5%	0.965					
	13.0 (17.4)	25.5	91.0%	0.955					
	15.0 (20.1)	29.0	91.0%	0.940					
PMM6-320-4	15.0 (20.1)	28.5	92.5%	0.990	856 (33.70)	144 (5.669)	64 (141)	27.5 (6100)	6 (1350)
	18.5 (24.8)	35.0	93.0%	0.985					
	22.0 (29.5)	41.5	93.5%	0.975					
	26.0 (34.9)	48.5	93.5%	0.970					
	30.0 (40.2)	57.0	93.0%	0.960					
	33.0 (44.3)	63.0	93.0%	0.950					
	37.0 (49.6)	71.0	92.5%	0.935					
	40.0 (53.6)	77.0	92.5%	0.925					
PMM6-600-4	40.0 (53.6)	79.0	94.5%	0.980	1136 (44.72)	144 (5.669)	101 (223)	27.5 (6100)	6 (1350)
	46.0 (61.7)	92.0	94.5%	0.970					
	50.0 (67.1)	100.0	94.5%	0.965					
	55.0 (73.8)	110.0	94.5%	0.960					
	60.0 (80.5)	121.0	94.5%	0.950					
	68.0 (91.2)	137.0	94.5%	0.935					
	75.0 (100.6)	153.0	94.0%	0.920					
PMM8-610-4	75.0 (100.6)	140.0	93.5%	0.985	1438 (56.61)	186 (7.323)	179 (395)	40.0 (9000)***	12.5 (2800)
	83.0 (111.3)	153.0	94.0%	0.985					
	90.0 (120.7)	166.0	94.0%	0.985					
	110.0 (147.5)	205.0	94.0%	0.975					
	140.0 (187.7)	260.0	94.0%	0.960					
	165.0 (221.0)	285.0	93.0%	0.940					
	**								

* at 120 Hz and 3600 rpm, max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, at Service Factor 1.0
** up to 200.0 (268) on request, *** max downthrust capacity 80KN/17,985 lbf on request

PLEUGER Standard and PMM Motors



Flat- or round cable

Space-saving cable design. Certified for drinking water applications.

NEMA or IEC flange connection

Universal connector to standard hydraulics.

Motor housing

Cast housing designed for reliability, corrosion resistance, strength and durability.

Induction Motor: Squirrel Cage Rotor for Asynchronous Motor or Permanent Magnet Motor: Rotor equipped with Permanent Magnets for Synchronous Motor

- Up to 14 % points higher motor efficiency compared to asynchronous motors, through reduction in copper loss
- Hermetically sealed rotor ensures protection of magnets against corrosion and mechanical damage
- Up to 200 kW (268 HP) available

Rewindable winding

Ease of maintenance and cost saving. PE or PE2 insulation.

PE2+PA insulation for optimized winding lifetime.

Breather diaphragm

Liquid pressure compensation to extend the service life of the mechanical seal and O-ring.

PLEUGER. Reliable. Always.

Signal Cable (Optional)

Used with temperature sensor PT100
For monitoring motor temperature.

Motor Shaft End

Standard duplex stainless steel for best combination of corrosion resistance, mechanical strength and stiffness. Special materials available upon request.

Mechanical Seal

High-grade SIC/SIC/Viton® as standard ensures wear resistance and ultra-low maintenance requirements.

Stator Tube

Standard 316 stainless steel construction for excellent corrosion resistance over the service life. Special materials available on request.

Motor Filling

Prefilled and tested with water/ glycol mixture, or potable water on request.

Thrust Bearing

Heavy-duty, custom polymer to ensure ultra-low maintenance and maximum reliability

Thrust Bearings

PLEUGER motors are equipped with heavy duty motor axial thrust bearings made of high-performance polymers for highest axial thrust loads ensuring extraordinary lifetime and reliability.

- Developed by PLEUGER Industries
- Benchmark in submersible motor technology
- In operation since 2013
- Custom Polymer Material
- Heavy-duty design, up to 300kN axial thrust
- Ensures extraordinary lifetime of motor

Advantages

- Tilting pads made of proprietary synthetic material
- Rotating runner made of Stainless Steel
- Increase of lifetime
- Maintenance free
- Allowed axial thrust increased by 100% (up to 300kN)
- Lower absorbed power by 20%

- Increased wear resistance by using new polymers
- Improved dry run capabilities
- Increased water hammer resistance
- Lower starting torque
- Bi-directional operation
- High temperature resistance
- No contamination based on carbon wear

VPI

ROTOR MANUFACTURE - VACUUM PRESSURE IMPREGNATION (VPI)

The manufacture of our rotors includes a vacuum pressure impregnation process that ensures complete penetration of the epoxy into the micro laminations which are used to build up the layers of the rotor.

The VPI process results in a far stronger and more durable construction than traditional processes, allowing for final milling and honing to ensure the perfect rotor balance.

Due to the vacuum, air and moisture between the rotor laminations are extracted and replaced by liquid epoxy resin.

This prevents the occurrence of harmful:

- imbalance due to air pockets during operation of the motor
- corrosion between the rotor blades

The subsequent heat treatment of the rotor solidifies the already impregnated rotor pack into a solid block, which further increases the stiffness of the complete rotor.

Consequently, the bending of the rotor and thus the bending moment in the radial bearings are reduced, which leads to a longer service life of the bearings and thus of the motor.

COOLING CIRCUIT

Efficient Motor Cooling

- internal cooling system manufactured with a highly efficient cooling impeller
- Customized impeller for each motor size
- The design ensures sufficient thermal motor reserves and minimizes energy losses
- Re-windable / water filled
- Sealed winding wire (PE, PE+PA, etc.)

Cooling and lubrication options:

- Water-Glycol Mixture (standard)
- Drinking Water
- Pure Glycol
- Oil

Glycol plus additives prevent corrosion and serve as anti freeze, as well as being environmentally safe.

Pleuger Submersible Motor range for Low Voltages SF 1.0

	Model d.o.l.	Power Output HP[3]	Voltage V[4] - 3Ph	Frequency Hz	Speed RPM	Current A	Thrust Capacity max. Down (lbf)[5]	Thrust Capacity max. Up (lbf)	Length inches	Power Factor 1/1	Power Factor 3/4	Power Factor 1/2	Efficiency 1/1	Efficiency 3/4	Efficiency 1/2	Standard motor leads No. of leads shape	Standard motor leads Length ft	Standard motor leads Cross section mm²
6" Motors	M6-160-2	8.5	460	60	3440	13.3	2800	1350	21.81	0.810	0.765	0.670	0.745	0.755	0.730	1Fl	9.8	4x2,5
	M6-200-2	11.5	460	60	3430	16.8	2800	1350	23.39	0.830	0.790	0.705	0.765	0.780	0.765	1Fl	9.8	4x2,5
	M6-240-2	15	460	60	3430	21	2800	1350	24.96	0.830	0.790	0.700	0.800	0.810	0.790	1Fl	9.8	4x2,5
	M6-270-2	17.5	460	60	3425	24	2800	1350	26.14	0.835	0.795	0.715	0.810	0.820	0.805	1Fl	9.8	4x2,5
	M6-305-2	21	460	60	3420	29	2800	1350	27.52	0.845	0.810	0.730	0.800	0.815	0.805	1Fl	9.8	4x2,5[1]
	M6-340-2	24	460	60	3420	33	2800	1350	28.90	0.845	0.810	0.725	0.810	0.825	0.815	1Fl	9.8	4x2,5[1]
	M6-400-2	29.5	460	60	3415	39.5	2800	1350	31.26	0.855	0.820	0.735	0.815	0.830	0.820	1Fl	9.8	4x4[1]
	M6-460-2	35	460	60	3430	47	6100	1350	34.49	0.840	0.800	0.710	0.830	0.840	0.825	1Fl	9.8	4x6
	M6-530-2	41.5	460	60	3425	55	6100	1350	37.24	0.850	0.810	0.725	0.830	0.845	0.835	1Fl	9.8	4x6[1]
	M6-600-2	48.5	460	60	3425	63	6100	1350	40.00	0.850	0.810	0.720	0.840	0.850	0.840	1Fl	9.8	4x10
	M6-650-2	53.5	460	60	3415	70	6100	1350	41.97	0.860	0.825	0.745	0.835	0.850	0.840	1Fl	9.8	4x10[1]
	M6-720-2	60.5	460	60	3415	78	6100	1350	44.72	0.860	0.825	0.740	0.840	0.850	0.845	1Fl	9.8	4x10[1]
8" Motors	M8-330-2	53.5	460	60	3470	70	17985	2800	40.87	0.855	0.840	0.790	0.840	0.850	0.835	1Fl	16.4	4x10[1]
	M8-410-2	64.5	460	60	3485	83	17985	2800	44.02	0.855	0.840	0.785	0.850	0.855	0.835	1Fl	23.0	4x16
	M8-480-2	74	460	60	3490	92	17985	2800	46.77	0.870	0.845	0.785	0.865	0.865	0.840	1Fl	23.0	4x16[1]
	M8-530-2	80.5	460	60	3485	102	17985	2800	48.74	0.860	0.850	0.795	0.860	0.865	0.845	1Fl	23.0	4x16[1]
	M8-580-2	88.5	460	60	3490	111	17985	2800	50.71	0.875	0.855	0.800	0.855	0.860	0.845	1Fl	23.0	4x16[1]
	M8-650-2	94	460	60	3495	116	17985	2800	53.46	0.875	0.855	0.805	0.865	0.860	0.845	1Rd	23.0	4x25
	M8-710-2	107	460	60	3490	133	17985	2800	55.83	0.850	0.835	0.780	0.885	0.890	0.885	1Rd	23.0	4x25[1]
	M8-820-2	121	460	60	3490	149	17985	2800	60.16	0.855	0.845	0.795	0.885	0.890	0.885	4Rd	23.0	1x16P[1]
	M8-930-2	134	460	60	3495	165	17985	2800	64.49	0.850	0.835	0.785	0.895	0.895	0.885	4Rd	23.0	1x25P
	M8-990-2	142	460	60	3500	175	17985	2800	66.85	0.850	0.830	0.775	0.895	0.895	0.885	4Rd	23.0	1x25P
	M8-135-4	6.5	460	60	1750	10.5	17985	2800	33.19	0.765	0.685	0.565	0.750	0.750	0.720	1Fl	23.0	4x2.5
	M8-170-4	9	460	60	1755	14.3	17985	2800	34.57	0.745	0.665	0.540	0.780	0.775	0.740	1Fl	23.0	4x2.5
	M8-210-4	12	460	60	1755	18.8	17985	2800	36.14	0.750	0.675	0.555	0.800	0.800	0.775	1Fl	23.0	4x2.5
	M8-280-4	18	460	60	1750	26.5	17985	2800	38.90	0.800	0.730	0.615	0.795	0.805	0.790	1Fl	23.0	4x2.5
	M8-340-4	24	460	60	1750	35	17985	2800	41.26	0.790	0.720	0.605	0.815	0.820	0.805	1Fl	23.0	4x4
	M8-420-4	29.5	460	60	1745	41	17985	2800	44.41	0.810	0.750	0.645	0.830	0.840	0.825	1Fl	23.0	4x4[1]
	M8-520-4	35	460	60	1750	48.5	17985	2800	48.35	0.800	0.740	0.630	0.840	0.845	0.835	1Fl	23.0	4x6
	M8-700-4	49.5	460	60	1745	69	17985	2800	55.43	0.820	0.765	0.655	0.820	0.835	0.825	1Fl	23.0	4x10[1]
	M8-870-4	60	460	60	1750	84	17985	2800	62.13	0.795	0.735	0.620	0.850	0.850	0.835	1Fl	23.0	4x16
	M8-1050-4	72.5	460	60	1750	101	17985	2800	73.15	0.785	0.720	0.600	0.855	0.855	0.840	1Fl	23.0	4x16[1]
10" Motors	MI10-420-2	121	460	60	3465	156	17985	5000	53.27	0.830	0.800	0.720	0.875	0.885	0.875	4Rd	23.0	1x25P
	MI10-490-2	141	460	60	3470	179	17985	5000	56.02	0.835	0.800	0.720	0.880	0.885	0.875	4Rd	23.0	1x25P[1]
	MI10-600-2	177	460	60	3465	220	17985	5000	60.35	0.850	0.820	0.745	0.880	0.890	0.880	4Rd	23.0	1x35P[1]
	MI10-740-2	221	460	60	3470	275	17985	5000	65.87	0.845	0.810	0.730	0.890	0.895	0.885	4Rd	23.0	1x50P[1,2]
	MI10-880-2	268	460	60	3470	330	17985	5000	71.38	0.845	0.805	0.725	0.895	0.895	0.885	3/4Rd	32.8	1x25PII[1]
	MI10-960-2	295	460	60	3460	360	17985	5000	74.53	0.860	0.835	0.765	0.890	0.895	0.890	3/4Rd	32.8	1x25PII[1]
	MI10-1070-2	322	460	60	3465	395	17985	5000	78.86	0.860	0.830	0.760	0.890	0.895	0.885	3/4Rd	32.8	1x25PII[1]
	MI10-1200-2	355	460	60	3475	435	17985	5000	83.98	0.855	0.820	0.745	0.895	0.895	0.890	3/4Rd	32.8	1x35PII[1]
	MI10-420-4	50	460	60	1750	66	17985	5000	53.27	0.805	0.765	0.685	0.870	0.875	0.860	1Fl	23.0	4x10
	MI10-420-4	72	460	60	1740	98	17985	5000	53.27	0.805	0.770	0.680	0.860	0.870	0.865	1Fl	23.0	4x16[1]
	MI10-490-4	88	460	60	1735	118	17985	5000	56.02	0.810	0.780	0.695	0.865	0.875	0.875	4Rd	23.0	1x16P
	MI10-600-4	115	460	60	1730	154	17985	5000	60.35	0.815	0.785	0.705	0.860	0.875	0.875	4Rd	23.0	1x25P
	MI10-740-4	145	460	60	1730	193	17985	5000	65.87	0.810	0.775	0.690	0.865	0.880	0.880	4Rd	23.0	1x25P[1]
	MI10-880-4	177	460	60	1735	235	17985	5000	71.38	0.810	0.780	0.695	0.870	0.880	0.880	4Rd	23.0	1x35P[1]
	MI10-960-4	193	460	60	1735	255	17985	5000	74.53	0.810	0.775	0.695	0.875	0.885	0.885	4Rd	23.0	1x35P[1]
	MI10-1070-4	212	460	60	1735	280	17985	5000	78.86	0.810	0.775	0.690	0.870	0.880	0.880	4Rd	23.0	1x50P[1,2]
	MI10-1200-4	241	460	60	1735	320	17985	5000	83.98	0.805	0.770	0.685	0.880	0.890	0.885	4Rd	23.0	1x50P[1,2]
12"[6]	VNI12-65-2	248	460	60	3495	300	26977	5000	67.48	0.875	0.860	0.815	0.885	0.880	0.860	2Rd	32.8	3/4x25II[1]
	VNI12-75-2	288	460	60	3495	345	26977	5000	71.42	0.880	0.870	0.830	0.885	0.880	0.860	2Rd	32.8	3/4x35II[1]
	VNI12-90-2	322	460	60	3505	385	26977	5000	77.32	0.880	0.860	0.810	0.885	0.880	0.855	2Rd	32.8	3/4x50II[1]
	VNI12-65-4	168	460	60	1720	215	26977	5000	67.48	0.825	0.805	0.745	0.875	0.885	0.880	1Rd	32.8	4x50[1]
	VNI12-75-4	201	460	60	1720	260	26977	5000	71.42	0.825	0.810	0.750	0.875	0.885	0.885	2Rd	32.8	3/4x25II[1]
	VNI12-90-4	248	460	60	1720	320	26977	5000	77.32	0.825	0.810	0.755	0.880	0.890	0.885	2Rd	32.8	3/4x35II[1]
	VNI12-100-4	275	460	60	1720	350	26977	5000	81.26	0.830	0.810	0.755	0.880	0.890	0.885	2Rd	32.8	3/4x35II[1]
	VNI12-110-4	308	460	60	1720	400	26977	5000	85.20	0.825	0.805	0.740	0.880	0.890	0.885	2Rd	32.8	3/4x50II[1]
	VNI12-120-4	350	460	60	1715	450	26977	5000	89.13	0.830	0.815	0.750	0.870	0.885	0.885	2Rd	32.8	3/4x50II[1]
14"[6]	VNI14-50-2	288	460	60	3500	355	33721	9000	71.81	0.850	0.850	0.810	0.895	0.890	0.870	2Rd	32.8	3/4x35II[1]
	VNI14-60-2	322	460	60	3515	395	33721	9000	75.75	0.850	0.835	0.780	0.895	0.890	0.865	2Rd	32.8	3/4x50II[1]
	VNI14-50-4	177	460	60	1730	230	33721	9000	71.81	0.810	0.790	0.720	0.880	0.885	0.875	1Rd	32.8	4x70
	VNI14-60-4	214	460	60	1730	280	33721	9000	75.75	0.820	0.800	0.735	0.880	0.885	0.875	1Rd	32.8	4x70[1]
	VNI14-70-4	241	460	60	1730	310	33721	9000	79.09	0.820	0.795	0.735	0.885	0.885	0.875	2Rd	32.8	3/4x35II[1]
	VNI14-80-4	275	460	60	1730	355	33721	9000	83.62	0.820	0.800	0.730	0.885	0.890	0.875	2Rd	32.8	3/4x35II[1]
	VNI14-90-4	308	460	60	1735	400	33721	9000	87.56	0.820	0.795	0.725	0.885	0.890	0.875	2Rd	32.8	3/4x50II[1]
	VNI14-100-4	335	460	60	1735	430	33721	9000	91.50	0.820	0.795	0.725	0.890	0.890	0.875	2Rd	32.8	3/4x50II[1]
16"[6]	MI16-65-4	322	460	60	1725	425	33721	9000	78.11	0.800	0.790	0.735	0.890	0.900	0.895	2Rd	32.8	3/4x50II[1]

1) Cable must be submerged, 2) PE conductor outside the motor, 3) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 4) +14/-6%, other voltages up to 1000V on request, 5) max. value for thrust bearing only, motor values see pages "motor measures & specifications", 6) higher power output on request

Pleuger Submersible Motor range for Low Voltages SF 1.15

	Model d.o.l.	Power Output HP 3)	Voltage V 4) - 3Ph	Frequency Hz	Speed RPM	Current A	Thrust Capacity max. Down(lbf) 5)	Thrust Capacity max. Up (lbf)	Length inches	Power Factor 1/1	Power Factor 3/4	Power Factor 1/2	Efficiency 1/1	Efficiency 3/4	Efficiency 1/2	Standard motor leads No. of leads shape	Standard motor leads Length ft	Standard motor leads Cross section mm²
6" Motors	M6-160-2	7.5	460	60	3470	11.6	2800	1350	21.81	0.790	0.730	0.630	0.755	0.750	0.715	1Fl	9.8	4x2,5
	M6-200-2	10	460	60	3460	14.9	2800	1350	23.39	0.815	0.770	0.670	0.775	0.780	0.750	1Fl	9.8	4x2,5
	M6-240-2	12.5	460	60	3460	18.3	2800	1350	24.96	0.810	0.760	0.665	0.805	0.805	0.780	1Fl	9.8	4x2,5
	M6-270-2	15	460	60	3450	21.5	2800	1350	26.14	0.820	0.775	0.685	0.815	0.820	0.795	1Fl	9.8	4x2,5
	M6-305-2	18	460	60	3450	25	2800	1350	27.52	0.830	0.785	0.695	0.810	0.815	0.795	1Fl	9.8	4x2,5 1)
	M6-340-2	21	460	60	3450	28.5	2800	1350	28.90	0.830	0.785	0.690	0.820	0.825	0.805	1Fl	9.8	4x2,5 1)
	M6-400-2	25.5	460	60	3450	34.5	2800	1350	31.26	0.840	0.795	0.700	0.825	0.830	0.815	1Fl	9.8	4x4 1)
	M6-460-2	30.5	460	60	3460	41	6100	1350	34.49	0.820	0.770	0.670	0.835	0.840	0.815	1Fl	9.8	4x6
	M6-530-2	36	460	60	3450	48.5	6100	1350	37.24	0.830	0.785	0.685	0.840	0.840	0.825	1Fl	9.8	4x6 1)
	M6-600-2	42	460	60	3450	56	6100	1350	40.00	0.830	0.785	0.685	0.845	0.850	0.830	1Fl	9.8	4x10
	M6-650-2	47	460	60	3440	62	6100	1350	41.97	0.845	0.805	0.715	0.845	0.850	0.835	1Fl	9.8	4x10 1)
	M6-720-2	52.5	460	60	3445	69	6100	1350	44.72	0.845	0.800	0.705	0.845	0.850	0.835	1Fl	9.8	4x10 1)
8" Motors	M8-330-2	46.5	460	60	3495	61	17985	2800	40.87	0.855	0.830	0.765	0.845	0.845	0.825	1Fl	16.4	4x10 1)
	M8-410-2	55.5	460	60	3505	72	17985	2800	44.02	0.850	0.825	0.760	0.855	0.850	0.825	1Fl	23.0	4x16
	M8-480-2	64.5	460	60	3505	81	17985	2800	46.77	0.860	0.830	0.760	0.865	0.860	0.830	1Fl	23.0	4x16 1)
	M8-530-2	70	460	60	3505	89	17985	2800	48.74	0.855	0.835	0.770	0.860	0.860	0.830	1Fl	23.0	4x16 1)
	M8-580-2	77	460	60	3505	98	17985	2800	50.71	0.865	0.840	0.775	0.855	0.860	0.835	1Fl	23.0	4x16 1)
	M8-650-2	82	460	60	3510	102	17985	2800	53.46	0.870	0.840	0.780	0.865	0.860	0.835	1Rd	23.0	4x25
	M8-710-2	94	460	60	3505	117	17985	2800	55.83	0.845	0.820	0.760	0.890	0.890	0.880	1Rd	23.0	4x25 1)
	M8-820-2	105	460	60	3505	129	17985	2800	60.16	0.850	0.830	0.775	0.890	0.890	0.880	4Rd	23.0	1x16P 1)
	M8-930-2	117	460	60	3510	144	17985	2800	64.49	0.845	0.820	0.760	0.895	0.895	0.880	4Rd	23.0	1x25P
	M8-990-2	123	460	60	3515	153	17985	2800	66.85	0.840	0.815	0.745	0.900	0.895	0.880	4Rd	23.0	1x25P
	M8-135-4	5.5	460	60	1760	9.3	17985	2800	33.19	0.715	0.630	0.510	0.755	0.740	0.695	1Fl	23.0	4x2.5
	M8-170-4	7.5	460	60	1765	12.7	17985	2800	34.57	0.695	0.610	0.485	0.780	0.765	0.720	1Fl	23.0	4x2.5
	M8-210-4	10.5	460	60	1760	17.3	17985	2800	36.14	0.725	0.640	0.520	0.800	0.795	0.755	1Fl	23.0	4x2.5
	M8-280-4	15.5	460	60	1755	23.5	17985	2800	38.90	0.765	0.690	0.565	0.805	0.800	0.775	1Fl	23.0	4x2.5
	M8-340-4	21	460	60	1755	31.5	17985	2800	41.26	0.755	0.680	0.560	0.820	0.820	0.795	1Fl	23.0	4x4
	M8-420-4	25.5	460	60	1755	36.5	17985	2800	44.41	0.780	0.715	0.600	0.835	0.835	0.815	1Fl	23.0	4x4 1)
	M8-520-4	30	460	60	1755	43.5	17985	2800	48.35	0.770	0.705	0.585	0.845	0.845	0.825	1Fl	23.0	4x6
	M8-700-4	43	460	60	1755	61	17985	2800	55.43	0.795	0.730	0.610	0.830	0.835	0.815	1Fl	23.0	4x10 1)
	M8-870-4	52.5	460	60	1755	75	17985	2800	62.13	0.770	0.695	0.575	0.850	0.850	0.825	1Fl	23.0	4x16
	M8-1050-4	63	460	60	1760	91	17985	2800	73.15	0.755	0.680	0.560	0.855	0.855	0.830	1Fl	23.0	4x16 1)
10" Motors	MI10-420-2	105	460	60	3485	136	17985	5000	53.27	0.820	0.775	0.680	0.880	0.880	0.865	4Rd	23.0	1x25P
	MI10-490-2	122	460	60	3490	157	17985	5000	56.02	0.820	0.775	0.680	0.885	0.885	0.865	4Rd	23.0	1x25P 1)
	MI10-600-2	154	460	60	3485	194	17985	5000	60.35	0.840	0.800	0.715	0.885	0.890	0.875	4Rd	23.0	1x35P 1)
	MI10-740-2	192	460	60	3490	240	17985	5000	65.87	0.830	0.785	0.695	0.895	0.890	0.875	4Rd	23.0	1x50P 1) 2)
	MI10-880-2	233	460	60	3490	295	17985	5000	71.38	0.830	0.780	0.685	0.895	0.895	0.880	3/4Rd	32.8	1x25PII 1)
	MI10-960-2	256	460	60	3480	315	17985	5000	74.53	0.850	0.815	0.735	0.895	0.895	0.880	3/4Rd	32.8	1x25PII 1)
	MI10-1070-2	280	460	60	3485	345	17985	5000	78.86	0.850	0.810	0.730	0.895	0.895	0.880	3/4Rd	32.8	1x25PII 1)
	MI10-1200-2	308	460	60	3490	385	17985	5000	83.98	0.840	0.795	0.710	0.895	0.895	0.880	3/4Rd	32.8	1x35PII 1)
	MI10-420-4	43	460	60	1760	58	17985	5000	53.27	0.790	0.740	0.645	0.875	0.870	0.850	1Fl	23.0	4x10
	MI10-420-4	63	460	60	1750	86	17985	5000	53.27	0.790	0.740	0.640	0.865	0.870	0.860	1Fl	23.0	4x16 1)
	MI10-490-4	76.5	460	60	1745	103	17985	5000	56.02	0.795	0.755	0.660	0.875	0.880	0.870	4Rd	23.0	1x16P
	MI10-600-4	100	460	60	1740	135	17985	5000	60.35	0.805	0.760	0.670	0.865	0.875	0.870	4Rd	23.0	1x25P
	MI10-740-4	126	460	60	1745	169	17985	5000	65.87	0.800	0.750	0.655	0.875	0.880	0.875	4Rd	23.0	1x25P 1)
	MI10-880-4	154	460	60	1745	205	17985	5000	71.38	0.800	0.755	0.660	0.875	0.885	0.875	4Rd	23.0	1x35P 1)
	MI10-960-4	168	460	60	1745	225	17985	5000	74.53	0.800	0.750	0.660	0.880	0.890	0.880	4Rd	23.0	1x35P 1)
	MI10-1070-4	184	460	60	1745	245	17985	5000	78.86	0.800	0.750	0.650	0.875	0.885	0.875	4Rd	23.0	1x50P 1) 2)
	MI10-1200-4	210	460	60	1745	280	17985	5000	83.98	0.795	0.745	0.645	0.885	0.890	0.880	4Rd	23.0	1x50P 1) 2)
12" 6)	VNI12-65-2	216	460	60	3510	260	26977	5000	67.48	0.870	0.845	0.790	0.885	0.875	0.845	2Rd	32.8	3/4x25II 1)
	VNI12-75-2	250	460	60	3510	305	26977	5000	71.42	0.875	0.860	0.805	0.885	0.875	0.850	2Rd	32.8	3/4x35II 1)
	VNI12-90-2	280	460	60	3520	340	26977	5000	77.32	0.870	0.850	0.790	0.885	0.875	0.840	2Rd	32.8	3/4x50II 1)
	VNI12-65-4	146	460	60	1735	190	26977	5000	67.48	0.820	0.790	0.715	0.880	0.885	0.875	1Rd	32.8	4x50 1)
	VNI12-75-4	175	460	60	1735	225	26977	5000	71.42	0.820	0.790	0.720	0.885	0.890	0.880	2Rd	32.8	3/4x25II 1)
	VNI12-90-4	216	460	60	1730	275	26977	5000	77.32	0.825	0.795	0.730	0.885	0.890	0.880	2Rd	32.8	3/4x35II 1)
	VNI12-100-4	239	460	60	1730	305	26977	5000	81.26	0.825	0.795	0.725	0.885	0.890	0.880	2Rd	32.8	3/4x35II 1)
	VNI12-110-4	268	460	60	1735	345	26977	5000	85.20	0.820	0.785	0.710	0.890	0.890	0.880	2Rd	32.8	3/4x50II 1)
	VNI12-120-4	303	460	60	1730	390	26977	5000	89.13	0.825	0.795	0.720	0.880	0.885	0.880	2Rd	32.8	3/4x50II 1)
14" 6)	VNI14-50-2	250	460	60	3515	305	33721	9000	71.81	0.855	0.840	0.790	0.895	0.885	0.860	2Rd	32.8	3/4x35II 1)
	VNI14-60-2	280	460	60	3530	350	33721	9000	75.75	0.845	0.820	0.755	0.895	0.885	0.855	2Rd	32.8	3/4x50II 1)
	VNI14-50-4	154	460	60	1740	205	33721	9000	71.81	0.805	0.770	0.690	0.885	0.885	0.865	1Rd	32.8	4x70
	VNI14-60-4	186	460	60	1740	240	33721	9000	75.75	0.815	0.780	0.705	0.885	0.885	0.865	1Rd	32.8	4x70 1)
	VNI14-70-4	210	460	60	1740	275	33721	9000	79.09	0.810	0.780	0.705	0.885	0.885	0.870	2Rd	32.8	3/4x35II 1)
	VNI14-80-4	239	460	60	1745	310	33721	9000	83.62	0.815	0.780	0.700	0.890	0.885	0.870	2Rd	32.8	3/4x35II 1)
	VNI14-90-4	268	460	60	1745	350	33721	9000	87.56	0.810	0.775	0.695	0.890	0.885	0.870	2Rd	32.8	3/4x50II 1)
	VNI14-100-4	291	460	60	1745	380	33721	9000	91.50	0.810	0.770	0.680	0.890	0.885	0.870	2Rd	32.8	3/4x50II 1)
16" 6)	MI16-65-4	280	460	60	1735	365	33721	9000	78.11	0.800	0.775	0.700	0.895	0.900	0.890	2Rd	32.8	3/4x50II 1)

1) Cable must be submerged, 2) PE conductor outside the motor, 3) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 4) +14/-6%, other voltages up to 1000V on request, 5) max. value for thrust bearing only, motor values see pages "motor measures & specifications", 6) higher power output on request

Pleuger Submersible Motor range for Medium Voltages SF 1.0

	Model d.o.l.	Power Output HP[2)]	Voltage V[3)] - 3Ph	Frequency Hz	Speed RPM	Current A	Thrust Capacity max. Down(lbf)[4)]	Thrust Capacity max. Up (lbf)	Length inches	Power Factor 1/1	Power Factor 3/4	Power Factor 1/2	Efficiency 1/1	Efficiency 3/4	Efficiency 1/2	Standard motor leads: No. of leads shape	Length ft	Cross section mm^2
14" Motors - 2300V	VNI14-60-4	115	2300	60	1755	33	33721	9000	75.75	0.775	0.720	0.615	0.855	0.845	0.815	3Rd	39.37	1x16
	VNI14-70-4	173	2300	60	1740	47	33721	9000	79.09	0.800	0.755	0.665	0.865	0.865	0.845	3Rd	39.37	1x16
	VNI14-80-4	230	2300	60	1730	61	33721	9000	83.62	0.815	0.780	0.710	0.870	0.875	0.860	3Rd	39.37	1x16
	VNI14-90-4	288	2300	60	1725	76	33721	9000	87.56	0.810	0.780	0.705	0.870	0.880	0.865	3Rd	39.37	1x16
	VNI14-100-4	316	2300	60	1730	84	33721	9000	91.50	0.805	0.775	0.695	0.875	0.880	0.870	3Rd	39.37	1x16
	VNI14-110-4	345	2300	60	1730	81	33721	9000	95.43	0.810	0.775	0.700	0.880	0.885	0.870	3Rd	39.37	1x16
	VNI14-120-4	403	2300	60	1725	106	33721	9000	99.37	0.805	0.775	0.700	0.880	0.885	0.875	3Rd	39.37	1x16
16" Motors - 4160V	MI16-120-4	230	4160	60	1760	34	33721	9000	99.76	0.810	0.765	0.680	0.860	0.845	0.815	3Rd	39.37	1x16
	MI16-130-4	288	4160	60	1760	42	33721	9000	103.70	0.810	0.765	0.680	0.870	0.860	0.830	3Rd	39.37	1x16
	MI16-145-4	403	4160	60	1760	60	33721	9000	109.61	0.785	0.730	0.630	0.880	0.875	0.845	3Rd	39.37	1x16
	MI16-165-4	575	4160	60	1750	84	33721	9000	117.48	0.795	0.745	0.645	0.890	0.885	0.865	3Rd	39.37	1x16
	MI16-185-4	690	4160	60	1745	99	33721	9000	125.35	0.810	0.770	0.685	0.890	0.890	0.875	3Rd	39.37	1x16

1) Cable must be submerged, 2) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 3) +10/-10%, other voltages up to 1000V on request
4) max. value for thrust bearing only, motor values see pages "motor measures & specifications"

Pleuger Submersible Motor range for Medium Voltages SF 1.15

	Model d.o.l.	Power Output HP[2)]	Voltage V[3)] - 3Ph	Frequency Hz	Speed RPM	Current A	Thrust Capacity max. Down(lbf)[4)]	Thrust Capacity max. Up (lbf)	Length inches	Power Factor 1/1	Power Factor 3/4	Power Factor 1/2	Efficiency 1/1	Efficiency 3/4	Efficiency 1/2	Standard motor leads: No. of leads shape	Length ft	Cross section mm^2
14" Motors - 2300V	VNI14-60-4	100	2300	60	1760	30	33721	9000	75.75	0.750	0.685	0.575	0.850	0.840	0.800	3Rd	39.37	1x16
	VNI14-70-4	150	2300	60	1750	42	33721	9000	79.09	0.780	0.730	0.630	0.865	0.860	0.835	3Rd	39.37	1x16
	VNI14-80-4	200	2300	60	1740	54	33721	9000	83,62	0.800	0.760	0.675	0.870	0.870	0.850	3Rd	39.37	1x16
	VNI14-90-4	250	2300	60	1740	67	33721	9000	87.56	0.800	0.760	0.670	0.875	0.875	0.860	3Rd	39.37	1x16
	VNI14-100-4	275	2300	60	1740	74	33721	9000	91.50	0.795	0.750	0.665	0.880	0.880	0.860	3Rd	39.37	1x16
	VNI14-110-4	300	2300	60	1740	80	33721	9000	95.43	0.795	0.755	0.665	0.885	0.880	0.865	3Rd	39.37	1x16
	VNI14-120-4	350	2300	60	1740	93	33721	9000	99.37	0.795	0.755	0.670	0.885	0.885	0.870	3Rd	39.37	1x16
16" Motors - 4160V	MI16-120-4	200	4160	60	1765	31	33721	9000	99.76	0.790	0.735	0.645	0.855	0.835	0.800	3Rd	39.37	1x16
	MI16-130-4	250	4160	60	1765	38	33721	9000	103.70	0.790	0.735	0.645	0.865	0.850	0.815	3Rd	39.37	1x16
	MI16-145-4	350	4160	60	1765	54	33721	9000	109.61	0.760	0.700	0.590	0.880	0.865	0.835	3Rd	39.37	1x16
	MI16-165-4	500	4160	60	1760	76	33721	9000	117.48	0.770	0.710	0.605	0.890	0.880	0.855	3Rd	39.37	1x16
	MI16-185-4	600	4160	60	1755	88	33721	9000	125.35	0.795	0.745	0.645	0.890	0.885	0.865	3Rd	39.37	1x16

1) Cable must be submerged, 2) max. water temperature: 30°C/86°F, min. water velocity at motor surface: 0,5 m/s /1.64 ft/s, 3) +10/-10%, other voltages up to 1000V on request
4) max. value for thrust bearing only, motor values see pages "motor measures & specifications"

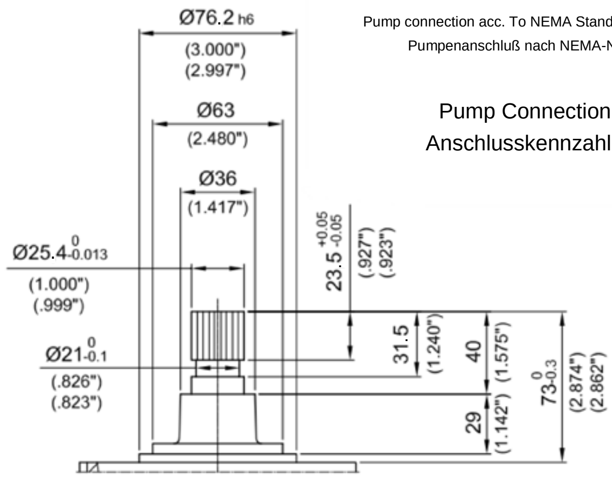
PLEUGER	Submersible motor Unterwassermotor	3626/0 09.18
	M6 – 2 Pol.	Zeichnungs-Nr.: Drawing-No.: 893 5-3/4

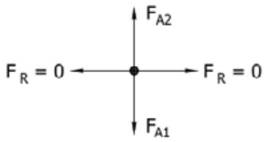
Spline data:	Daten der Verzahnung:
ANSI B92.1	ANSI B92.1
15 teeth	15 Zähne
30° pressure angle	30° Eingriffswinkel

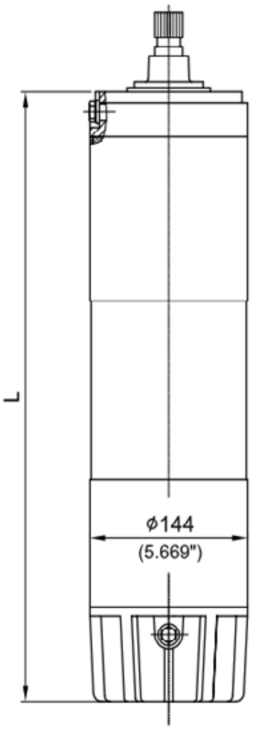
Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm

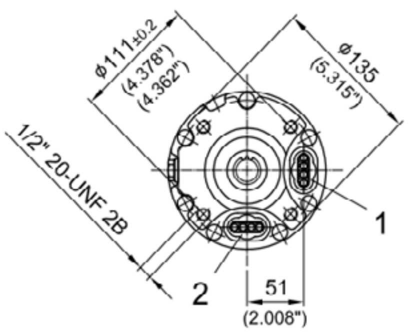
Pump connection acc. To NEMA Standards
Pumpenanschluß nach NEMA-Norm

Pump Connection 38
Anschlusskennzahl 38









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity max. Max. Axialkraft F_{A1}		F_{A2}		Series No. Baustufe
	mm	inch	kg	lb	kN	lbf	kN	lbf	
M6-160-2	554	21.81	38	84	12.5	2800	6	1350	3
M6-200-2	594	23.39	42	93	12.5	2800	6	1350	
M6-240-2	634	24.96	46	102	12.5	2800	6	1350	
M6-270-2	664	26.14	49	109	12.5	2800	6	1350	
M6-305-2	699	27.52	53	117	12.5	2800	6	1350	
M6-340-2	734	28.90	57	126	12.5	2800	6	1350	
M6-400-2	794	31.26	64	142	12.5	2800	6	1350	
M6-460-2	876	34.49	71	157	27.5	6100	6	1350	4
M6-530-2	946	37.24	79	175	27.5	6100	6	1350	
M6-600-2	1016	40.00	87	192	27.5	6100	6	1350	
M6-650-2	1066	41.97	93	206	27.5	6100	6	1350	
M6-720-2	1136	44.72	100	221	27.5	6100	6	1350	

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity
Ma. Axialkraft in Richtung Motor

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	Motor Leads Herausführbare Stromzuführungsleitungen							
	Single / Einfachleitung				Double / Doppelleitung			
	Flat / Flach							
	No. of cores / Anzahl der Adern							
mm²	3x		4x		3x		4x	
2,5	●	●	⊖	●	⊖	●	●	⊖
4	●	●	⊖	●	⊖	●	●	⊖
6 2)	●	●	●	⊖	●	●	●	●
10 2)	●	●		⊖	●	●		●
16 2)	●	●						
Position of leads Lage d. Leitungsdurchführung	1	2	1	2	1	2	1	2

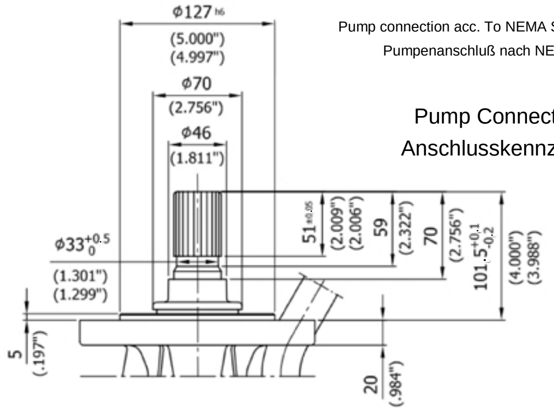
2) For installation into 6"-well please check O.D. of pumping unit
Bei Einbau in 6"-Brunnen, bitte den max. Aggregatdurchmesser beachten

⊖ Standard cable / Standardleitung

● Special cable / Sonderleitung

Max. cable dimensions **Max. Leitungsabmessungen**	
Position	1 + 2
Round / Rund	Ø22
Flat / Flach	17 x 36,5

PLEUGER	**Submersible motor** **Unterwassermotor**	**3630/0** 09.18
	M8 – 2 Pol.	Zeichnungs-Nr.: Drawing-No.: 894 5-4

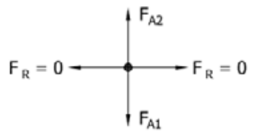


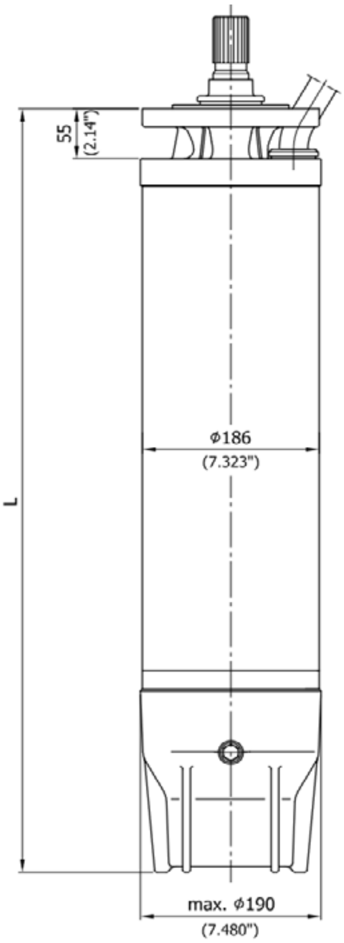
Pump connection acc. To NEMA Standards
Pumpenanschluß nach NEMA-Norm

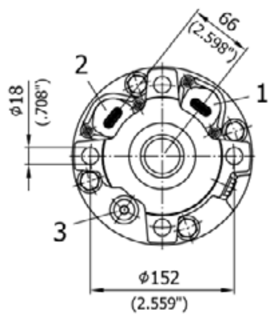
Pump Connection 39
Anschlusskennzahl 39

Spline data:	**Daten der Verzahnung:**
ANSI B92.1	ANSI B92.1
23 teeth	23 Zähne
30° pressure angle	30° Eingriffswinkel

Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm







Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
M8-330-2	1038	40.87	126	278	40	9000	12.5	2800
M8-410-2	1118	44.02	139	307	40	9000	12.5	2800
M8-480-2	1188	46.77	154	340	40	9000	12.5	2800
M8-530-2	1238	48.74	163	360	40	9000	12.5	2800
M8-580-2	1288	50.71	172	380	40	9000	12.5	2800
M8-650-2	1358	53.46	185	408	40	9000	12.5	2800
M8-710-2	1418	55.83	196	433	40	9000	12.5	2800
M8-820-2	1528	60.16	216	477	40	9000	12.5	2800
M8-930-2	1638	64.49	237	523	40	9000	12.5	2800
M8-990-2	1698	66.85	247	545	40	9000	12.5	2800

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungsquerschnitt	Motor Leads Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund			Flat Flach			2 Whips 2 Peitschen 2)	
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	●	●	●		●	●	●	●						
Position of leads Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

● Special cable / Sonderleitung

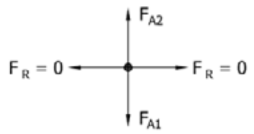
Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø21
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

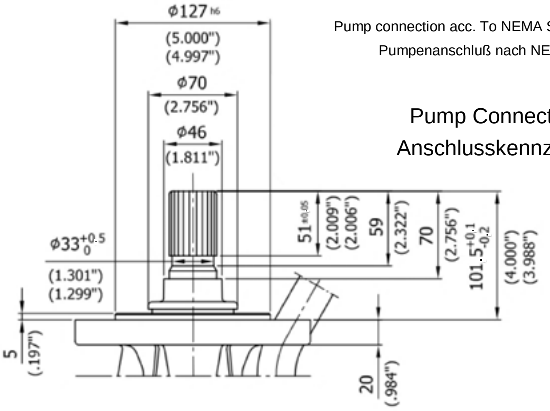
PLEUGER	**Submersible motor** **Unterwassermotor**	**3631/0** 09.18
	M8 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 894 5-4

Spline data:
ANSI B92.1
23 teeth
30° pressure angle

Daten der Verzahnung:
ANSI B92.1
23 Zähne
30° Eingriffswinkel

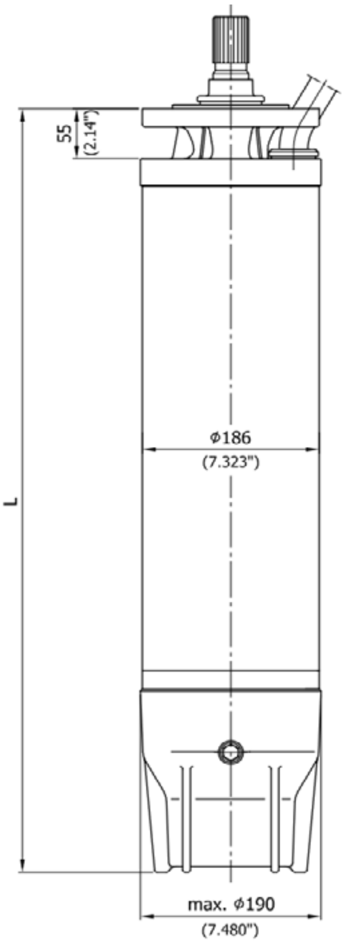
Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm

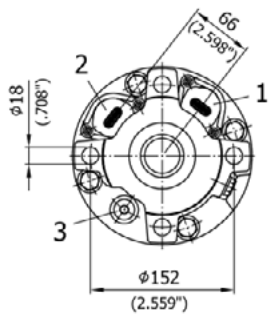




Pump connection acc. To NEMA Standards
Pumpenanschluß nach NEMA-Norm

Pump Connection 39
Anschlusskennzahl 39





Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
M8-135-4	843	33.19	87	192	40	9000	12.5	2800
M8-170-4	878	34.57	94	208	40	9000	12.5	2800
M8-210-4	918	36.14	102	225	40	9000	12.5	2800
M8-280-4	988	38.90	113	250	40	9000	12.5	2800
M8-340-4	1048	41.26	127	280	40	9000	12.5	2800
M8-420-4	1128	44.41	143	216	40	9000	12.5	2800
M8-520-4	1228	48.35	165	364	40	9000	12.5	2800
M8-700-4	1408	55.43	205	452	40	9000	12.5	2800
M8-870-4	1578	62.13	245	541	40	9000	12.5	2800
M8-1050-4	1758	69.21	275	607	40	9000	12.5	2800

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungsquerschnitt	Motor Leads Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund			Flat Flach		2 Whips 2 Peitschen 2)		
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔					✔	✔	✔					
4	✔	✔	✔	✔			✔	✔	✔	✔	✔			
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	●	●	●		●	●	●	●						
Position of leads Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

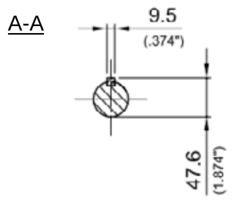
2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

● Special cable / Sonderleitung

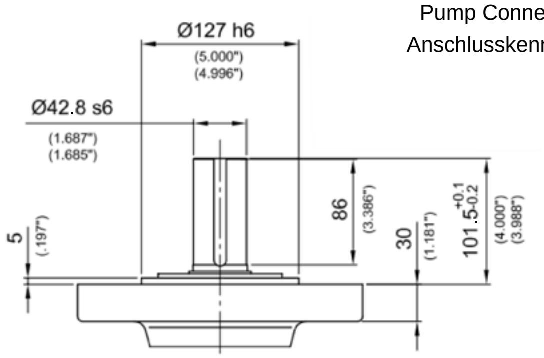
Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø21
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

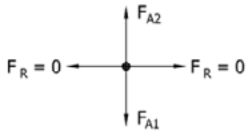
PLEUGER	Unterwassermotor Submersible motor	3628/0 09.18
	MI10 – 2 Pol.	Zeichnungs-Nr.: Drawing-No.: 877 5-3

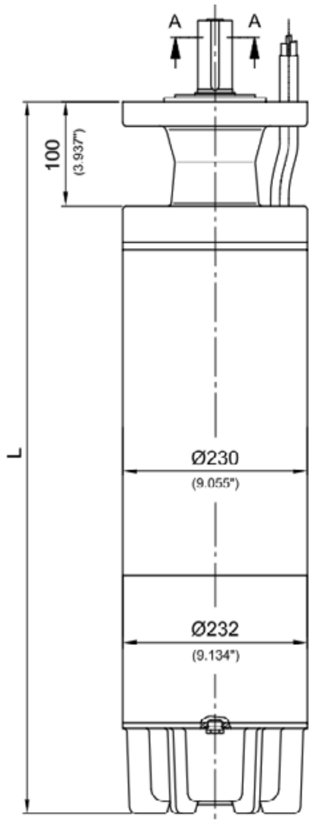
Pump Connection 43
Anschlusskennzahl 43

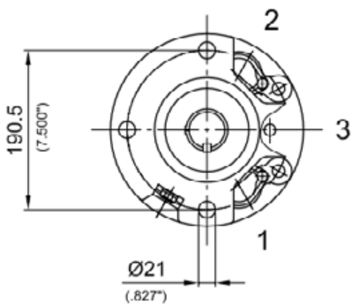


Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
MI10-420-2	1353	53.27	231	510	50	11250	22.5	5000
MI10-490-2	1423	56.02	249	549	50	11250	22.5	5000
MI10-600-2	1533	60.35	276	609	50	11250	22.5	5000
MI10-740-2	1673	65.87	312	688	50	11250	22.5	5000
MI10-880-2	1813	71.38	347	766	50	11250	22.5	5000
MI10-960-2	1893	74.53	367	810	50	11250	22.5	5000
MI10-1070-2	2003	78.86	395	871	50	11250	22.5	5000
MI10-1200-2	2133	83.98	428	944	50	11250	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungsquerschnitt	Motor Leads Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund		Flat Flach		2 Whips 2 Peitschen 2)			
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔	✔				✔	✔	✔	✔	✔			
4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔	✔	✔
35	✔	✔			✔	✔	✔	✔	✔			✔	✔	✔
50	✔				✔	●	✔					✔	●	
Position of leads Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

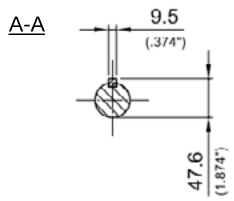
● Special cable / Sonderleitung

Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø15
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

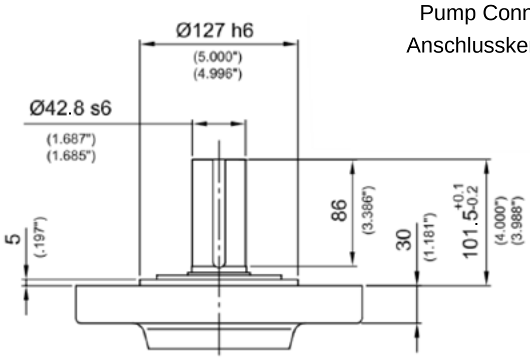
MI10 – 4 Pol.

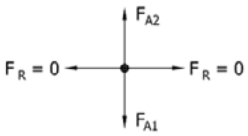
Zeichnungs-Nr.: Drawing-No.: 877 5-3

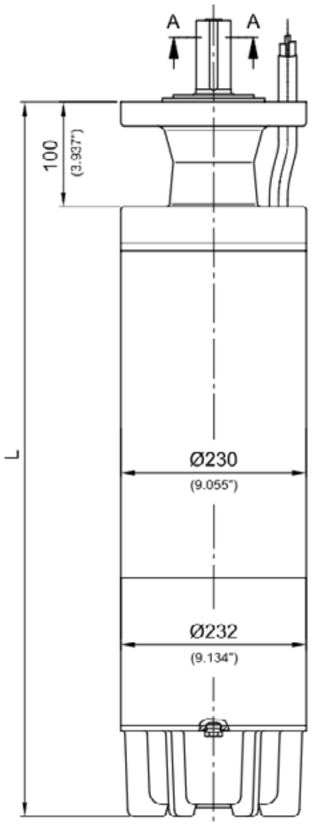
Pump Connection 43
Anschlusskennzahl 43

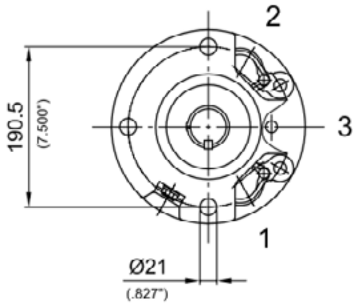


Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
MI10-420-4	1353	53.27	231	510	50	11250	22.5	5000
MI10-490-4	1423	56.02	249	549	50	11250	22.5	5000
MI10-600-4	1533	60.35	276	609	50	11250	22.5	5000
MI10-740-4	1673	65.87	312	688	50	11250	22.5	5000
MI10-880-4	1813	71.38	347	766	50	11250	22.5	5000
MI10-960-4	1893	74.53	367	810	50	11250	22.5	5000
MI10-1070-4	2003	78.86	395	871	50	11250	22.5	5000
MI10-1200-4	2133	83.98	428	944	50	11250	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (80 kN/17,985 lbf on request)
Ma. Axialkraft in Richtung Motor (80 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungsquerschnitt	Motor Leads Herausführbare Stromzuführungsleitungen													
	Single / Einfachleitung						Double / Doppelleitung							
	Round Rund		Flat Flach		1 Whip 1 Peitsche 2)		Round Rund			Flat Flach		2 Whips 2 Peitschen 2)		
	No. of cores / Anzahl der Adern													
mm²	1x3	1x4	1x3	1x4	1x3	1x4	2x3	1x3 1x4	2x4	2x3	1x3 1x4	2x3	1x3 1x4	2x4
2,5	✔	✔	✔	✔			✔	✔	✔	✔	✔			
4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔	✔	✔
35	✔	✔			✔	✔	✔	✔	✔			✔	✔	✔
50	✔				✔	●	✔					✔	●	
Position of leads Lage d. Leitungsdurchführung	1	1	1	1	1	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

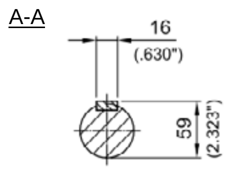
2) Three or four single core round cables, vulcanized (whip)
Mehrere 1-Adr. Rundleitungen mit gemeinsamer Vulkanisation im Bereich der Kabeldurchführung

● Special cable / Sonderleitung

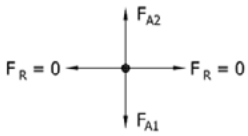
Max. cable dimensions / Max. Leitungsabmessungen			
Position	1	2	3
Round / Rund	Ø42	Ø42	Ø15
Flat / Flach	17 x 44 19 x 40	17 x 44 19 x 40	-

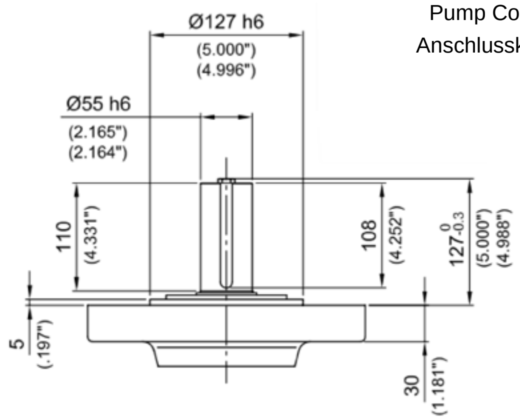
PLEUGER	Submersible motor Unterwassermotor	3509/0 09.18
	VNI12 – 2 Pol.	Zeichnungs-Nr.: Drawing-No.: 878 5-2

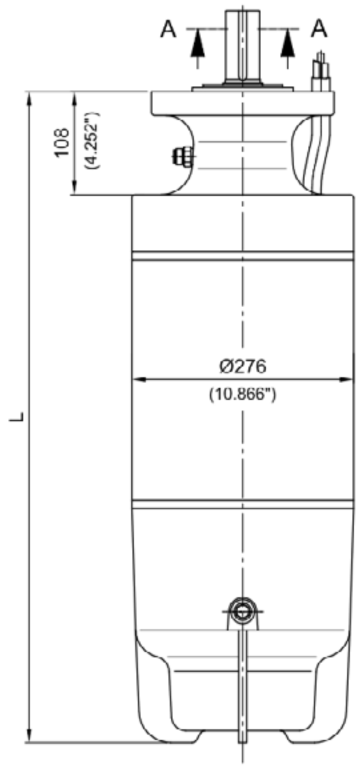
Pump Connection 41
Anschlusskennzahl 41

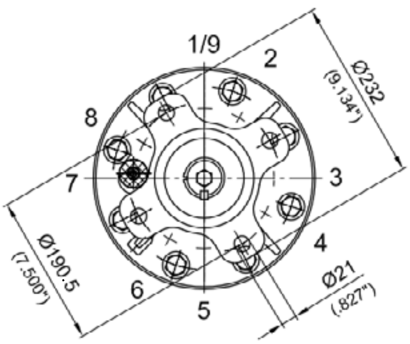


Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
VNI12-65-2	1714	67.48	475	1048	60	13500	22.5	5000
VNI12-75-2	1814	71.42	525	1158	60	13500	22.5	5000
VNI12-90-2	1964	77.32	600	1323	60	13500	22.5	5000
VNI12-100-2	2064	81.26	650	1434	60	13500	22.5	5000
VNI12-110-2	2164	85.20	700	1544	60	13500	22.5	5000
VNI12-120-2	2264	89.13	750	1654	60	13500	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (120 kN/26,977 lbf on request)
Ma. Axialkraft in Richtung Motor (120 kN auf Anfrage)

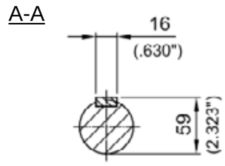
F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	**Motor Leads Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔			✔		✔	✔	✔	✔	✔
95						✔	✔			
Position of leads Lage der Leitungsdurchführung	1/9	1/9	1,5 / 9,10	1,5 / 9,10	1,5 / 9,10	1,2,4	1…4	1…6	1…6, 8	1…8

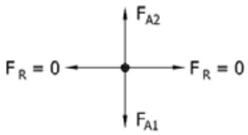
Max. cable dimensions / Max. Leitungsabmessungen										
Position	1	2	3	4	5	6	7	8	9	10
Round / Rund	ø40	ø26	ø40	ø26	ø26	ø26	ø26	ø26	ø45	ø45

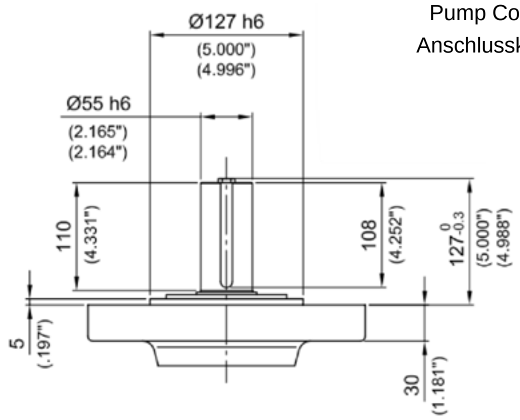
PLEUGER	Submersible motor Unterwassermotor	3510/0 09.18
	VNI12 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 878 5-2

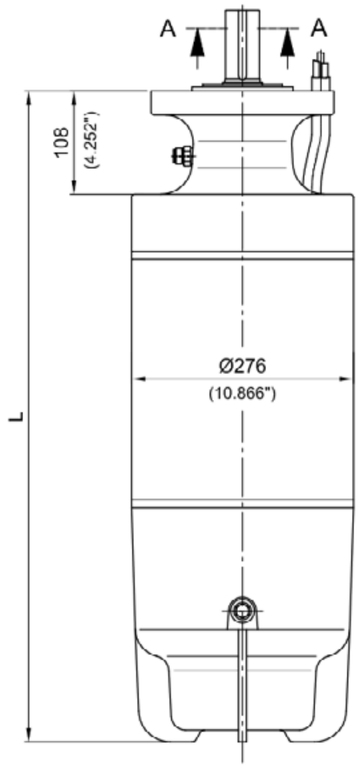
Pump Connection 41
Anschlusskennzahl 41



Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm







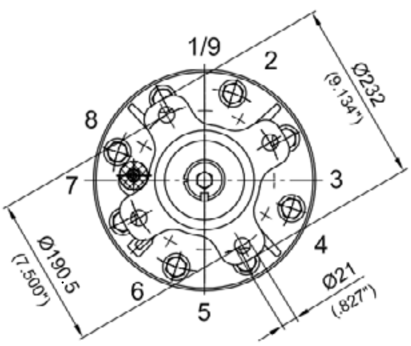
Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
VNI12-65-4	1714	67.48	475	1048	60	13500	22.5	5000
VNI12-75-4	1814	71.42	525	1158	60	13500	22.5	5000
VNI12-90-4	1964	77.32	600	1323	60	13500	22.5	5000
VNI12-100-4	2064	81.26	650	1434	60	13500	22.5	5000
VNI12-110-4	2164	85.20	700	1544	60	13500	22.5	5000
VNI12-120-4	2264	89.13	750	1654	60	13500	22.5	5000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (120 kN/26,977 lbf on request)
Ma. Axialkraft in Richtung Motor (120 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	**Motor Leads Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔			✔		✔	✔	✔	✔	✔
95						✔	✔			
Position of leads Lage der Leitungsdurchführung	1/9	1/9	1 ,5 / 9 ,10	1 ,5 / 9 ,10	1 ,5 / 9 ,10	1,2,4	1…4	1…6	1…6, 8	1…8

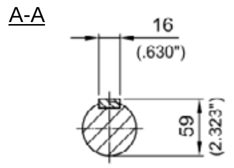


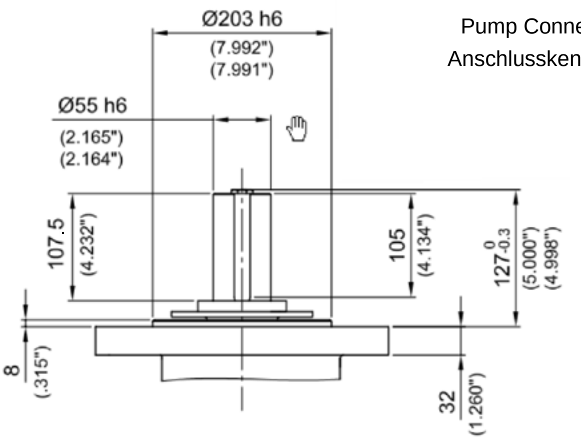
Max. cable dimensions / Max. Leitungsabmessungen										
Position	1	2	3	4	5	6	7	8	9	10
Round / Rund	ø40	ø26	ø40	ø26	ø26	ø26	ø26	ø26	ø45	ø45

VNI14 – 2 Pol.

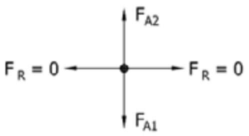
Zeichnungs-Nr.:
Drawing-No.: 879 5-3

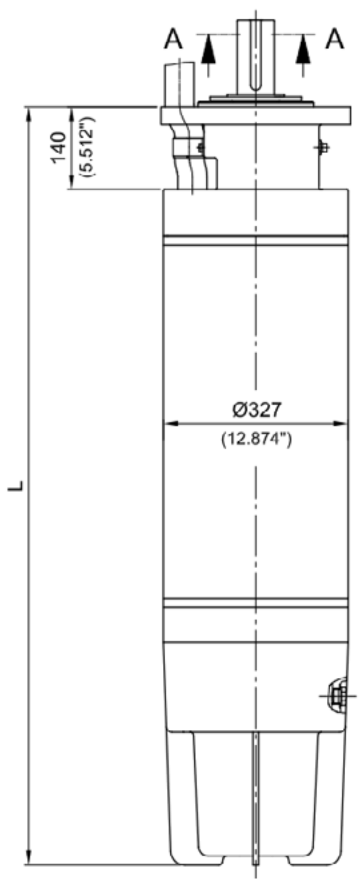
Pump Connection 40
Anschlusskennzahl 40





Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm





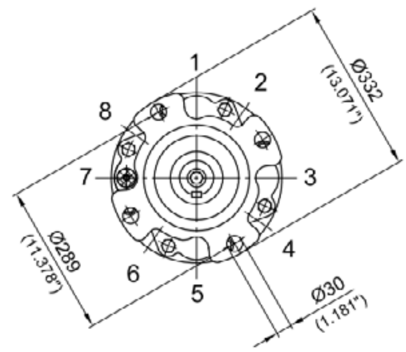
Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
VNI14-50-2	1824	71.81	590	1301	75	17000	40	9000
VNI14-60-2	1924	75.75	650	1334	75	17000	40	9000
VNI14-70-2	2024	79.09	710	1566	75	17000	40	9000
VNI14-80-2	2124	83.62	770	1698	75	17000	40	9000
VNI14-90-2	2224	87.56	830	1830	75	17000	40	9000
VNI14-100-2	2324	91.50	890	1963	75	17000	40	9000
VNI14-110-2	2424	95.43	950	2095	75	17000	40	9000
VNI14-120-2	2524	99.37	1010	2227	75	17000	40	9000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (150 kN/33,721 lbf on request)
Ma. Axialkraft in Richtung Motor (150 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

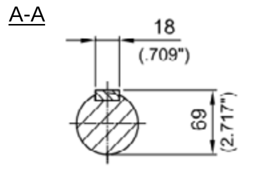
Cross Section Leitungs-querschnitt	**Motor Leads Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
95						✔	✔	✔	✔	✔
120						✔	✔	✔	✔	✔
Position of leads Lage der Leitungsdurchführung	1	1	1 ,5	1 ,5	1 ,5	1,3,5	1, 3 5, 7	2…4 6…8	2…8	1…8



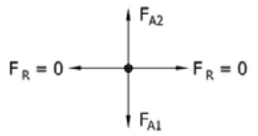
Max. cable dimensions / Max. Leitungsabmessungen								
Position	1	2	3	4	5	6	7	8
Round / Rund	ø51	ø26	ø45	ø26	ø51	ø26	ø45	ø26

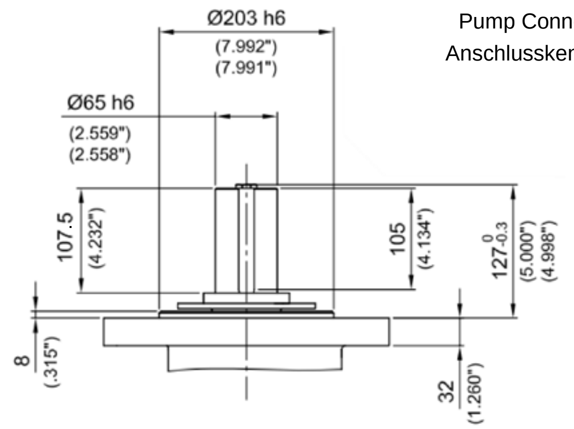
PLEUGER	Submersible motor Unterwassermotor	3608/0 09.18
	VNI14 – 4 Pol.	Zeichnungs-Nr.: Drawing-No.: 879 5-3

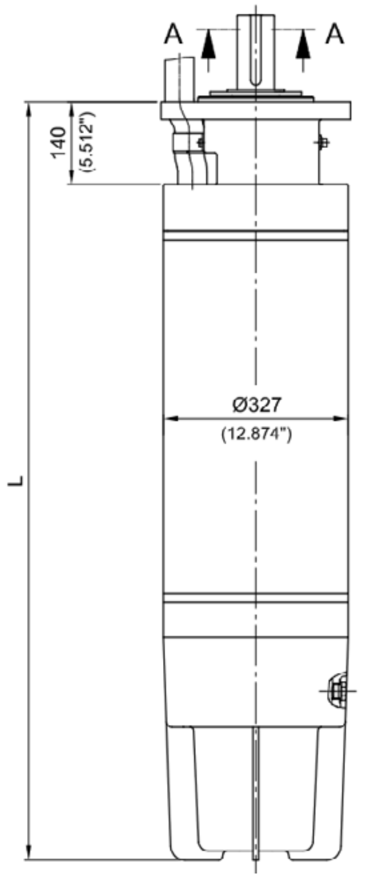
Pump Connection 42
Anschlusskennzahl 42

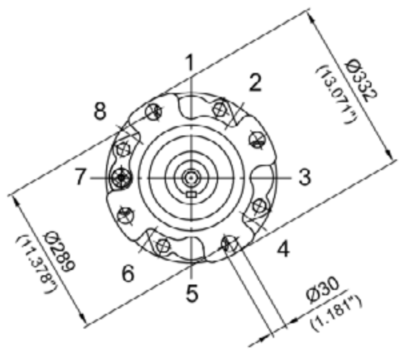


Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm









Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
VNI14-50-4	1824	71.81	590	1301	75	17000	40	9000
VNI14-60-4	1924	75.75	650	1334	75	17000	40	9000
VNI14-70-4	2024	79.09	710	1566	75	17000	40	9000
VNI14-80-4	2124	83.62	770	1698	75	17000	40	9000
VNI14-90-4	2224	87.56	830	1830	75	17000	40	9000
VNI14-100-4	2324	91.50	890	1963	75	17000	40	9000
VNI14-110-4	2424	95.43	950	2095	75	17000	40	9000
VNI14-120-4	2524	99.37	1010	2227	75	17000	40	9000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (150 kN/33,721 lbf on request)
Ma. Axialkraft in Richtung Motor (150 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	**Motor Leads Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
95						✔	✔	✔	✔	✔
120						✔	✔	✔	✔	✔
Position of leads Lage der Leitungsdurchführung	1	1	1, 5	1, 5	1, 5	1,3,5	1, 3 5, 7	2…4 6…8	2…8	1…8

Max. cable dimensions / Max. Leitungsabmessungen								
Position	1	2	3	4	5	6	7	8
Round / Rund	ø51	ø26	ø45	ø26	ø51	ø26	ø45	ø26

PLEUGER

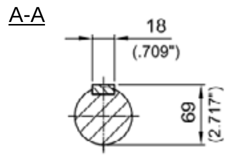
Submersible motor
Unterwassermotor

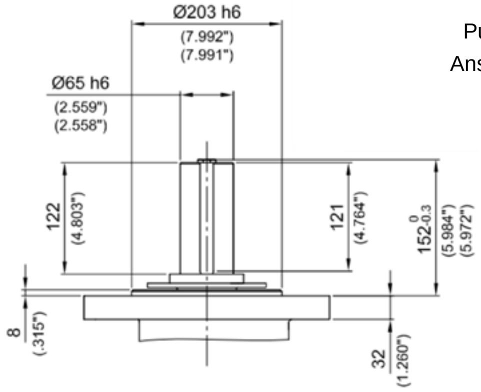
3613/0
09.18

MI16 – 4 Pol.

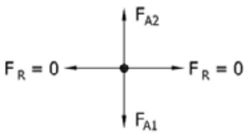
Zeichnungs-Nr.:
Drawing-No.: 881 5-2

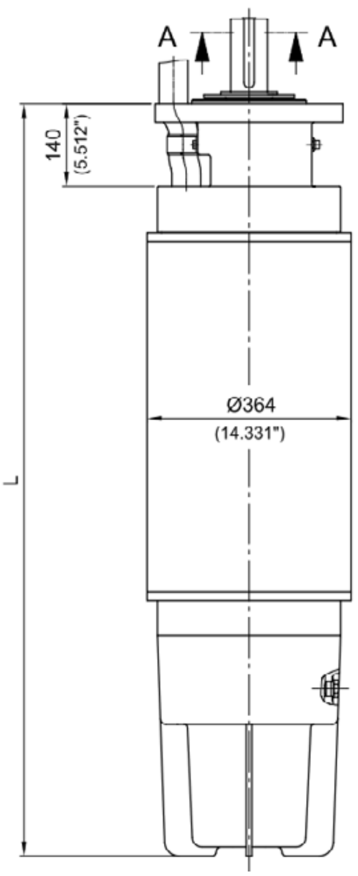
Pump Connection 47
Anschlusskennzahl 47

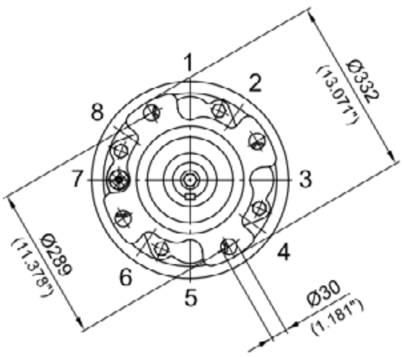




Axial clearance approx.. 0.02" / Axiales Spiel ca. 0,5 mm







Motor type Motortyp	L		Weight Gewicht 1)		Thrust capacity Axialkraft			
					F_{A1}		F_{A2}	
	mm	inch	kg	lb	kN	lbf	kN	lbf
MI16-65-4	1984	78.11	860	1896	75	17000	40	9000
MI16-75-4	2084	82.05	925	2040	75	17000	40	9000
MI16-85-4	2184	85.98	990	2183	75	17000	40	9000
MI16-95-4	2284	89.92	1055	2326	75	17000	40	9000
MI16-110-4	2434	95.83	1150	2536	75	17000	40	9000
MI16-120-4	2534	99.76	1215	2679	75	17000	40	9000
MI16-130-4	2634	103.7	1280	2822	75	17000	40	9000
MI16-145-4	2784	109.61	1375	3032	75	17000	40	9000
MI16-165-4	2984	117.48	1505	3318	75	17000	40	9000
MI16-185-4	3184	125.35	1635	3605	75	17000	40	9000

1) Weight for standard construction (G) without power supply cable
Gewicht für Standardausführung (G) ohne Stromzuführungsleitungen

F_{A1} Max. downthrust capacity (150 kN/33,721 lbf on request)
Ma. Axialkraft in Richtung Motor (150 kN auf Anfrage)

F_{A2} Max. upthrust capacity
Max. Axialkraft in Richtung Pumpe

Cross Section Leitungs-querschnitt	**Motor Leads Herausführbare Stromzuführungsleitungen**									
	Single Einfachleitung		Double Doppelleitung			Single-Core-Cable Einzeladerleitung				
	Round 7 Multi-Core Rund / Mehradrig					Round Rund				
	No. of cores Anzahl der Adern					No. of leads Anzahl der Leitungen				
mm²	1x3	1x4	1x3 1x4	2x3	2x4	3	4	6	7	8
16	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
35	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
50	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
70	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
95						✔	✔	✔	✔	✔
120						✔	✔	✔	✔	✔
150						●	●			
Position of leads Lage der Leitungsdurchführung	1	1	1, 5	1, 5	1, 5	1,3,5	1, 3 5, 7	2…4 6…8	2…8	1…8

● Special cable / Sonderleitung

Max. cable dimensions / Max. Leitungsabmessungen								
Position	1	2	3	4	5	6	7	8
Round / Rund	ø51	ø26	ø45	ø26	ø51	ø26	ø45	ø26

PLEUGER Technologies/

PLEUGER Motor Sensors

PLEUGER pump sensors provide the operator real-time monitoring and data for key areas of pump performance

TEMPERATURE SENSORS
Plug-in 3 wire sensor Pt100 Sub Temp

Detects temperature for real-time feedback with 3x1.5 mm³ EPR cable

- The purpose of the measurement is to protect the motor
- Measures the temperature of the motor fill. The measurement is based on the change in resistance which is proportional to the change in temperature
- Plug-in sensor intended to be installed in PLEUGER submersible motor with an applicable interface (seal)

FEATURES

- Simple plug-in installation
- Compact, single piece design
- Retrofittable
- Flexible, water resistant cable

VIBRATION SENSORS
Vibration Sensor PI-100 Sub Accelerometer (one axes)

PI-300 Sub Accelerometer (three axes X,Y,Z)

- Sub Accelerometer detects the incorrect operating conditions of rotating components (e.g. impeller)
- Side entry for easy access
- Waterproof
- Resistant to oil

CONDUCTIVITY SENSORS
Motor fill monitoring sensor PI-100 Sub Con

- Detects an incorrect or contaminated fill of the PLEUGER motor
- System consists of the sensor, a cable and the monitoring controller. The sensor measures the conductivity of the motor fill and its temperature.
- Plug-in sensor intended to be installed in PLEUGER motor with an applicable interface (adapter and seal).

FEATURES

- Plug-in installation
- Waterproof
- Dual function
- For PLEUGER Motors M8 to MI40
- Alternative Solution for Header Tank

PLEUGER Motors for Special Applications

Hot water motor

Designed for hot water applications such as District heating and Geothermal energy

- District heating and Geothermal
- All-weather greenhouse energy
- Cooling water and process pumps
- Thermal spas

Features

- 270 kW (362 HP) up to 85°C (185°F) water temperature
- Motor sizes 6″ to 12″
- Starting method DOL, Star-Delta (on request)
- Different cooling solutions available

Examples of PLEUGER Submersible Motors for customized applications

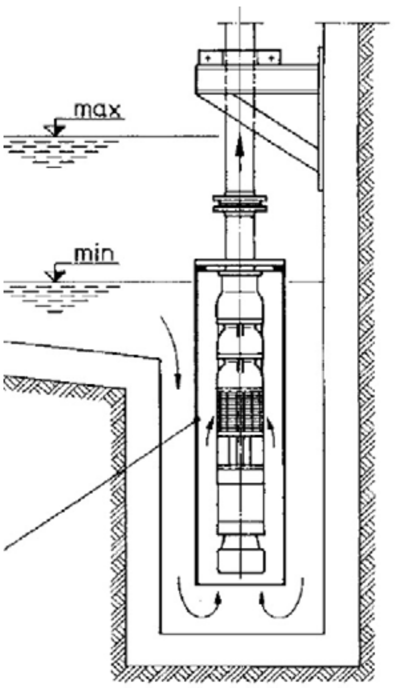
- MI10-600-4 , 10″, 600 mm stator length, 4-pole design
- MIP16-130-6 Polder construction, 1300 mm stator length
- PMM6-320-4 Permanent Magnet Motor, 320 mm stator length (6″ and 8″ PMM)
- MIT19-130-2 Tandem configuration – two identical MI19-130-2 working together
- VNI22-200-4
- MOE8-410-2 Oil-filled motor
- MHA8-410-2 Filling liquid temperature $\vartheta > 90$ °C or 194 °F
- MK6-460-2 Oil (petroleum) cavern installation

PLEUGER Technologies/

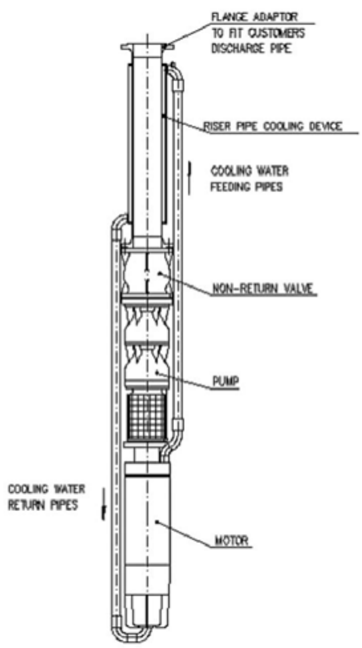
External Cooling Systems

Customized Cooling Systems for individual cooling requirements

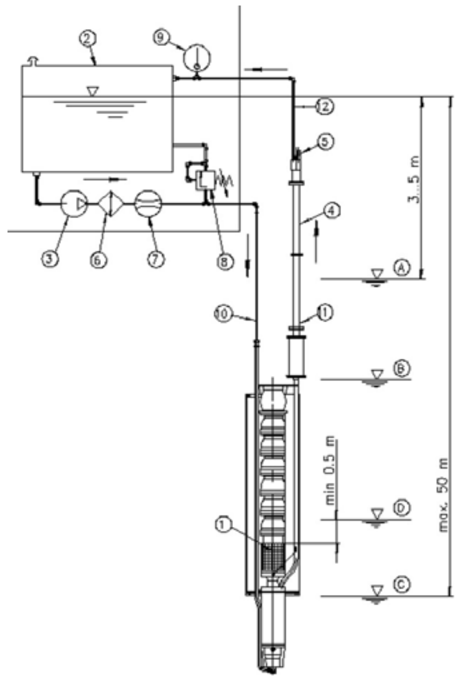
- Simple plug-in installation
- Compact, single piece design
- Retrofittable
- Flexible, water resistant cable



Cooling Shroud



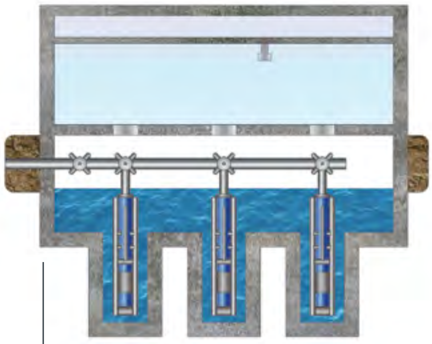
Riser Pipe Cooler

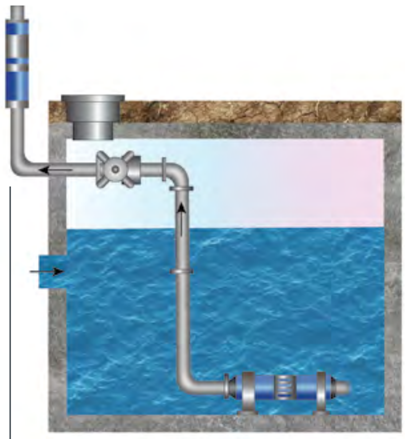


External Cooling Device

Pump installation options

With various installation options, PLEUGER's pump units are the ideal solution for almost any application in the water industry.





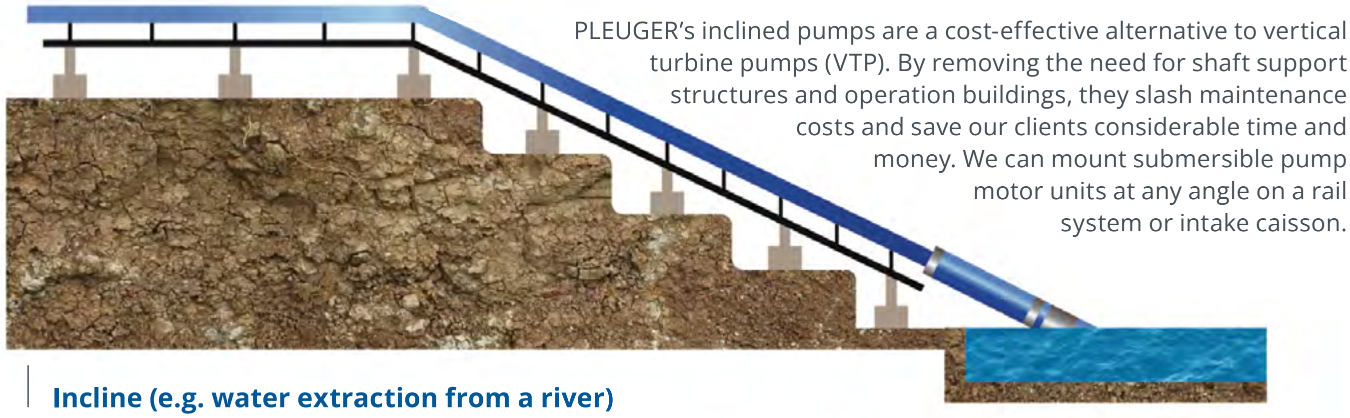
Vertical (e.g. bore well installation)

Parallel

Booster pump in pipeline

Horizontal (e.g. bottom of tank)

Inclined pumps for processing and cooling water applications



PLEUGER's inclined pumps are a cost-effective alternative to vertical turbine pumps (VTP). By removing the need for shaft support structures and operation buildings, they slash maintenance costs and save our clients considerable time and money. We can mount submersible pump motor units at any angle on a rail system or intake caisson.

Incline (e.g. water extraction from a river)

ATTACHMENT #3

MW-PW03 AQUIFER TESTING
FIELD DATA SHEETS

STEP-DRAWDOWN TEST - PRODUCTION WELL # MJ-PW3

FIELD DATA FORM

Test date: 3-10-25

Well Information

Date drilled: ______ Borehole diameter: ______ (inches) Borehole depth: ______ ft BLS
Casing ID diameter: ______ (inches) Casing material & thickness: ______ Casing length: ______ ft BLS
Screen ID diameter: ______ (inches) Screen material & slot size: ______ Screen length: ______ ft BLS
Screen Type: ______ Screen fittings: ______ Total well depth: ______ ft BLS

Pump Information

Pump type: ______ Pump diameter: ______ Pump stages: ______
Pump column -type/diameter: ______ Check valve-type/material: ______
Pump intake level: ______ ft BLS
Motor type: ______ Motor horsepower: ______ Motor length: ______
Motor voltage: ______ Phase: ______ Service factor: ______ Full-load amps: ______

Step-Test Setup

Water discharged to: ______ Discharge distance from PW: ______ (feet)
Orifice size: 10 (inches) Discharge pipe diameter: 7 (inches)
Static water level from top of access port: ~~20.03~~ 21.18 (feet) Date/time: 3-10-25 / 0828
Contractor performing test: ______
Measurements made by: ______

STEP #1						
Notes	Time (hr:min)	Elapse Time (minutes)	Depth to Water (feet)	Line Pressure (psi)	Orifice Reading (inches)	Pumping Rate (gpm)
Static Water Level		-5				
Pump On - Shut In HD	1000	0	21.18			
Valve Open	1001	1				
	1002	2	~~29.83~~ 30.98		13"	739
	1003	3	34.70			
	1004	4	34.70			
Step #1 Motor	1005	5	34.80			
Amp Readings	1010	10	34.97			
L_1 =	1015	15	34.97			
L_2 =	1020	20	35.02			
L_3 =	1025	25	35.05			
	1030	30	35.10			
	1040	40	35.17			
	1050	50	35.20			
	1100	60	35.26			
	1120	80	35.35			
	1140	100	35.39		13"	739
	1200	120	35.45			

1.15'

Test date: ________

STEP #2						
Notes	Time (hr:min)	Elapse Time (minutes)	Depth to Water (feet)	Line Pressure (psi)	Orifice Reading (inches)	Pumping Rate (gpm)
Change Pump Rate	1200	0	35.45			
	1201	1	42.77			
	1202	2	44.07		29"	1104
	1203	3	44.10			
	1204	4	44.06			
Step #2 Motor	1205	5	44.08			
Amp Readings	1210	10	44.15			
L_1 =	1215	15	44.18			
L_2 =	1220	20	44.21			
L_3 =	1225	25	44.27			
	1230	30	44.26			
	1240	40	44.40			
	1250	50	44.43			
	1300	60	44.45			
	1320	80	44.56			
	1340	100	44.62			
	1400	120	44.70			
STEP #3						
Change Pump Rate	1400	0	44.70			
	1401	1	54.55		53.5	1500
	1402	2	54.57			
	1403	3	54.63			
	1404	4	54.62			
Step # 3 Motor	1405	5	54.72			
Amp Readings	1410	10	55.42			
L_1 =	1415	15	55.62			
L_2 =	1420	20	55.87			
L_3 =	1425	25	56.02			
	1430	30	56.19			
	1440	40	56.82			
	1450	50	57.03			
	1500	60	57.17			
	1520	80	57.51			
	1540	100	57.75			
	1600	120	57.95			

Test date: 3/10/25

STEP #4						
Notes	Time (hr:min)	Elapse Time (minutes)	Depth to Water (feet)	Line Pressure (psi)	Orifice Reading (inches)	Pumping Rate (gpm)
Change Pump Rate	1600	0	~~45~~ 57.95			
	1601	1	62.87			
	1602	2	63.05		65"	Q≈1650
	1603	3	63.08			
	1604	4	63.05			
Step #4 Motor	1605	5	63.10			
Amp Readings	1610	10	63.22			
L_1 =	1615	15	63.65			
L_2 =	1620	20	63.74			
L_3 =	1625	25	63.87			
	1630	30	64.69			
	1640	40	64.85			
	1650	50	65.09			
	1700	60	65.23			
	1720	80	65.65			
	1740	100	65.85			
	1800	120	66.13		Pump Off	
Recovery						
Pump Off	1801	0	22.25			
	1802	1	22.13			
	1803	2	22.13			
	1804	3	22.12			
	1805	4	22.15			
		5				
		6				
		7				
		8				
		9				
		10				
		20				
		30				
		40				
		50				
		60				

Comments & Additional Notes:

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Page No. 1

Owner ______ Address ______

Location of well on property T-PW3 SDT

County ______ Township ______

Date ______ / ______ (Test Started / Test Ended) ODNR Log# ______ Other Well ID TRW-3

Company Conducting Test NWS & Tetran Individual Making Measurements ______

Type of Test SDT Distance From Pumping Well ______

Measuring Equipment Used ______

Static Water Level (S_0) 19.00 Measuring Point Top Pro Co Elevation Above Ground ______

Pumping Water Level (ft.) ______ Depth of Pump (ft.) ______

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
3/10	08:50		18.98			
	09:59		19.00			
						Pump on @ 10:00
	10:02		19.32			Step#1 ≈ 740 gpm
	10:05		19.32			
	10:26		19.37			
	11:02		19.42			
	11:37		19.45			
	12:00		19.49			up to 2nd step
	12:04		19.68			≈ 1100 gpm
	12:42		19.76			
	13:00		19.76			
	13:41		19.83			
	14:00		19.86			up to 3rd step
	14:05		20.05			≈ 1500 gpm
	14:23		20.10			
	15:06		20.19			
	15:50		20.27			
	16:00		20.31			up to 4th step
	16:11		20.40			≈ 1650 gpm
	16:33		20.46			
	16:36		20.45			
	16:50		20.47			
	17:41		20.59			
	18:09		19.85			

DNR 7811.93

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

Owner ______ Address ______

Location of well on property ______

County ______ Township ______

Date ______ / ______ ODNR Log# ______ Other Well ID MJ-PW3
(Test Started / Test Ended)

Company Conducting Test ______ Individual Making Measurements ______

Type of Test ______ Distance From Pumping Well ______

Measuring Equipment Used ______

Static Water Level (S_0) 21.69 Measuring Point ______ Elevation Above Ground ______

Pumping Water Level (ft.) ______ Depth of Pump (ft.) ______

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
3/11/25	0930		21.74			
3/11	1000		21.69			Pump ON
	1001		25.52			
	1002		28.42			
	1003		43.03			
	1004		45.04			
	1005		45.84			
	1010		46.93			
	1015		47.88			
	1020		48.34		1493	53"-orifice
	1025		48.68			
	1030		49.25		1500	valve bumped
	1040		49.81			
	1050		50.27		1500	valve bumped
	1100		50.61			
	1130		51.35			
	1200		52.37			Orifice = 54"
	12:30		52.81			
	1:00		53.20			
	1:30		53.75			Checked orfice = 54"
	2:00		54.43			
	3:00		54.98			Checked orfice 54"
	4:00		55.42			
	500		55.81			
	600		56.07			AdJQ↑
	700		56.43			
	800		56.69			orfice 53-54
	900		56.97			orfice 53-54
	1000		57.21			orfice 53-54

Owner______________________ Well ID ______________ Date____________ Page No. ______

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
	1100		57:38			53.5
	1200		57:51			33.54
	100		57.65			53.57
	200		57:86			53
	300		57:97			53
	400		58:21			53
	500		58:32			53
	600		58:48			53
	700		58:61			
	800		58:75			
	900		59:15			
	1000		59.31			
	1015		59:123			Pump off
	1016		26:90			
	1017		24.05			
	1018		24.00			
	1019		23.96			
	1020		23.97			

PUMPING TEST RECORD
Observation Wells
ODNR-Division of Water
Water Resources Section

DNR 7811.93

Page No. 1

Owner ______ Address ______

Location of well on property ______

County ______ Township ______

Date ______ / ______ ODNR Log# ______ Other Well ID TRW-3
(Test Started / Test Ended)

Company Conducting Test ______ Individual Making Measurements ______

Type of Test CRT@PW3 Distance From Pumping Well ______

Measuring Equipment Used ______

Static Water Level (S_0) ______ Measuring Point ______ Elevation Above Ground ______

Pumping Water Level (ft.) ______ Depth of Pump (ft.) ______

Date	Clock Time (Use Military Time)	Time Since Pumping Started (In Minutes)	Depth to Water (S)	Change in Water Level ($S - S_0$)	Discharge Rate (GPM)	Comments (Include Weather Conditions)
3/11	0927		19.43			
	1009		20.13			
	1024		20.24			
	1051		20.29			
	1133		20.39			
	1203		20.46			
3/12	1024		21.70			Stop CRT @ 1015 Recovery @ 1015

ATTACHMENT #4

GROUNDWATER LAB RESULTS

MASI LABORATORIES

7940 Memorial Drive   Plain City, Ohio 43064   (614) 873-4654

Date: March 14, 2025

National Water Services LLC (1384)
Attn: Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

RE: Certificate of Analysis for Project - Private Drinking Water

The following report contains analytical results for samples submitted on the chain of custody dated March 12, 2025.

I have reviewed the validity of the analytical data generated. All data is reported in accordance to our laboratory QA/QC plan. Any exceptions are noted in the Case Narrative or with qualifiers in the report.

If you have any questions or need additional documentation, please contact our Office.

Sincerely,

Cheryl Rex

Cheryl Rex
MASI Laboratories
QA/QC Officer
cheryl@masilabs.com
(614) 873-4654

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877

Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number: 082606
Date Received: 3/12/25 15:39
Ohio EPA Analyzed Date: 3/14/25 11:29

Sampler Name: Grant Herron
Sample Date/Time: 3/12/25 09:45
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Well Field South Lebanon, OH (PW-3)

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165986-01

Lab Sample # : 5C01574-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Microbiology									
Total Coliform	Absence	/ 100 ml		N/A	N/A	03/12/25 15:24	03/13/25 09:39	EFMG	SM 9223 B

The contents of this report apply to the sample(s) analyzed in accordance with the chain of custody document.
No duplication of this report is allowed, except in its entirety.

MASI LABORATORIES

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877

Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number: 082606
Date Received: 3/12/25 15:39
Ohio EPA Analyzed Date: 3/14/25 11:29

Sampler Name: Grant Herron
Sample Date/Time: 3/12/25 10:15
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Well Field South Lebanon, OH (PW-3)

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165986-02

Lab Sample # : 5C01574-02 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Microbiology									
Total Coliform	Absence	/ 100 ml		N/A	N/A	03/12/25 15:24	03/13/25 09:39	EFMG	SM 9223 B

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National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number: 082606
Date Received: 3/12/25 15:39
Ohio EPA Analyzed Date: 3/14/25 11:29

Notes and Definitions

Item	Definition
mg/kg Dry	Sample results reported on a dry weight basis
ug/L	ppb/Part per Billion
mg/L	ppm/Part per Million
ng/L	ppt/Part per Trillion
ND	Analyte NOT DETECTED at or above the method detection limit (MDL)
!	Analyte is at or above the Maximum Contaminate Level
MDL	Method Detection Limit
CFU	Colony Forming Units
MPN	Most Probable Number
NTU	Nephelometric Turbidity Unit
pCi/L	Picocuries per liter
SVI	Sludge Volume Index
%	Percent
GPD	Gallons per Day
su	Standard Units

Notes:
1. Calculated analytes are based on raw data and may not reflect the rounding of the individual compounds.
2. Samples are analyzed using the information received on the request sheet and may not be analyzed when the parameters fall outside required guidelines.

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MASI ®
ENVIRONMENTAL LABORATORIES
7940 Memorial Drive
Plain City, OH 43064
614-873-4654

5C01568-01/2/3

New ~~AR~~ # 165986 st Sheet

Analysis Received: 3/12/2025 on Bottle: 165986

Matrix: Potable

** See reverse for important SDS information **

Client #: 1384 Client Name: National Water Services County: ______ P.O.# 082606

Sampler Name: Grant Herron SMP ID : ______ Sample Type/Class: (X) New Well/Special

Sample Tap: Spigot Date Collected: 3/12/2025 (MM/DD/YY) Time Collected: 09:45 am (hh:mm am/pm)

Tap Address: Warren County Well Field, South Lebanon, OH (PW-3)

( ) Public Sample ( ) PWS ID #: ______ ( ) Facility ID #: ______

( ) (New Well Trans) Transient Noncommunity

( ) (New Well Nontrans) Nontransient-Noncommunity + PFAS

(X) (New Well Comm) Community Water Systems + PFAS

Work Order

5C01574-01/2

(Office Use Only)

Microbiological Tests

	Time Collected
( ) 140 Total Coliform #1	9:45 am KLF hh:mm am/pm
( ) 140 Total Coliform #2	10:15 am KLF hh:mm am/pm

Time taken from bottle-10:15

Office Use Only: 8°
FD

Route	
Office/Lab	CO KLF

COOLER:

REVISED 2-15-23 DN

7940 Memorial Drive   Plain City, Ohio 43064   (614) 873-4654

Date: April 10, 2025

National Water Services LLC (1384)
Attn: Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

RE: Certificate of Analysis for Project - Private Drinking Water

The following report contains analytical results for samples submitted on the chain of custody dated March 12, 2025.

I have reviewed the validity of the analytical data generated. All data is reported in accordance to our laboratory QA/QC plan. Any exceptions are noted in the Case Narrative or with qualifiers in the report.

If you have any questions or need additional documentation, please contact our Office.

Sincerely,

Cheryl Rex

Cheryl Rex
MASI Laboratories
QA/QC Officer
cheryl@masilabs.com
(614) 873-4654

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877
Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number: 082606
Date Received: 3/12/25 15:28
Ohio EPA Analyzed Date: 4/10/25 09:05

Sampler Name: Grant Herron
Sample Date/Time: 3/12/25 09:45
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Well Field South Lebanon, OH (PW-3)

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165986
Lab Sample # : 5C01568-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
EPA 200.8 Rev. 5.4									
Antimony, Total	<3.0	ug/L		3.0	3.0	03/12/25 09:45	03/17/25 17:23	SLB	EPA 200.8 Rev. 5.4
Thallium, Total	<1.0	ug/L		1.0	1.0	03/12/25 09:45	03/17/25 17:23	SLB	EPA 200.8 Rev. 5.4

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Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number: 082606
Date Received: 3/12/25 15:28
Ohio EPA Analyzed Date: 4/10/25 09:05

Sampler Name: Grant Herron
Sample Date/Time: 3/12/25 09:45
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Well Field South Lebanon, OH (PW-3)

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165986

Lab Sample # : 5C01568-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Wet Chemistry Analysis									
Alkalinity, Total	**275**	mg/L CaCO3		4.00		03/18/25 16:18	03/18/25 16:18	JOL	SM 2320 B 2011
Chloride	**91.3**	mg/L		25.0	25.0	03/14/25 16:02	03/14/25 16:02	JOL	SM 4500Cl B 2011
Cyanide, Free	**0.734**	ug/L (as free CN)	**J**	3.00	0.682	03/17/25 13:30	03/17/25 13:30	JOL	ASTM D6888-16 2023
Fluoride	**0.20**	mg/L		0.20	0.05	03/18/25 10:30	03/18/25 10:30	JOL	SM 4500 F C 2011
Nitrate-Nitrite	**0.45**	mg/L	**J**	0.50	0.19	03/13/25 11:10	03/13/25 14:04	JOL	EPA 353.2 Rev 2.0
Nitrate as Nitrate-Nitrite	**0.447**	mg/L		0.500	0.185	03/13/25 11:10	03/13/25 14:04	JOL	EPA 353.2 Rev 2.0
Nitrite	**0.01**	mg/L	**J**	0.10	0.01	03/12/25 16:30	03/12/25 17:06	JOL	EPA 353.2 Rev 2.0
pH (su)	**6.0**	su	**HOLD**			03/12/25 15:00	03/12/25 15:00	JAC	SM 4500H B 2011
Temperature (Centigrade)	**18.5**	su	**HOLD**			03/12/25 15:00	03/12/25 15:00	JAC	SM 4500H B 2011
Total Dissolved Solids/Total Filterable Residue	**476**	mg/L		10.0	4.0	03/14/25 09:51	03/14/25 17:25	JOL	SM 2540 C 2015
Sulfate	**49.5**	mg/L		20.0	4.1	03/17/25 17:45	03/17/25 17:45	JOL	SM 4500 SO42 E 2011
Metals Analysis									
Arsenic, Total	**2**	ug/L	**J**	3	0.5	03/14/25 14:39	03/14/25 15:59	KRM	SM 3113 B 2010
Barium, Total	**128**	ug/L		25.0	0.5	03/20/25 10:42	03/20/25 10:42	KRM	EPA 200.7 1994
Beryllium, Total	ND	ug/L		1.0	0.06	03/20/25 10:42	03/20/25 10:42	KRM	EPA 200.7 1994
Cadmium, Total	ND	ug/L		1.0	0.2	03/20/25 10:42	03/20/25 10:42	KRM	EPA 200.7 1994
Calcium, Total	**93.1**	mg/L		2.0	0.09	03/13/25 16:41	03/13/25 16:41	CJS	EPA 200.7 1994
Chromium, Total	ND	ug/L		5.0	0.8	03/20/25 10:42	03/20/25 10:42	KRM	EPA 200.7 1994
Copper, Total	**10**	ug/L	**J**	50	1	03/14/25 15:40	03/14/25 15:40	CJS	EPA 200.7 1994
Iron, Total	**579**	ug/L		80	0.8	03/18/25 18:08	03/18/25 18:08	KRM	EPA 200.7 1994
Lead, Total	**0.5**	ug/L	**J**	5.0	0.4	03/14/25 12:32	03/14/25 14:29	KRM	SM 3113 B 2010

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Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

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Ohio EPA Analyzed Date: 4/10/25 09:05

Sampler Name: Grant Herron
Sample Date/Time: 3/12/25 09:45
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Well Field South Lebanon, OH (PW-3)

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165986 (Continued)
Lab Sample # : 5C01568-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Metals Analysis (Continued)									
Magnesium, Total	**24.0**	mg/L		5.0	0.04	03/13/25 16:41	03/13/25 16:41	CJS	EPA 200.7 1994
Manganese, Total	**15**	ug/L	**J**	20	0.6	03/18/25 18:08	03/18/25 18:08	KRM	EPA 200.7 1994
Mercury, Total	ND	ug/L		0.5	0.07	03/18/25 12:59	03/19/25 14:05	CJS	EPA 245.1 1994
Nickel, Total	ND	ug/L		10.0	1.2	03/20/25 10:42	03/20/25 10:42	KRM	EPA 200.7 1994
Selenium, Total	ND	ug/L		5.0	0.5	03/14/25 16:05	03/14/25 17:20	KRM	SM 3113 B 2010
Silver, Total	ND	ug/L		10.0	0.6	03/14/25 11:28	03/14/25 11:28	CJS	EPA 200.7 1994
Sodium, Total	**42.3**	mg/L		5.0	0.2	03/13/25 16:41	03/13/25 16:41	CJS	EPA 200.7 1994
Zinc, Total	**19.5**	ug/L		10.0	0.9	03/20/25 10:42	03/20/25 10:42	KRM	EPA 200.7 1994
Volatile Organic Chemicals (VOC)									
1,1,1-Trichloroethane	ND	ug/L		0.5	0.09	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
1,1,2-Trichloroethane	ND	ug/L		0.5	0.07	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
1,1-Dichloroethene	ND	ug/L		0.5	0.09	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
1,2,4-Trichlorobenzene	ND	ug/L		0.5	0.1	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
1,2-Dichlorobenzene	ND	ug/L		0.5	0.03	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
1,2-Dichloroethane	ND	ug/L		0.5	0.05	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
1,2-Dichloropropane	ND	ug/L		0.5	0.08	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
1,4-Dichlorobenzene	ND	ug/L		0.5	0.07	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Benzene	ND	ug/L		0.5	0.06	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Carbon Tetrachloride	ND	ug/L		0.5	0.08	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Chlorobenzene	ND	ug/L		0.5	0.04	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
cis-1,2-Dichloroethene	ND	ug/L		0.5	0.04	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Ethylbenzene	ND	ug/L		0.5	0.05	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Methylene Chloride	ND	ug/L		0.5	0.05	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Styrene	ND	ug/L		0.5	0.07	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2

The contents of this report apply to the sample(s) analyzed in accordance with the chain of custody document.
No duplication of this report is allowed, except in its entirety.

CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877
Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number: 082606
Date Received: 3/12/25 15:28
Ohio EPA Analyzed Date: 4/10/25 09:05

Sampler Name: Grant Herron
Sample Date/Time: 3/12/25 09:45
Sample Monitoring Point:
Sample Type:
Sample Tap/Address: Spigot Warren County Well Field South Lebanon, OH (PW-3)

PWSID: Facility ID:
Repeat Sample #:
Total Chlorine (mg/L):
Free Chlorine (mg/L):
Combined Chlorine (mg/L):

Sample ID: 165986 (Continued)
Lab Sample # : 5C01568-01 (Potable)

Analyte	Result	Units	Qual	Reporting Limit	MDL	Date/Time Prepared	Date/Time Analyzed	Analyst	Method
Volatile Organic Chemicals (VOC) (Continued)									
Tetrachloroethene	ND	ug/L		0.5	0.07	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Toluene	ND	ug/L		0.5	0.05	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
trans-1,2-Dichloroethene	ND	ug/L		0.5	0.1	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Trichloroethene	ND	ug/L		0.5	0.08	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Vinyl Chloride	ND	ug/L		0.5	0.1	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Total Xylenes	ND	ug/L		1.5	0.2	03/14/25 17:56	03/14/25 17:56	DTS	EPA Method 524.2
Surrogate: 4-Bromofluorobenzene			*94%*			*70-130*			*EPA Method 524.2*
Surrogate: 1,2-Dichlorobenzene-d4			*92%*			*70-130*			*EPA Method 524.2*
Synthetic Organic Compounds (SOC) Group 1									
Alachlor	ND	ug/L		0.20	0.07	03/14/25 16:20	03/18/25 23:56	MEM	EPA Method 525.2
Atrazine	ND	ug/L		0.30	0.07	03/14/25 16:20	03/18/25 23:56	MEM	EPA Method 525.2
Simazine	ND	ug/L		0.35	0.06	03/14/25 16:20	03/18/25 23:56	MEM	EPA Method 525.2
Surrogate: 1,3-Dimethyl-2-nitrobenzene			*93%*			*70-130*			*EPA Method 525.2*
Surrogate: Triphenylphosphate			*106%*			*70-130*			*EPA Method 525.2*
Surrogate: Perylene-d12			*101%*			*70-130*			*EPA Method 525.2*

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CERTIFICATE of ANALYSIS

Microbiological/Inorganic Certification - 877

Organic Certification - 4100

National Water Services LLC
Josh Gavin
281 Hamburg Rd SW
Lancaster, OH 43130

Client #: 1384
PO Number: 082606
Date Received: 3/12/25 15:28
Ohio EPA Analyzed Date: 4/10/25 09:05

Notes and Definitions

Item	Definition
HOLD	Exceeds Recommended Holding Time
J	Analyte was positively identified, the associated numerical value is estimated.
mg/kg Dry	Sample results reported on a dry weight basis
ug/L	ppb/Part per Billion
mg/L	ppm/Part per Million
ng/L	ppt/Part per Trillion
ND	Analyte NOT DETECTED at or above the method detection limit (MDL)
!	Analyte is at or above the Maximum Contaminate Level
MDL	Method Detection Limit
CFU	Colony Forming Units
MPN	Most Probable Number
NTU	Nephelometric Turbidity Unit
pCi/L	Picocuries per liter
SVI	Sludge Volume Index
%	Percent
GPD	Gallons per Day
su	Standard Units
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was matrix spiked or duplicated.

Notes:
1. Calculated analytes are based on raw data and may not reflect the rounding of the individual compounds.
2. Samples are analyzed using the information received on the request sheet and may not be analyzed when the parameters fall outside required guidelines.

The contents of this report apply to the sample(s) analyzed in accordance with the chain of custody document.
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MASI ®
ENVIRONMENTAL LABORATORIES
7940 Memorial Drive
Plain City, OH 43064
614-873-4654

5C01568-01/2/3

New Analysis Request Sheet

~~AR~~ # 165986
Received: 3/12/2025
Matrix: Potable

on Bottle: 165986

** See reverse for important SDS information **

Client #: 1384 Client Name: National Water Services County: ______ P.O.# 082606

Sampler Name: Grant Herron SMP ID : ______ Sample Type/Class: (X) New Well/Special

Sample Tap: Spigot Date Collected: 3/12/2025 (MM/DD/YY) Time Collected: 09:45 am (hh:mm am/pm)

Tap Address: Warren County Well Field, South Lebanon, OH (PW-3)

( ) Public Sample ( ) PWS ID #: ______ ( ) Facility ID #: ______

( ) (New Well Trans) Transient Noncommunity

( ) (New Well Nontrans) Nontransient-Noncommunity + PFAS

(X) (New Well Comm) Community Water Systems + PFAS

Work Order

5C01574-01/2

(Office Use Only)

Microbiological Tests

	Time Collected
( ) 140 Total Coliform #1	9:45 am KJ hh:mm am/pm
( ) 140 Total Coliform #2	10:15 am KJ hh:mm am/pm

Time taken from bottle-10:15

Office Use Only: 8°
FD

Route	
Office/Lab	CO KJ

COOLER:

REVISED 2-15-23 DN

Alliance Technical Group - Akron
3310 Win St.
Cuyahoga Falls, Ohio 44223
TEL: (330) 253-8211 FAX: (330) 253-4489
Website: http://www.settek.com

April 08, 2025

Audrey Cooper
MASI Environmental Services
7940 Memorial Dr.
Plain City, OH 43064
TEL: (614) 873-4654
FAX: (614) 873-3809

RE: 5C01568

Order No.: 25031198

Dear Audrey Cooper:

Alliance Technical Group - Akron received 2 sample(s) on 3/14/2025 for the analyses presented in the following report.

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

Quality control data is within laboratory defined or method specified acceptance limits except where noted.

If you have any questions regarding these tests results, please feel free to call the laboratory.

Sincerely,

Brian J. Fackelman
Project Manager, LIMS Administrator

3310 Win St.
Cuyahoga Falls, Ohio 44223

Arkansas 88-0735, California 2943, Colorado, Connecticut PH-0108, Florida NELAC E87688, Idaho OH00923, Illinois 200061, Indiana C-OH-13, ISO/IEC 17025:2017 119125 L22-544, Kansas E-10347, Kentucky (Underground Storage Tank) 3, Kentucky 90146, Maryland 339, Michigan 9988, Minnesota 1780279, Nevada OH009232020-1, New Hampshire 2996, New Jersey OH006, New York 11777, North Carolina 39705 and 631, North Dakota R-201, Ohio DW, Ohio VAP CL0052, Oklahoma 2019-155, Oregon OH200001, Pennsylvania 68-01335, Rhode Island LA000317, South Carolina 92016001, Texas T104704466-19-16, Utah OH009232020-12, Virginia VELAP 10381, West Virginia 9957C

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Case Narrative

WO#: **25031198**
Date: **4/8/2025**

CLIENT: MASI Environmental Services
Project: 5C01568

WorkOrder Narrative:
25031198: This report in its entirety consists of the following documents: Cover Letter, Case Narrative, Analytical Results, QC Summary Report, Applicable Accreditation Information, Chain-of-Custody, Cooler Receipt Form, and other applicable forms as necessary. All documents contain the Alliance Technical Group Work Order Number assigned to this report.

Alliance Technical Group holds the accreditations/certifications listed at the bottom of the cover letter that may or may not pertain to this report. Please refer to the "Accreditation Program Analytes Report" for accredited analytes list.

The information contained in this analytical report is the sole property of Alliance Technical Group and that of the customer. It cannot be reproduced in any form without the consent of Alliance Technical Group or the customer for which this report was issued. The results contained in this report are only representative of the samples received. Conditions can vary at different times and at different sampling conditions. Alliance Technical Group is not responsible for use or interpretation of the data included herein.

All results for solid samples are reported on an "as received" or "wet weight" basis unless indicated as "dry weight" using the "-dry" designation on the reporting units.

This report is believed to meet all of the requirements of the accrediting agency, where applicable. Any comments or problems with the analytical events associated with this report are noted below.

WorkOrder Comments:
25031198: State required accreditation not specified; results may not be reported as certified data. Data is not for compliance per the chain of custody; data is for private use.

Analytical Sequence Sample Notes:
25031198-002A SVOC-EPA537_DW(537): Sample exhibited low recoveries for multiple surrogates. Potential low bias. Confirmed via reanalysis.

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Workorder Sample Summary

WO#: **25031198**

08-Apr-25

CLIENT: MASI Environmental Services
Project: 5C01568

Lab SampleID	Client Sample ID	Tag No	Date Collected	Date Received	Matrix
25031198-001	5C01568-01		3/12/2025 9:45:00 AM	3/14/2025 4:10:00 PM	Drinking Water
25031198-001	5C01568-01		3/12/2025 9:45:00 AM	3/14/2025 4:10:00 PM	Drinking Water
25031198-002	5C01568-02 FRB		3/12/2025 9:45:00 AM	3/14/2025 4:10:00 PM	Drinking Water

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Analytical Report

(consolidated)

WO#: **25031198**

Date Reported: **4/8/2025**

CLIENT: MASI Environmental Services **Collection Date:** 3/12/2025 9:45:00 AM

Project: 5C01568

Lab ID: 25031198-001 **Matrix:** DRINKING WATER

Client Sample ID: 5C01568-01

Analyses	Result	RL	Qual	Units	Uncertainty	DF	Date Analyzed
GROSS ALPHA / GROSS BETA RADIOACTIVITY (EPA 900.0)					**E900.0**	**E900**	Analyst: **SMZ**
ALPHA, Gross	ND	3.00		pCi/L	± 2.23	1	3/25/2025 4:18:09 PM
BETA, Gross	ND	4.00		pCi/L	± 1.14	1	3/25/2025 4:18:09 PM
RADIUM-228 (904.0)					**E904.0**	**E903-904**	Analyst: **HDJ**
Radium-228	ND	1.00		pCi/L	± 0.510	1	4/7/2025 3:25:00 PM
Yield	1.00					1	4/7/2025 3:25:00 PM

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected	PL	Permit Limit
RL	Reporting Detection Limit	W	Sample container temperature is out of limit as specified at testcode

Original

Alliance Technical Group - Akron
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Analytical Report

(consolidated)

WO#: **25031198**

Date Reported: **4/8/2025**

CLIENT: MASI Environmental Services
Collection Date: 3/12/2025 9:45:00 AM
Project: 5C01568
Lab ID: 25031198-001
Matrix: DRINKING WATER
Client Sample ID: 5C01568-01

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
PFAS BY EPA 537.1				**E537.1**	**E537.1**	Analyst: **JJF**
PERFLUORINATED ALKYL ACIDS (EPA 537.1)						
PFBS	2.09	1.73		ng/L	1	3/21/2025 3:00:00 AM
PFHxS	ND	1.73		ng/L	1	3/21/2025 3:00:00 AM
PFOA	2.72	1.73		ng/L	1	3/21/2025 3:00:00 AM
PFOS	8.39	1.73		ng/L	1	3/21/2025 3:00:00 AM
PFNA	ND	1.73		ng/L	1	3/21/2025 3:00:00 AM
HFPO-DA	ND	1.73		ng/L	1	3/21/2025 3:00:00 AM
Surr: 13C2-PFDA	101	70 - 130		%Rec	1	3/21/2025 3:00:00 AM
Surr: 13C2-PFHxA	99.9	70 - 130		%Rec	1	3/21/2025 3:00:00 AM
Surr: 13C3-HFPO-DA	91.2	70 - 130		%Rec	1	3/21/2025 3:00:00 AM

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected	PL	Permit Limit
RL	Reporting Detection Limit	W	Sample container temperature is out of limit as specified at testcode

Original

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Cuyahoga Falls, Ohio 44223
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Analytical Report

(consolidated)

WO#: **25031198**

Date Reported: **4/8/2025**

CLIENT: MASI Environmental Services
Collection Date: 3/12/2025 9:45:00 AM
Project: 5C01568
Lab ID: 25031198-002
Matrix: DRINKING WATER
Client Sample ID: 5C01568-02 FRB

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
PFAS BY EPA 537.1				**E537.1**	**E537.1**	Analyst: **JJF**
PERFLUORINATED ALKYL ACIDS (EPA 537.1)						
PFBS	ND	0.0189		ng/L	1	3/21/2025 3:16:00 AM
PFHxS	ND	0.0189		ng/L	1	3/21/2025 3:16:00 AM
PFOA	ND	0.0189		ng/L	1	3/21/2025 3:16:00 AM
PFOS	ND	0.0189		ng/L	1	3/21/2025 3:16:00 AM
PFNA	ND	0.0189		ng/L	1	3/21/2025 3:16:00 AM
HFPO-DA	ND	0.0189		ng/L	1	3/21/2025 3:16:00 AM
Surr: 13C2-PFDA	98.3	70 - 130		%Rec	1	3/21/2025 3:16:00 AM
Surr: 13C2-PFHxA	18.1	70 - 130	S	%Rec	1	3/21/2025 3:16:00 AM
Surr: 13C3-HFPO-DA	15.6	70 - 130	S	%Rec	1	3/21/2025 3:16:00 AM

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected	PL	Permit Limit
RL	Reporting Detection Limit	W	Sample container temperature is out of limit as specified at testcode

Original

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Cuyahoga Falls, Ohio 44223
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QC SUMMARY REPORT

WO#: **25031198**
08-Apr-25

Client: MASI Environmental Services
Project: 5C01568 **BatchID:** **82982**

Sample ID: **MB-82982** SampType: **MBLK** TestCode: **UCMR5_SVO** Units: **ng/L** Prep Date: **3/18/2025** RunNo: **205459**
Client ID: **BatchQC** Batch ID: **82982** TestNo: **E537.1** **E537.1** Analysis Date: **3/20/2025** SeqNo: **5502042**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	ND	2.00									
PFHxS	ND	2.00									
PFOA	ND	2.00									
PFOS	ND	2.00									
PFNA	ND	2.00									
HFPO-DA	ND	2.00									
Surr: 13C3-HFPO-DA	0.0366		0.04000		91.5	69.5	130.5				
Surr: 13C2-PFDA	0.0445		0.04000		111	69.5	130.5				
Surr: 13C2-PFHxA	0.0400		0.04000		100	69.5	130.5				
Surr: 13C3-HFPO-DA	0.0366		0.04000		91.5	69.5	130.5				
Surr: NETFOSAA-d5	0.178		0.1600		111	69.5	130.5				

Sample ID: **25031063-003AMS** SampType: **MS** TestCode: **UCMR5_SVO** Units: **ng/L** Prep Date: **3/18/2025** RunNo: **205459**
Client ID: **BatchQC** Batch ID: **82982** TestNo: **E537.1** **E537.1** Analysis Date: **3/21/2025** SeqNo: **5502050**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	34.6	1.78	31.4	0.723	108	69.5	130.5				
PFHxS	33.0	1.78	32.4	0	102	69.5	130.5				
PFOA	31.2	1.78	35.5	0	87.8	69.5	130.5				
PFOS	37.9	1.78	32.9	0	115	69.5	130.5				
PFNA	36.1	1.78	35.5	0	102	69.5	130.5				
HFPO-DA	43.4	1.78	35.5	2.10	116	69.5	130.5				

Qualifiers:
H Holding times for preparation or analysis exceeded
PL Permit Limit
W Sample container temperature is out of limit as specified at testcode
M Manual Integration used to determine area response
RL Reporting Detection Limit
ND Not Detected
S Spike Recovery outside accepted recovery limits

Original

Alliance Technical Group - Akron
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Cuyahoga Falls, Ohio 44223
TEL: (330) 253-8211 FAX: (330) 253-4489
Website: http://www.settek.com

QC SUMMARY REPORT

WO#: **25031198**
08-Apr-25

Client: MASI Environmental Services
Project: 5C01568 **BatchID:** **82982**

Sample ID: **25031063-003AMS** SampType: **MS** TestCode: **UCMR5_SVO** Units: **ng/L** Prep Date: **3/18/2025** RunNo: **205459**
Client ID: **BatchQC** Batch ID: **82982** TestNo: **E537.1** **E537.1** Analysis Date: **3/21/2025** SeqNo: **5502050**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 13C3-HFPO-DA	0.0299		0.03552		84.1	69.5	130.5				
Surr: 13C2-PFDA	0.0359		0.03552		101	69.5	130.5				
Surr: 13C2-PFHxA	0.0320		0.03552		90.2	69.5	130.5				
Surr: 13C3-HFPO-DA	0.0299		0.03552		84.1	69.5	130.5				
Surr: NETFOSAA-d5	0.131		0.1421		92.0	69.5	130.5				

Sample ID: **25031063-003AMSD** SampType: **MSD** TestCode: **UCMR5_SVO** Units: **%Rec** Prep Date: **3/18/2025** RunNo: **205459**
Client ID: **BatchQC** Batch ID: **82982** TestNo: **E537.1** **E537.1** Analysis Date: **3/21/2025** SeqNo: **5502051**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 13C3-HFPO-DA	0.0324		0.03681		88.0	69.5	130.5		0	0	
Surr: 13C2-PFDA	0.0361		0.03681		98.0	69.5	130.5		0	30	
Surr: 13C2-PFHxA	0.0324		0.03681		88.0	69.5	130.5		0	30	
Surr: NETFOSAA-d5	0.146		0.1472		99.1	69.5	130.5		0	30	

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected	PL	Permit Limit
RL	Reporting Detection Limit	S	Spike Recovery outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode		

Original

Alliance Technical Group - Akron
3310 Win St.
Cuyahoga Falls, Ohio 44223
TEL: (330) 253-8211 FAX: (330) 253-4489
Website: http://www.settek.com

QC SUMMARY REPORT

WO#: **25031198**

08-Apr-25

Client: MASI Environmental Services

Project: 5C01568 **BatchID:** 82982

Sample ID: **MB-82982** SampType: **MBLK** TestCode: **UCMR5_SVO** Units: **ng/L** Prep Date: **3/18/2025** RunNo: **205456**

Client ID: **BatchQC** Batch ID: **82982** TestNo: **E537.1** **E537.1** Analysis Date: **3/19/2025** SeqNo: **5501908**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	ND	2.00									
PFHxS	ND	2.00									
PFOA	ND	2.00									
PFOS	ND	2.00									
PFNA	ND	2.00									
HFPO-DA	ND	2.00									
Surr: 13C3-HFPO-DA	0		0.04000		0	69.5	130.5				S
Surr: 13C2-PFDA	0.0477		0.04000		119	69.5	130.5				
Surr: 13C2-PFHxA	0.0414		0.04000		104	69.5	130.5				
Surr: 13C3-HFPO-DA	0.0401		0.04000		100	69.5	130.5				
Surr: NETFOSAA-d5	0.183		0.1600		114	69.5	130.5				

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	RL	Reporting Detection Limit	S	Spike Recovery outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode				

Original

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3310 Win St.
Cuyahoga Falls, Ohio 44223
TEL: (330) 253-8211 FAX: (330) 253-4489
Website: http://www.settek.com

QC SUMMARY REPORT

WO#: **25031198**
08-Apr-25

Client: MASI Environmental Services
Project: 5C01568 **BatchID:** 82982

Sample ID: **MB-82982** SampType: **MBLK** TestCode: **SVOC-EPA53** Units: **ng/L** Prep Date: **3/18/2025** RunNo: **205458**
Client ID: **BatchQC** Batch ID: **82982** TestNo: **E537.1** **E537.1** Analysis Date: **3/20/2025** SeqNo: **5502015**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	ND	2.00									
PFHxS	ND	2.00									
PFOA	ND	2.00									
PFOS	ND	2.00									
PFNA	ND	2.00									
HFPO-DA	ND	2.00									
Surr: 13C2-PFDA	0.0445		0.04000		111	70	130				
Surr: 13C2-PFHxA	0.0400		0.04000		100	70	130				
Surr: 13C3-HFPO-DA	0.0366		0.04000		91.5	70	130				
Surr: NETFOSAA-d5	0.178		0.1600		111	70	130				

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	RL	Reporting Detection Limit	S	Spike Recovery outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode				

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QC SUMMARY REPORT

WO#: **25031198**
08-Apr-25

Client: MASI Environmental Services
Project: 5C01568 **BatchID:** 82982

Sample ID: **MB-82982** SampType: **MBLK** TestCode: **SVOC-EPA53** Units: **ng/L** Prep Date: **3/18/2025** RunNo: **205455**
Client ID: **BatchQC** Batch ID: **82982** TestNo: **E537.1** **E537.1** Analysis Date: **3/19/2025** SeqNo: **5501890**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
PFBS	ND	2.00									
PFHxS	ND	2.00									
PFOA	ND	2.00									
PFOS	ND	2.00									
PFNA	ND	2.00									
HFPO-DA	ND	2.00									
Surr: 13C2-PFDA	0.0477		0.04000		119	70	130				
Surr: 13C2-PFHxA	0.0414		0.04000		104	70	130				
Surr: 13C3-HFPO-DA	0.0401		0.04000		100	70	130				
Surr: NETFOSAA-d5	0.183		0.1600		114	70	130				

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	RL	Reporting Detection Limit	S	Spike Recovery outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode				

Original

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QC SUMMARY REPORT

WO#: **25031198**
08-Apr-25

Client: MASI Environmental Services
Project: 5C01568 **BatchID:** 83122

Sample ID: **MB-83122** SampType: **MBLK** TestCode: **AlphaBeta_D** Units: **pCi/L** Prep Date: **3/24/2025** RunNo: **205781**
Client ID: **BatchQC** Batch ID: **83122** TestNo: **E900.0** **E900** Analysis Date: **3/25/2025** SeqNo: **5509294**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
ALPHA, Gross	ND	3.00									
BETA, Gross	ND	4.00									

Sample ID: **LCS-83122** SampType: **LCS** TestCode: **AlphaBeta_D** Units: **pCi/L** Prep Date: **3/24/2025** RunNo: **205781**
Client ID: **BatchQC** Batch ID: **83122** TestNo: **E900.0** **E900** Analysis Date: **3/25/2025** SeqNo: **5509295**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
ALPHA, Gross	11.6	3.00	15.00	0	77.5	70	130				
BETA, Gross	18.7	4.00	20.00	0	93.5	70	130				

Sample ID: **RLC-83122** SampType: **RLC** TestCode: **AlphaBeta_D** Units: **pCi/L** Prep Date: **3/24/2025** RunNo: **205781**
Client ID: **BatchQC** Batch ID: **83122** TestNo: **E900.0** **E900** Analysis Date: **3/25/2025** SeqNo: **5509297**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
ALPHA, Gross	3.93	3.00	3.000	0	131	50	150				
BETA, Gross	ND	4.00	4.000	0	80.5	50	150				

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	RL	Reporting Detection Limit	S	Spike Recovery outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode				

Original

Alliance TECHNICAL GROUP

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QC SUMMARY REPORT

WO#: **25031198**
08-Apr-25

Client: MASI Environmental Services
Project: 5C01568 **BatchID:** **83157**

Sample ID: **MB-83157** SampType: **MBLK** TestCode: **Radium-228_** Units: **pCi/L** Prep Date: **3/25/2025** RunNo: **206535**
Client ID: **BatchQC** Batch ID: **83157** TestNo: **E904.0** **E903-904** Analysis Date: **4/7/2025** SeqNo: **5528483**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	ND	1.00		0	0						
Yield	1.00			0	0						

Sample ID: **LCS-83157** SampType: **LCS** TestCode: **Radium-228_** Units: **pCi/L** Prep Date: **3/25/2025** RunNo: **206535**
Client ID: **BatchQC** Batch ID: **83157** TestNo: **E904.0** **E903-904** Analysis Date: **4/7/2025** SeqNo: **5528484**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	3.37	1.00	5.000	0	67.4	50	130				
Yield	1.00			0	0						

Sample ID: **LCSD-83157** SampType: **LCSD** TestCode: **Radium-228_** Units: **pCi/L** Prep Date: **3/25/2025** RunNo: **206535**
Client ID: **BatchQC** Batch ID: **83157** TestNo: **E904.0** **E903-904** Analysis Date: **4/7/2025** SeqNo: **5528485**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Radium-228	3.75	1.00	5.000	0	75.0	50	130	3.370	10.7	20	
Yield	1.00			0	0			1.000	0		

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	RL	Reporting Detection Limit	S	Spike Recovery outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode				

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QC SUMMARY REPORT

WO#: **25031198**
08-Apr-25

Client: MASI Environmental Services
Project: 5C01568 **BatchID:** 83157

Sample ID: **RLCD-83157**	SampType: **RLC**	TestCode: **Radium-228_**	Units: **pCi/L**		Prep Date: **3/25/2025**			RunNo: **206535**				
Client ID: **BatchQC**	Batch ID: **83157**	TestNo: **E904.0**	**E903-904**		Analysis Date: **4/7/2025**			SeqNo: **5528488**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	
Radium-228	1.10	1.00	1.000	0	110	50	150					
Yield	1.00			0	0							

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response	ND	Not Detected
PL	Permit Limit	RL	Reporting Detection Limit	S	Spike Recovery outside accepted recovery limits
W	Sample container temperature is out of limit as specified at testcode				

Original

These commonly used Qualifiers and Acronyms may or may not be present in this report.

Qualifiers

U	The compound was analyzed for but was not detected above the MDL.
J	The reported value is greater than the Method Detection Limit but less than the Reporting Limit.
H	The hold time for sample preparation and/or analysis was exceeded. Not Clean Water Act compliant.
D	The result is reported from a dilution.
E	The result exceeded the linear range of the calibration or is estimated due to interference.
MC	The result is below the Minimum Compound Limit.
*****	The result exceeds the Regulatory Limit or Maximum Contamination Limit.
m	Manual integration was used to determine the area response.
d	Manual integration in which peak was deleted
N	The result is presumptive based on a Mass Spectral library search assuming a 1:1 response.
P	The second column confirmation exceeded 25% difference.
C	The result has been confirmed by GC/MS.
X	The result was not confirmed when GC/MS Analysis was performed.
B	The analyte was detected in the Method Blank at a concentration greater than the RL.
MB+	The analyte was detected in the Method Blank at a concentration greater than the MDL.
G	The ICB or CCB contained reportable amounts of analyte.
QC-/+	The CCV recovery failed low (-) or high (+).
R/QDR	The RPD was outside of accepted recovery limits.
QL-/+	The LCS or LCSD recovery failed low (-) or high (+).
QLR	The LCS/LCSD RPD was outside of accepted recovery limits.
QM-/+	The MS or MSD recovery failed low (-) or high (+).
QMR	The MS/MSD RPD was outside of accepted recovery limits.
QV-/+	The ICV recovery failed low (-) or high (+).
S	The spike result was outside of accepted recovery limits.
W	Samples were received outside temperature limits (0° – 6° C). Not Clean Water Act compliant.
Z	Deviation; A deviation from the method was performed; Please refer to the Case Narrative for additional information

Acronyms

ND	Not Detected	**RL**	Reporting Limit
QC	Quality Control	**MDL**	Method Detection Limit
MB	Method Blank	**LOD**	Level of Detection
LCS	Laboratory Control Sample	**LOQ**	Level of Quantitation
LCSD	Laboratory Control Sample Duplicate	**PQL**	Practical Quantitation Limit
QCS	Quality Control Sample	**CRQL**	Contract Required Quantitation Limit
DUP	Duplicate	**PL**	Permit Limit
MS	Matrix Spike	**RegLvl**	Regulatory Limit
MSD	Matrix Spike Duplicate	**MCL**	Maximum Contamination Limit
RPD	Relative Percent Different	**MinCL**	Minimum Compound Limit
ICV	Initial Calibration Verification	**RA**	Reanalysis
ICB	Initial Calibration Blank	**RE**	Reextraction
CCV	Continuing Calibration Verification	**TIC**	Tentatively Identified Compound
CCB	Continuing Calibration Blank	**RT**	Retention Time
RLC	Reporting Limit Check	**CF**	Calibration Factor

This list of Qualifiers and Acronyms reflects the most commonly utilized Qualifiers and Acronyms for reporting. Please refer to the Analytical Notes in the Case Narrative for any Qualifiers or Acronyms that do not appear in this list or for additional information regarding the use of these Qualifiers on reported data.

25031198

MASI LABORATORIES

SUBCONTRACT ORDER

Sending Laboratory:

Mobile Analytical Services, Inc.
7940 Memorial Dr
Plain City, OH 43064
Phone: 614-873-4654

Project Manager: Audrey Cooper

Subcontracted Laboratory:

Summit Environmental Technologies (5626)
3310 Win Street
Cuyahoga Falls, OH 44223
Phone: (330) 253-8211

Work Order: 5C01568

Analysis	Expires	Method	Comments Private
Sample ID: 5C01568-01 ***Potable***	***Sampled: 03/12/2025 09:45***		
PFOA/PFOS M537 Regulated List	03/26/2025 09:45	Rec'd 2 PFAS containers	
Radium-228	09/08/2025 09:45		
Gross Beta	09/08/2025 09:45		
Gross Alpha	09/08/2025 09:45		
Containers Supplied:		cpm 24 pH 1	
Sample ID: 5C01568-02 ***Potable***	***Sampled: 03/12/2025 09:45***		
PFOA/PFOS M537 Regulated List Field Blank	03/26/2025 09:45		
Containers Supplied:			

1.1-0.0=1.1°C, ATG, Cooler, Ice

Released By: HM Date: 3/14/25

Received By: [signature] Date: 3/14/25, 1610

Relinq. T. Lalal 3-14-25 1610

7940 Memorial Drive Plain City, Ohio 43064 (614) 873-4654

Alliance Technical Group - Akron
3310 Win St.
Cuyahoga Falls, Ohio 44223
TEL: (330) 253-8211 FAX: (330) 253-4489
Website: http://www.settek.com

Sample Log-In Check List

Client Name: MAS-OH-43017 Work Order Number: 25031198 RcptNo: 1

Logged by:	Tegan A. Richards	3/14/2025 4:10:00 PM	Tegan Richards
Completed By:	Tegan A. Richards	3/15/2025 2:07:27 PM	Tegan Richards
Reviewed By:	Brian J. Fackelman	3/17/2025 3:44:44 PM	

Chain of Custody

1. Is Chain of Custody complete? Yes ☐ No ☑ Not Present ☐
2. How was the sample delivered? Alliance

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
   Custody seals intact on shipping container/cooler? Yes ☐ No ☐ Not Present ☑
   No. Seal Date: Signed By:
5. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
6. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
7. Sample(s) in proper container(s)? Yes ☑ No ☐
8. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
9. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
10. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
11. Is the headspace in the VOA vials less than 1/4 inch or 6 mm? Yes ☐ No ☐ No VOA Vials ☑
12. Were any sample containers received broken? Yes ☐ No ☑
13. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
14. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
15. Is it clear what analyses were requested? Yes ☑ No ☐
16. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

Special Handling (if applicable)

17. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:
By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

18. Additional remarks:

Project information (address/state), preservation, and number of containers not recorded on COC.

Cooler Information

Cooler No	Temp ºC	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.1	Good	Not Present			