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Wisconsin Groundwater-Level Monitoring Network Improvement

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Open-File Report 2017-04

Contents:

- report (41 pages)
- 8 appendices

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Wisconsin Groundwater-Level Monitoring Network Improvement

Project activities: Well Maintenance (Objective 4) and Well Drilling (Objective 5)

July 31, 2017

USGS Award # G16AC00302
08/01/2016 to 07/31/2017

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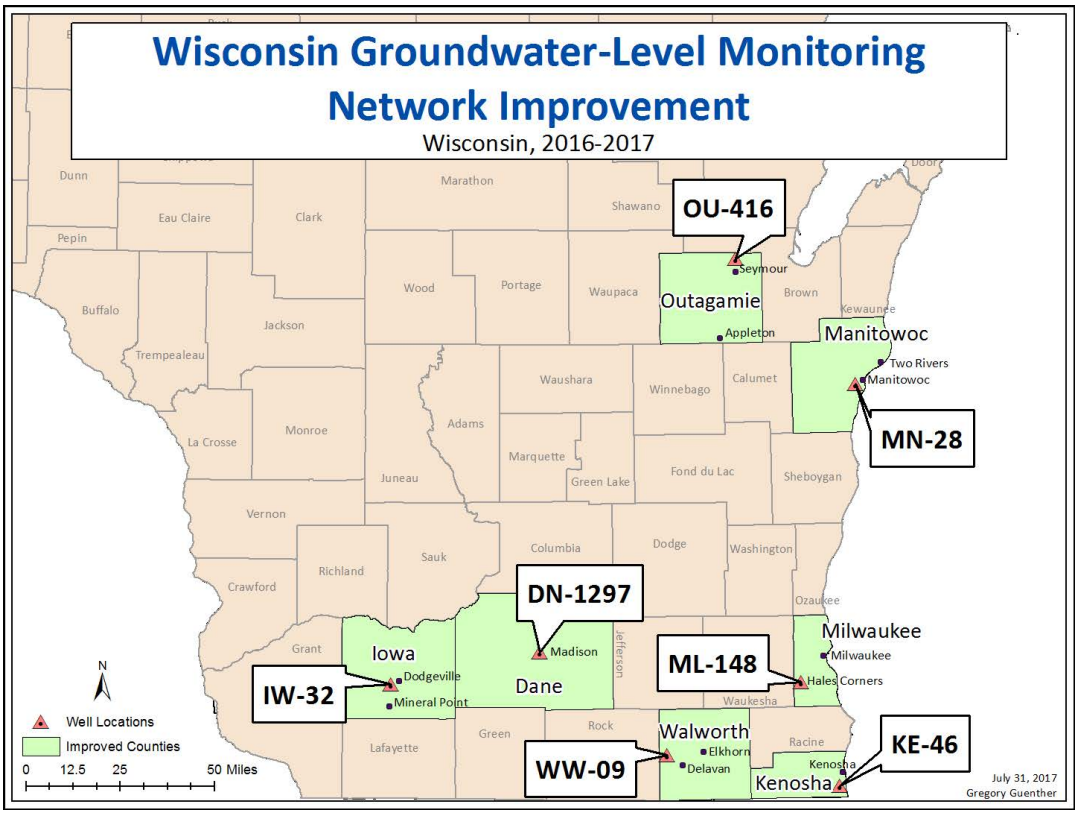

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Introduction

Background

The Wisconsin Geological and Natural History Survey (WGNHS) is part of the University of Wisconsin-Extension system. Our mission is as follows:

> *"The WGNHS conducts earth-science surveys, field studies, and research. We provide objective scientific information, about the geology, mineral resources, water resources, soil, and biology of Wisconsin. We collect, interpret, disseminate, and archive natural resource information. We communicate the results of our activities through publications, technical talks, and responses to inquiries from the public. These activities support informed decision making by government, industry, business, and individual citizens of Wisconsin."*

The Wisconsin Groundwater-Level Monitoring Network (WGLMN) dates back to 1946, when the Wisconsin State Legislature requested that the WGNHS and U.S. Geological Survey (USGS) formally establish a groundwater monitoring network. Today the WGLMN is a cooperative monitoring network operated, maintained, and managed by the WGNHS and USGS Wisconsin Water Science Center (USGS WIWSC) with additional effort and funding support from the Wisconsin Department of Natural Resources (WDNR).

During the late 1940s and 1950s the WGLMN network rapidly grew to 270 wells, before stabilizing around 200 wells from the 1960s through the 1980s. Beginning in the late 1980s, the number of wells decreased rapidly as funding support decreased and wells were abandoned or fell into disrepair. While the USGS WIWSC, WGNHS, and DNR have continued to maintain, operate, and actively manage the WGLMN, the total number of long-term monitoring wells is now below 100 in addition to two spring gaging stations.

The USGS principal aquifers and areas that are monitored include:

- Sand and gravel aquifers (glaciated regions)
- Silurian-Devonian aquifer system,
- Cambrian-Ordovician aquifer system, and
- Precambrian aquifer system.

As of May 2016, the Wisconsin Groundwater-Level Monitoring Network's (WGLMN) long-term monitoring network consists of 93 wells and 2 spring gaging stations. Of these, 40 are considered to be part of the USGS' National Ground-Water Monitoring Network (NGWMN). The locations of all monitoring sites in the WGLMN and the NGWMN, at the time this project proposal was originally submitted in May 2016, are included in *figure 1*.

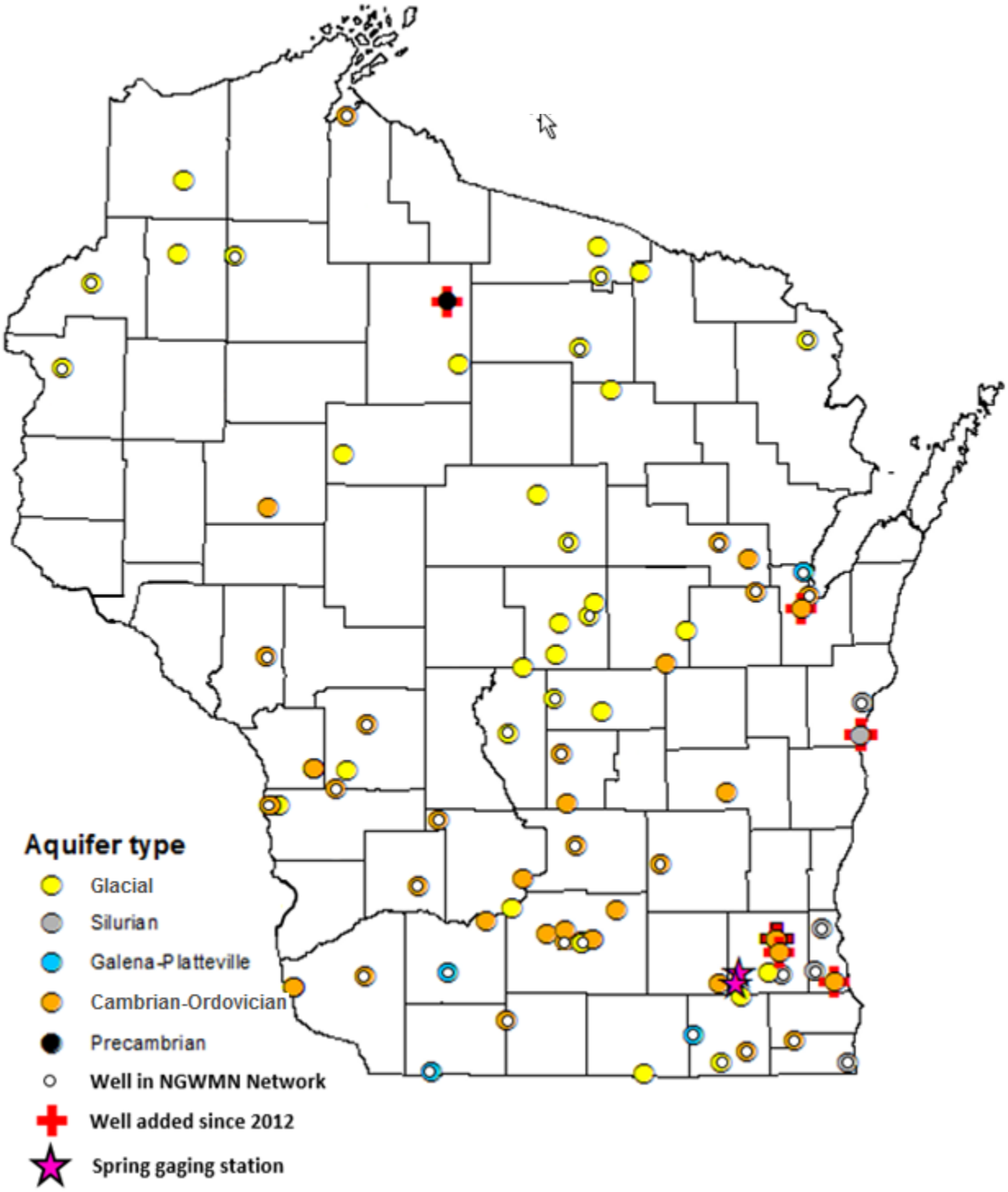


Figure 1: *Locations of all monitoring sites in the Wisconsin Groundwater-level Monitoring Network wells and the USGS National Ground-Water Monitoring Network. Aquifer type is the USGS designation.*

Project Objectives and Summary

The project proposal submitted in late May 2016, included five work items in fulfillment of Objective 4 (Well maintenance) and Objective 5 (Well drilling) as outlined in the program announcement (USGS funding opportunity G16AS00043). The activities proposed for each well were as follows:

Objective 4: Well Maintenance

Item A: KE-46	Replace equipment shelter.
Item B: MN-28	Redevelop well and test well-aquifer connection.
Item C: OU-416	Evaluate and repair blockage in well, redevelop well, and test well-aquifer connection.
Item D: WW-09	Redevelop well and test well-aquifer connection.

Objective 5: Well Drilling

Item A: ML-148	Overdrill and abandon existing well and drill a replacement well nearby of comparable well construction. Confirm well-aquifer connection of new well.

In autumn 2016, while working on each of the five work items, historical well records were identified for ML-148 suggesting that the well could be repaired instead of needing to be replaced. In March 2017, ML-148 was successfully repaired, eliminating the need (and cost) to overdrill and abandon ML-148 and drill a replacement well. This modification represented a significant cost savings for the project and allowed for new repairs and evaluations to be performed at several additional wells within the NGWMN and WGLMN. Some of these new repairs and evaluations were performed on wells that were included in the original proposal while others were at additional wells. Many of the new repairs and evaluations were suggested by our partners at the USGS WIWSC and our two agencies worked closely together to perform the work between March and July 2017.

The following is a summary of the additional well repairs and evaluations performed by the WGNHS between March and July 2017:

DN-1297	Collected borehole video log and gamma geophysical log to confirm geology and evaluate well condition.
IW-32	Collected borehole video log and suite of geophysical logs to evaluate well condition. Also tested the well-aquifer connection.
MN-28	Collected video log.
ML-148	Collected borehole video log and suite of geophysical logs to evaluate well condition. Tested the well-aquifer connection. Also reconstructed the well head and installed a new protective flush-mount cover.
OU-416	Collected borehole video log of well, identified clay fouling at base of well. Backfilled clay-fouled area of well, and tested the well-aquifer connection
WW-09	Purchased and installed a new protective well-head cover.

At the completion of this project all project work items included in the original proposal, with exception of the modification at ML-148, were successfully completed.

The following chapters of the report describe all work that was performed at each well, irrespective of whether a particular activity was included in the original project proposal. For this reason, the well repairs are not organized by Objectives or Work Items but instead alphabetically by county. Appendices are included for each well which include supporting documents such as well construction reports and other historical notes that were identified during the investigation of each well. Well names and locations are shown below in *figure 2*.

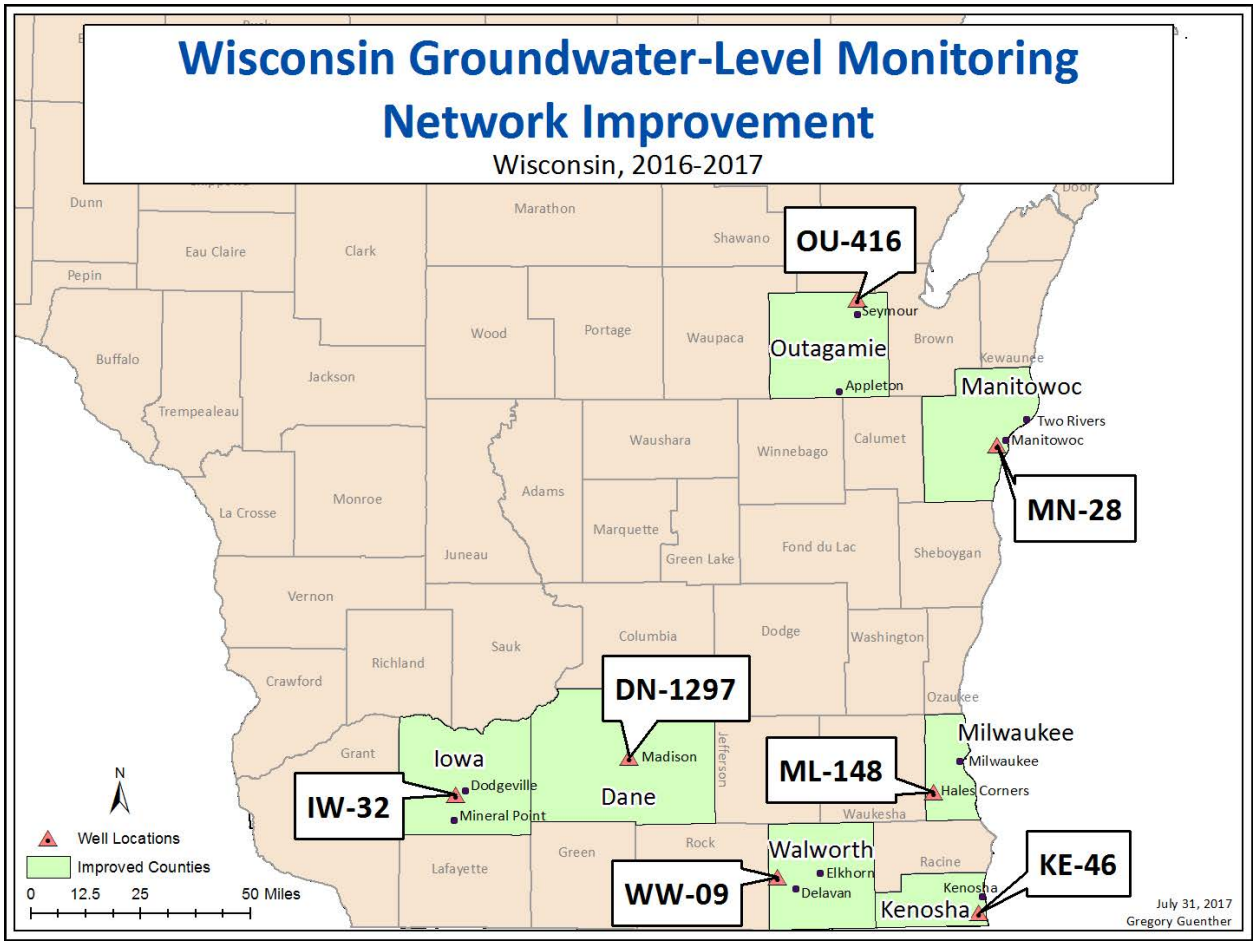


Figure 2: *The wells improved by this project are shown above.*

For ease of use, this report has been structured as a linked PDF file. The document names in the table of contents are linked to their respective report. Individual documents contain text in the header that, when clicked, will return the user to the table of contents. Each appendix cover page works like the table of contents and contains a link that, when clicked, will return to the first page of the respective appendix.

DN-1297 (Dane County, WI)

Well Information

USGS Site Number: 430406089232901
USGS Site Name: DN-07/09E/23-1297
WGNHS Well ID: 13001297 (aka: DN-1297)

Well Details*

Latitude: 43°04'06.14", Longitude: 89°23'34.08" - NAD83 (see location in *figure 3*)
Dane County, Wisconsin, Hydrologic Unit: 07090001
Well depth: 68.0 feet below land surface
Hole depth: 68.0 feet below land surface
Land surface altitude: 859.0 feet above NAVD88
Well completed in: "Cambrian-Ordovician aquifer system" (S300CAMORD) national aquifer
Well completed in: "Sandstone Aquifer" (300SNDSA) local aquifer

**Well details included here were obtained from the USGS Groundwater Watch webpage at the time of proposal submittal in May 2016.*

Work activities at this well created the following discrepancies with the official well record:

- *The depth of the well was determined to be 65.41 feet below land surface (ft-bls).*
- *The casing consists of 10-foot sections and there is a casing joint at 55.8 ft-bls. This suggests the bottom of the casing is likely to be at 65.8 feet or 75.8 ft-bls, rather than the previously recorded 68 ft-bls.*

*Additional documentation for this well is included in appendix **A**.*

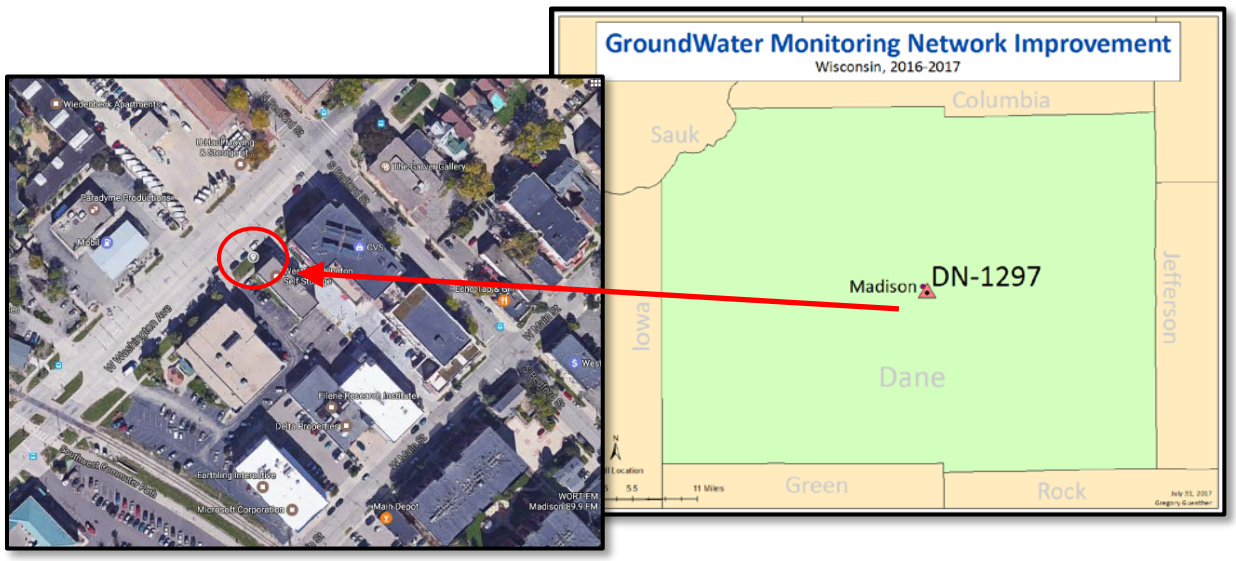


Figure 3: *Well location. Street address closest to location is* 615 W Washington Ave, Madison, WI 53703.

Well Description

This well was originally called DN-1099 and recording for this well began in 1978. Neither a well construction report nor a geologic log is available for this well so the geology and well casing depth are not definitively known for this well. Since the casing extends to the bottom of the current hole (with an estimated 1-10 feet of accumulated sediment present), the well is not directly in contact with the aquifer. According to well construction reports and geologic logs for neighboring wells (DN-36, DN-47, DN-6067, see *appendix **A***) DN-1297 is believed to be completed mostly (or entirely) into unconsolidated Quaternary sediments with anywhere from 0 - 15 feet of sandy Tunnel City Group or Wonewoc Formation present at the bottom.

Figure 4: *Photo of the general site area.*

Work Plan

Due to a lack of well construction records, the geology surrounding the casing is unknown. A video log was recorded to determine the depth of the casing and the well. The WGNHS also ran a gamma geophysical log and performed a slug test.

Description of Work Completed

In the original USGS well schedules and water-level record datasheets for this well, the distance between the water-level measuring point and land surface was 2.24 feet. The present land surface to measuring point (MP) distance is 1.69 feet.

The WGNHS visited this well twice. First to perform the video log and slug test on May 25th, 2017 (*figure 7*) and again on June 5th, 2017 to perform a gamma geophysical log (results in *appendix **A)***.

The purpose of the slug test was to check on the hydrologic connection between the well and the surrounding aquifer by displacing the water level in the well and observing how the well recovered from this stress. A properly operating well ought to recover relatively quickly (within a few minutes) and smoothly (no sharp jumps in the recovery curve), while a well with a severely clogged or fouled screen or open interval or having a leaky casing might recover very slowly or in erratic steps. The slug test is performed by first lowering a pressure transducer hanging from a cable down below the water level. Then a slug is swiftly lowered below the water level to displace water in the well. In our case the slug is a bundle of filled PVC pipe. The pressure transducer records the change in water level over time. The data recorded by the transducer is exported to Excel in table form and plotted into a line graph with the water level on the Y-axis and time on the X-axis. This is done to show the water level displacement and

equalization for a single slug-in or slug-out measurement. In this way, we can get a rough estimate of the quality of connection to the aquifer. For more accurate results, there are more sophisticated programs to plot the data that take lithology into account.

Images from the video log are included below in *figures 5 and 6*. The water level at the first visit was 15.11 ft-bls.

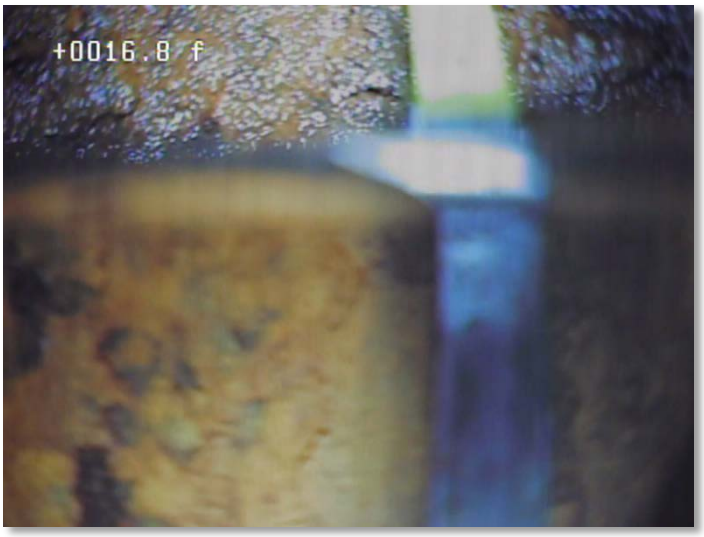


Figure 5: *Image from the video log showing the casing condition as it appears above and below the water level. This view, above and below the water level, illustrates the appearance of the casing as seen in the video log both in and out of water.*

Figure 6: *Image of the casing joint under water at 55.8 ft-bls (57.5 feet from top of casing). As discussed previously in the Well Details section, the depth of this joint is what suggests there is most likely more casing below the current bottom of the well at 65.41 ft-bls.*

Slug test data can be viewed in *figure 7*. We compared the gamma log to those of nearby wells and the recorded gamma log did not contain any distinct markers that would determine the difference between sandstone and quaternary sediments. The ability of the gamma tool to record an identifiable log may have been dampened by the steel casing. An example gamma log for nearby well 13006067 was included in *appendix **A***. Nearby wells have geologic logs showing bedrock at varying depths, from 31 feet to 73 ft-bls. The compared geologic logs of WGNHS ID 13000036 and 13000047 are included in *appendix **A***. The nearby wells were completed in Cambrian sandstone aquifers.

Due to the casing reaching past the sediment accumulated at the bottom, we could not determine the geologic make-up or confirm the aquifer type.

Digital versions of the borehole video log, gamma log, and slug test data are archived at the WGNHS and available upon request.

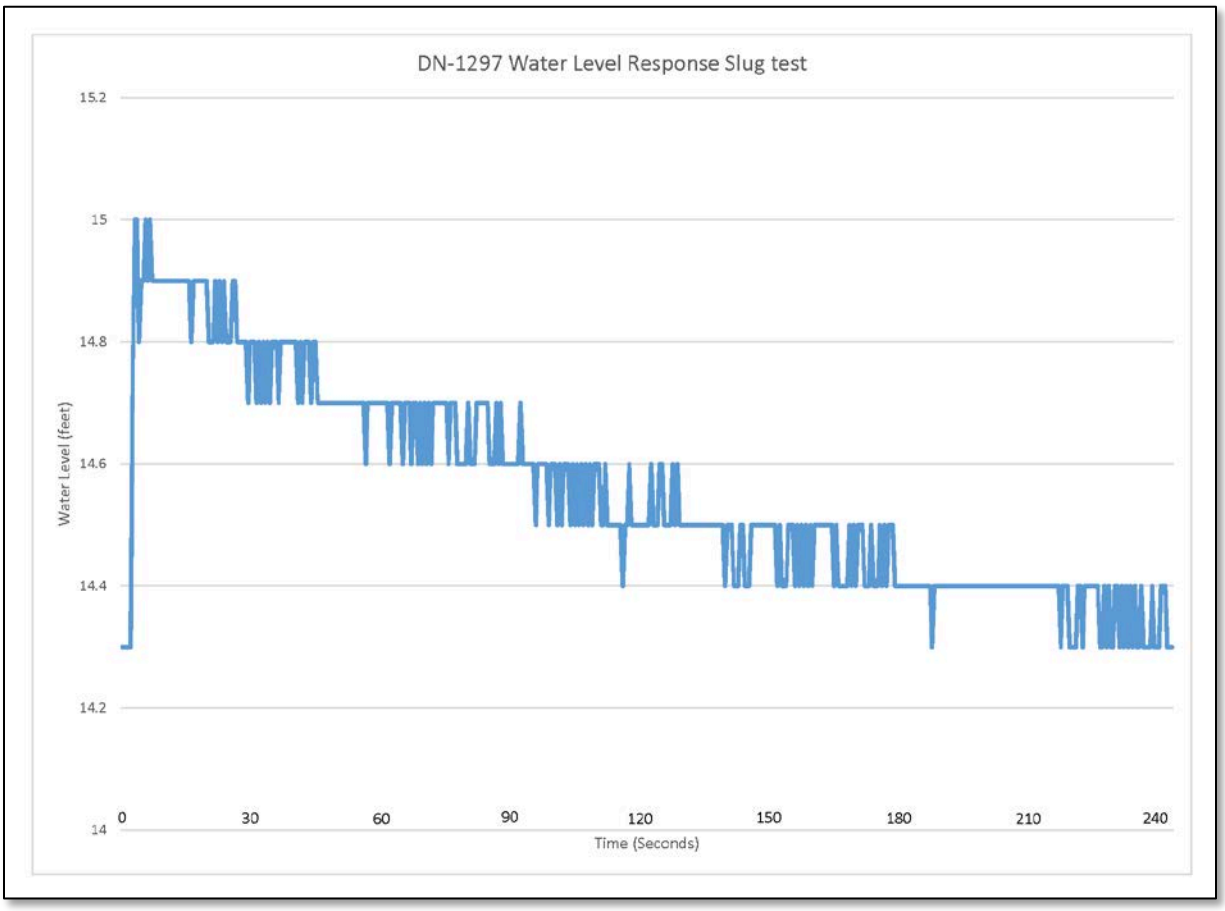


Figure 7: *Slug-in test data showing the recovery time of the DN-1297 well. The water level recovered after 4 minutes. Despite the lack of open hole and considering the only connection to the aquifer is through the sediment at the bottom of the hole, this well responded quickly.*

Summary

The goal at this well was to gain a better understanding of the geology and well construction.

In the original USGS well schedules and water-level record datasheets for this well, the distance between the water-level measuring point and land surface was 2.24 feet. The present land surface to measuring point (MP) distance is 1.69 feet.

A gamma geophysical log was performed in this well to compare the results with that of other nearby wells in attempt to determine the geology surrounding the well. The results were inconclusive, and the aquifer type and geologic setting were unconfirmed. The water level recovered from the slug test after 4 minutes. Despite the lack of open hole, and considering the only connection to the aquifer is through the sediment at the bottom of the hole, this well responded quickly.

Suggestions for Future Work

Future consideration includes redeveloping the well to clear out the sediment accumulated at the bottom. This would improve the well's condition and should allow investigators to determine the casing depth as well as the aquifer type supplying this well. Following redevelopment we recommend performing a video log, a complete suite of geophysical logs, and a slug test.

IW-32 (Iowa County, WI)

Well Information

USGS Site Number: 425644090101901
USGS Site Name: IW-06/03E/32-0032
WGNHS Well ID: 25000032 (aka IW-32)

Well Details*

Latitude: 42°56'44.53", Longitude: 90°10'19.64" - NAD83 (see location in *figure 8*)
Iowa County, Wisconsin, Hydrologic Unit: 07090003
Well depth: 92 feet below land surface
Hole depth: 92 feet below land surface
Land surface altitude: 1,201.8 feet above NAVD88
Well completed in: "Silurian-Devonian aquifers" (N400SLRDVN) national aquifer.
Well completed in: "Galena-Platteville Aquifer" (365GAPV) local aquifer

**Well details included here were obtained from the USGS Groundwater Watch webpage at the time of proposal submittal in May 2016.*

Work activities at this well created the following discrepancies with the official well record:

- *The casing was confirmed to be a thin 6-inch metal "stove-pipe" casing (previously reported as unknown) and extends to a depth of 13.2 feet below land surface (ft-bls).*
- *Well evaluation confirmed that the well depth is 73.5 ft-bls, 18.5 feet shallower than previously measured.*

*Additional documentation for this well is included in appendix **B**.*

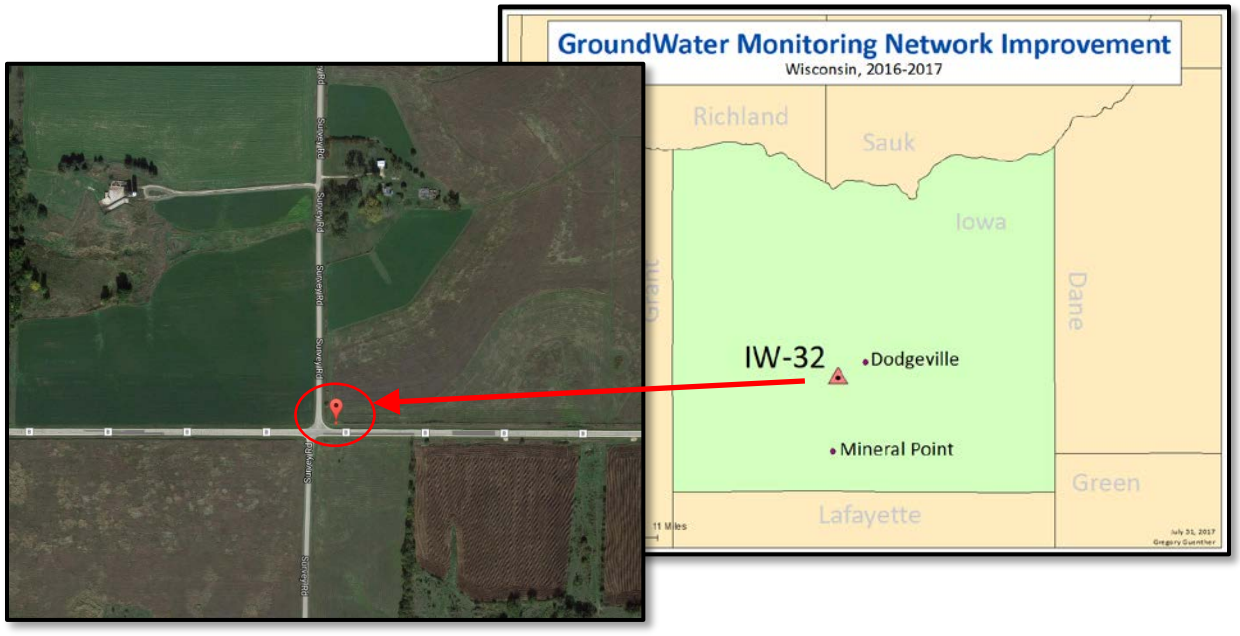


Figure 8: *Well location. Street address closest to location is 3900 Co Rd B, Dodgeville, WI 53533.*

Well Description

This well was originally drilled in 1906 to a depth of 92 feet to supply water to a school house, the North Survey School. The school was closed down in 1960 and groundwater-level monitoring began shortly before in 1957. This well was removed from the monitoring network from 1979 to 1981 due to vandalism. In 2016, the well was reported to have a bad casing and the depth to bottom of hole was measured to be 80.6, corresponding to 11.4 ft. of sediment infill.

Work Plan

The plan for this location was to perform a video log of the well for the purpose of inspecting the casing condition and verifying the length and type of casing. A full suite of geophysical logs were also performed to complement the video log and provide additional information about the borehole wall and the geology. A slug test was also planned but not performed due to the presence of pipes and concern that down-hole equipment could become tangled. Estimated diameters of the pipes are 1-inch PVC and 2-inch metal pipe.

Description of Work Completed

The WGNHS coordinated with the USGS to verify the location of and access to the well. Logging and construction details were searched for in USGS water schedule records stored at the WGNHS. In preparation for evaluating the well, WGNHS staff reached out to the local Iowa County Historical Society to find additional well construction details. This search turned up the original construction date of 1906 and the year when the school shut down of 1960.

The video log was performed to get an idea of the condition of the well and determine the bottom depth. The video log showed that there are two pipes sitting in the well, a white plastic pipe and a larger diameter metal pipe (see video log photo in *figures 9 and 10*). The plastic pipe may have been used to push down on debris that clogged the well when it was vandalized in 1979 or possibly acted as an access to the well below the sediment. It is clearly broken, not cut. The metal pipe may have broken or been cut, it is hard to see. This well used to have a hand pump on it when it was used by the North Survey Schoolhouse, so the metal pipe may be an original pipe that fell to the bottom of the well.

Geophysical logging was hindered by the pipes in the hole, certain probes failed to pass certain depths resulting in a partial geophysical log. The bottom of the well contains accumulated sediment which can be seen settling in *figure 11*.

The well access is behind a gate that is often left open by the landowner, but the well access is not visible from the road due to vegetation. The general site area can be viewed in *figure 12*.The well access itself is in poor condition. The well is seated in a small concrete pad in the corner of a farm field and the cap is a piece of marine plywood with a pipe screwed to it. This cap sits loosely over the hole, unsecured. The well access can be seen in *figure 13*. The casing itself, despite being thin and over 100 years old is in relatively good condition. There is one rust spot in the interior of the casing approximately 2.2 ft-bls. The main issues with the well access are the lack of security and inability to seal the well head.

A log of geophysical data was collected and the report can be viewed in *appendix **B***. Digital versions of the borehole video log and geophysical log are archived at the WGNHS and available upon request.

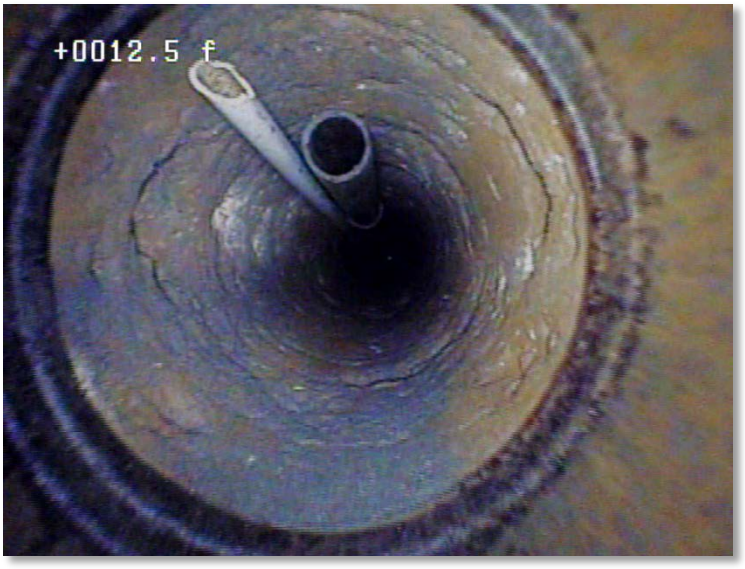


Figure 9: *Video log image of the bottom of the casing with the two pipes sitting inside the well. The casing stops at 13.2 ft-bls and the pipes start at 13.4 ft-bls.*

Figure 10: *Video log image of the pipes under water which also shows staining on the borehole walls.*

Figure 11: *Video log image at the bottom of the well. The PVC pipe is behind the metal pipe in this image.*

Figure 12: *Photo of the general site area facing southwest.*

Figure 13: *Photo of current well access displaying need for installation of a protective cover.*

Summary

The goal for this well was to evaluate the overall condition of the well; confirming the total well depth, the amount of sediment infill, and the condition of the casing and borehole wall.

The well appears to be in reasonably good condition considering the thin casing. The depth measurements and video log confirm the well is 18.5 feet shallower than originally drilled in 1906 and 7.1 feet shallower than measured as recently as 2016.

The video log showed the presence of 2 pipes within the well which are roughly 60 feet long. One pipe appears to be 1-inch PVC and the other appears to be a 2-inch metal pipe.

Suggestions for Future Work

Future work would be to remove the two pipes and redevelop the well by clearing the debris from the bottom of the borehole. Once the redevelopment work is completed it would be recommended to perform a video log, a complete suite of geophysical logs, and a slug test.

The well cover currently consists of a wooden board with a pipe screwed to it. We recommend that a new protective well cover be installed. Either a flush-mount protective cover or a taller 2-3 foot protective cover, which would be visible in case the area were mowed.

KE-46 (Kenosha County WI)

Well Information

USGS Site Number: 423214087503801
USGS Site Name: KE-01/22E/13-0046
WGNHS Well ID: 30000046 (aka: KE-46)

Well Details*
Latitude: 42°32'13.76", Longitude: 87°50'35.58" - NAD83 (see location in *figure 14*)
Kenosha County, Wisconsin, Hydrologic Unit: 04040002
Well depth: 135 feet below land surface
Hole depth: 135 feet below land surface
Land surface altitude: 641.9 feet above NAVD88
Well completed in: "Silurian-Devonian aquifers" (N400SLRDVN) national aquifer
Well completed in: "Niagaran Series" (355NGRN) local aquifer

**Well details included here were obtained from the USGS Groundwater Watch webpage at the time of proposal submittal in May 2016.*

*Additional documentation for this well is included in appendix **C**.*

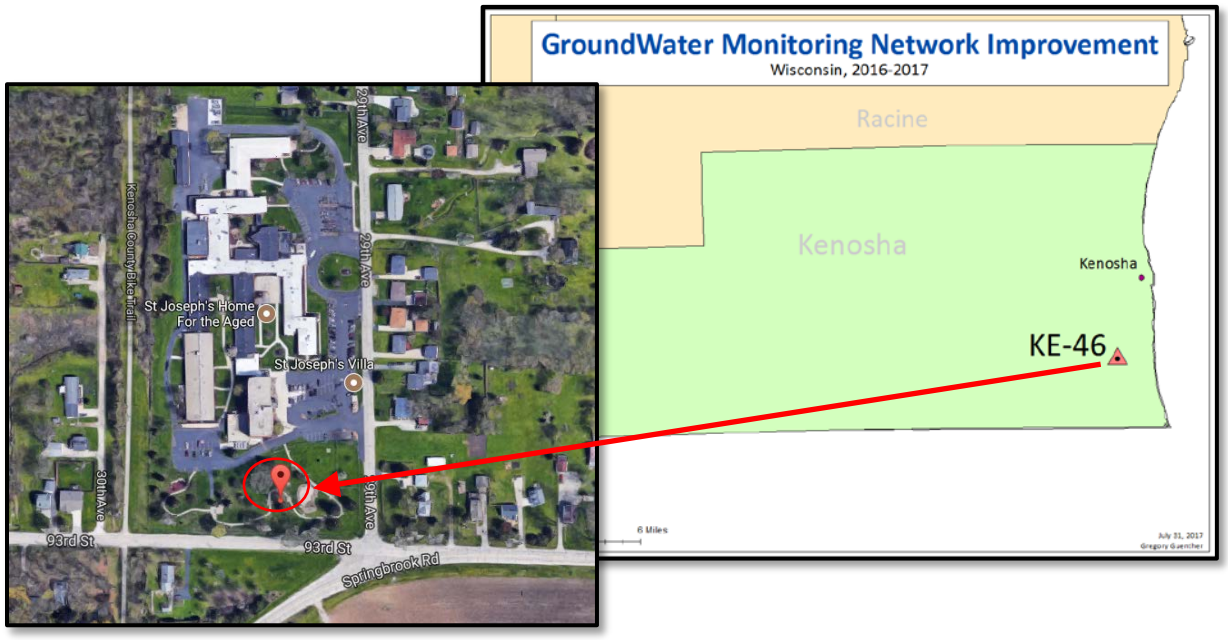


Figure 14: *Well location. Street address closest to location is 9244 29th Ave, Kenosha, WI 53143.*

Well Description

This well was drilled in 1955 to a total depth of 135 feet below land surface (ft-bls) into the Silurian-Devonian aquifer system and has been recording water-level data since 1961. A general site photo is shown in *figure 15*.

Figure 15: *Photo of the general site area.*

Work Plan

The plan was to construct a new weather-proof well house to protect the existing well. No improvement needed to be made to the well itself, only the protective housing. Due to adverse winter conditions the well shelter is critical for maintaining proper function.

Description of Work Completed

WGNHS provided the weather-proof well housing and staff at the USGS Wisconsin Water Science Center installed the housing during a routine visit to this well in late September 2016. Photos of the new housing are attached below in *figures 16 and 17*.

Figure 16: *New housing exterior*

Figure 17: *New housing Interior*

Summary

The well required a replacement shelter/housing to prevent damage due to adverse winter conditions. A protective housing was installed in late September 2016.

Suggestions for Future Work

Although not necessary at this time, future work could include video and geophysical logging to provide more detailed geologic information for this well.

MN-28 (Manitowoc County, WI)

Well Information

USGS Site Number: 440430087420401
USGS Site Name: MN-19/23E/35-0028
WGNHS Well ID: 36000028 (aka: MN-28)

Well Details*

Latitude: 44°04'25.39", Longitude: 87°42'06.15" - NAD83 (see location in *figure 18*)
Manitowoc County, Wisconsin, Hydrologic Unit: 04030101
Well depth: 147 feet below land surface
Hole depth: 147 feet below land surface
Land surface altitude: 682.1 feet above NAVD88
Well completed in: "Silurian-Devonian aquifers" (N400SLRDVN) national aquifer
Well completed in: "Silurian System" (350SLRN) local aquifer
**Well details included here were obtained from the USGS Groundwater Watch webpage at the time of proposal submittal in May 2016.*

Work activities at this well created the following discrepancies with the official well record:

- *Well evaluation confirmed the depth of this well to be 145.8 feet below land surface (ft-bls), and a casing depth of 131 ft-bls.*

*Additional documentation for this well is included in appendix **D**.*

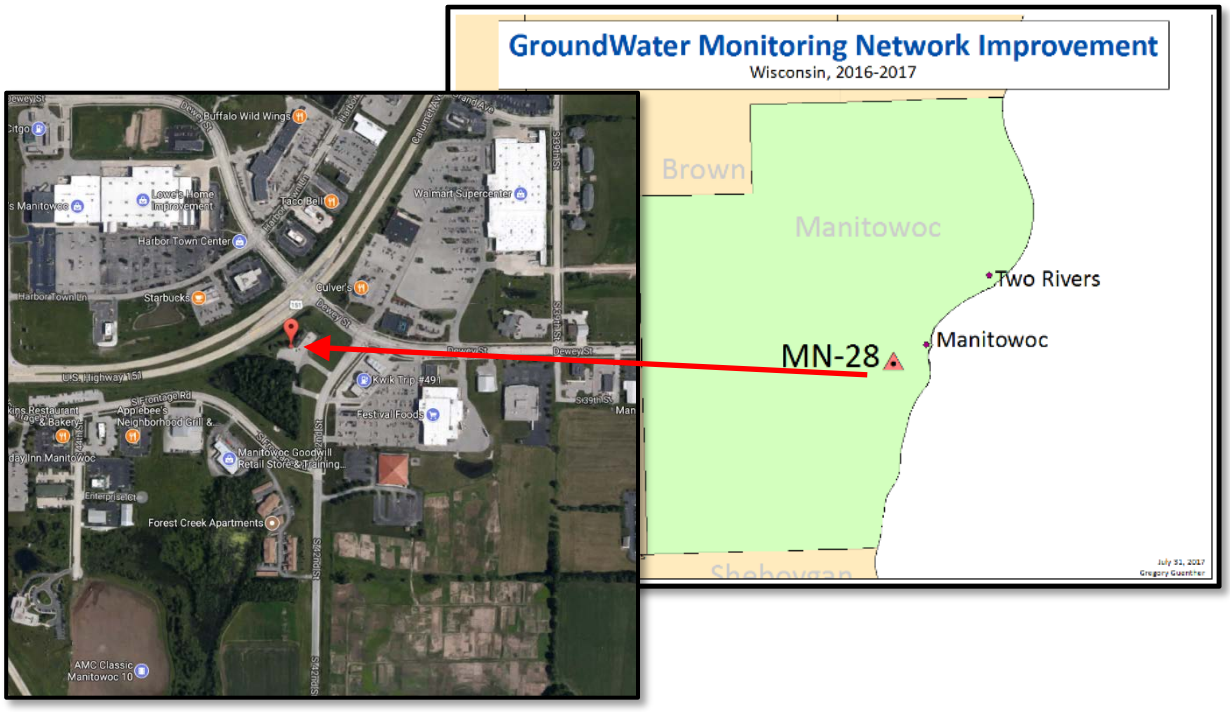


Figure 18: *Well location. Street address closest to location is* 4221 Calumet Ave, Manitowoc, WI 54220.

Well Description

This well was drilled in 1959 to a total depth of 147 feet from land surface into the Silurian-Devonian aquifer system and has been recording water-level data since 1968. Recent field measurements indicate that the bottom 10-feet of the well have filled in with sediment. The well is cased to 131 ft-bls. A general site photo is shown in *figure 19*.

Figure 19: *Photo of the general site area.*

Work Plan

The maintenance and repair needs for this well include redeveloping the well to remove sediment from the bottom, and to perform slug/pump testing to confirm the well's connection to the aquifer following the redevelopment.

Description of Work Completed

The WGNHS established site contact with the Manitowoc Area Visitor and Convention Bureau. The well is located behind the visitor center building. Prior to any work inside the well, a series of slug tests were conducted to assess the well's hydraulic connection with the surrounding aquifer. This initial slug test confirmed that the well is well connected to the aquifer and a graph of the slug test results is included in *figure 20*. The initial slug test showed a typical well response and had a decent connection to the aquifer.

The purpose of the slug test was to check on the hydrologic connection between the well and the surrounding aquifer by displacing the water level in the well and observing how the well recovered from this stress. A properly operating well ought to recover relatively quickly (within a few minutes) and smoothly (no sharp jumps in the recovery curve), while a well with a severely clogged or fouled screen or open interval or having a leaky casing might recover very slowly or in erratic steps. The slug test is performed by first lowering a pressure transducer hanging from a cable down below the water level. Then a slug is swiftly lowered below the water level to displace water in the well. In our case the slug is a bundle of filled PVC pipe. The pressure transducer records the change in water level over time. The data recorded by the transducer is exported to Excel in table form and plotted into a line graph with the water level on the Y-axis and time on the X-axis. This is done to show the water level displacement and equalization for a single slug-in or slug-out measurement. In this way, we can get a rough estimate of the quality of connection to the aquifer. For more accurate results, there are more sophisticated programs to plot the data that take lithology into account.

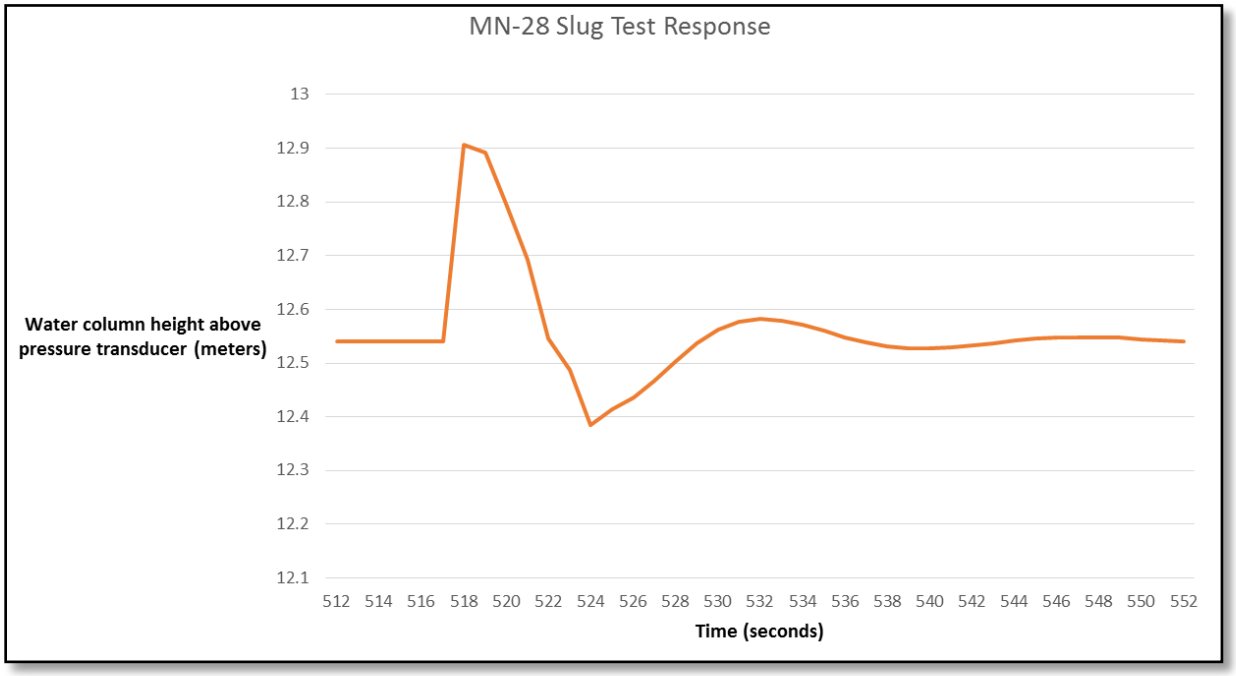


Figure 20: *Well initial response to the slug test. The well recovers within 35 seconds.*

The WGNHS contracted a local drilling firm, Ground Source, to redevelop the well. An initial well depth of 138 ft-bls was measured before the crew began removing sediment from the well on October 17, 2016. The airlift process consisted of a ten-foot steel pipe with ~150 feet of flexible poly tubing lowered to the bottom of the well. Air was then injected through the poly tubing and out the end of the steel pipe using an air compressor at the surface. The added pressure from the air injection forced water and sediment to overflow the casing at the surface. Pictures from the well clean-out process are shown in *figures 21-23*.

Figure 21: *Photo of the air lift process.*

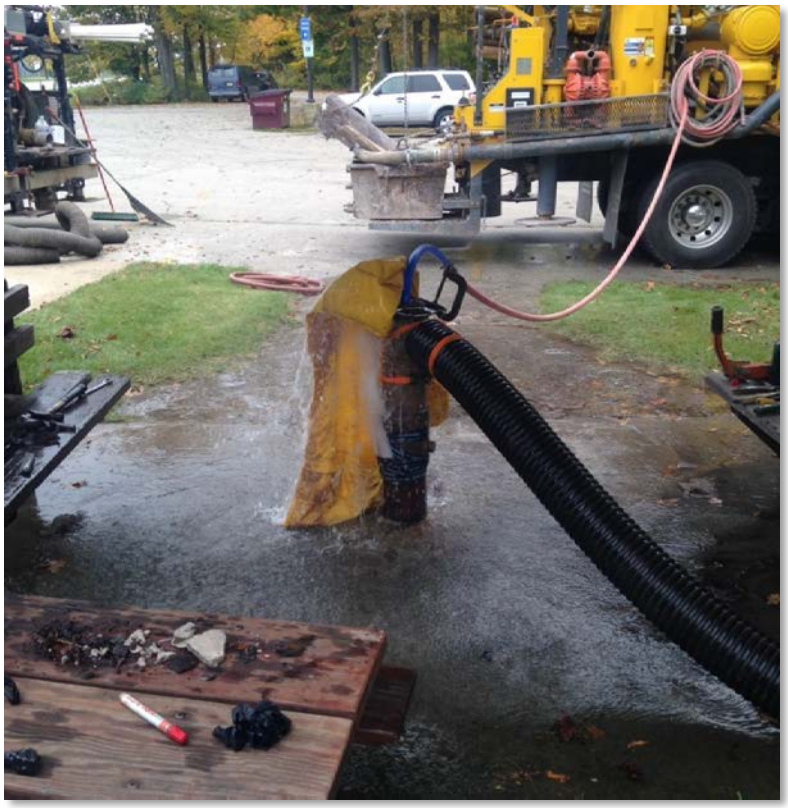


Figure 22: *Air lift process in action.*

Figure 23: *Typical sediment removed from the well during the air lift process. The largest piece of dolomite is just over 3 inches across.*

The redevelopment process also cleans the formation and casing wall because the air, water, and sediment acts like an abrasive on the borehole and casing wall. The redevelopment removed 7.8 feet of sediment from the bottom of the well, increasing the depth to 145.8 ft-bls. Most of the sediment removed appeared to be either rust chips (most likely from the aging steel casing) or dolomite fragments. Photos showing a representative sample of sediment removed from the well are shown in *figure 23*.

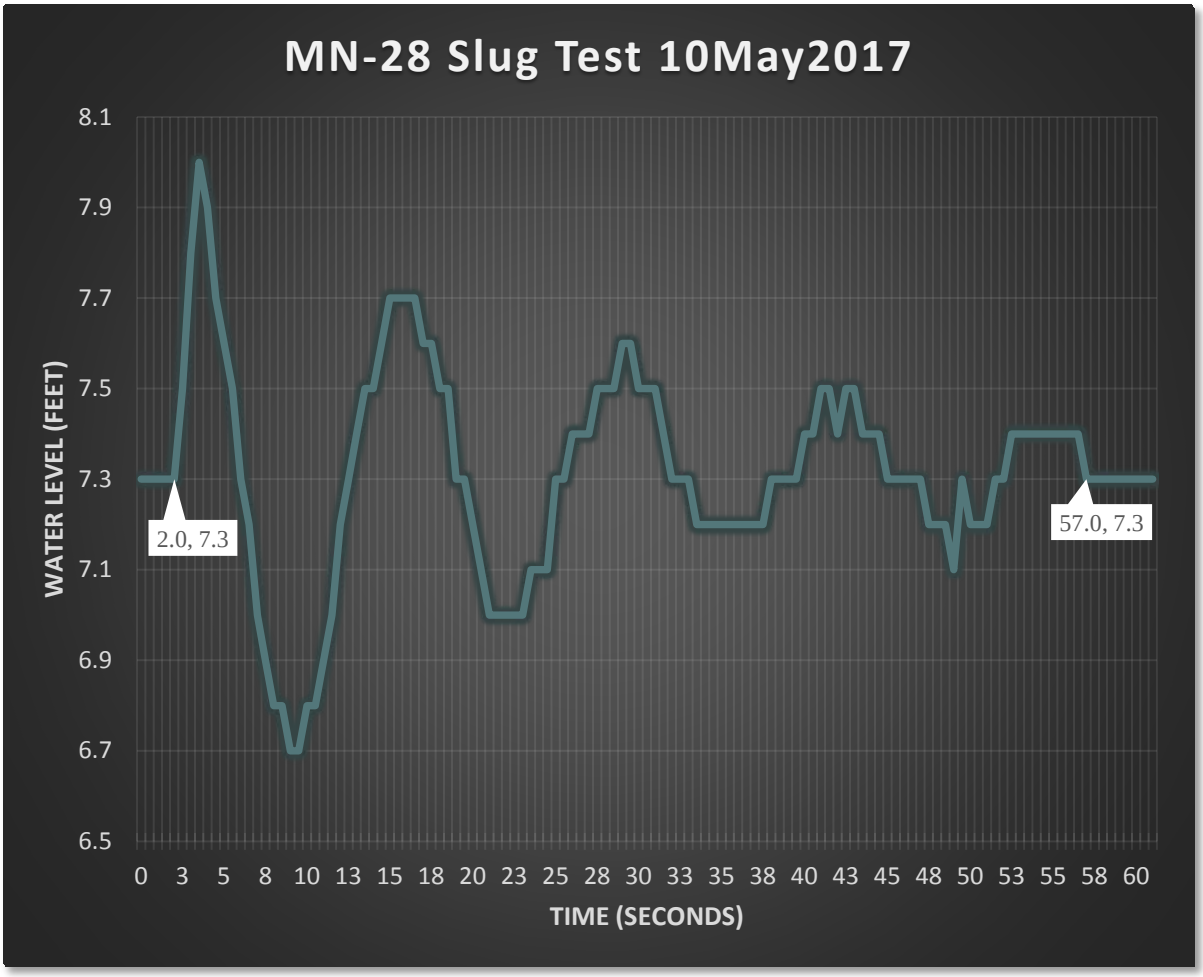


Figure 24: *Slug-in test results after redevelopment. This test had a 55 second recovery time after a 1.3 foot displacement. The depth to water was 24.4 ft.*

The WGNHS performed a video log and a final slug test on May 10, 2017. The slug test is shown above in *figure 24*. The final slug test shows an oscillatory response indicating a strong connection to the aquifer. The force of the slug entering the water causes the water level to raise in the hole and increases pressure at the water level.

The video log shows a casing depth of 131 ft-bls in *figure 25*. In the image at the bottom of the casing there appears to be a bit of deterioration in the steel at the base of the casing, but there appears to be a solid contact and no open void space. This suggests the casing is well seated.

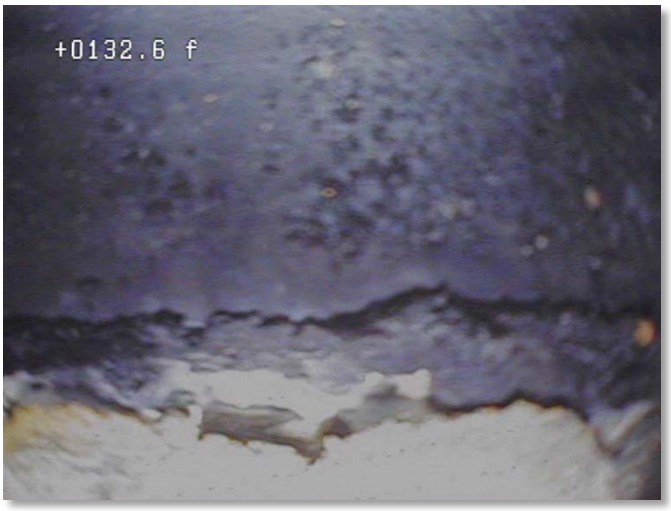


Figure 25: *Video image at the bottom of the casing.*

This well is open to the formation via the many open fractures observed in *figure 26*. The video tool was used in an attempt to retrieve a level logger pressure transducer that was inadvertently dropped in the well during fieldwork in the fall 2016. The presence of the lost level logger at the bottom of this well has been noted in our records in the event that future efforts can be made to remove the pressure transducer.

Figure 26: *Video image showing some of the many open fractures in this borehole.*

The location of the well is ideal for future work as there is plenty of space in the nearby parking lot. The only drawback is the small shelter built above the well that limits a drill rig's access to the well.

Digital versions of the borehole video log and slug test data are archived at the WGNHS and available upon request.

Summary

The goal for this well was to redevelop the well by removing sediment accumulated at the bottom. Sediment was removed from the bottom of the well. A video log was performed to verify the borehole and casing depths. The connection to the aquifer was tested by performing slug tests before and after redevelopment.

Suggestions for Future Work

Ideas for future work include performing a complete suite of geophysical logs and retrieving the fallen level logger.

ML-148 (Milwaukee County, WI)

Well Information

USGS Site Number: 425613088014301
USGS Site Name: ML-06/21E/32-0148
WGNHS Well ID: 41000148 (aka: ML-148)

Well Details*

Latitude: 42°56'12.55", Longitude: 88°01'44.28" - NAD83 (see location in *figure 27*)
Milwaukee County, Wisconsin, Hydrologic Unit: 04040002
Well depth: 180 feet below land surface
Hole depth: 180 feet below land surface
Land surface altitude: 774.6 feet above NAVD88
Well completed in: "Silurian-Devonian aquifers" (N400SLRDVN) national aquifer
Well completed in: "Niagaran Series" (355NGRN) local aquifer
**Well details included here were obtained from the USGS Groundwater Watch webpage at the time of proposal submittal in May 2016.*

Work activities at this well created the following discrepancies with the official well record:

- *The depth of the well was determined to be 173.5 feet below land surface (ft-bls).*
- *The casing of this well was determined to be 43 ft-bls.*
- *The well casing diameter is 6 inches, but the PVC access installed above it has a 4-inch diameter.*

*Additional documentation for this well is included in appendix **E**.*

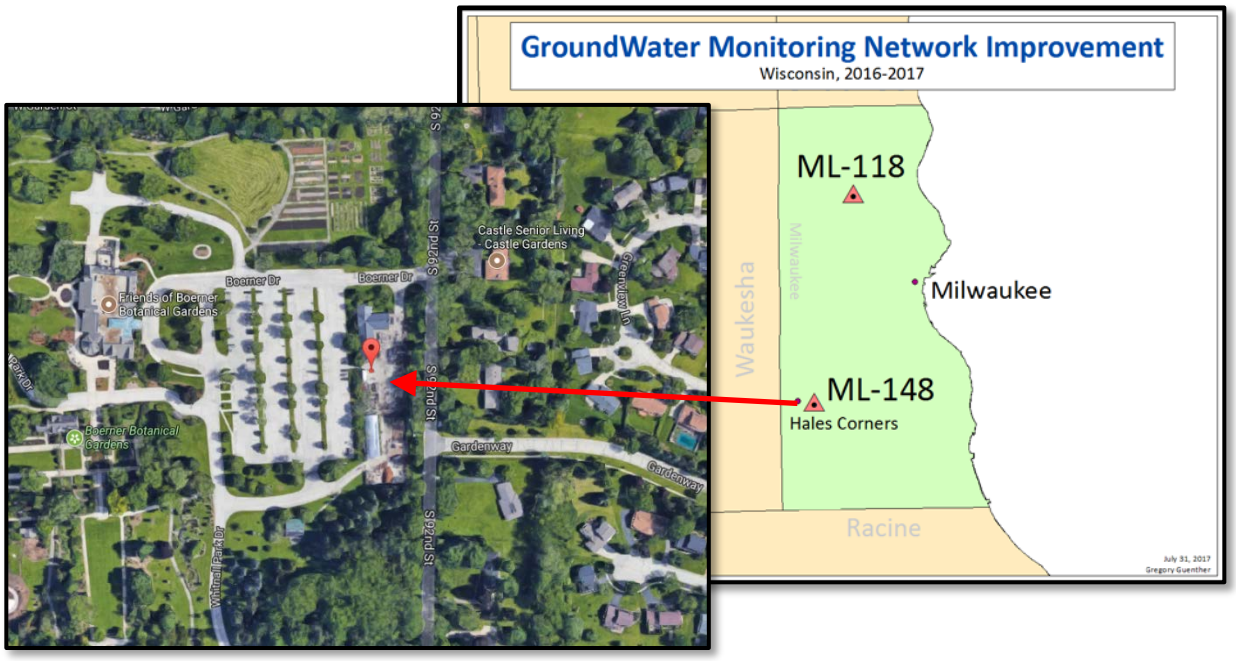


Figure 27: *Well location. Street address closest to location is 5879 S 92nd St, Hales Corners, WI 53130.*

Well Description

This well was drilled in 1933 to a total depth of 180 feet into the Silurian-Devonian aquifer system and has been recording water-level data since 1946. Prior to this investigation, the well was recorded to have a 5-inch diameter casing and casing depth of 46 ft-bls. This investigation showed that the well is in fact a 6-inch diameter casing that extends to 43 ft-bls. A very brief geologic log exists, as well as a geophysical log performed as part of this investigation. A general site photo is shown in *figure 28*.

Figure 28: *Photo of the general site area facing west.*

Work Plan

The original work plan was designed to over-drill and abandon the existing well and replace it with a newly drilled well at the same site. The new well would provide a high-quality monitoring well for years to come and allow us to perform routine maintenance and hydraulic tests to confirm the connection of the well to the surrounding aquifer system. As described below in the Description of Work section, this work plan was modified over the course of the project due to the discovery of historical well records which provided evidence that the existing well could in fact be rehabilitated. The historical well records described a ¼-inch access port attached to a plate that was welded to the top of the casing.

Description of Work Completed

A site access agreement with Milwaukee County was established. Agreed terms for a permit allowing both abandonment and re-drilling of ML-148 can be found in *appendix **E: Milwaukee Co Parks right of entry permit***. This was needed for the original work plan to abandon and drill a new well.

The records found in the preliminary stages of the evaluation suggested a site visit to verify the well condition and access. (*appendix **E: ML-148_Original USGS Well Schedule***) This record provided evidence that the ¼-inch pipe installation was attached to the well header. Due to the very small ¼-inch access pipe, we have not been able to evaluate the condition of the well, service the well, or perform aquifer testing. A drawing of the hole at land surface is in *figure 29*.

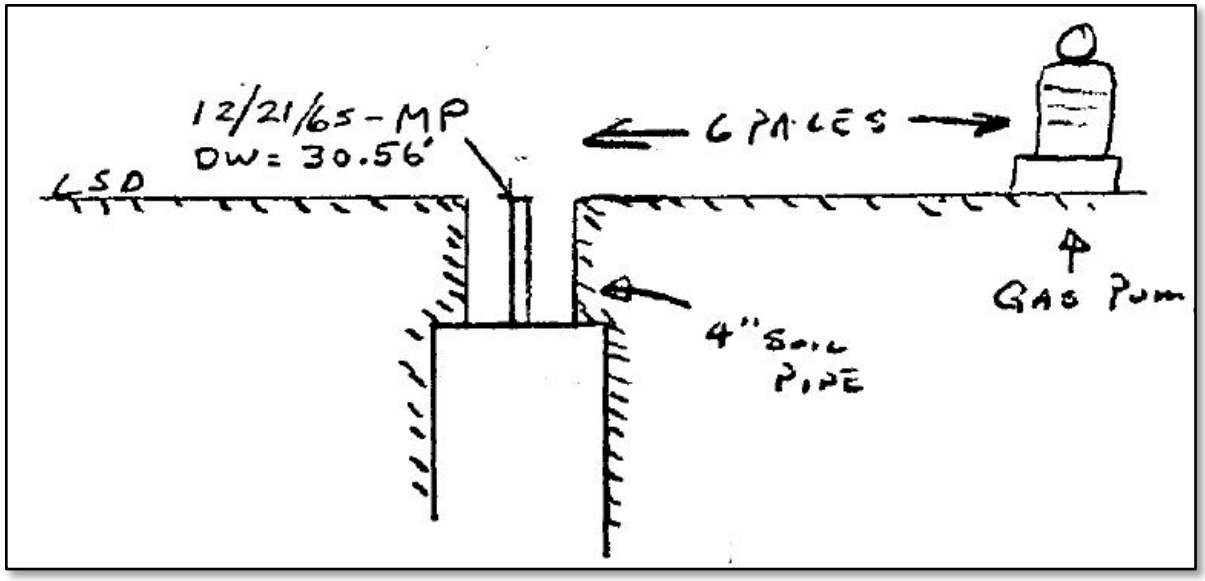


Figure 29: *Diagram of Small Diameter pipe installation from 1965.*

An updated site access permit was requested/granted from Milwaukee County Parks. The scope of work changed to reflect the updated work plan, and the expiration date was changed to allow more time for work to be completed. On January 31, 2017, the WGNHS visited the site to evaluate the well and determine what measures could be taken to rehabilitate it. The small man-hole cover or protective flush-mount, which did not seal properly, is located within 10 meters of the botanical garden herbicide/pesticide storage shed and the on-site gasoline storage tank.

The historical records in conjunction with the visit to the site led to a decision that we should rehabilitate the existing well, rather than abandon it and replace it with a new boring. The WGNHS decided to remove the steel plate and the ¼ inch access port from the well, install a well casing extension, and a new protective flush-mount cover.

On March 23, 2017, the WGNHS repaired the well access and replaced the protective cover. The flush-mount cover was removed and the cement flange was pulled out of the hole providing better access and more space to work around the well head. The diameter of the hole in the pavement was widened and debris was removed from the hole above the casing using a wet/dry vacuum. The upper several inches of the 6-inch casing were also exposed by vacuuming dirt and debris from the bottom of the hole. Once the hole was cleaned out, an angle grinder was used to cut off the steel plate that was welded to the top of the well casing. With the well open, WGNHS staff performed a suite of geophysical logs (i.e., optical borehole imaging, temperature, fluid conductivity, gamma, resistivity, and caliper), a borehole video log and a slug test. The casing depth was found to be (43 ft-bls) and approximately 7 feet of sediment is estimated to have accumulated at the bottom of this 180-foot well. Photographs of the rehabilitation in progress are in *figures 30-35*.

Figure 30: *Removal of existing protective flush-mount.*

Figure 31: *Steel plate with ¼-inch access port.*

Figure 32: *Angle grinder being used to cut through steel plate on well.*

Figure 33: *Well after the angle grinding was completed.*

Figure 34: *Photo of 6-inch steel casing reduced to 4-inch PVC and raised closer to land surface.*

Figure 35: *Annular space filled with pea-gravel and new protective flush-mount cover cemented in place.*

The purpose of the slug test was to check on the hydrologic connection between the well and the surrounding aquifer by displacing the water level in the well and observing how the well recovered from this stress. A properly operating well ought to recover relatively quickly (within a few minutes) and smoothly (no sharp jumps in the recovery curve), while a well with a severely clogged or fouled screen or open interval or having a leaky casing might recover very slowly or in erratic steps. The slug test is performed by first lowering a pressure transducer hanging from a cable down below the water level. Then a slug is swiftly lowered below the water level to displace water in the well. In our case the slug is a bundle of filled PVC pipe. The pressure transducer records the change in water level over time. The data recorded by the transducer is exported to Excel in table form and plotted into a line graph with the water level on the Y-axis and time on the X-axis. This is done to show the water level displacement and equalization for a single slug-in or slug-out measurement. In this way, we can get a rough estimate of the quality of connection to the aquifer. For more accurate results, there are more sophisticated programs to plot the data that take lithology into account. Slug test results confirmed that the well is in good hydraulic connection with the Silurian aquifer (*figure 36*).

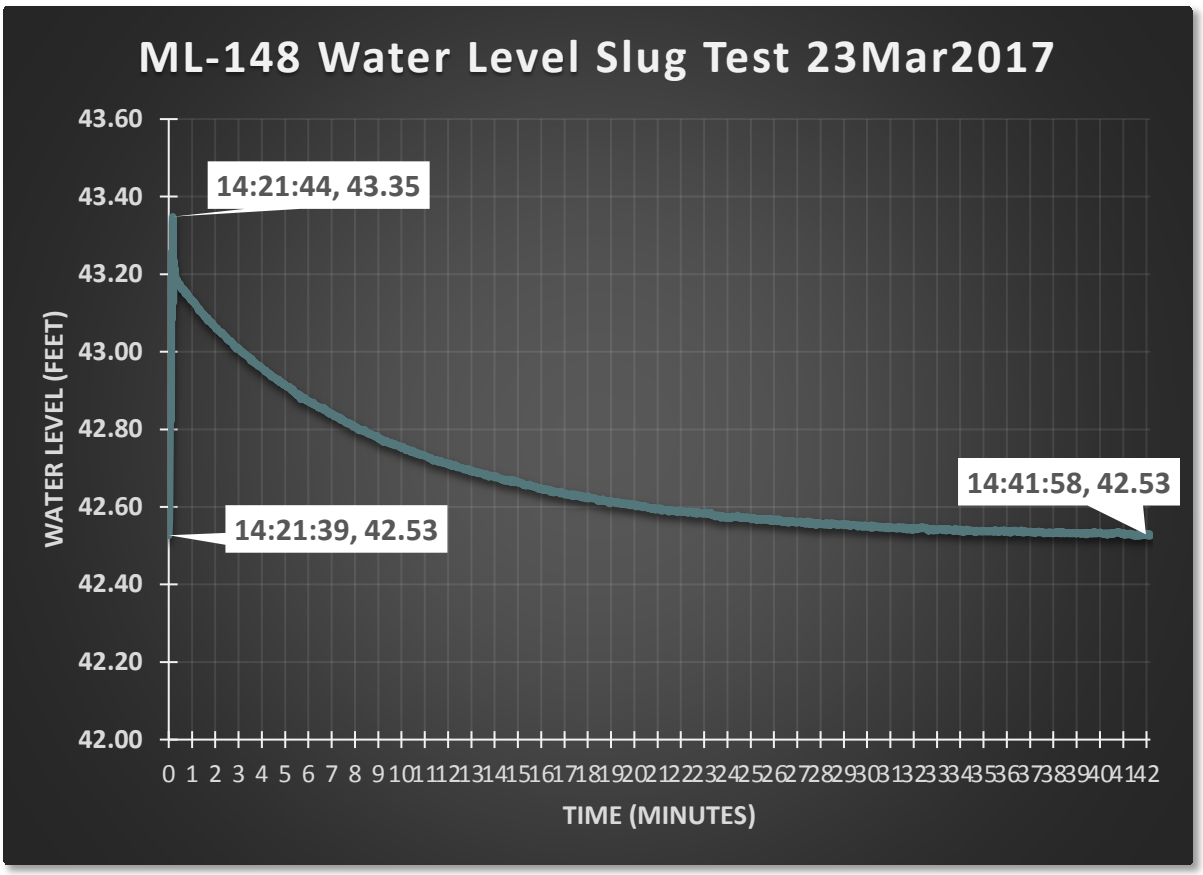


Figure 36: *Slug-in test results.*

The well took just over 20 minutes to recover from the slug insertion. This is an edited graph that has been normalized for an inadvertent depth change of the level logger. The data before and after has been truncated to provide an accurate representation on the quality of connection to the aquifer. Being that the aquifer is a Silurian dolomite, a slow rate of recovery is expected.

Once the condition of the well was confirmed, a 4-inch PVC riser pipe (with screw-top) was attached to the top-of-casing with a 6-inch to 4-inch rubber coupling and attached with hose clamps. This was done

to extend the top of well closer to land surface and make the well head more secure in the event of any spill near the well. A new metal flange with a protective flush-mount cover was finally cemented in place.

By extending the well head closer to land surface the former measuring point (MP) needed to be corrected upward. The new MP value (top of PVC riser pipe) was determined to be -0.54 feet, a negative value since it is located below the land-surface datum. A collection of photos that were taken during well rehabilitation are shown below in *figures 37-39* and are included in *appendix* ***E: Rehab photos March, 2017*****.**

Digital versions of the borehole video log, geophysical log, and slug test data are archived at the WGNHS and available upon request.

Figure 37: *The updated access with the cover off.*

Figure 38: *The measure from MP to LSD (-0.54 ft.).*

Figure 39: *The updated access with the cover on.*

Summary

The goal for this well was to improve access to the aquifer for the purposes of reliably measuring water-levels and performing routine maintenance and well evaluations at this site. The original proposal sought to over-drill and abandon the existing well and replace it with a new nearby well, constructed similarly to ML-148. After finding historical well records, with a sketch of the well-head construction, the work plan was modified to instead rehabilitate the existing well.

The flange was removed and the annular space around the well was cleaned of debris. The steel plate on top of the well was removed and the casing was outfitted with a pipe to make it more secure and raise it closer to the land surface. A new metal flange was installed along with a high-quality flush-mount protective cover. A complete suite of geophysical logs, a video log, and a slug test were performed to confirm the condition of the well and verify the connection of the well to the surrounding aquifer. The measuring point (MP) value at the top of the well casing was also corrected to account for the modified casing height.

Suggestions for Future Work

Ideas for future work could include sediment removal from the bottom of the well followed by another round of geophysical logging and slug tests to confirm the condition and connectedness of the well.

OU-416 (Outagamie County, WI)

Well Information

USGS Site Number: 443353088194201
USGS Site Name: OU-24/18E/08-0416
WGNHS Well ID: 45000416 (aka: OU-416)

Well Details*

Latitude: 44°33'52.71", Longitude: 88°19'42.57" - NAD83 (see location in *figure 40*)
Outagamie County, Wisconsin, Hydrologic Unit: 04030202
Well depth: 740 feet below land surface
Hole depth: 740 feet below land surface
Land surface altitude: 905.9 feet above NAVD88
Well completed in: "Cambrian-Ordovician aquifer system" (S300CAMORD) national aquifer
Well completed in: "Sandstone Aquifer" (300SNDSA) local aquifer
**Well details included here were obtained from the USGS Groundwater Watch webpage at the time of proposal submittal in May 2016.*

Work activities at this well created the following discrepancies with the official well record:

- *After backfilling, the well depth is 261 feet below land surface (ft-bls).*

*Additional documentation for this well is included in appendix **F**.*

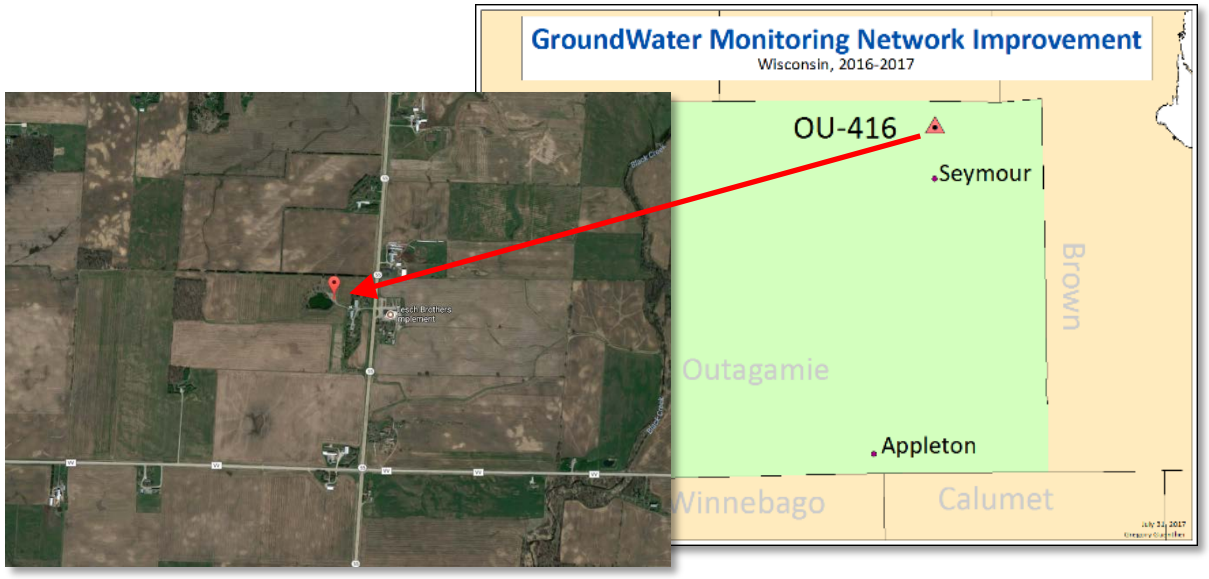


Figure 40: *Well location. Street address closest to location is 9042 WI-55 Seymour, WI 54165.*

Well Description

This well was drilled in 1992 to a total depth of 740 ft-bls into the Cambrian-Ordovician aquifer system and has been providing water-level data since 1992. The only geologic log and well construction details published for this well are from WGNHS Information Circular 75, "Regional Groundwater Flow System between the Wolf and Fox Rivers near Green Bay, Wisconsin". A diagram of OU-416 as included in

WGNHS IC-75 is included in *figure 41*. The well was originally constructed with a shallow casing on the order of 20 feet depth. Arsenic detections in a neighboring well shortly after construction of OU-416 led to concerns that arsenic was becoming mobilized from the Glenwood Formation near the top of the borehole wall (W.G. Batten, oral commun., 2016). Working in close coordination with the WDNR during the 1990s, USGS/WGNHS researchers grouted a smaller-diameter PVC pipe into the existing casing to a depth of approximately 148 ft-bls, isolating the Glenwood Formation and top of the St. Peter Formation (W.G. Batten, oral commun., 2016). A general site photo is shown in *figure 42*. A picture showing the original 6-inch steel casing with the new 3-inch PVC pipe grouted into place is included in *figure 43*.

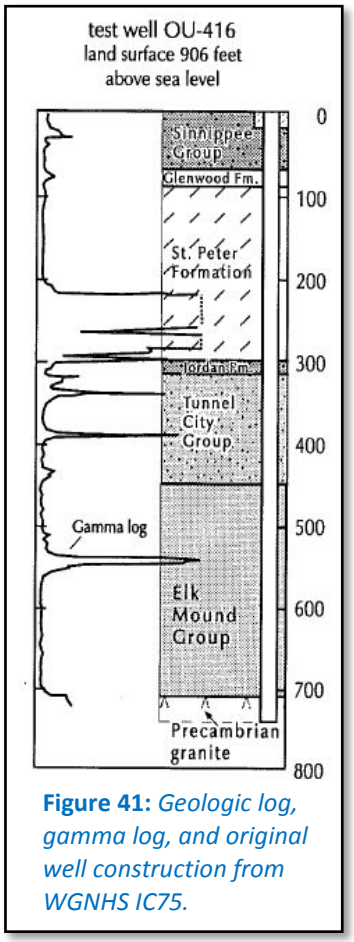


Figure 41: *Geologic log, gamma log, and original well construction from WGNHS IC75.*

Figure 42: *Photo of the general site area.*

Figure 43: *Photo showing the 3-inch pipe (called liner elsewhere) installed within the original casing.*

Work Plan

In 2015, this well was identified as having a blockage at roughly 148 ft-bls and had several maintenance and repair needs including evaluation and repair of the plugged well, redevelopment of the well, and slug testing to confirm the well's connection to the aquifer following redevelopment.

Description of Work Completed

This well is located inside several small concrete barriers in the center of a gravel lot behind a storage barn and next to a holding pond used by the fire department. The well is easy to access and is marked by a 10-foot white PVC pipe. The WGNHS contracted a local drilling company, Ground Source, and they removed the blockage on December 8, 2016. On January 30, 2017, WGNHS staff recorded a video log and determined the well was fouled with clay in the lower portions of the hole as seen in *figure 44*.

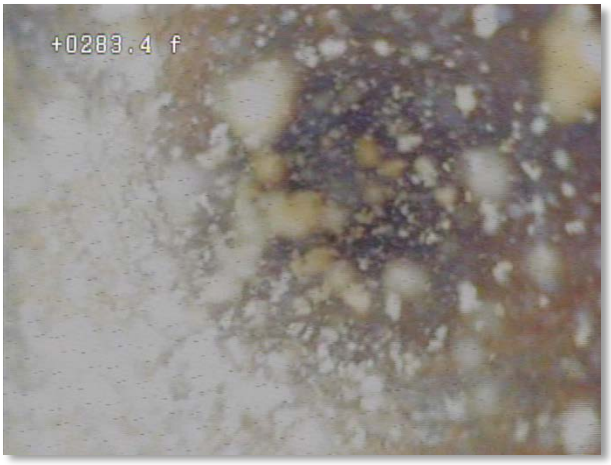


Figure 44: *Image from video log showing clay fouling at 281.3 ft-bls. The depth in the video is measured from the MP at the top of the casing.*

The bottom of the PVC liner was also confirmed to be at a depth of 148 ft-bls. Based on this video log, the work plan was updated to backfill the well from the bottom, at 639 ft-bls, up to 261 ft-bls. By backfilling the monitoring well, the clay fouling would be isolated, the well would become easier to maintain, and the monitoring interval would be restricted to a single aquifer, the St. Peter sandstone aquifer.

WGNHS personnel backfilled the lower 378 feet of the well, from 639 ft-bls to 261 ft-bls on May 4, 2017. With the bottom of the PVC liner at 148 ft-bls, the open interval of the well is 115 feet. A modified diagram showing these updated well depths is included below in *figure 45*. Depths and types of backfill are detailed below:

263-261 ft-bls Sand to help prevent bentonite expansion
266-263 ft-bls Bentonite chip layer
304-266 ft-bls pea gravel
304-312 ft-bls Bentonite chip layer
312-639 ft-bls pea gravel

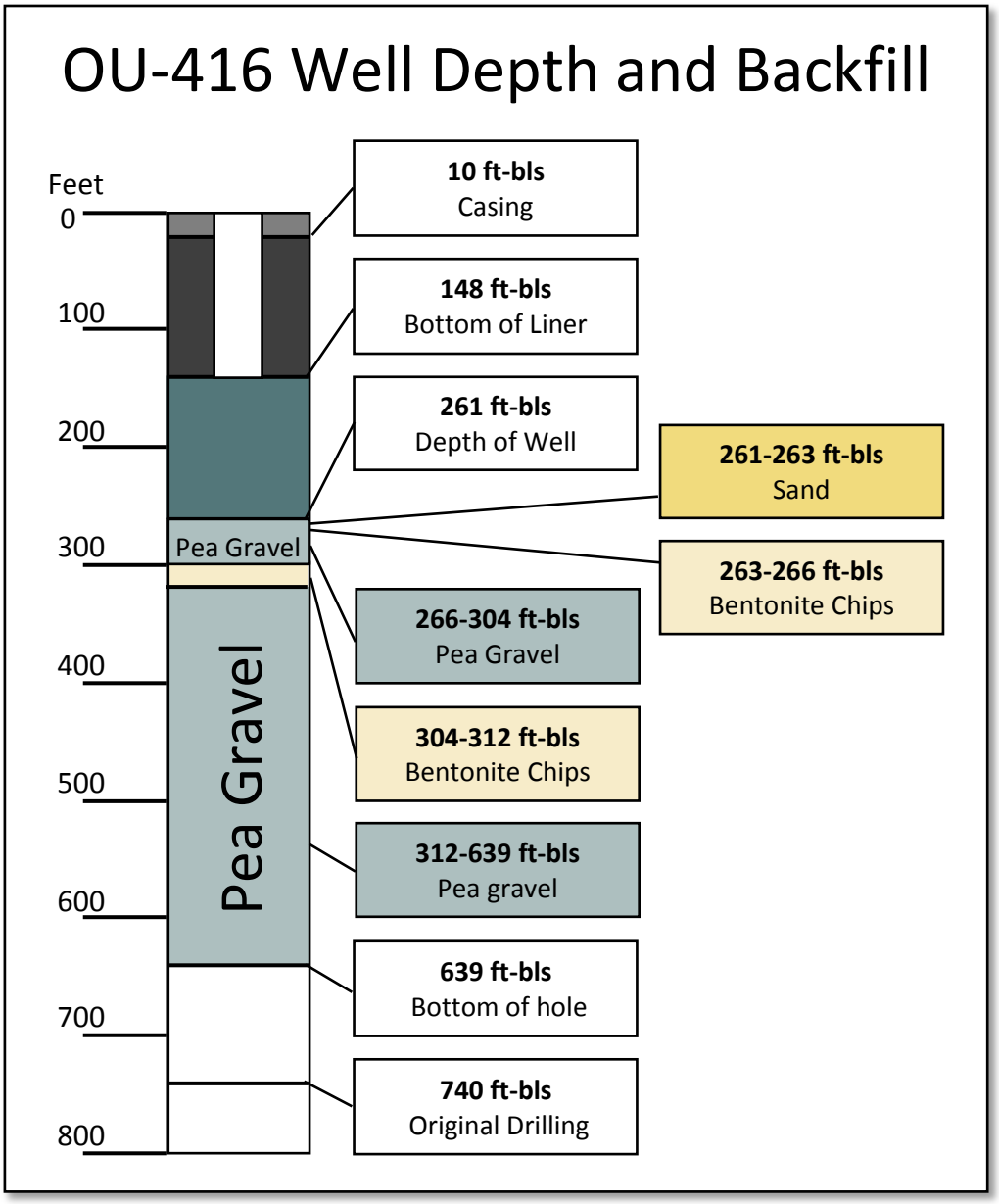


Figure 45: *Diagram of well depth and backfill.*

Slug tests were performed before and after backfilling the well. The results are in *figure 46*. The pre-backfill slug test had an 11 second recovery time and the post-backfill slug test had an 18 second recovery time after a displacement of 2.7 ft. The backfill increased the recovery time, but the connection to the aquifer is still strong. The difference in water level between the two measurements is due to the depth the level logger was lowered to. Depth to water was 91.5 ft-bls.

The purpose of the slug test was to check on the hydrologic connection between the well and the surrounding aquifer by displacing the water level in the well and observing how the well recovered from this stress. A properly operating well ought to recover relatively quickly (within a few minutes) and smoothly (no sharp jumps in the recovery curve), while a well with a severely clogged or fouled screen or open interval or having a leaky casing might recover very slowly or in erratic steps. The slug test is performed by first lowering a pressure transducer hanging from a cable down below the water level.

Then a slug is swiftly lowered below the water level to displace water in the well. In our case the slug is a bundle of filled PVC pipe. The pressure transducer records the change in water level over time. The data recorded by the transducer is exported to Excel in table form and plotted into a line graph with the water level on the Y-axis and time on the X-axis. This is done to show the water level displacement and equalization for a single slug-in or slug-out measurement. In this way, we can get a rough estimate of the quality of connection to the aquifer. For more accurate results, there are more sophisticated programs to plot the data that take lithology into account.

Digital versions of the borehole video log and slug test data are archived at the WGNHS and available upon request.

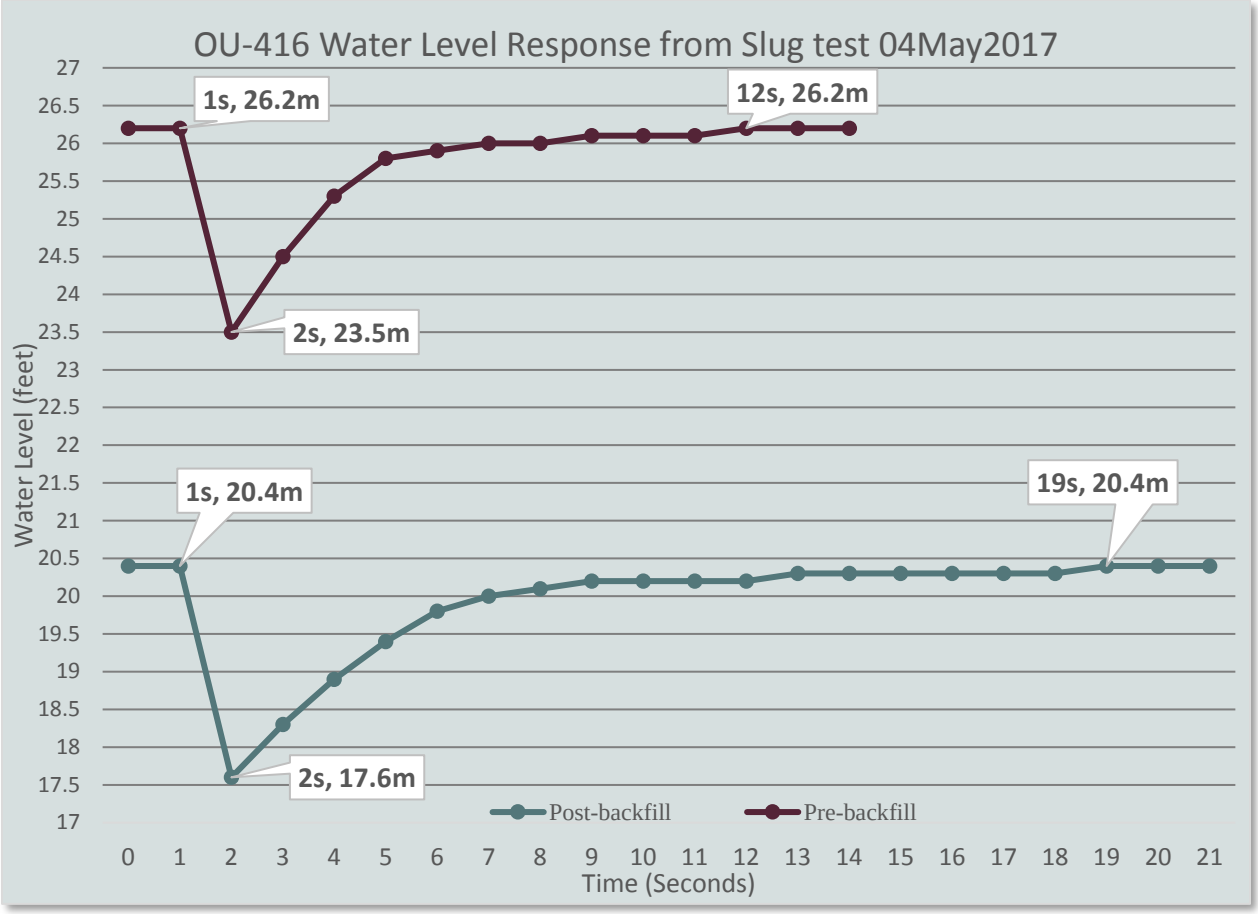


Figure 46: *Slug-out test results pre-backfill and post-backfill.*

Summary

The goal was to redevelop the well and verify aquifer connectivity. The obstruction was cleared and the well was backfilled to isolate clay fouling at the base of the well, simplify well maintenance, and restrict monitoring to a single aquifer, the St. Peter sandstone. Slug testing confirmed a good hydraulic connection to the St. Peter aquifer.

Suggestions for Future Work

Possible future work includes recording a video log of the well after settling to verify well cleanliness and backfill condition.

WW-09 (Walworth County, WI)

Well Description

USGS Site Number: 424004088440601
USGS Site Name: WW-03/15E/33-0009
WGNHS Well ID: 65000009 (aka: WW-9)

Well Details*

Latitude: 42°40'04.10", Longitude: 88°44'04.56" - NAD83 (see location in *figure 47*)
Walworth County, Wisconsin, Hydrologic Unit: 07090001
Well depth: 287 feet below land surface
Hole depth: 287 feet below land surface
Land surface altitude: 967.5 feet above NAVD88
Well completed in: "Silurian-Devonian aquifers" (N400SLRDVN) national aquifer
Well completed in: "Sinnipee Group" (365SNNP) local aquifer
**Well details included here were obtained from the USGS Groundwater Watch webpage at the time of proposal submittal in May 2016.*

Work activities at this well created the following discrepancies with the official well record:

- *The depth of the well after redevelopment is 261.7 feet below land surface (ft-bls).*
- *The video log confirmed a casing depth of 202 ft-bls.*
- *Evaluation confirmed this well has a 5-inch diameter casing.*

*Additional documentation for this well is included in appendix **G**.*

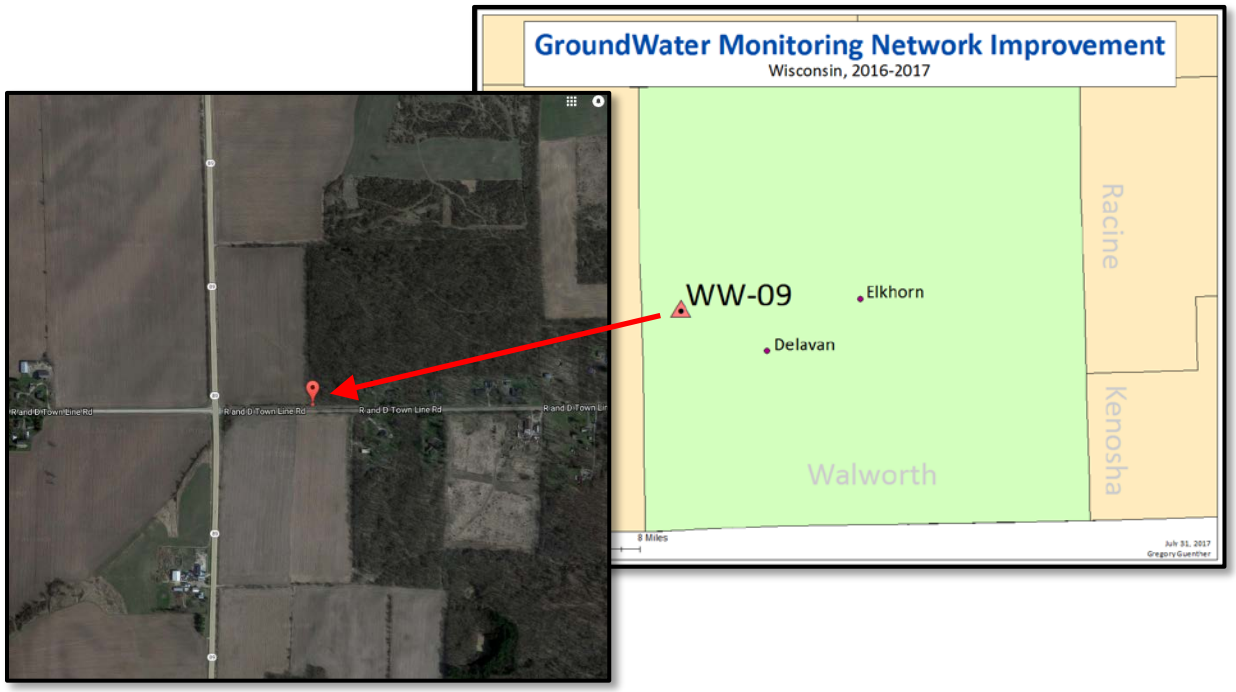


Figure 47: *Well location. Street address closest to location is W8802 W Town line Rd Whitewater, WI 53190.*

Well Description

This well was drilled in 1920 to a total depth of 287 feet into the Silurian-Devonian aquifer system and has been recording water-level data since 1947. Neither a well construction record nor geologic log are available for this well. A small windmill was once located on the well platform. A general site photo is shown in *figure 48*.

Figure 48: *Photo of the general site area.*

Work Plan

Field measurements in 2016 indicated that the bottom 36-feet of the well was filled in with accumulated sediment. The maintenance and repair needs identified for this well included redevelopment of the well to remove sediment from the bottom and perform slug testing to confirm the well's hydraulic connection to the aquifer.

Description of Work Completed

The WGNHS contacted the site owner and performed an initial site visit in September 2016. During this visit, it was determined that a tree was obstructing access to the well for well redevelopment. The property owner was notified and their caretaker removed the overhanging tree and surrounding brush on January 25, 2017, creating access to the well head. A new protective well cap was also installed to improve the access and secure the well.

WGNHS contracted with Aqua Well and Pump to redevelop the well and remove sediment accumulated at the base of the well. The redevelopment work was performed in late January 2017 and removed 3.7 feet of sediment from the bottom of the well. The depth of the well was previously recorded as 258 ft-bls, and after redevelopment is now 261.7 ft-bls. The small amount of sediment removed from the well suggests that the original well depth was not accurately measured. The bottom of the well shows the water is clear until a depth of roughly 254 feet where it becomes cloudy due to fine sediment that has not yet settled from the redevelopment. This can be seen in *figure 49*.

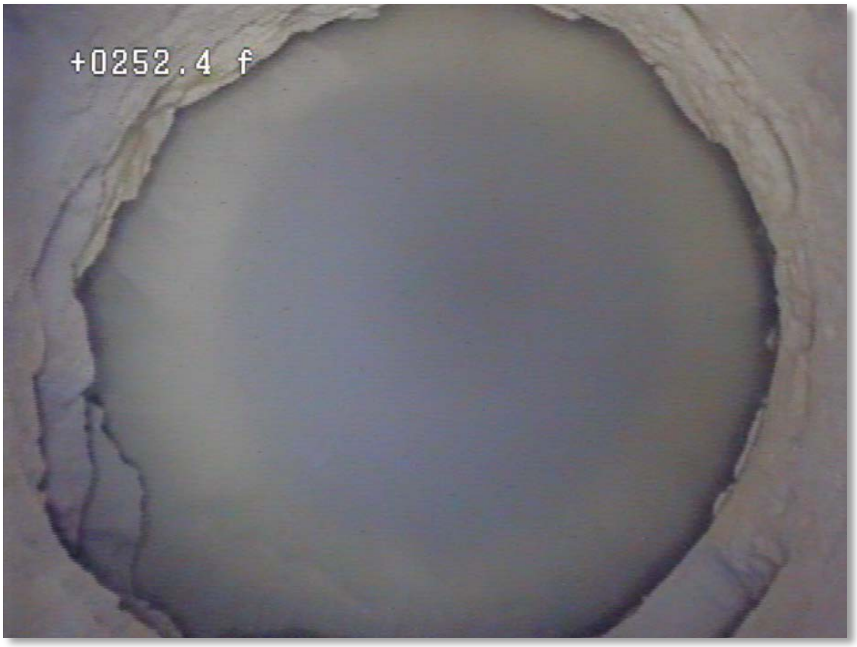


Figure 49: *Bottom of the well.*

The WGNHS performed a video log and slug test on February 15th, 2017. The video log confirmed a casing depth of 202 ft-bls, previously recorded as 287 ft-bls and showed that the borehole wall is relatively clean and free of biofilms or mineral deposits. The sharp contact between the bottom of casing and bedrock indicate the casing is firmly seated in bedrock (*figures 50 and 51)*. Furthermore, the absence of observed groundwater flow into the well at the base of the casing suggests the well will not be compromised by preferential flow.

Figure 50: *Base of steel casing showing good contact with the carbonate bedrock. Casing and borehole wall appear clean.*

Figure 51: *Base of steel casing side view at 202 ft-bls.*

The purpose of the slug test was to check on the hydrologic connection between the well and the surrounding aquifer by displacing the water level in the well and observing how the well recovered from this stress. A properly operating well ought to recover relatively quickly (within a few minutes) and smoothly (no sharp jumps in the recovery curve), while a well with a severely clogged or fouled screen or open interval or having a leaky casing might recover very slowly or in erratic steps. The slug test is performed by first lowering a pressure transducer hanging from a cable down below the water level. Then a slug is swiftly lowered below the water level to displace water in the well. In our case the slug is a bundle of filled PVC pipe. The pressure transducer records the change in water level over time. The data recorded by the transducer is exported to Excel in table form and plotted into a line graph with the water level on the Y-axis and time on the X-axis. This is done to show the water level displacement and equalization for a single slug-in or slug-out measurement. In this way, we can get a rough estimate of the quality of connection to the aquifer. For more accurate results, there are more sophisticated programs to plot the data that take lithology into account.

A slug test was only performed after the redevelopment and it confirmed that the well is in good hydraulic connectivity with the aquifer. *Figure 52* shows the water-level data collected during the slug test. The oscillation of the water level for approximately one minute after slug-in displacement indicates a strong connection to the aquifer. This is reinforced by the fracture openings in the borehole wall as seen in the previous images.

Digital versions of the borehole video log and slug test data are archived at the WGNHS and available on request.

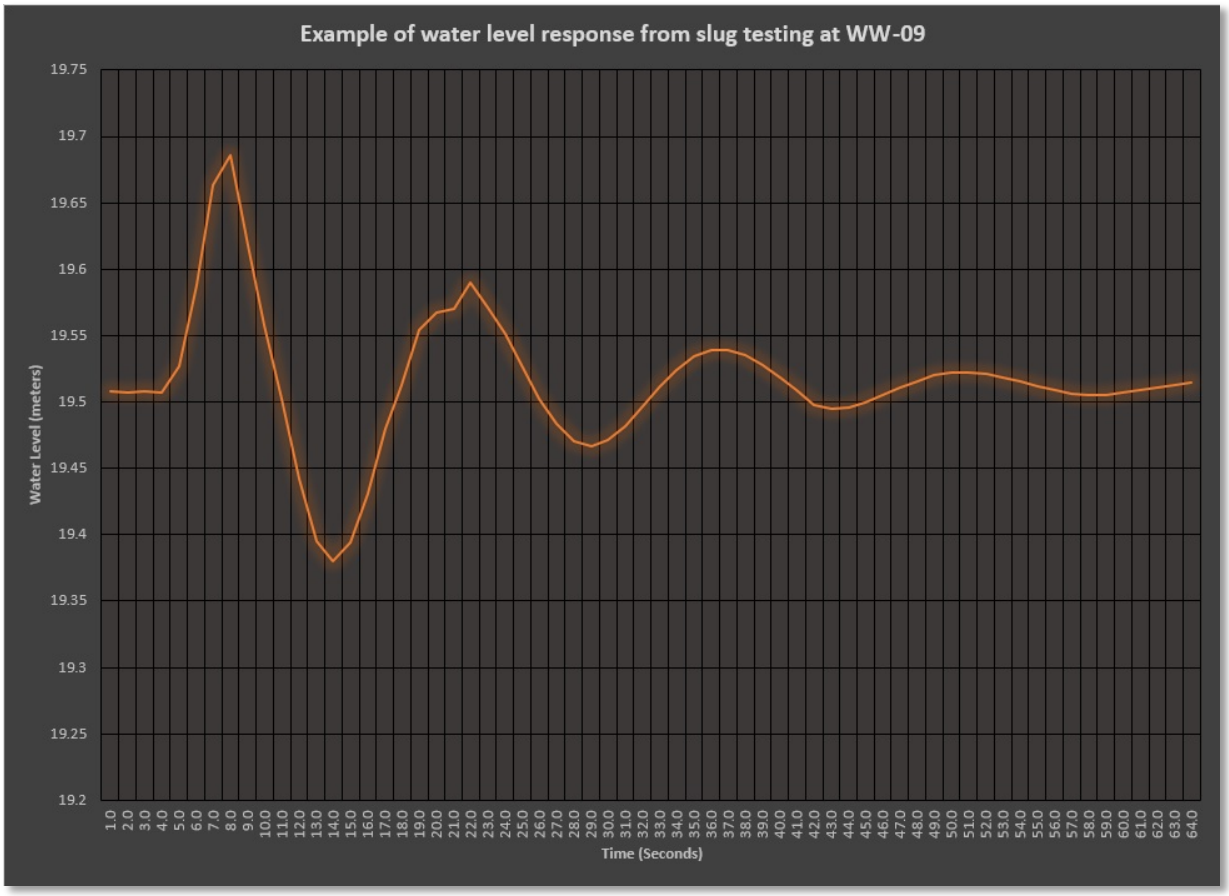


Figure 52: *Graph of slug-in test data.*

Summary

The goal was to redevelop the well and verify the hydraulic connection to the aquifer. The well had 3.7 feet of sediment removed during redevelopment. A slug test and video log verified the aquifer connection and depth and integrity of the steel casing. A new protective well cap has been installed to improve the access and secure the well.

Suggestions for Future Work

Ideas for future work include performing a complete suite of geophysical logs to improve our understanding of the hydrogeology for this monitoring well.

APPENDIX A OF REFERENCE DOCUMENTS
DN-1297

USGS Basic Data and Maps 1981
USGS personnel went through in 1980 to combine observation well records

USGS Water Resources Water Level Records 1978-1986
USGS water level measurements from 1982 to 1983, handwritten, DN-1297 was once 1099

Alex Zaporozec City of Madison Static Water Levels 1982
Alex Zaporozec requested the water level measurements 1978-1982 from the City of Madison

Alex Zaporozec Graphs of Water Levels 1978-1999
water levels graphed onto paper

DN-1297 Geophysical log 2017
Gamma log at 10ft/min and 3ft/min

DN-36 Geologic log 1924
Nearby well Geologic log

DN-47 Geologic log 1924
Nearby well Geologic log

DN-6067 Geophysical log 2012
Nearby well Geophysical log

BASIC DATA ON WATER-LEVEL OBSERVATION WELL

Well number 1297 (former 1099) Well name

Owner

Location (Co., T/R.sec)

Land surface altitude Topographic setting

Drainage basin

distance to the nearest perennial stream:

WELL DATA

Depth Date drilled

Casing depth

Screened interval

Diameter

Aquifers open to well

Geologic log available?

Construction report available?

Use of well Unused

Access to measure well

Other logs or data available

NEAREST SUPPLEMENTAL DATA POINTS

Precipitation stations

Streamgaging stations

Observation wells

Other

EXISTING RECORD

Measuring point (description) LSD: Elev.:

Measuring equipment

Frequency of measurement

Period of record --

Started (date) 1st measurement: ft LSD

Ended (date)

Volume of missing record

Recorded by _____ on _____


Second Point
Picnic Point
MADISON
University Bay
Pumping Station
UNIVERSITY OF WISCONSIN
Veterans Hospital
Tower
High Sch
State Capitol
Lincoln Sch
Main Well
Waterworks
Randall Sch
High Sch
Washington Sch
St James Sch
Longfellow Sch
Hospital
Edgewood College
Vilas Park
Caging Sta
Brittingham Park
LAKE MONONA
Monona Bay
Law Park
FOREST HILL CEMETERY
Holy Cross Cem
Dudgeon Sch
Playground
Lake Wingra
Franklin Sch
Franklin Field
Armory
Fitchburg Field
Fairground
Olin Park
Murphy
UNIVERSITY OF WISCONSIN ARBORETUM
Dn51
Dn1094
Dn45
Dn7
Dn5
Dn1099
Dn1297
#1
#2
#17
#18
#19
BM 878
BM 877
BM 917
BM 874
BM 863
BM 802
UNIVERSITY AVE
STATE ST
GULF
PACIFIC
SPRING ST
DRAKE ST
ERIN ST
LAKESIDE
DANE
MONROE
ILLINOIS
CENTRAL
FISHER
PARK
MILLS
RANDALL
ADAMS
ALLEN
LATHROP
FARLEY
FRANCES
GORHAM
BROOM
WASHINGTON
WILSON
BUTLER
BLOUNT
PINCKNEY
CARROL
C M St P & P


Lock and Dam
Tenney Park
Picnic Point
Gidding Park
Lapham Sch
James Madison Park
UNIVERSITY OF WISCONSIN
Clarke Park
Madison Area Technical College
State Capitol
Camp Randall Stadium
Hospital
Courthouse
Law Park
DN 1297
MADISON
St James Sch
Longfellow Sch
Brittingham Park
LAKE MONONA
ELEV 845
Vilas Circle
Edgewood College
Zoo
Vilas Park
High Sch
Monona Bay
Franklin Sch
Franklin Field
OLIN PARK
Quann Park
Fairground
Coliseum
Bowman Park
Murphy Creek
Penn Park
Radio Tower
Lincoln Sch
Trailer Park
MADISON TWP
Wingra
Ramp
WISCONSIN
BORETUM
DISON TWP
LAKE

DN-1099

WRD/Mad-26

Site Ident. No. 430406089232901 (5 – 19)

R = 234 * T = A *

U.S. DEPT. OF INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

GROUND WATER SITE INVENTORY
WATER-LEVEL DATA

HIGHEST WATER LEVEL 14.35 Apr. 26, 1983

LOWEST WATER LEVEL 22.05 July 15, 1980

RECORDS AVAILABLE 1978 -

DATE	WATER LEVEL (BELOW LSD)	STATUS	METHOD	DATE	WATER LEVEL (BELOW LSD)	STATUS	METHOD
235 # 01/28/1982 *	237 = 16.74 *	238 = *	239 = S *	235 # 02/27/1984 *	237 = 17.69 *	238 = *	239 = S *
235 # 02/23/1982 *	237 = 16.96 *	238 = *	239 = S *	235 # 03/30/1984 *	237 = 17.88 *	238 = *	239 = S *
235 # 03/23/1982 *	237 = 16.22 *	238 = *	239 = S *	235 # 04/26/1984 *	237 = 17.35 *	238 = *	239 = S *
235 # 04/29/1982 *	237 = 15.64 *	238 = *	239 = S *	235 # 05/31/1984 *	237 = 16.66 *	238 = *	239 = S *
235 # 05/27/1982 *	237 = 15.18 *	238 = *	239 = S *	235 # 06/ /1984 *	237 = *	238 = *	239 = *
235 # 06/28/1982 *	237 = 15.54 *	238 = *	239 = S *	235 # 07/03/1984 *	237 = 16.26 *	238 = *	239 = S *
235 # 07/29/1982 *	237 = 15.58 *	238 = *	239 = S *	235 # 07/27/1984 *	237 = 16.90 *	238 = *	239 = S *
235 # 08/26/1982 *	237 = 16.35 *	238 = *	239 = S *	235 # 08/30/1984 *	237 = 17.99 *	238 = *	239 = S *
235 # 09/ /1982 *	237 = pumping *	238 = *	239 = *	235 # 09/27/1984 *	237 = 18.27 *	238 = *	239 = S *
235 # 10/01/1982 *	237 = 17.13 *	238 = *	239 = S *	235 # 10/29/1984 *	237 = 17.28 *	238 = *	239 = S *
235 # 10/29/1982 *	237 = 16.73 *	238 = *	239 = S *	235 # 11/30/1984 *	237 = 16.63 *	238 = *	239 = S *
235 # 11/29/1982 *	237 = 15.92 *	238 = *	239 = S *	235 # 12/27/1984 *	237 = 16.37 *	238 = *	239 = S *
235 # 12/29/1982 *	237 = 15.50 * Q	238 = *	239 = *	235 # 01/29/1985 *	237 = 16.67 *	238 = *	239 = S *
235 # 01/28/1983 *	237 = 15.76 *	238 = *	239 = D *	235 # 02/25/1985 *	237 = 16.27 * f	238 = *	239 = S *
235 # 02/21/1983 *	237 = 15.72 *	238 = *	239 = S *	235 # 03/29/1985 *	237 = 15.61 *	238 = *	239 = S *
235 # 03/29/1983 *	237 = 15.32 *	238 = *	239 = S *	235 # 04/29/1985 *	237 = 15.79 *	238 = *	239 = S *
235 # 04/26/1983 *	237 = 14.30 *	238 = *	239 = S *	235 # 05/30/1985 *	237 = 15.90 * P	238 = *	239 = S *
235 # 05/24/1983 *	237 = 14.62 *	238 = *	239 = S *	235 # 06/27/1985 *	237 = 16.96 * P	238 = *	239 = S *
235 # 06/28/1983 *	237 = 16.01 *	238 = *	239 = S *	235 # 07/ /1985 *	237 = *	238 = *	239 = *
235 # 07/26/1983 *	237 = 17.10 *	238 = *	239 = S *	235 # 08/02/1985 *	237 = 18.24 * f	238 = *	239 = S *
235 # 08/29/1983 *	237 = 17.53 *	238 = *	239 = S *	235 # 08/30/1985 *	237 = 18.53 *	238 = *	239 = S *
235 # 09/27/1983 *	237 = 17.15 *	238 = *	239 = S *	235 # 10/02/1985 *	237 = 17.43 *	238 = *	239 = S *
235 # 10/28/1983 *	237 = 17.37 *	238 = *	239 = S *	235 # 11/04/1985 *	237 = 17.88 *	238 = *	239 = S *
235 # 11/29/1983 *	237 = 16.98 *	238 = *	239 = S *	235 # 12/06/1985 *	237 = 16.98 *	238 = *	239 = S *
235 # 12/30/1983 *	237 = 17.26 *	238 = *	239 = S *	235 # 01/ /1986 *	237 = *	238 = *	239 = *
235 # 01/30/1984 *	237 = 17.97 * P	238 = *	239 = S *	235 # 02/25/1986 *	237 = 16.89 * P	238 = *	239 = S *

Method of Measurement 239 =

A	C	E	G	H	L	M	R	S	T	V	Z
airline,	calibrated, airline	estimated,	pressure, gage	calibrated, pressure gage	geophysical, logs	manometer,	reported,	steel, tape	electric, tape	calibrated electric tape	other

Site Status 238 =

D	E	F	G	H	Ø	P	R	S	T	V	X	Z
dry,	flowed recently	flowing,	nearby, flowing	nearby, recently flowing	obstruction,	pumping,	recently, pumped	nearby, pumping	nearby, recently pumped	foreign, substances	surface-water, effect	other

615 W. WASHINGTON AVE

-2.42 TO LSD

DN-07/09E/23-1099

1287

DN-1099

WRD/Mad-26

Site Ident. No. 430406089232901 (5–19)

U.S. DEPT. OF INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

GROUND WATER SITE INVENTORY
WATER-LEVEL DATA

HIGHEST WATER LEVEL 14.30 Apr. 26, 1983

LOWEST WATER LEVEL 23.05 July 15, 1980

RECORDS AVAILABLE 1978-

R = 234 * T = A *

DATE	WATER LEVEL (BELOW LSD)	STATUS	METHOD
235 # 01/28/1982 *	237 = 16.74 *	238 = *	239 = S *
235 # 02/23/1982 *	237 = 16.96 *	238 = *	239 = S *
235 # 03/23/1982 *	237 = 16.22 *	238 = *	239 = S *
235 # 04/29/1982 *	237 = 15.64 *	238 = *	239 = S *
235 # 05/27/1982 *	237 = 15.18 *	238 = *	239 = *
235 # 06/28/1982 *	237 = 15.54 *	238 = *	239 = S *
235 # 07/29/1982 *	237 = 15.58 *	238 = *	239 = S *
235 # 08/26/1982 *	237 = 16.35 *	238 = *	239 = S *
235 # 09/ /1982 *	237 = missing *	238 = *	239 = S *
235 # 10/01/1982 *	237 = 17.13 *	238 = *	239 = S *
235 # 10/29/1982 *	237 = 16.73 *	238 = *	239 = S *
235 # 11/29/1982 *	237 = 15.92 *	238 = *	239 = S *
235 # 12/29/1982 *	237 = 15.50 *	238 = *	239 = S *
235 # 01/28/1983 *	237 = 15.76 *	238 = *	239 = S *
235 # 02/21/1983 *	237 = 15.72 *	238 = *	239 = S *
235 # 03/29/1983 *	237 = 15.32 *	238 = *	239 = S *
235 # 04/26/1983 *	237 = 14.30 *	238 = *	239 = S *
235 # 05/24/1983 *	237 = 14.62 *	238 = *	239 = S *
235 # 06/28/1983 *	237 = 16.01 *	238 = *	239 = S *
235 # 07/26/1983 *	237 = 17.10 *	238 = *	239 = S *
235 # 08/29/1983 *	237 = 17.53 *	238 = *	239 = S *
235 # 09/27/1983 *	237 = 17.15 *	238 = *	239 = S *
235 # 10/28/1983 *	237 = 17.37 *	238 = *	239 = S *
235 # 11/29/1983 *	237 = 16.98 *	238 = *	239 = S *
235 # 12/30/1983 *	237 = 17.26 *	238 = *	239 = S *
235 # 01/30/1984 *	237 = 17.97 *	238 = *	239 = S *
235 # 02/27/1984 *	237 = 17.69 *	238 = *	239 = S *
235 # 03/30/1984 *	237 = 17.88 *	238 = *	239 = S *
235 # 04/26/1984 *	237 = 17.35 *	238 = *	239 = S *
235 # 05/31/1984 *	237 = 16.66 *	238 = *	239 = S *
235 # 06/ /1984 *	237 = *	238 = *	239 = *
235 # 07/03/1984 *	237 = 16.38 *	238 = *	239 = S *
235 # 07/27/1984 *	237 = 16.99 *	238 = *	239 = S *
235 # 08/30/1984 *	237 = 17.99 *	238 = *	239 = S *
235 # 09/27/1984 *	237 = 18.27 *	238 = *	239 = S *
235 # 10/29/1984 *	237 = 17.28 *	238 = *	239 = S *
235 # 11/30/1984 *	237 = 16.63 *	238 = *	239 = S *
235 # 12/27/1984 *	237 = 16.37 *	238 = *	239 = S *
235 # 01/29/1985 *	237 = 16.67 *	238 = *	239 = S *
235 # 02/25/1985 *	237 = 16.27 * P	238 = *	239 = S *
235 # 03/29/1985 *	237 = 15.61 *	238 = *	239 = S *
235 # 04/29/1985 *	237 = 15.79 *	238 = *	239 = S *
235 # 05/30/1985 *	237 = 15.90 * P	238 = *	239 = S *
235 # 06/27/1985 *	237 = 16.96 *	238 = *	239 = S *
235 # 07/ /1985 *	237 = *	238 = *	239 = *
235 # 08/02/1985 *	237 = 18.24 * P	238 = *	239 = S *
235 # 08/30/1985 *	237 = 18.53 *	238 = *	239 = S *
235 # 10/02/1985 *	237 = 17.43 *	238 = *	239 = S *
235 # 11/04/1985 *	237 = 17.88 *	238 = *	239 = S *
235 # 12/06/1985 *	237 = 16.98 *	238 = *	239 = S *
235 # 01/ /1986 *	237 = *	238 = *	239 = *
235 # 02/25/1986 *	237 = 16.89 * P	238 = *	239 = S *

Method of Measurement (239 =)

A airline, C calibrated, airline, E estimated, G pressure, gage, H calibrated, pressure gage, L geophysical, logs, M manometer, R reported, S steel, tape, T electric, tape, V calibrated electric tape, Z other

Site Status (238 =)

D dry, E flowed recently, F flowing, G nearby, flowing, H nearby, recently flowing, Ø obstruction, P pumping, R recently, pumped, S nearby, pumping, T nearby, recently pumped, V foreign, substances, X surface-water, effect, Z other

615 W. Washington Ave

-2.42 TO LSD

DN-07/09E/23-1099

1297
DN-1099

WRD/Mad-26

Site Ident. No. 430406089232501
(5 … 19)

R = 234 * T = A *

U.S. DEPT. OF INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

GROUND WATER SITE INVENTORY
WATER-LEVEL DATA

HIGHEST WATER LEVEL 15.83 SEPT. 29, 1981
LOWEST WATER LEVEL 23.05 JULY 15, 1980
RECORDS AVAILABLE 1978-

DATE	WATER LEVEL (BELOW LSD)	STATUS	METHOD
235 # 11/10/1978 *	237 = 22.12 *	238 = *	239 = S *
235 # 11/22/1978 *	237 = 22.08 *	238 = *	239 = S *
235 # 11/29/1978 *	237 = 21.74 *	238 = *	239 = S *
235 # 12/11/1978 *	237 = 22.25 *	238 = *	239 = S *
235 # 12/22/1978 *	237 = 22.08 *	238 = *	239 = S *
235 # / / *	237 = *	238 = *	239 = *
235 # 01/ /1979 *	237 = missing *	238 = *	239 = *
235 # 02/02/1979 *	237 = 22.58 *	238 = *	239 = S *
235 # 03/30/1979 *	237 = 21.50 *	238 = *	239 = *
235 # 04/23/1979 *	237 = 20.83 *	238 = *	239 = S *
235 # 05/ /1979 *	237 = missing *	238 = *	239 = *
235 # 06/19/1979 *	237 = 21.00 *	238 = *	239 = *
235 # 07/12/1979 *	237 = 21.15 *	238 = *	239 = *
235 # 08/23/1979 *	237 = 20.66 *	238 = *	239 = S *
235 # 09/19/1979 *	237 = 21.37 *	238 = *	239 = *
235 # 10/29/1979 *	237 = 21.54 *	238 = *	239 = *
235 # 11/ /1979 *	237 = missing *	238 = *	239 = S *
235 # 12/ /1979 *	237 = missing *	238 = *	239 = *
235 # / / *	237 = *	238 = *	239 = *
235 # 01/ /1980 *	237 = missing *	238 = *	239 = S *
235 # 02/12/1980 *	237 = 22.41 *	238 = *	239 = S *
235 # 02/22/1980 *	237 = 22.58 *	238 = *	239 = *
235 # 03/19/1980 *	237 = 22.45 *	238 = *	239 = *
235 # 04/02/1980 *	237 = 22.91 *	238 = *	239 = *
235 # 04/30/1980 *	237 = 22.50 *	238 = *	239 = *
235 # 05/15/1980 *	237 = 22.83 *	238 = *	239 = *

DATE	WATER LEVEL (BELOW LSD)	STATUS	METHOD
235 # 05/30/1980 *	237 = 22.58 *	238 = *	239 = S *
235 # 06/13/1980 *	237 = 22.25 *	238 = *	239 = S *
235 # 06/27/1980 *	237 = 22.91 *	238 = *	239 = S *
235 # 07/15/1980 *	237 = 23.05 *	238 = *	239 = S *
235 # 07/31/1980 *	237 = 22.91 *	238 = *	239 = S *
235 # 08/ /1980 *	237 = missing *	238 = *	239 = *
235 # 09/25/1980 *	237 = 20.37 *	238 = *	239 = S *
235 # 10/ /1980 *	237 = missing *	238 = *	239 = *
235 # 11/20/1980 *	237 = 21.00 *	238 = *	239 = S *
235 # 12/ /1980 *	237 = missing *	238 = *	239 = *
235 # / / *	237 = *	238 = *	239 = *
235 # 01/17/1981 *	237 = missing *	238 = *	239 = *
235 # 02/17/1981 *	237 = 21.66 *	238 = *	239 = S *
235 # 03/ /1981 *	237 = missing *	238 = *	239 = *
235 # 04/24/1981 *	237 = 19.25 *	238 = *	239 = S *
235 # 05/ /1981 *	237 = missing *	238 = *	239 = *
235 # 06/03/1981 *	237 = 18.41 *	238 = *	239 = S *
235 # 07/ /1981 *	237 = missing *	238 = *	239 = *
235 # 08/04/1981 *	237 = 17.16 *	238 = *	239 = S *
235 # 09/29/1981 *	237 = 15.83 *	238 = *	239 = S *
235 # 10/ /1981 *	237 = missing *	238 = *	239 = *
235 # 11/24/1981 *	237 = 16.27 *	238 = *	239 = P *
235 # 12/21/1981 *	237 = 15.93 *	238 = *	239 = P *
235 # / / *	237 = *	238 = *	239 = *
235 # / / *	237 = *	238 = *	239 = *
235 # / / *	237 = *	238 = *	239 = *

Method of Measurement: 239 = A airline; C calibrated, airline; E estimated; G pressure, gage; H calibrated, pressure gage; L geophysical, logs; M manometer; R reported; S steel, tape; T electric, tape; V calibrated electric tape; Z other

Site Status: 238 = D dry; E flowed recently; F flowing; G nearby, flowing; H nearby, recently flowing; Ø obstruction; P pumping; R recently, pumped; S nearby, pumping; T nearby, recently pumped; V foreign, substances; X surface-water, effect; Z other

615 W. WASHINGTON AVE.
-2.42 TO LSD

DN-07/09E/23-1099

CITY OF MADISON

INTER-DEPARTMENTAL

CORRESPONDENCE

Date: October 19, 1982

To: Alex Zaporozec, WG & NHS

From: Larry Deibert

Subject: Static Water Levels

Depth: 68 ft
? First owner
? Drilled:

? 625

As per your request the following are static water levels from the observation well @ 615 West Washington Ave.

The measuring point (top of pipe) is 29 inches above ground level. (≈ 810)
These readings are to the MP. Note change from inches to tenths of feet on 11/24/81. (- 2.42)

11/10/78	-	24' 6½"	22.12
11/21	-	24' 6	22.08
11/29	-	24' 2"	21.74
12/11	-	24'8"	22.25
12/22	-	24'6"	22.08
2/2/79	-	25' 0"	22.58
3/30	-	23' 11"	21.50
4/23	-	23' 3"	20.83
6/19	-	23' 5"	21.00
7/12	-	23' 8"	21.25
8/23	-	23' 1"	20.66
9/19	-	23' 9½"	21.37
10/29	-	23' 11½"	21.54
2/12/80	-	24' 10"	22.41
2/22	-	25' 0"	22.58
3/19	-	24' 10½"	22.45
4/2	-	25' 4"	22.91
4/30	-	24' 11"	22.50
5/15	-	25' 3"	22.83
5/30	-	25' 0"	22.58
6/13	-	24' 8"	22.25
6/27	-	25' 4'	22.91
7/15	-	25' 5½"	23.05
7/31	-	25' 4"	22.91
9/25	-	22' 9½"	20.37
11/20	-	23' 5"	21.00
2/17/81	-	24' 1"	21.66
4/24	-	21' 8"	19.35
6/3	-	20'10"	18.91
8/4	-	19' 7"	17.16
9/29	-	18' 3"	15.83
11/24	-	18.69'	16.27
12/21	-	18.35'	15.93
1/28/82	-	19.16'	16.74
2/23	-	19.38'	16.96
3/23	-	18.64'	16.22
4/29	-	18.06'	15.64
5/27	-	17.6'	15.18
6/28	-	17.96'	15.54
7/29	-	18.00'	15.58
8/26	-	18.77'	16.35
10/1 = Symb.	-	19.55'	17.13
10/29			16.73
11/29			15.92
12/29			15.50
01/28/83			15.76
02/21			15.72

Average 11/78 - 10/82 = 19.57
(≈790 msl)
(= -55 ft below Lake level)

DN 1099

CITY OF MADISON

INTER-DEPARTMENTAL

CORRESPONDENCE

Date: October 19, 1982

To: Alex Zaporozec, WG & NHS

From: Larry Deibert LD

Subject: Static Water Levels

As per your request the following are static water levels from the observation well @ 615 West Washington Ave.

The measuring point (top of pipe) is 29 inches above ground level. These readings are to the MP. Note change from inches to tenths of feet on 11/24/81.

11/10/78	-	24' 6½"	6/27	-	25' 4'
11/21	-	24' 6	7/15	-	25' 5½"
11/29	-	24' 2"	7/31	-	25' 4"
12/11	-	24'8"	9/25	-	22' 9½"
12/22	-	24'6"	11/20	-	23' 5"
2/2/79	-	25' 0"	2/17/81	-	24' 1"
3/30	-	23' 11"	4/24	-	21' 8"
4/23	-	23' 3"	6/3	-	20'10"
6/19	-	23' 5"	8/4	-	19' 7"
7/12	-	23' 8"	9/29	-	18' 3"
8/23	-	23' 1"	11/24	-	18.69'
9/19	-	23' 9½"	12/21	-	18.35'
10/29	-	23' 11½"	1/28/82	-	19.16'
2/12/80	-	24' 10"	2/23	-	19.38'
2/22	-	25' 0"	3/23	-	18.64'
3/19	-	24' 10½"	4/29	-	18.06'
4/2	-	25' 4"	5/27	-	17.6'
4/30	-	24' 11"	6/28	-	17.96'
5/15	-	25' 3"	7/29	-	18.00'
5/30	-	25' 0"	8/26	-	18.77'
6/13	-	24' 8"	10/1	-	19.55'

1297

Dn-7/9/23- 1099.615 W. Washington Ave. SW¼SW¼NE¼. Drilled unused well.
Lsd 810 ft above msl. MP - top of pipe, 2.42 ft (29 inches) above lsd.
863

Measured monthly by the Madison Water Utility

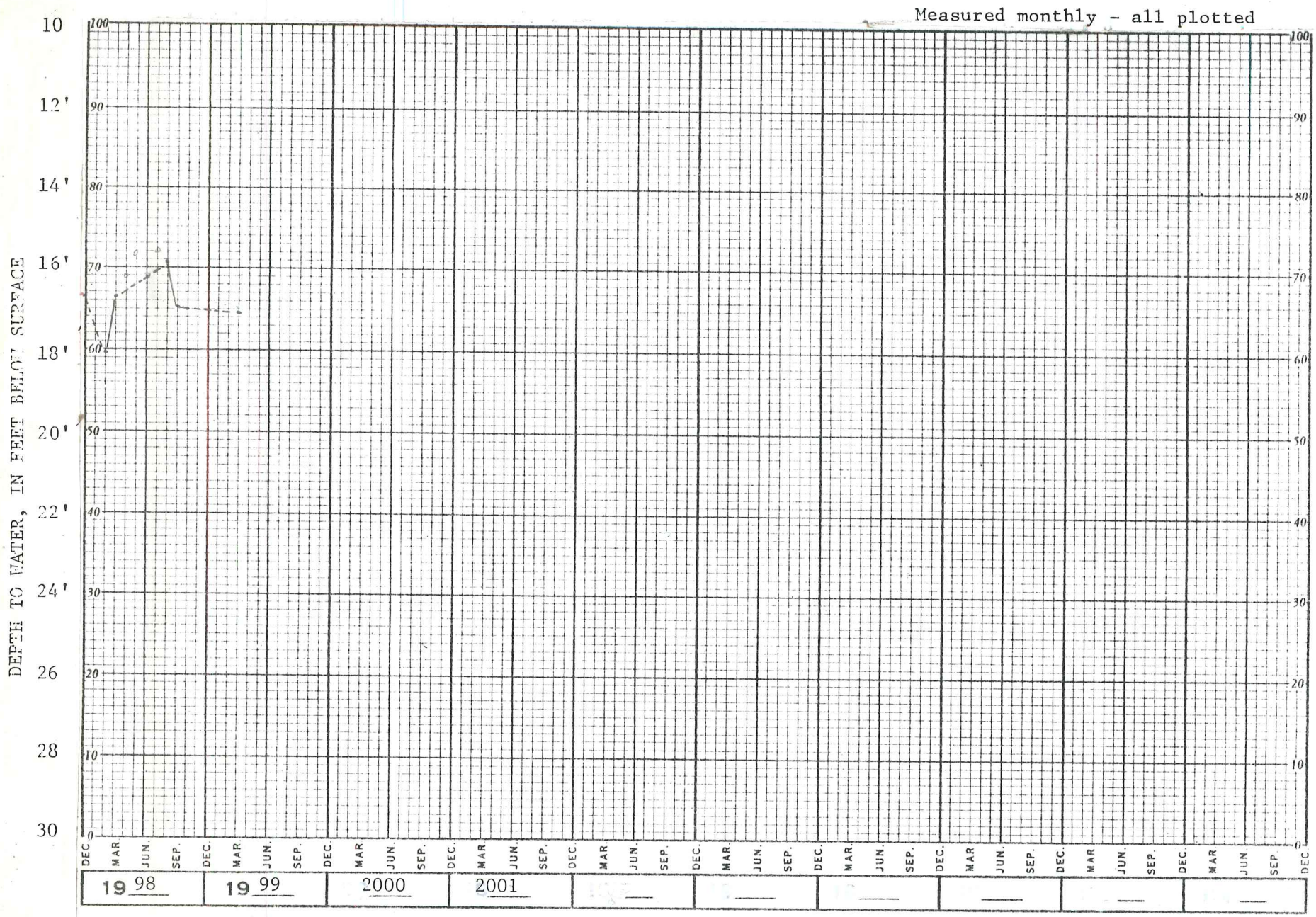
14'
16'
18'
20'
22'
24'

100 90 80 70 60 50 40 30 20 10 0

DEC. MAR. JUN. SEP.

19 78 | 1979 | 19 80 | 19 81 | 19 82 | 19 83 | 19 84 | 19 85 | 19 86 | 19 87

Dn-7/9/23-1297. W. Washington Ave. SW-SW-NE 1/4. Drilled unused well.
Lsd 863 ft above msl. MP - top of pipe, 2.42 ft (29 inches) above lsd.



Geophysical Logs WGNHS Well ID 13001297

DATE 06/05/2017 **WELL NAME** USGS Observation Well

LOCATION SW of the insection of W. Washington and S Bedford St.

COUNTY Dane **LOGGED BY** G. Guenther

LATITUDE 43.06837222 **LONGITUDE** -89.3928

LOCATION METHOD GPS **ELEVATION** 859 **ELEVATION METHOD** Surveyed

WELL DEPTH 65.4 **CASING DEPTH** 65.4 **DEPTH TO WATER** 15.2

CASING STICK UP 1.8 **WUWN** _____ ***File Created on:*** 6/6/2017 ***by:*** AMB

Comments: *Casing depth is unknown as casing reaches past bottom of well. Gamma down completed at 10 ft/min. Gamma Up completed at 3 ft/min. Well Construction field represents the well, casing, and water-level as measured on the day of logging.*

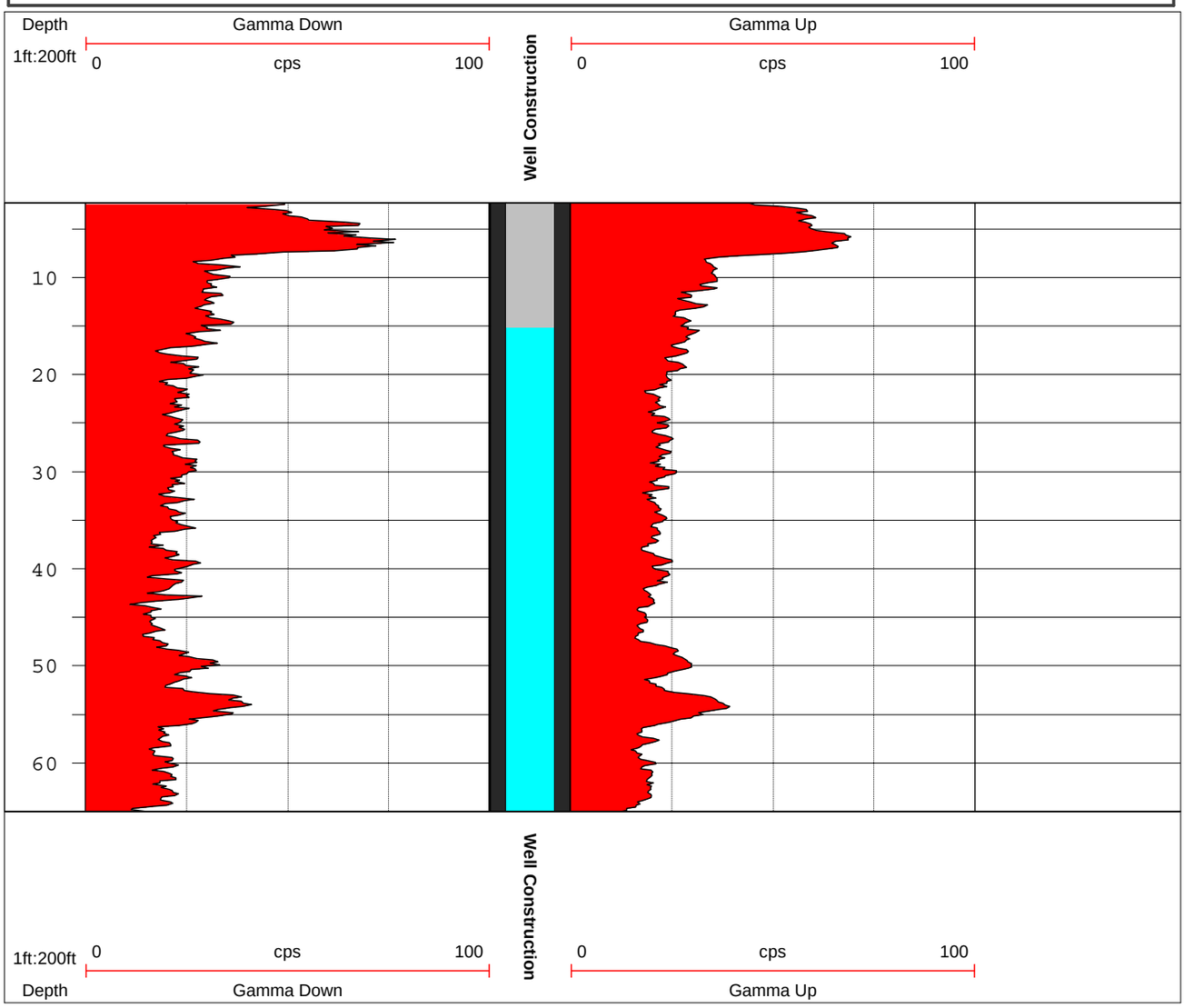
LOGS COLLECTED:

X	Gamma		Fluid Conductivity
	Caliper		Flow Meter- HeatPulse
	Single Point Resistivity		Flow Meter- Spinner
	Self Potential		*- flow up is negative, flow down is positive* Optical Borehole Imager
	Normal Resistivity		Acoustic Borehole Imager
	Fluid Temperature	X	OTHER: Video

Unless Noted:

- ***all depths are in feet***
- ***well depth, casing depth and depth to water are interpreted from geophysical log***
- ***datum is the top of casing***

For more information or to obtain collected data not shown please contact us at geodata@wgnhs.uwex.edu

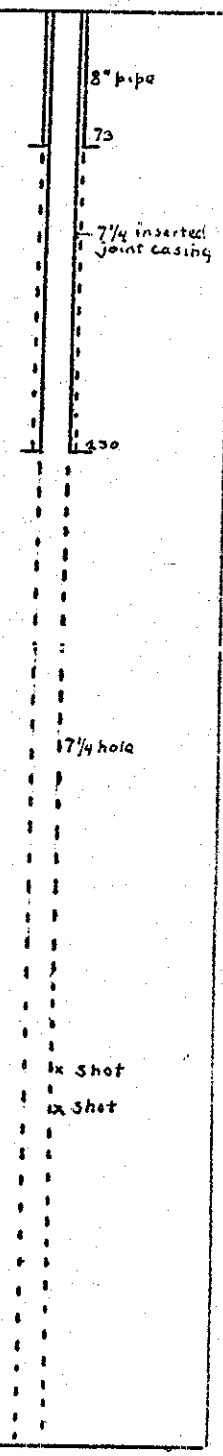


DN-36

KENNEDY DAIRY CO. WELL, MADISON

(Now BORDEN Co.) 629 W. Washington Ave.
Wm. Haak, Driller to 230', 1922
W. L. Thorne, Driller, 1923-24
W. G. Kirchoffer Engineer
Samples examined by F. T. Thwaites U.W. Nos. 72560-72633, 72968-72989
NE¼, SW¼, SE¼, SW¼, SW¼, NE¼, sec. 23, T. 7N., R. 9E.

DRIFT	73	0-73		Drift, no samples
DRESBACH MAZOMANIE	27? 125?	73-230		Sandstone, yellow and white, no samples (division uncertain)
EAU CLAIRE	135	230-235		ss., medium to fine, pink, calc.; shale, green; dolomite, yellow
		235-250		Sandstone, medium, gray, calcareous
		250-305		Sandstone, medium, white, calcareous, chips of hard pink and gray colors; shale, green
		305-325		Sandstone, medium to fine, white
		325-365		Sandstone, medium to fine, white, chips of hard pink and white calcareous sandstone
MT. SIMON	370	365-380		Sandstone, medium-fine, gray, calcareous
		380-390		Sandstone, like above, hard, pink chips
		390-425		Sandstone, fine to medium, gray, calcareous, few hard chips
		425-435		ss. medium to fine, gray, calc., some pink chips
		435-465		Sandstone, medium to fine, white, few pink chips, some pyrite
		465-495		Sandstone, medium to fine, gray, calcareous, some hard chips and some pyrite
		495-520		Sandstone, fine to coarse, light gray, pyritic
		520-530		ss. medium to fine, gray, calc.; some hard pink chips
		530-590		Sandstone, coarse to fine, light gray, some pink calcareous chips
		590-595		Sandstone, medium to fine, gray
		595-600		Sandstone, fine to very fine, gray, green sandy shale
		600-655		Sandstone, very coarse to medium, light gray
		655-680		Sandstone, very coarse to very fine, gray
PRE-CAMBRIAN	5	680-685		Sandstone, fine, light pinkish gray
		685-700		Shale, sandy, light yellowish gray
		700-705		Sandstone, fine to very fine, gray
		705-730		Sandstone, very coarse to fine, gray
		730-735		Sandstone, fine, light yellowish gray
		735-740		Shale, dark reddish brown and green, slightly calc.
		740-745		Trap rock, decomposed



NOW CITY UNIT WELL #2

DN-47

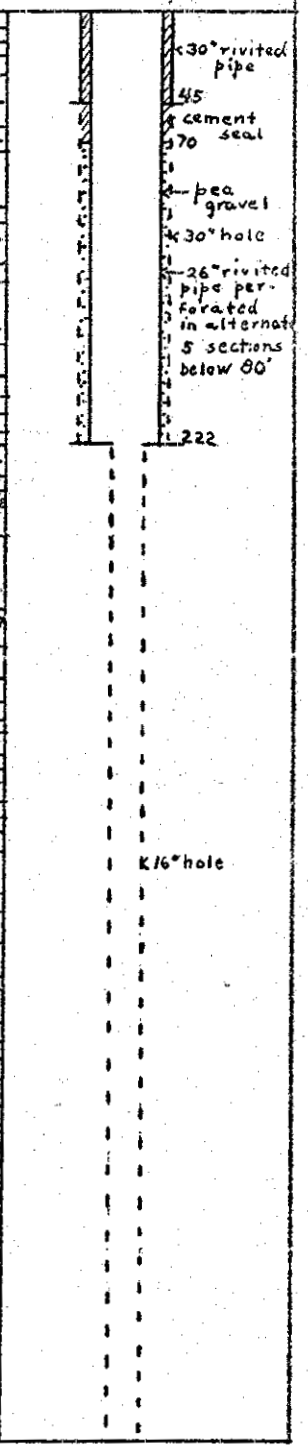
CITY WELL NO. 13, MADISON, WIS.

SE Corner, W Washington Ave. and Park St.
Layne-Bowler-Chicago Co., Contractors
R.C. Lacey, Driller, 1923-1924
Samples examined by F.T. Thwaites, Nos 72456-72511
73354-73514

NW¼, NW¼, SE¼, NE¼, SW¼, SW¼, sec. 23, T.7N., R.9E.

Alt. =

DRIFT	31	0-5		Peat and filling
		5-10		Marl, gray
		10-15		Clay, gray, calcareous
		15-31		Sand, reworked sandstone with gravel
FRANCONIA	44	31-45		Sandstone, fine, light yellowish gray, calcareous, some glauconite
		45-60		Sandstone, very fine, gray, calcareous, glauconitic
		60-70		ss, medium fine, gray to yellowish gray, calcareous
		70-75		Sandstone, coarse to fine, white
DRESBACH	115	75-100		Sandstone, medium to fine white
		100-105		Sandstone, medium, white, green shale streaks
		105-110		Sandstone, medium, gray and yellow, calcareous
		110-135		Sandstone, medium to coarse, white & yellow, calc.
		135-140		Sandstone, medium, light yellowish gray, calcareous
		140-165		Sandstone, medium-fine, white, slightly calc.
		165-170		Sandstone, medium to fine, yellowish gray, calcar.
		170-190		Sandstone medium-fine white
EAU CLAIRE	170	190-200		Sandstone, fine, white
		200-215		ss., medium to fine, light gray, calcareous, green shale
		215-221		ss., fine, gray, layers of gray, calcareous shale
		221-222		shale, gray, calcareous
		222-225		Sandstone, fine, gray, calcareous; gray calc. shale?
		225-227		ss., medium to fine, pink, calc., some red dolomite
		227-228		ss., medium, white, calc. ss., fine, pink, calc. glauconitic
		228-245		Sandstone, medium to fine, gray & white, calc., some pink dol.
		245-270		Sandstone, medium to fine, gray, calcareous, some hard chips
		270-300		Sandstone, medium to fine, gray, calcareous, some greenshale and hard pink layers
		300-315		Sandstone, medium to fine, white, part calcareous
		315-320		Dolomite, floating sand, gray, pink spots, ss., gray, calc.; shale, green
		320-330		Sandstone, fine to medium, gray & pink, calcareous
		330-345		Sandstone, fine to medium, gray and white
		345-360		Sandstone, medium to fine, gray, calcareous, gray & pink chips
MT. SIMON	370	360-370		Sandstone, fine, gray, calcareous
		370-375		ss., medium, gray, calcareous, hard pink and gray chips
		375-385		Sandstone, medium, white
		385-390		Sandstone, medium white, pink calcareous layers
		390-400		ss, medium, gray, calcareous, layers of pink Janey dolomite
		400-415		Sandstone, fine, gray, calcareous
		415-423		Sandstone, fine, gray, calcareous, pink & gray hard layers
		423-430		Sandstone, medium to fine, white
		430-435		No sample
		435-465		Sandstone fine gray, calcareous, some hard pink layers
		465-470		Sandstone, medium to fine, white
		470-485		Sandstone, fine, gray & white, green shale layers
		485-500		Sandstone, medium to fine, gray & white
		500-510		ss, medium to fine, white, 2" layer sandy pink dolomite
		510-535		Sandstone, medium to very fine, gray
		535-540		Sandstone, medium to very fine, gray; shale, red
		540-545		Sandstone, fine to very fine, gray, calcareous
		545-565		Sandstone, very coarse to very fine, light gray; calcareous
		565-570		Sandstone like above, some hard pink layers
		570-575		Sandstone, medium to very fine, light gray
		575-600		Sandstone, coarse to fine, white
		600-610		Sandstone, coarse to fine, white layers of green gray shale
		610-615		Sandstone, medium to very fine, gray; gray shale
		615-620		Shale, greenish gray
		620-625		Sandstone, coarse to very fine, gray; calcareous
		625-635		Sandstone, medium to very fine, gray
		635-638		ss., coarse to very fine, gray; shale, red & green; dolomite, gy.
		638-690		Sandstone, very coarse to fine, light gray
PRE-CAMBRIAN	370	690-695		Sandstone, exceedingly fine, gray
		695-715		Sandstone, very coarse to fine, white
		715-718		Sandstone, coarse to very fine, light gray
		718-720		Sandstone, exceedingly fine, gray
		720-722		Sandstone, exceedingly coarse to fine, white
		722-730		Sandstone coarse to fine, gray; shale, red
	15	730-745		Basalt



Geophysical Logs WGNHS Well ID 13006067

DATE 4/16/2012 **WELL NAME** Meriter Health Services

LOCATION E. of S. Park St. along Meriter Hospital building (Madison)

COUNTY Dane **LOGGED BY** Mike Parsen, Jake Krause

LATITUDE 568757 (UTM91) **LONGITUDE** 288319 (UTM91)

LOCATION METHOD: *GPS* ☐ *AIR PHOTO/TOPO* ☐ *PLSS* ☐ *OTHER* _____

ELEVATION 855.75 **ELEVATION METHOD:** *DEM* ☐ *TOPO* ☐ *OTHER* _____

WELL DEPTH see note **CASING DEPTH** ~ 255 **DEPTH TO WATER** _____

CASING STICK UP 1.5 ***File Created on:*** 8/7/2012 ***by:*** SJ

Comments: Hit a snag at ~349 ft on first log, so all logs, except heat pulse, were run to 350 only. True hole depth=525 ft logged (Sam's Rotary recorded total depth of 560 ft on 4/2/2012) WUWN=YH017

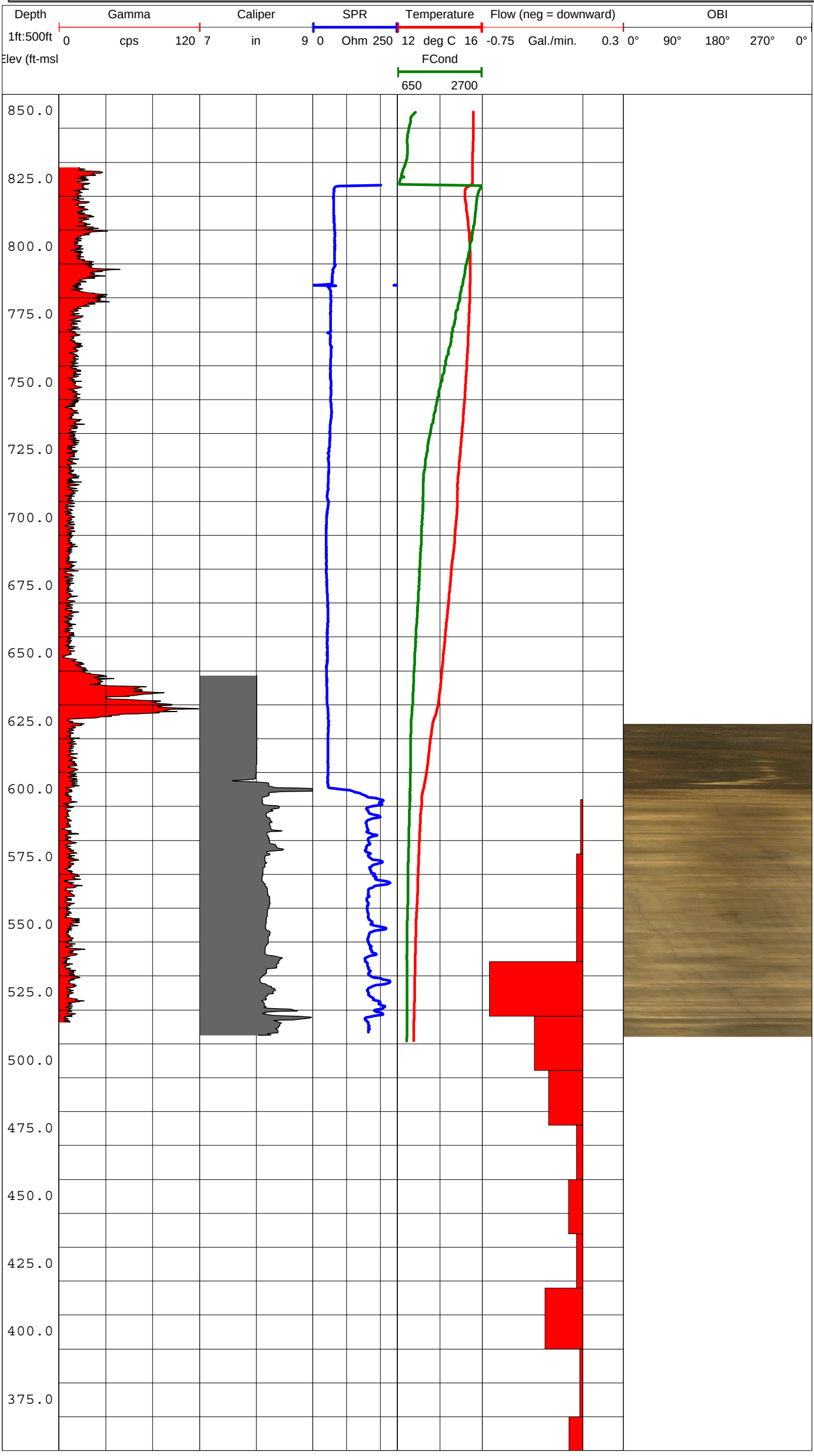
LOGS COLLECTED:

Gamma	X	Fluid Conductivity	X
Caliper	X	Flow Meter- HeatPulse	X
Single Point Resistivity	X	Flow Meter- Spinner	
Self Potential	X	Optical Borehole Imager	X
Normal Resistivity	X	Acoustic Borehole Imager	
Fluid Temperature	X	OTHER:	

Unless Noted:

- *all depths are in feet*
- *casing and depth to water are interpreted from geophysical log*
- *datum is the top of casing*

For more information or to obtain collected data not shown please contact us at askageologist@uwex.edu



APPENDIX B OF REFERENCE DOCUMENTS
IW-32

USGS Basic Data and Map 1980
USGS personnel went through in 1980 to combine observation well records

Alex Zaporozec Graphs of Water Levels 1957-1998
water levels graphed onto paper

USGS Well Schedule 1967
USGS Well Schedule contains some well construction information and hand-drawn location

IW-32 Geophysical log 2017
Gamma log, Caliper, Single Point Resistivity, Self Potential, Temperature, Fluid Conductivity

History of the North Survey School 1976
IW-32 was drilled for this school in 1906

7/11/80

BASIC DATA ON WATER-LEVEL OBSERVATION WELL

Well number IW 32

Owner Archie Lee (old school house)

Location (Co., T/R.sec) IOWA Co., T. 6 N., R. 3 E., Sec. 32 SW¼, SW¼, SW¼; 2mi SW of Dodgeville

Land surface altitude 1202'

Drainage basin PECATONICA R.: Mineral Point Branch & unnamed tributary

Distance to the nearest perennial stream: (local divide)

WELL DATA

Depth 92'

Casing depth unknown

Screened interval —"—

Diameter 6"

Aquifers open to well Ordovician (Galena-Platteville dolomites)

Geologic log available? no

Construction report available? no

Use of well unused

Access to measure well

NEAREST SUPPLEMENTAL DATA POINTS

Precipitation stations Dodgeville 2.25 mi NE
Lone Rock 18.0 mi N

Streamgaging stations Muscoda 22.5 mi NW
05432500 Pecatonica River at Darlington 18.75 mi SSE

Observation wells Lf 78 - 15 mi SE
IW 110 - 18 mi NE

Other Lf 11 - 23 mi SW

EXISTING RECORD

Measuring point ¼ in. hole in pump base; at lsd

Measuring equipment tape

Frequency of measurement monthly from 10/18/66 (quarterly 08/05/57 – 08/11/66)

Period of record -- 1957 - 1979

Started 08/05/57

Ended 11/20/79 (well destroyed by vandals - filled in)

Volume of missing record 23.4%

Recorded by Alex Zenny on 12/11/80

 IW 32

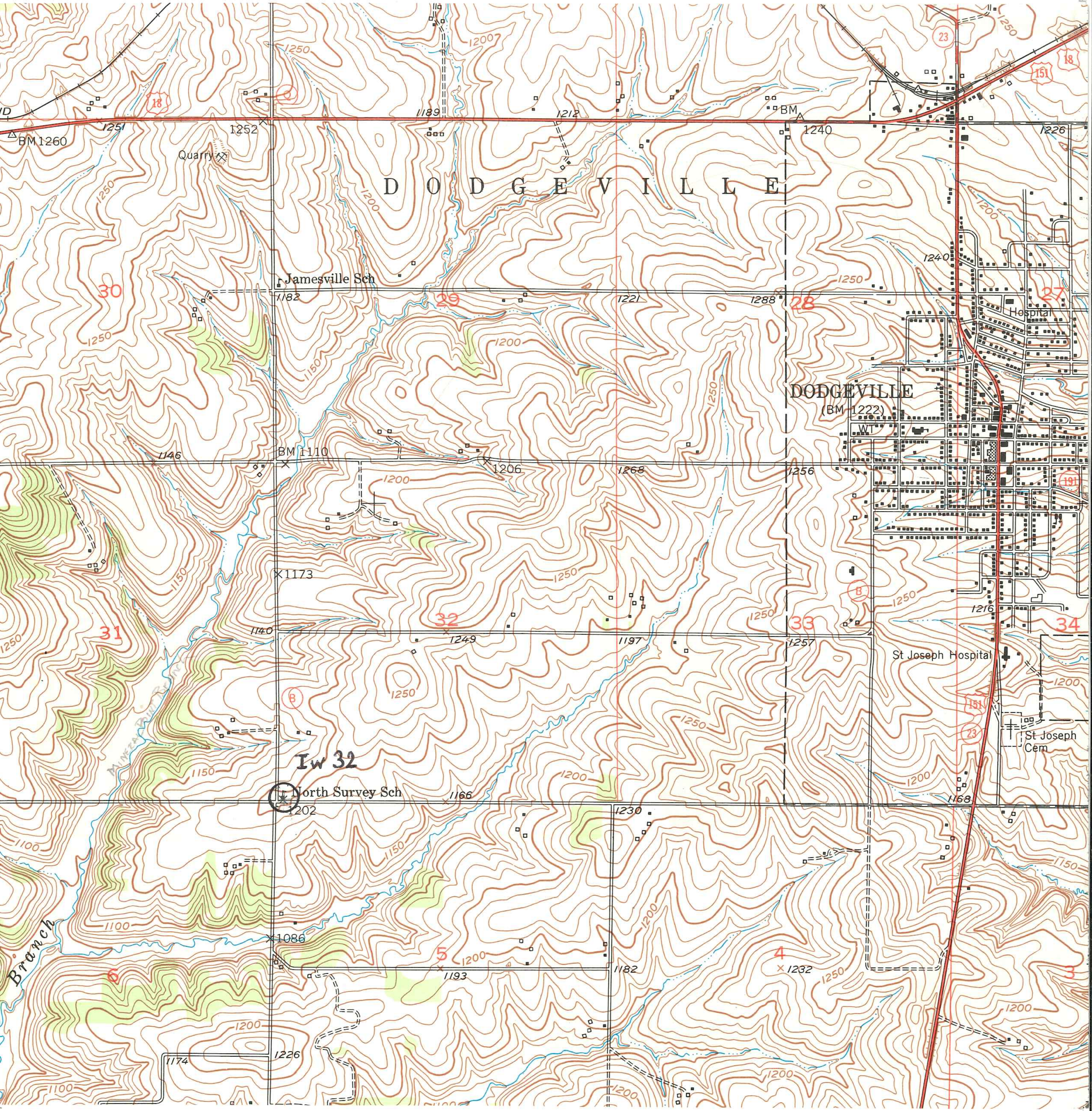
LIST OF CRITERIA FOR THE EVALUATION OF
EXISTING OBSERVATION WELLS IN WISCONSIN

1. Areal spacing -- distance from any observation well 15 mi
   -- distance from observation well in same aquifer 23 mi
2. Ownership: (private) -- public
3. Use of well unused (old school well)
4. Access -- physical
   -- owner's permission
5. Condition of well -- casing
   -- housing
6. Geologic log: yes -- (no)
7. Construction report: yes -- (no)
   Well completion date: unknown
8. Diameter (4 in. minimum for recorder) 6"
9. Aquifer: single -- multiple ? (Ord.)
10. Good hydraulic connection with aquifer yes
11. Knowledge of pumping effect none
12. Range and character of w.l. fluctuations 30ft (39-69); long-term + seasonal
13. Length of record 23 years
14. Missing record 23.4%
15. Adequacy of current measuring frequency Destroyed in Dec. 1979 by vandals
16. Probability of permanence —
17. Recommendations/Improvements

~~-replace by another nearby w/ same conditions~~

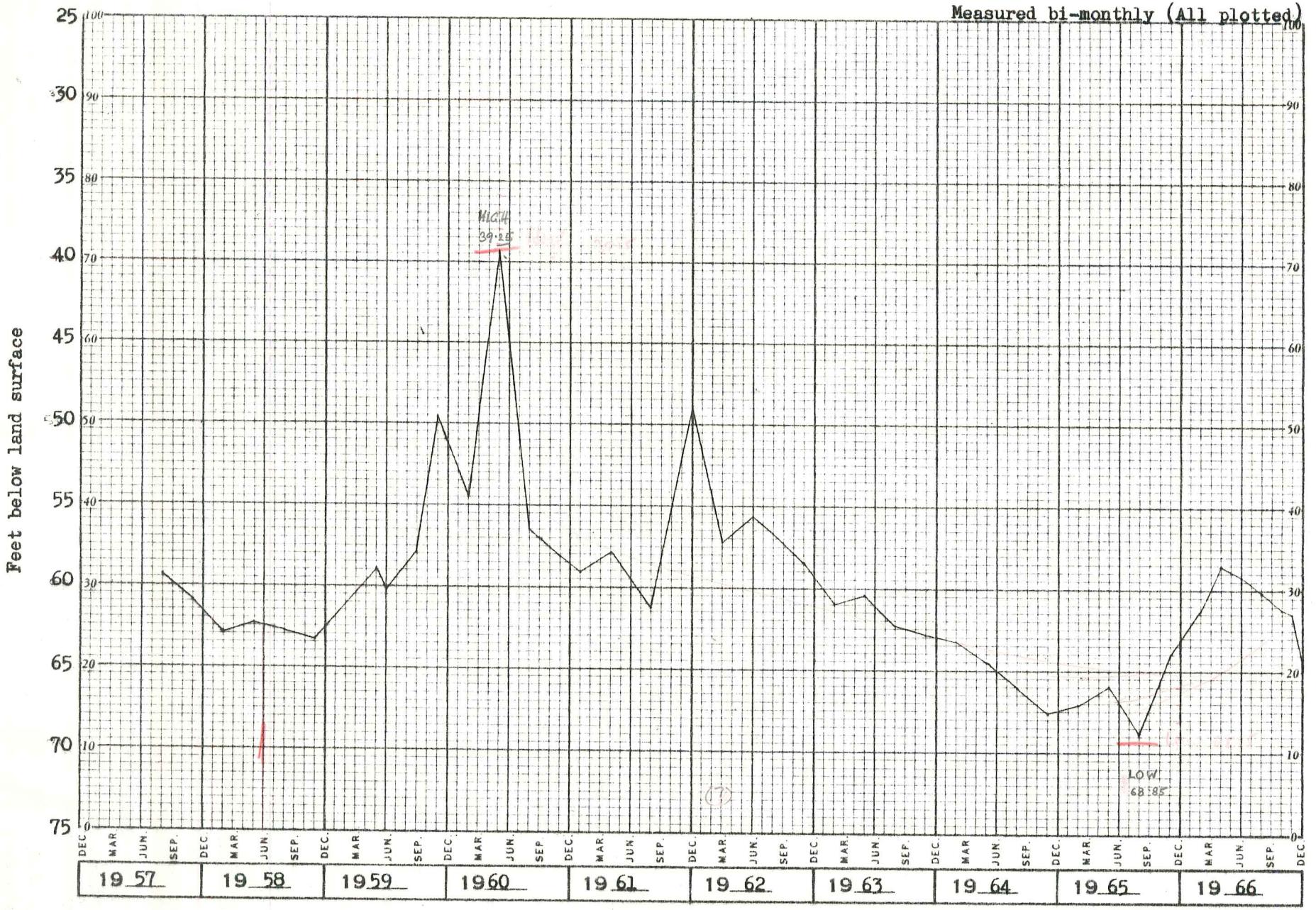
✓ -try to clean the plugged portion of the well

Evaluated by A. Zaporozec on 12/19/80

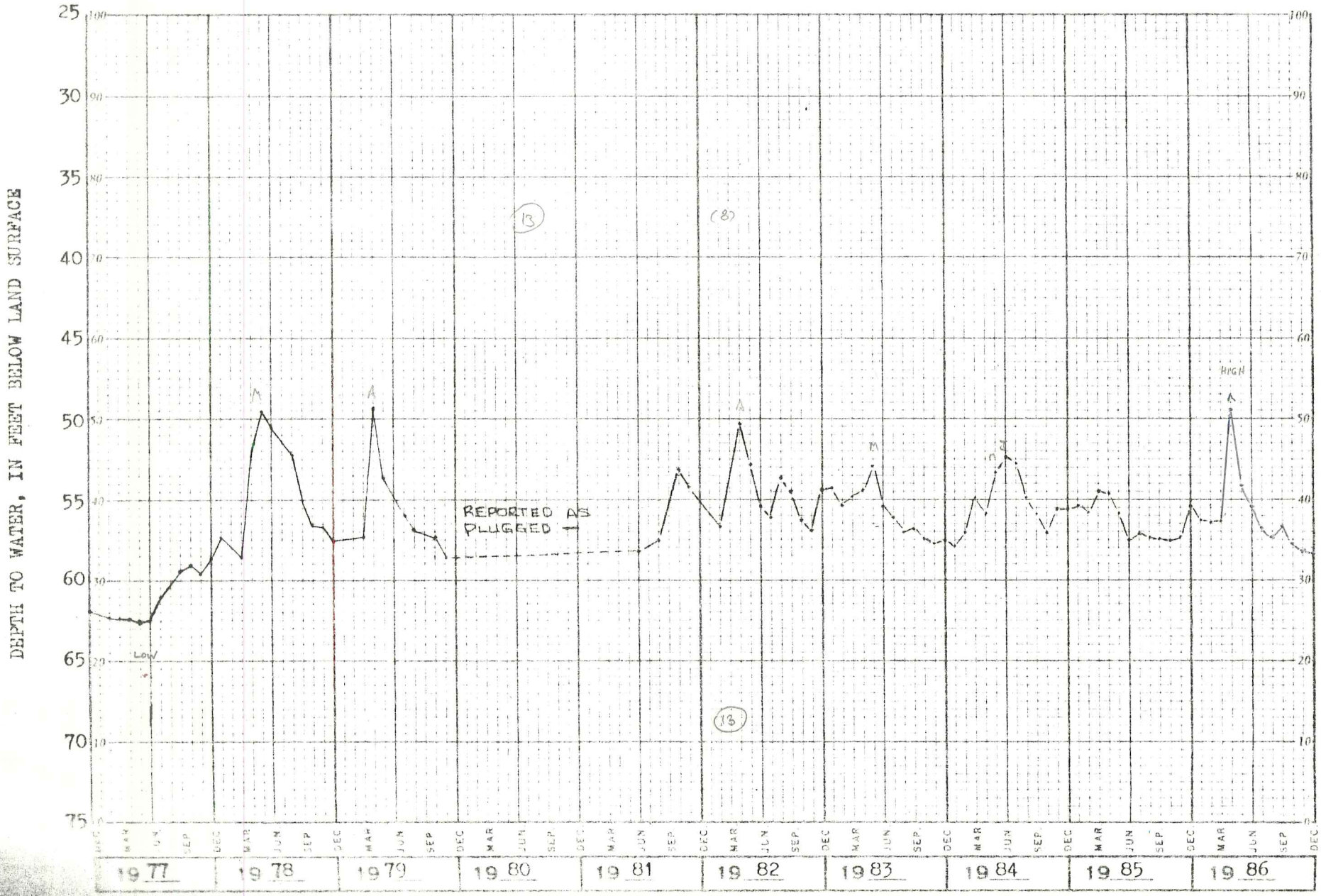

DODGEVILLE
Jamesville Sch
Quarry
BM1260
1251
1252
1189
1212
BM
1240
1226
1182
1221
1288
1240
Hospital
DODGEVILLE
(BM 1222)
WT
BM 1110
1146
1206
1268
1256
1173
1140
1249
1197
1257
1216
St Joseph Hospital
St Joseph Cem
Iw 32
North Survey Sch
1202
1166
1230
1168
1086
1193
1182
1232
1174
1226
Branch
30
29
28
27
31
32
33
34
6
5
4
3

Archie Lee 8/11/66

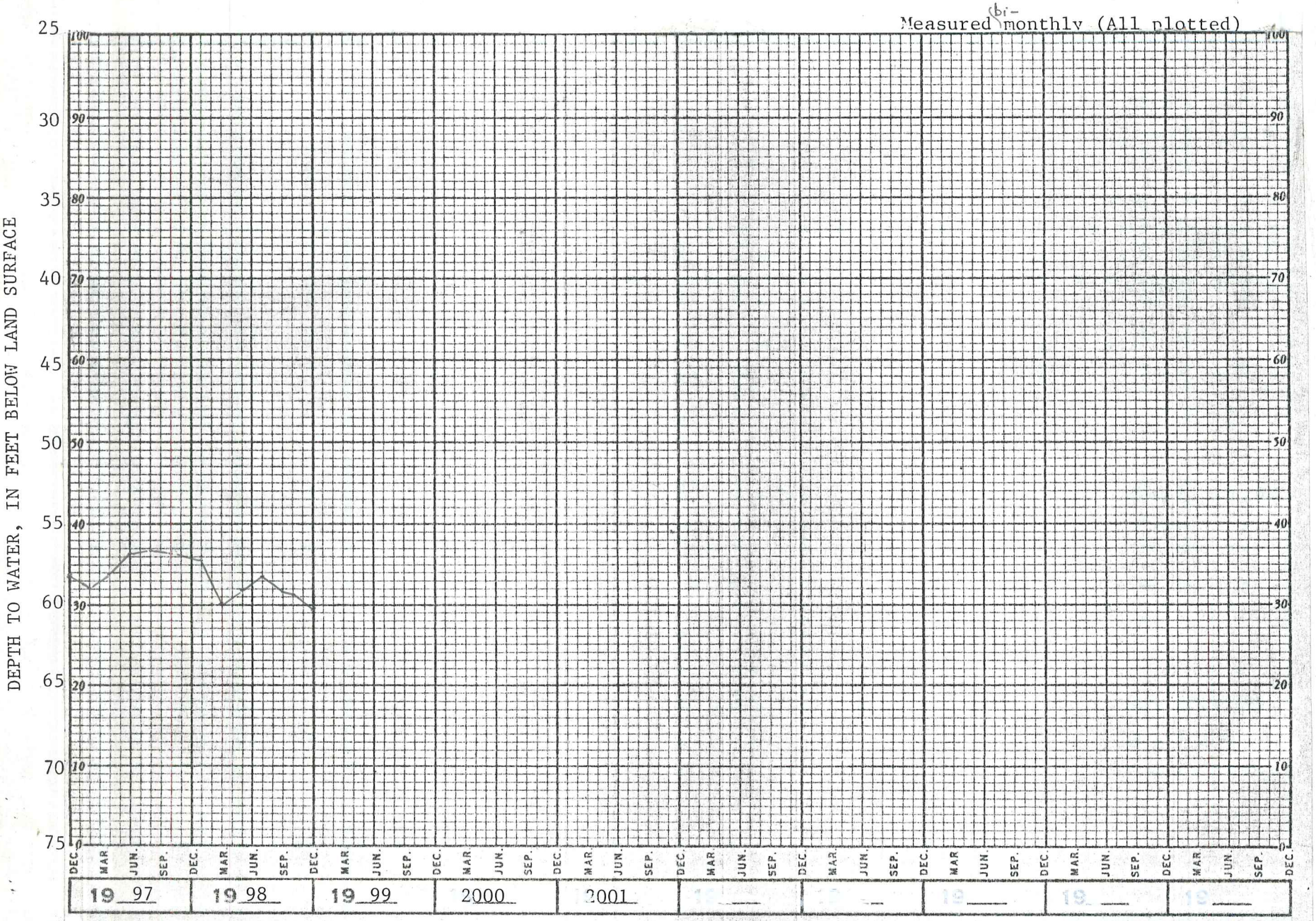
Iw-6/3/32-32. ~~North Survey School.~~ SW¼ SW¼ sec. 32, T. 6 N., R. 3 E. Drilled public supply artesian well in Galena dolomite, diam 6 in, depth 92 ft. Lsd, 1,200 ft above msl. MP, top of casing, at lsd.



Iw-06/03E/32-0032. Archie Lee. Drilled public-supply artesian well in Galena Dolomite of Middle Ordovician age, diam 6 in, depth 92 ft. Lsd 1,200 ft above msl. MP $\frac{1}{4}$-in hole in pump base, at lsd.



Iw-06/03E/32-0032. Archie Lee. Drilled public-supply artesian well in Galena Dolomite of Middle Ordovician age, diam 6 in, depth 92 ft. Lsd 1,200 ft above msl. MP ¼-in hole in pump base, at lsd.



WRD Exp. (
April 1966

Well No. IW-6/3E/32-32

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

{ DR CLINE SAUG 57 }

Verified FCH

MASTER CARD

Record by E J DASPIT Source of data FIELD Date 4DEC67 Map DODGEVILLE 1:24000

State WISCONSIN 58 County (or town) IOWA IW

Latitude: 4 2 5 6 4 4 N Longitude: 0 9 0 1 0 1 9 Sequential number: 1

Lat-long accuracy: 2 T 6 N R 3 E Sec 32, SW ¼, SW ¼, SW ¼ 4 B & M

Local well number: 0 6 N 0 3 E 3 2 C C C C Other number:

Local use: IW0032 Owner or name: ARCHIE LEE

Owner or name: ARCHIE LEE Address: R#1, DODGEVILLE

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private (circled), (S) State Agency, (W) Water Dist — P

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused (circled), (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other — U

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs (circled), (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (X) Waste, (Z) Destroyed — O

DATA AVAILABLE: Well data 9 Freq. W/L meas.: MONTHLY 1957→ M Field aquifer char.

Hyd. lab. data:

Qual. water data; type:

Freq. sampling: Pumpage inventory: yes no, period:

Aperture cards: yes

Log data:

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 92 ft 92 Meas (circled) rept TAPE accuracy 0

Depth cased (first perf.): ft Casing type: ; Diam. 6 in C

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, (X) open hole, (Z) other

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other

Date Drilled: Pump intake setting: ft

Driller: name, address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston (circled), (R) rot, (S) submerg, (T) turb, (Z) other — P Deep ~~Shallow~~ D

Power (type): diesel, elec, nat gas, gasoline, hand (circled), LP gas, wind; H.P. 1 Trans. or meter no.

Descrip. MP ¼" HOLE IN PUMP BASE @ ~~above below~~ LSD, Alt. MP 1200

Alt. LSD: 1200 1200 Accuracy (source): TOPO - 10' CI. 4

Water Level 65.01 ft above below MP; Ft above below LSD 65 Accuracy: TAPE A

Date meas: 20DEC67 D67 Yield: gpm Method determined

Drawdown: ft Accuracy: Pumping period hrs

QUALITY OF WATER DATA: Iron ppm Sulfate ppm Chloride ppm Hard. ppm

Sp. Conduct K x 10⁶ Temp °F Date sampled Punched FRC

Taste, color, etc.

EJD 2/1/68 EJD 2/1/68

4256 44N090 1019.1

9-185
(October 1950)

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
WATER RESOURCES DIVISION IW-6/3/32-32

WELL SCHEDULE

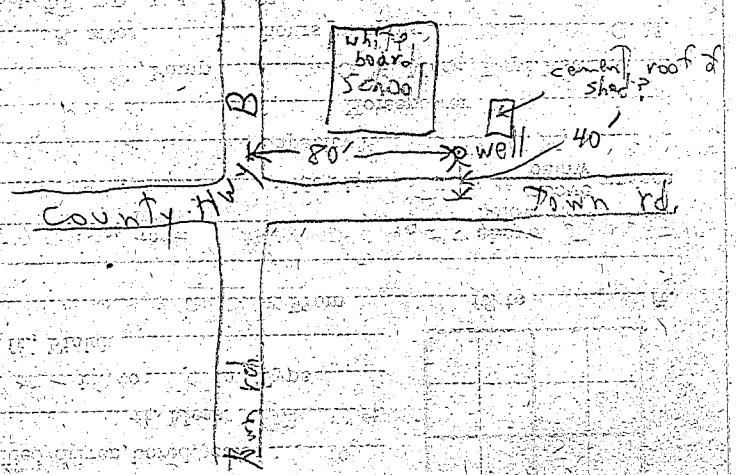
Date Aug 5, 1957 Field No. IW 32
Record by DRC Office No.
Source of data Observation

1. *Location:* State Wis County Iowa
   Map
   SW ¼ SW ¼ sec. 32 T 6 N R 3 E
2. *Owner:* ~~North Survey School~~ (over) Address RFD Dodgeville, Wis
   Tenant School is now abandoned Address
   Driller Address
3. *Topography* Top of hill
4. *Elevation* 1200 ft. above ~~below~~ m.s.l
5. *Type:* Dug, drilled (circled), driven, bored, jetted 19
6. *Depth:* Rept. ft. Meas. 92 ft.
7. *Casing:* Diam. 6 in., to in., Type
   Depth ft., Finish
8. *Chief Aquifer* galena - platteville From ft. to ft.
   Others
9. *Water level* 59.31 ft. ~~rept.~~ meas. Aug 5 1957 ~~above~~ below ~~Top of casing~~ *¼" hole in pump base 5/15/64 which is 0 ft. above below surface
10. *Pump:* Type Cylinder lift Capacity G. M.
    Power: Kind hand Horsepower —
11. *Yield:* Flow G. M., Pump G. M., Meas., Rept. Est.
    Drawdown ft. after hours pumping G. M.
12. *Use:* Dom., Stock (PS) (circled) R.R., Ind., Irr., Obs.
    Adequacy, permanence
13. *Quality* Temp °F.
    Taste, odor, color Sample Yes No
    Unfit for
14. *Remarks:* (Log, Analyses, etc.) *lift pump up to measure; water table

ADP SCHEDULE MADE

In 2K Data Base verified

There is a white X on side of pump 2' above lsd that was a topog elev. mark "X" is 1202' elev.



8/11/66

NEW OWNER - MR. ARCHIE LEE
DODGEVILLE

Well No. IW-6/3E/ 32

Latitude-longitude 42 (d) 56 (m) 44 (s) N S 90 (d) 10 (m) 19 (s)

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD | Physiographic Province: CENT LOW (72) | Section: WDS

C (22) | Drainage Basin: UP MISS (26P) | Subbasin: PLATTE-SUGAR

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (♦) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat — H

MAJOR AQUIFER: ORDIVICIAN, MIDDLE (02) system, series | PLATTEVILLE-GALENA (8A) aquifer, formation, group

Lithology: DOLOMITE (D) | Origin: MAR (C) | Aquifer Thickness: ft

Length of well open to: ft | Depth to top of: ft

MINOR AQUIFER: system, series | aquifer, formation, group

Lithology: | Origin: | Aquifer Thickness: ft

Length of well open to: ft | Depth to top of: ft

Intervals Screened:

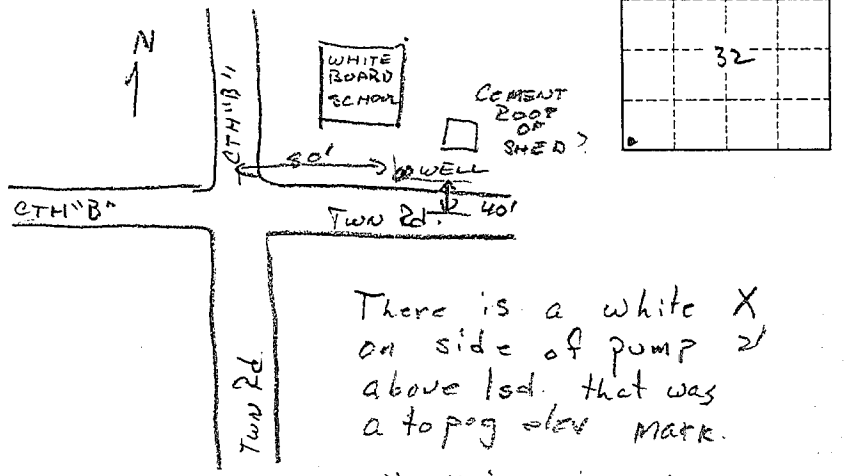
Depth to consolidated rock: ft | Source of data:

Depth to basement: ft | Source of data:

Surficial material: | Infiltration characteristics:

Coefficient Trans: gpd/ft | Coefficient Storage:

Coefficient Perm: gpd/ft²; Spec cap: gpm/ft; Number of geologic cards:



There is a white X on side of pump 2' above lsd that was a topog elev mark. "X" is 1202' elev.

In 2K Data Base verified

GPO 857-700

Well No.

Appendix B: IW-32

Geophysical Logs WGNHS Well ID 25000032

DATE 05/30/2017 **WELL NAME** Archie Lee Well

LOCATION Old North Survey School, corner of HWY B and Survey Rd, Dodgeville

COUNTY Iowa **LOGGED BY** Greg Guenther

LATITUDE 42.945702 **LONGITUDE** -90.172122

LOCATION METHOD GPS **ELEVATION** 1200 **ELEVATION METHOD** DEM

WELL DEPTH 73.5 **CASING DEPTH** 13.2 **DEPTH TO WATER** 53.5

CASING STICK UP 0.0 **WUWN** _____ ***File Created on:*** 6/6/2017 ***by:*** AMB

Comments: *Well construction field represents the well, casing, and water-level as measured on the day of logging. Loose PVC and metal pipe in well. Caliper would not descend past 59 ft. Instrumentation for SP and SPR would not descend past 59.9 ft.*

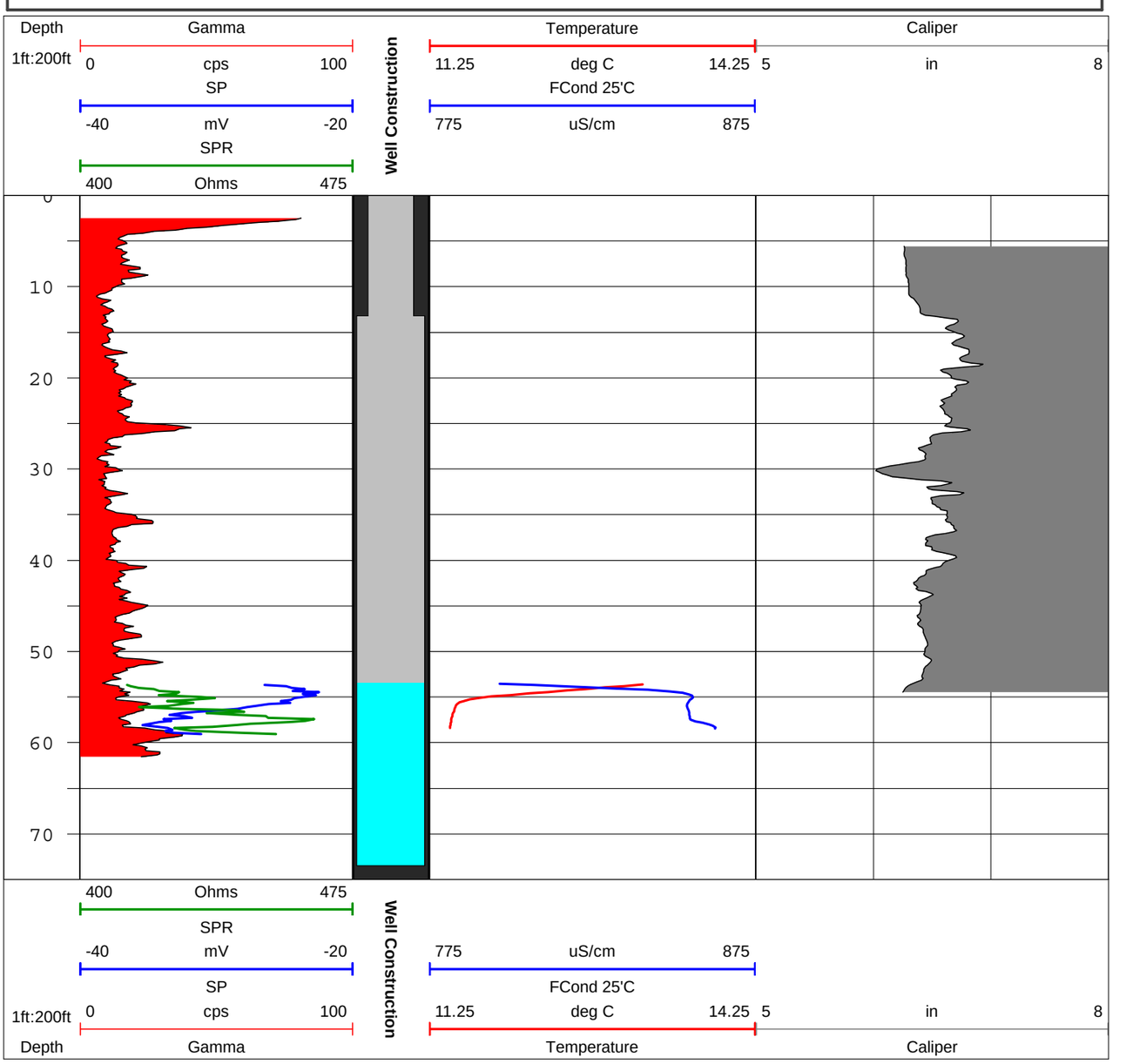
LOGS COLLECTED:

X	Gamma	X	Fluid Conductivity
X	Caliper		Flow Meter- HeatPulse
X	Single Point Resistivity		Flow Meter- Spinner
X	Self Potential		*- flow up is negative, flow down is positive* Optical Borehole Imager
	Normal Resistivity		Acoustic Borehole Imager
X	Fluid Temperature	X	OTHER: Video

Unless Noted:

- ***all depths are in feet***
- ***well depth, casing depth and depth to water are interpreted from geophysical log***
- ***datum is the top of casing***

For more information or to obtain collected data not shown please contact us at geodata@wgnhs.uwex.edu



History

The IW-32 well was built for the North Survey Schoolhouse in 1906. The school was shut down in 1960. This image is from the Schools of Iowa County book published in September, 1976. The image was provided by the Iowa County Historical Society through Facebook on May 31st, 2017.

North Survey District No. 13

The North Survey School is located on a lot in the S.W. ¼ of Sec. 32 twp. 6 Range 3 at the intersection of County Trunk B and Survey Road in the Town of Dodgeville.

The historical foundation for the name of this district comes from the Van Matre Survey recorded in the Iowa Co. History 1881. Late in the fall of 1827 the Van Matre brothers, Jeff and Louis, discovered on Section 5, Town 5, Range 3, a rich paying lode. Afterward, Abe and John became associated with them when they made what to this day is recognized as the "Van Matre Survey," which was one mile square, comprising half of Section 5 and one-half of Section 6. The present "Survey Road" runs between Section 5 and Section 6 with the Francis M. Aide farm and the Ed Miller home on the west side of the road in Section 6 and Ray Spease home on the east side in Section 5 (1976).

During the two years the survey was mined, the lead yield, which was very heavy, was sold to General Dodge for smelting. According to the old government mining rule, two men could hold and work under the supervision of the United States Agent, two hundred yards square, and on a survey, the law required the presence of at least twenty men to hold it.

Some time prior to 1868 William Smith donated the land and a frame building was erected for school purposes. At the close of the school in 1960 the land of the school lot returned to the farm property then owned by John Smith, a grandson of the donor. Shortly thereafter, Mr. John Smith bought the building and the contents were offered for sale at an auction.

Points of interest connected with this district school have been related by people who lived there.

Many debates were held in the North Survey School. Mr. Ben Webster and Mr. John E. Wedlake were often on debating teams. One issue debated was "The Validity of a Silo for the Storage of Ensilage."

At one time a dispute over a bet of a new hat to be given to the one who could eat the most bowls of oyster soup resulted in a mock trial. The victor was named but the other party contested stating that the bowls were not the same size. A judge was appointed, lawyers named for each the plaintiff and the defendant, and a panel of 11 jurors were drawn. The defendant won the case and received the hat.

Many literary meetings were held at this school; school programs and picnics were annually enjoyed; a good community spirit prevailed.

North Survey School
Back row: Lee Oxnem, Edith Miller, Sanrda Buckingham, Jimmy Aide, Lois Matthias, Patsy Lee, Billy Miller, Linda Beckett; front row: Billy Lee, Joan Oxnem, Vicky Beckett, Janice Brennum, Terry Goldthorpe, Phyllis Miller, Catherine Brennum, Eileen Goldthorpe (absent), Cyrilla Mullen (teacher).

An item unique to this district was that watchmen were hired to keep things in order on Halloween night.

In 1906 a well was drilled. Regular repairs were made to the building as needed. At one time the entry was torn off and an addition added that matched the rest of the building. Electric lights, oil burner, and a telephone were installed in later years.

The building and lot are now the property of Mr. and Mrs. Archie Lee.

50

Schools of Iowa County
Pages 49-50

APPENDIX C OF REFERENCE DOCUMENTS
KE-46

USGS Basic Data and Map мфум
USGS personnel went through in 1980 to combine observation well records

USGS Well Schedule 1961
USGS Well Schedule contains some well construction information and hand-drawn location

USGS Site Schedule 1978
USGS meta-data similar to Well Schedule

Well Construction Report (WCR) to State Board of Health 1955
WCR to Wisconsin State Board of Health

KE-10 Geologic Log 1923
Nearby well KE-10 record of geology

KE-29 WCR 1960
Included due to proximity, WGNHS record of geology

KE-29 Geologic 1960
Included due to proximity

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7/11/80

KE-0046

BASIC DATA ON WATER-LEVEL OBSERVATION WELL

Well number KE-01/22E/13-0046

Owner ST. JOSEPH HOME

Location (Co., T/R.sec) KENOSHA Co. SW¼, SW¼, SW¼, SE¼
T. 1N., R. 22E., Sec. 13 SW¼ SE¼

Land surface altitude 645 FT. (or 642)

Drainage basin Lake Michigan Basin

Dist. to nearest perennial stream: 0.5 mi to Barnes Creek

WELL DATA

Depth 135 FT.

Casing depth 82 FT.

Screened interval

Diameter 6 IN.

Aquifers open to well DOLOMITE

Geologic log available? No

Construction report available? – Maybe

Use of well OBSERVATION

Access to measure well OK

NEAREST SUPPLEMENTAL DATA POINTS

Precipitation stations Kenosha – 4 mi N Union Grove – 15.5 mi NW
Racine – 14 mi N

Streamgaging stations
04087257 Pike River near Racine, WI – 8 mi N

Observation wells KE4 – 4mi NNW KE288 – 10.5 mi NSW
KE6 – 8 mi N

Other

EXISTING RECORD

Measuring point TOP OF CASING, 1.60 FT ABOVE LSD

Measuring equipment TAPE

Frequency of measurement MONTHLY

Period of record --

Started 1961

Ended CONTINUING

Volume of missing record

28 617

KE-0046

July 1980
R. D. Cotter

CRITERIA FOR EVALUATION OF WATER–LEVEL OBSERVATION WELLS IN WISCONSIN

1. Areal spacing -- distance from any observation well
   -- distance from observation well in same aquifer

2. Ownership -- private
   -- public

3. Use of well OBSERVATION

4. Access -- physical OK
   -- owner's permission OK

5. Condition of well -- casing OK
   -- housing

6. Geologic log -- yes
   -- no

7. Construction report -- yes ?
   -- no

8. Diameter (4 inch minimum for recorder) 6 IN.

9. Aquifer -- single
   -- multiple

10. Hydraulic connection with aquifer

11. Knowledge of pumping effects

12. Range and character of water level fluctuations 31 FT.

13. Length of record 20 yrs.

14. Missing record

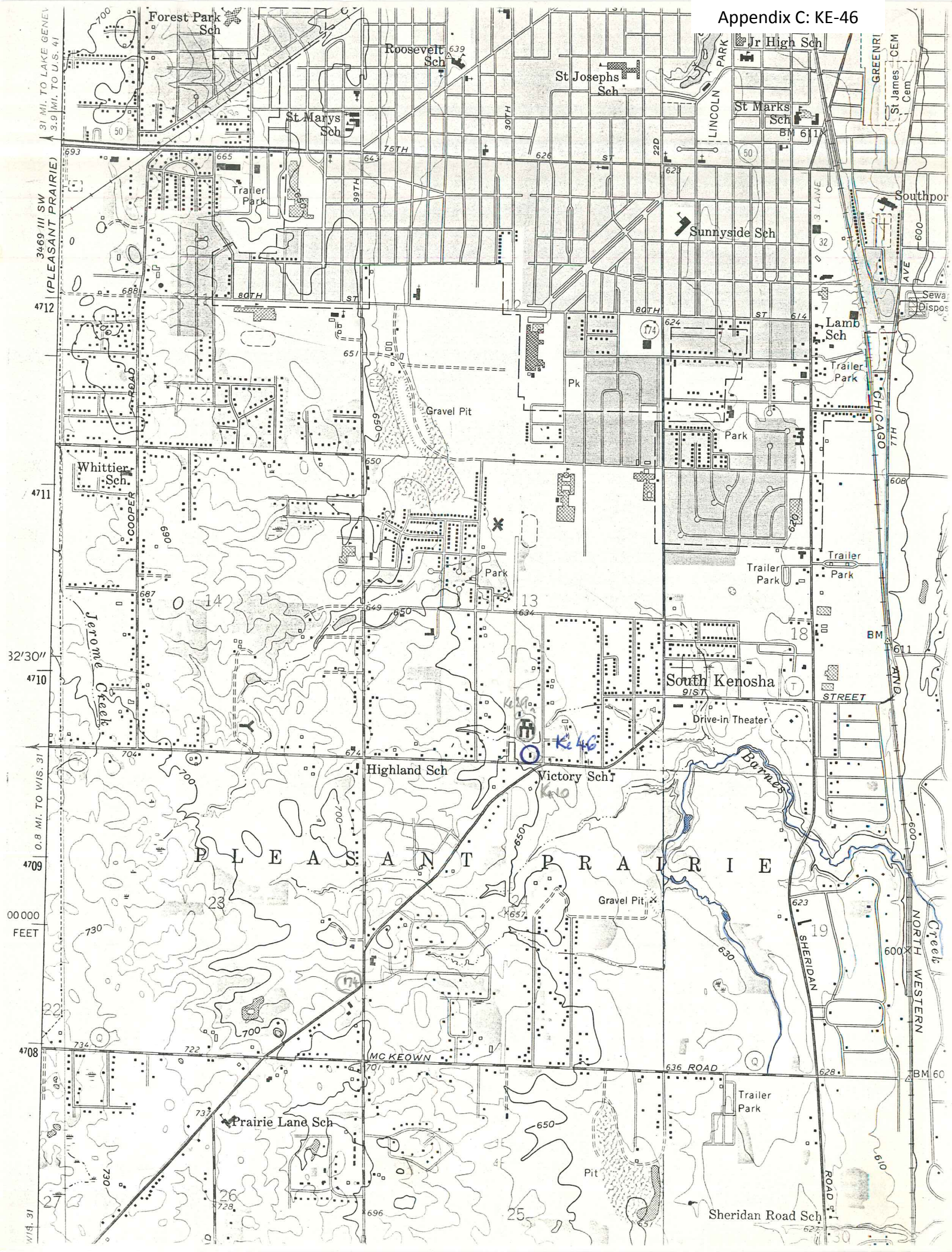
15. Adequacy of current measuring frequency OK

16. Probability of permanance GOOD

NOTES

Recommendations

Appendix C: KE-46



FORM NO 9-1904— A

SITE NO. KE-01/22E/13-0046

U.S. DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
GROUND WATER SITE INVENTORY
SITE SCHEDULE

Recorded by RS LYSTER

Date 03/22/1973

Check One ✓ English ___ Metric Units

GENERAL SITE DATA (0)

Site Ident No 423214087503801 (5–19) | RG Number R=0 * | Transaction T=(A) D M V * (add, delete, modify, verified)

Site-Type 2= C D H I M P T (W) * (collector, drain, sinkhole, connector, multiple, pond, tunnel or, well shaft, well) | Data Reliability 3= (C) U L M * (field checked, unchecked, location not accurate, minimal data) | Reporting Agency 4= USGS *

Project No. 5= * | District 6= 55 * | State 7= 55 * | County (or town) KENOSHA | 8= 059 *

Latitude 9= 42 32 14 * (deg min sec) | Longitude 10= 087 50 38 * (deg min sec) | Lat-Long Accuracy 11= S (F) T M * (sec, 5 sec, 10 sec, Min)

Local Number 12= KE-01/22E/13-0046 * | Land Net Loc. 13= -/-/SW/SE/13/T 09 N/R 23 E/4 * (1/4 1/4 1/4 section, township, range, merid)

Location Map 14= KENOSHA * | Scale 15= 24000 *

Altitude 16= 645. * | Method of Measurement 17= A L (M) * (altimeter, level, map) | Accuracy 18= 5 *

Topo Setting 19= D C E F H K L Ø P S T (U) V W * (depression, stream channel, dunes, flat, hilltop, sink, swamp, offshore, pediment, hillside, terrace, undulating, valley flat, upland draw) | Hydrologic Unit (OWDC) 20= *

Date of First Construction/Completion 21= / / * (month day year) | Use of Site 23= A D E G H (Ø) M P R S T U W X Z * (anode, drain, geothermal, seismic, heat reserv, observation, mine, oil or gas, recharge, repress, test, unused, withdrawal, waste, destroyed)

Use of Water 24= A B C D E F H I M N P R S T (U) Y Z * (air cond., bottling, commercial, dewater, power, fire, domestic, irrigation, medicinal, industrial, public supply, recreation, stock, institution, unused, desal, other)

Secondary Water Use 25= * | Tertiary Use of Water 26= * | Depth of Hole 27= 135. * | Depth of Well 28= 135. * | Source of Depth Data ① 29= S *

Water Level 30= 22.4 * | Date Measured 31= 12/03/1962 * (month day year) | Source ① 33= S *

Method of Measurement 34= A C E G H L M R S T V Z * (airline, calibrated airline, estimated, pressure gage, calibrated pressure gage, geophysical logs, manometer, reported, steel tape, electric tape, calibrated electric tape, other)

Site Status 37= D F G H Ø P R S T V X Z * (dry, flowing, nearby flowing, nearby recently flowing, obstruction, pumping, recently pumped, nearby pumping, nearby recently pumped, foreign substance, surface water effects, other)

Source of Geohydrologic Data ① 36= * | Pump Used 35= * (no) | Measuring Point 266= 1.6 * | Measuring Point Date 267= 12/03/1962 * (month day year)

OWNER IDENTIFICATION (1)

R=158 * | T=(A) D M * (add, delete, modify) | Date of Ownership 159 # 0000/1962 * (month day year)

Name: Last 161= ST JOSEPH * | First 162= HOME * | Middle Initial 163= *

OTHER SITE IDENTIFICATION NUMBERS (1)

R=189 * | T=(A) D M * (add, delete, modify) | Ident 190 # KE-0046 * | Assigner 191= USGS *

New Card Same R & T | Ident 190 # * | Assigner 191= *

SITE VISIT DATA (1)

R=186 * | T=(A) D M * (add, delete, modify) | Date of Visit 187# 12/03/1962 * (month day year) | Name of Person 188= HUTCHINSON *

FIELD WATER QUALITY MEASUREMENTS (1)

R=192 * | T=A D M * (add, delete, modify) | Date 193 # / / * (month day year) | Geohydrologic Unit 195 # *

New Card Same R thru 195

Temperature 196# 00010 * | Degrees C 197= *

Conductance 196# 00095 * | µ Mhos 197= *

Other (STORET) Parameter 196# * | Value 197= *

Other (STORET) Parameter 196# * | Value 197= *

FOOT NOTES:

① Source of Data Codes:

S D Ø A R L G Z
(reporting agency, driller, owner, other gov't, other reported, logs, geologist, other)

Is this Data Base verified

KE-01/22E/13-0046

WELL CONSTRUCTION DATA (1)

R = 55 * | T = A D M * (add, delete, modify) | Entry No 59 # * | Date of Construction Completion 60 = / / * (month / day / year) | Source of ① Const. Data 64 = *

Name of Contractor/Driller 63 = *

Method of Construction 65 = A air-, rotary | B bored, or augered | C cable-, tool | D dug, | H hydraulic, rotary | J jetted, | P air-per-, cussion | R reverse, rotary | T trenching, | V driven, | W drive, wash | Z other *

Finish 66 = C porous, concrete | F gravel w, perf | G gravel, screen | H horizontal, gallery, | Ø open, end | P perforated, or slotted | S screen, | T sand point, | W walled, | X open, hole | Z other *

Type of Seal 67 = B bentonite, | C clay, | G cement, grout | Z other *

Bottom of Seal 68 = *

Method of Development 69 = A air-lift, pump | B bailed, | C compressed, air | J jetted, | N none, | P other, pump | S surged, | Z other *

Number of Hours in Development 70 = *

Special Treatment During Development 71 = C chemicals, | D dry ice, | E explosives, | F deflocculent, | H hydrofracturing, | M mechanical, | Z other *

DIMENSIONS OF THE HOLE CONSTRUCTED (2)

R = 72 * | T = A D M * (add, delete, modify) | Construction Entry No 59 # *

New Card for Each Hole Segment Same R, T & Field 59

Top of Hole Segment Below LSD	Bottom of Hole Segment below LSD	Diameter of Hole Segment
73 # *	74 = *	75 = *
73 # *	74 = *	75 = *
73 # *	74 = *	75 = *
73 # *	74 = *	75 = *
73 # *	74 = *	75 = *

CASING SCHEDULE (2)

R = 76 * | T = (A) D M * (add, delete, modify) | Construction Entry No 59 # * | New Card for Each Casing With Same R, T & Field 59

Top of Casing Segment Below LSD	Bottom of Casing Segment Below LSD	Diameter of Casing Segment	Casing Material ⑤	Thickness of Casing
77 # 0.0 *	78 = 82. *	79 # 5. *	80 = C *	81 = *
77 # *	78 = *	79 # *	80 = *	81 = *
77 # *	78 = *	79 # *	80 = *	81 = *
77 # *	78 = *	79 # *	80 = *	81 = *
77 # *	78 = *	79 # *	80 = *	81 = *

OPENINGS SCHEDULE (2)

R = 32 * | T = (A) D M * (add, delete, modify) | Construction Entry No 59 # 1 * | New Card for Each Open Section With Same R, T and Field 59

	(Openings Data)	(Openings Data)	(Openings Data)
Top of Section Below LSD	83 # 82. *	83 # *	83 # *
Bottom of Section Below LSD	84 = 36. *	84 = *	84 = *
Type of Openings ⑥	85 = X *	85 = *	85 = *
Type of Material ⑦	86 = *	86 = *	86 = *
Diameter of Open Section	87 = *	87 = *	87 = *
Width of Opening	88 = *	88 = *	88 = *
Length of Opening	89 = *	89 = *	89 = *

FOOT NOTES:

① Source of Data Codes:

S reporting agency | D driller, | Ø owner, | A other gov't, | R other reported, | L logs, | G geologist, | Z other

⑤ Casing Material Codes

B brick, | C concrete, | G galv. iron | I wrought iron | M other, metal | P PVC or, plastic | R rock or, stone | S steel, | T tile, | U coated, steel | W wood, | Z other

⑥ Type of Openings Codes

F fracture, | L louvered, shuttered | M mesh, | P perforated, or slotted | R wire-wound | S screen, (unknown) | T sand point | W walled, | X open, hole | Z other

⑦ Type of Material Codes for Open Sections

B brass or, bronze | C concrete, | G galv. iron | I wrought iron | M other, metal | P PVC or, plastic | R stainless, steel | S steel, | T tile, | Z other

GEOHYDROLOGIC UNIT DESCRIPTIONS (1)

R = 90 * | T = A D M * (add, delete, modify) | Entry No 256 # * | Depth to Top 91 = . * | Depth to Bottom 92 = . *

Unit Identifier 93 = * | Lithology 96 = * | Lithologic Modifier 97 = *

AQUIFER DATA (2)

R = 94 * | T = A D M * (add, delete, modify) | Geohydrologic Unit Entry No 256 # *

Date 95 # / / * (month day year) | Water Level 126 = . * | % Water Contributed 132 = *

GEOHYDROLOGIC UNIT DESCRIPTIONS (1)

R = 90 * | T = A D M * (add, delete, modify) | Entry No 256 # * | Depth to Top 91 = . * | Depth to Bottom 92 = . *

Unit Identifier 93 = * | Lithology 96 = * | Lithologic Modifier 97 = *

AQUIFER DATA (2)

R = 94 * | T = A D M * (add, delete, modify) | Geohydrologic Unit Entry No 256 # *

Date 95 # / / * (month day year) | Water Level 126 = . * | % Water Contributed 132 = *

PERTINENT REMARKS

R = 133 * | T = (A) *

185 = ` 32I / DATE CONSTRUCTED UNKNOWN ' *

185 = ` ' *

185 = ` ' *

New Card Same R&T

NOTES:

U. S. GOVERNMENT PRINTING OFFICE : 1976 O - 213-137

PRODUCTION DATA (1)

R = 134 146 * (flowing, pumped) | T = A D M * (add, delete, modify) | Entry No 147 # * | Date 148 = / / * (month / day / year)

Discharge: 150 = * | Source of Data ① 151 = * |

Method of Measurement 152 = B C E F M O P R T U V W Z * (bailer, current meter, estimated, flume, totaling meter, orifice, pitot-tube meter, reported, trajectory, venturi, volumetric, weir, other)

Production Level 153 = * | Static Level 154 = * | Source of Data ① 155 = * | Specific Capacity 272 = *

Method of Measurement 156 = A C E G H L M R S T V Z * (airline, calibrated, estimated airline, pressure gage, calibrated pressure gage, geophysical logs, manometer, reported, steel tape, electric tape, calibrated electric tape, other) | Pumping Period 157 = *

LIFT DATA (1)

R = 42 * | T = A D M * (add, delete, modify) | Type of Lift 43 # A B C J P R S T U Z * (air, bucket, centrifugal, jet, piston, rotary, submergible, turbine, unknown, other) | Entry No 254 # *

Pump Intake Setting 44 = * | Type of Power 45 = D E G H L N W Z * (diesel, electric, gasoline, hand, LP gas, natural gas, windmill, other)

Date 38 = / / * (month / day / year) | Horsepower 46 = *

MAJOR PUMP DATA (2)

R = 47 * | T = A D M * (add, delete, modify) | Type of Lift 43 # * | Lift Entry No 254 # * | Manufacturer of Pump 48 = *

Serial No of Pump 49 = * | Name of Power Company 50 = *

Power Company Account No 51 = * | Power Meter No 52 = * | Pump Rating 53 = *

Person or Company Who Maintains the Pump 54 = * | Additional Lift 255 = * | Rated Pump Capacity 268 = *

STANDBY POWER DATA (2) (See LIFT DATA for codes of fields 43 and 56 below)

R = 55 * | T = A D M * (add, delete, modify) | Type of Lift 43 # * | Type of Power 56 = * | Horsepower 57 = * | Lift Entry No 254 # *

AVAILABLE LOG DATA (1)

R = 198 * | T = A D M * (add, delete, modify) | New Card for Each Log Type Same R & T

Type of Log ②	Begin Depth	End Depth	Source of Data ①
199 # *	200 = *	201 = *	202 = *
199 # *	200 = *	201 = *	202 = *
199 # *	200 = *	201 = *	202 = *
199 # *	200 = *	201 = *	202 = *

WATER QUALITY DATA COLLECTION (1)

R = 114 * | T = A D M * (add, delete, modify) | Begin Year 115 # * | End Year 116 = * | Source Agency 117 = *

Frequency of Collection ③ 118 = * | Network Site 257 = * | Type of Analyses ④ 120 = *

WATER LEVEL DATA COLLECTION (1)

R = 121 * | T = A D M * (add, delete, modify) | Begin Year 122 # 1963 * | End Year 123 = * | Source Agency 124 = USGS *

Frequency of Collection ③ 125 = M * | Network Site 258 = Y *

WATER PUMPAGE/WITHDRAWAL DATA COLLECTION (1)

R = 127 * | T = A D M * (add, delete, modify) | Begin Year 128 # * | End Year 129 = * | Source Agency 130 = *

Frequency of Collection ③ 131 = * | Network Site 259 = * | Method of Collection 133 = C E M U Z * (calculated, estimated, metered, unknown, other)

OTHER DATA AVAILABLE (1)

R = 180 * | T = A D M * (add, delete, modify) | Type of Data 181 # * | Loc 182 = C D Z * (cooperator, district, other) | Format 261 = F M P Z * (files, machine, published, other readable)

New Card Same R & T | Type of Data 181 # * | Loc 182 = C D Z * | Format 261 = F M P Z *

FOOT NOTES:

① Source of Data Codes: S D Ø A R L G Z (reporting agency, driller, owner, other gov't, other reported, logs, geologist, other)

② Type of Log Codes: A B C D E F G H I J K L M N Ø P Q (time, collar, caliper, driller's, electric, fluid conduct, geologist, magnetic, induction, gamma ray, dipmeter, laterlog, microlog, neutron, μ later, photo, radio-active); S T U V Z (sonic, temp, gamma-gamma, fluid velocity, other)

③ Frequency of Collection Codes: A B C D F I M Ø Q S W Z (annual, bi-monthly, continuous, daily, semi monthly, intermittent, monthly, one time only, quarter annual, semi-annual, weekly, other)

④ Type of Quality Analyses Codes: A B C D E F G H J K L M Z (physical, common chemical, trace elements, pesticides, nutrients, sanitary, codes B&D, codes B&E, codes B&F, codes D&E, codes C,D&E, all or most, other)

Long. 87°50'38"

(...85 ...er 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Ke-1/22/13-46

WELL SCHEDULE

Date 12-03, 19 62 Field No. _____
Record by R. D. Hutchinson Office No. _____
Source of data Mother Superior, field

1: *Location:* State Wisconsin County Kenosha
Map ~~Pleasant Prairie~~ 7½ min. Kenosha
SW ¼ SE ¼ sec. ~~23~~ 13 T RDH 1 (N) S R 22 (E) W

2. *Owner:* St. Joseph Home for Aging Address South Kenosha
Tenant _____ Address _____
Driller _____ Address _____

3. *Topography* Slightly rolling

4. *Elevation* 645 ft. (above) below msl (map)

5. *Type:* Dug, (drilled), driven, bored, jetted 19 55

6. *Depth:* Rept. _____ ft. Meas. 139 below MP ft.

7. *Casing:* Diam. ~~6~~ 8 in., to _____ in., Type steel
Depth 82 ? ft., Finish open ?

8. *Chief Aquifer* Niagara From 82 ? ft. to _____ ft.
...ers _____

9. *Water level* 22.40 ft (rept.) meas. 12-03 19 62 (above) below top of casing which is 1.6 ft. (above) below surface

10. *Pump:* Type none Capacity _____ G. M. _____
Power: Kind _____ Horsepower _____

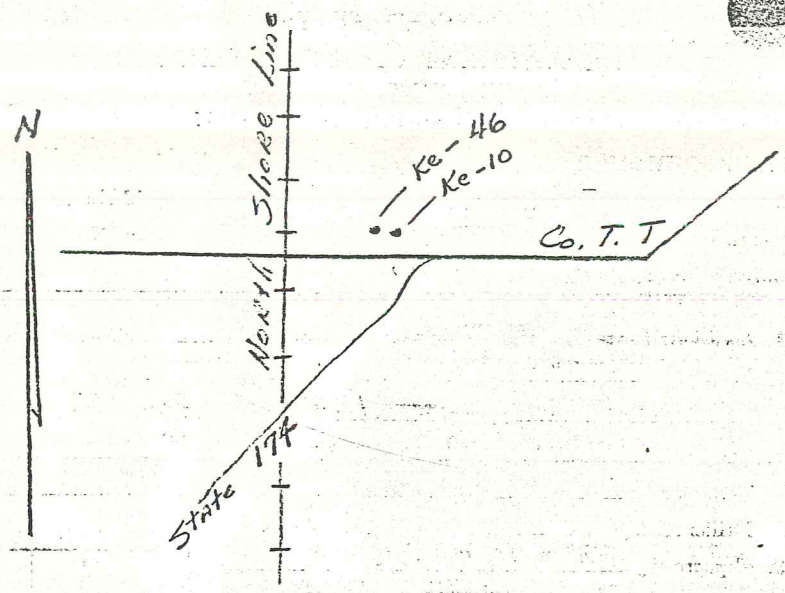
11. *Yield:* Flow _____ G. M., Pump _____ G. M., Meas., Rept. Est. _____
Drawdown _____ ft. after _____ hours pumping _____ G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., (Obs.) unused - may be used for lawn watering in future.
Adequacy, permanence _____
1963 →

13. *Quality* _____ Temp _____ °F.
Taste, odor, color _____ Sample (Yes) No
Unfit for _____

14. *Remarks:* (Log, Analyses, etc.) Original MP 4 ft. below lsd.
Landscaped and extension added to casing at time old home was torn down.

U. S. GOVERNMENT PRINTING OFFICE 16—62801-1



642' 645'

Date	Water level	Obs.	Remarks
3-16-61	10.83 +4	14.83	below MP, 4' below LSD
10-10-61	14.56 +2	16.56	below MP, 2' below LSD
12-3-62	22.40 -1.6	20.80	below MP, 1.6' above LSD

USGS → Depth: 139
Cond: 82?

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD OF HEALTH

See Instructions on Reverse Side

1. County Kenosha — Town ☒ Village ☒ City ☐ Pleasant Prairie (Check one and give name)
2. Location S.E. ¼ Sec. 13 T 1 N R 22 E (Name of street and number of premise or Section, Town and Range numbers)
3. Owner ☒ or Agent ☐ Carmelite Home (Name of individual, partnership or firm)
4. Mail Address South Kenosha (Complete address required)
5. From well to nearest: Building 7 ft; sewer ___ ft; drain ___ ft; septic tank 50 ft; ___ dry well or filter bed ___ ft; abandoned well ___ ft.
6. Well is intended to supply water for: Old People's Home

7. DRILLHOLE:

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
10	0	20			

8. CASING AND LINER PIPE OR CURBING:

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
6	Std wt steel	0	103

9. GROUT:

Kind	From (ft.)	To (ft.)
Puddled clay	0	20

10. FORMATIONS:

Kind	From (ft.)	To (ft.)
Subsoil & red clay	14	14
Blue clay	12	26
Sand	22	48
Hd Pan	17	65
Blue clay	6	71
Hd Blue clay	8	79
Hd Pan	12	91
Sand	12	103
Limestone	37	140

Construction of the well was completed on: 8/18 1955

The well is terminated 10 inches ☒ above, below ☐ the permanent ground surface.

Was the well disinfected upon completion? Yes X No ___

Was the well sealed watertight upon completion? Yes X No ___

11. MISCELLANEOUS DATA:

Yield test: 12 Hrs. at 28 GPM.

Depth from surface to water-level: 10 ft.

Water-level when pumping: 84 ft.

Water sample was sent to the state laboratory at: Kenosha (City) on 8/21 1955

Signature S. Cairns Wm F Brittle Co. (Registered Well Driller) 9356 - Sher Rd. Kenosha Wis. (Complete Mail Address)

Please do not write in space below

Rec'd ___ No. ___

Ans'd ___

Interpretation RECEIVED MAY 2 1958 ENVIRONMENTAL SANITATION

	10 ml	10 ml	10 ml	10 ml	10 ml
Gas—24 hrs.					
48 hrs.					
Confirm					
B. Coli					

Examiner ___

Ke-10

Ke-10

CARMELITE SISTERS WELL,

SOUTH KENOSHA, WIS. SW¼, SW¼, SE¼, Sec. 13, T.1N., R.22E.

F.M. Gray. Jr., Co., Contractors

Arthur Bartley, Driller, 1923

LSA = 645'

Samples examined by F.T. Thwaites, U.W. Nos. 72650-72685

DRIFT	82	0-26	Clay, gray, calcareous, some stones
		26-82	Sand, fine, gray, calcareous
NIAGARA	284	82-140	Dolomite, light gray
		140-144	Dolomite, light gray, much pyrite
		144-162	Dolomite, light gray
		162-169	Dolomite white
		169-235	Dolomite, white and greenish gray
		235-350	Dolomite, gray
		350-352	Shale, blue, calcareous
		352-362	Dolomite white, coarse grained
		362-366	Dolomite, gray and light pinkish gray
		366-370	Dolomite, light gray & blue; shale, blue, calc.
RICHMOND	178	370-405	Dolomite, dark gray
		405-409	Dolomite, light and dark gray
		409-420	Shale, blue, dolomitic; dolomite, gray and blue
		420-544	Shale, blue, calcareous
GALENA-BLACK RIVER	368	544-730	Dolomite, gray
		730-740	Dolomite, light gray, blue spots
		740-752	Dolomite, gray, white chert
		752-759	Dolomite, light bluish gray
		759-769	Dolomite, gray; chert, white
		769-815	Dolomite, gray and blue
		815-830	Dolomite, gray
ST. PETER		830-850	Sandstone, medium to fine, gray, calcareous
		850-882	Dolomite, gray and bluish gray
		882-886	Sandstone, fine, gray, very dolomitic
		886-897	Dolomite, blue, shaley
		897-912	Dolomite, gray, very sandy
	-	912 -	Sandstone, medium, gray

Wel 6

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD OF HEALTH

See Instructions on Reverse Side

ALT. 640'

KE-29

1. County Kenosha { Town ☒ / Village ☐ / City ☐ } Pleasant Prairie (Check one and give name)

2. Location S.W.1/4, of S.W.1/4, of S.E.1/4, Sec.13, T.1 N., Range 22 E.
Name of street and number of premise or Section, Town and Range numbers

3. Owner ☒ or Agent ☐ Carmelite Sisters D.C.J. PEEM WELL # 80403
Name of individual, partnership or firm

4. Mail Address 1214 Kavanaugh Place, Wauwatosa, Wisconsin
Complete address required

5. From well to nearest: Building_____ft; sewer_____ft; drain_____ft; septic tank_____ft; dry well or filter bed_____ft; abandoned well_____ft.

6. Well is intended to supply water for: nursing home

7. DRILLHOLE:

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
16"	0	40			
10"	40	306			

8. CASING AND LINER PIPE OR CURBING:

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
16"	Steel	0	40'9"
10"	Steel	1'9"	112

9. GROUT:

Kind	From (ft.)	To (ft.)
Neat	0	40

10. FORMATIONS:

Kind	From (ft.)	To (ft.)
Clay and hardpan with streaks of gravel	0	100
Limestone	100	306

RECEIVED
MAY 2 1960
SANITARY ENGINEERING

Construction of the well was completed in: March 19 60

The well is terminated 21 inches ☒ above, below ☐ the permanent ground surface.

Was the well disinfected upon completion? Yes X No

Was the well sealed watertight upon completion? Yes X No

11. MISCELLANEOUS DATA:

Yield test: 2 Hrs. at 80 GPM.

Depth from surface to water-level: 11 (629) ft. (641 631)

Water-level when pumping: 212 ft.

Water sample was sent to the state laboratory at: Upon installation of permanent pump. City on 19

Signature D. E. Leicht
Registered Well Driller

LAYNE-NORTHWEST COMPANY
6005 West Martin Drive, Milwaukee, Wis.
Complete Mail Address

T. E. Leicht, Geologist

Please do not write in space below TEL.s 4/26/1960

Rec'd_____ No._____

Ans'd _____

Interpretation cc: S.B.S. 5-5-60

	10 ml	10 ml	10 ml	10 ml	10 ml
Gas—24 hrs.					
48 hrs.					
Confirm					
B. Coli					

Examiner_____

plot

Wisconsin Geological Survey, Science Hall, Madison, Wisconsin — Log No. Ke-29

Carmelite Sisters D.C.J., Pleasant Prairie, Wisconsin
SW¼, SW¼, SE¼, Sec. 13, T 1N, R 22E
Layne-Northwest Co., Driller, March 1960
Sample Nos. 221297-221356 - Examined by M. E. Ostrom
640-642 Alt = ~~650~~ ETA

+1'9"

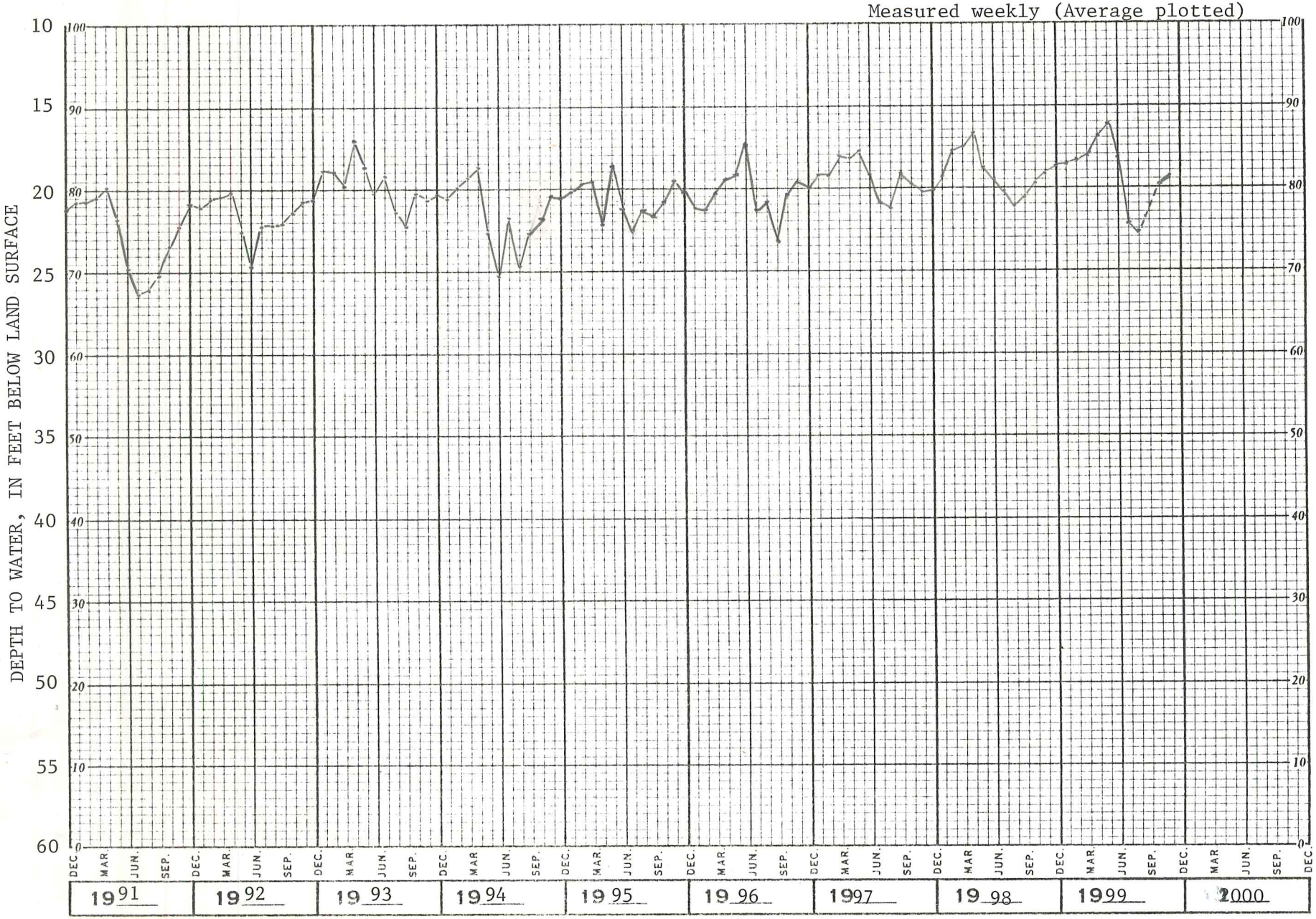
DRIFT	0- 5	5		Snd,dk yl bn,Vfn-VC,Sang;mch st&cl;ltl Vfn-fn gvl	grout neat cement, 0-40'
	5- 25	20		St & Cl,bn gry,calcic;ltl Vfn-VC mxd snd	11'
	25- 30	5		Gvl,Vfn-fn,Srnd,P srtg,mxd;mch st&cl,mch VC-Vfn snd	16"hole
	30- 40	10		St & Cl,bn gry,calcic;ltl VC-Vfn snd;ltl Vfn-fn gvl	16"pipe
	40- 60	20		St & Cl,bn gry,calcic;ltl VC-Vfn snd;tr Vfn-fn gvl	40'9"
	60- 65	5		St&Cl,bn gry,calcic;ltl VC-Vfn snd;ltl Vfn-M gvl	
	65- 80	15		St&Cl,by gry,calcic;ltl VC-Vfn snd;ltl Vfn-fn mxd gvl	10"pipe 10"hole
	80- 90	10		St&Cl,bn gry,calcic;ltl VC-Vfn snd;tr Vfn mxd gvl	
100	90-100	10		St&Cl,bn gry,calcic;ltl VC-Vfn snd;mch Vfn-fn mxd gvl	
NIAGARA	100-125	25		Dol,lt gry,fn-C,por;tr pyr	112'
	125-130	5		Dol,yl gry,M-fn,slgt por	
	130-135	5		Dol,yl gry,M-Vfn,dns	
	135-145	10		Dol,yl gry,C-Vfn,slgt por	
	145-155	10		Dol,yl gry,C-Vfn,slgt por;tr pyr	
	155-165	10		Dol,yl gry,C-Vfn,por;tr pyr	
	165-170	5		Dol,lt gry,Vfn-M,dns;tr wh cht;tr pl gn cl	
	170-180	10		Dol,lt gry,Vfn-fn,dns;tr wh cht;tr pl gn cl	
	180-185	5		Dol,lt gry,Vfn-fn,dns;tr cht & pyr;tr pl gn cl	
	185-215	30		Dol,lt gry,Vfn-M,dns;tr wh cht & pyr;tr pl gn cl	
	215-220	5		Dol,lt gry mot Vlt pnk,Vfn-M,dns;tr pyr & cl	
	220-225	5		Dol,lt gry mot Vlt pnk,Vfn-M,dns;ltl cl;tr pyr	
	225-235	10		Dol,yl gry mot pnk,C-fn,slgt por;tr pyr & pl gn cl	
	235-245	10		Dol,yl gry,C-fn,slgt por	
	245-250	5		Dol,yl gry,M-Vfn,slgt por;tr pl gn sh	
	250-265	15		Dol,yl gry,C-fn,slgt por	
	265-270	5		Dol,yl gry,C-fn,slgt por;tr pyr & pl gn sh	
	270-280	10		Dol,yl gry,C-fn,slgt por	
	280-285	5		Dol,yl gry,C-fn,slgt por;tr pyr;tr glauc	
	285-290	5		Dol,yl gry,C-fn,slgt por;tr pyr;ltl sh	
	290-295	5		Dol,yl gry,C-fn,slgt por;tr pyr	
200	295-300	5		Dol,yl gry,C-fn,slgt por;tr pyr;tr pl gn sh	306'

Formations: Drift, Niagara
Well tested for 2 hrs. at 80 gpm with 201 ft. of drawdown, specific capacity 0.4 gpm per foot of drawdown.

642 20-25ft
622-617
645 625-620

KE-01/22E/13-0046. St.Joseph Home for the Aged. SW¼SE¼. Drilled observation artesian well in Niagara Dolomite of Silurian age, diam 6 in., depth 135 140 ft, cased to 82 103 ft. Lsd 645 642 ft above msl. MP top of casing, 1.60 ft above lsd.

Measured weekly (Average plotted)



APPENDIX D OF REFERENCE DOCUMENTS
MN-28

USGS Basic Data and Map 1980

USGS personnel went through in 1980 to combine observation well records

Well Construction Report (WCR) to State Board of Health 1959

WCR to Wisconsin State Board of Health

USGS Well Schedules 1972

USGS Well Schedule contains some well construction information and hand-drawn location

USGS Site Schedule 1976

USGS meta-data similar to Well Schedule

Alex Zaporozec Graphs of Water Levels 1991-1999

water levels graphed onto paper

MN-28 Geologic Log 1959

MN-28 record of geology

7/11/80

MN-0028

BASIC DATA ON WATER-LEVEL OBSERVATION WELL

Well number MN-19/23E/35-0028
Owner Wis. Dept. of Transportation
Location (Co., T/R.sec) Manitowoc Co.
T. 19 N., R. 23 E., Sec. 35 SE1/4 NE1/4
Land surface altitude 670 ft.
Drainage basin Lake Michigan Basin
Dist. to nearest perennial stream: 4000 ft SW to Silver Creek

WELL DATA

Depth 147 ft.
Casing depth 133 ft.
Screened interval
Diameter 6 in.
Aquifers open to well Niagara
Geologic log available?
Construction report available? Y
Use of well Domestic
Access to measure well OK

NEAREST SUPPLEMENTAL DATA POINTS

Precipitation stations Manitowoc - 1 m. NE Brillion - 21 m. NW
Two Rivers - 8 m. NE

Streamgaging stations
04085427 Manitowoc River at Manitowoc - 2 m. NW

Observation wells MN 29 - 11 mi SSW MN 493 - 14 mi NW
MN 489 - 13 mi SW MN 494 - 18 mi NNW

Other

EXISTING RECORD

Measuring point 1/4 in. hole in pump base, 1.00 ft. above LSD
Measuring equipment Tape
Frequency of measurement Monthly
Period of record --
Started 1968
Ended Continuing
Volume of missing record

MN-0028

July 1980
R. D. Cotter

CRITERIA FOR EVALUATION OF WATER–LEVEL OBSERVATION WELLS IN WISCONSIN

1. Areal spacing -- distance from any observation well 12 Mi.
   -- distance from observation well in same aquifer 12 Mi.

2. Ownership -- private
   -- public

3. Use of well DOMESTIC

4. Access -- physical OK
   -- owner's permission OK

5. Condition of well -- casing OK
   -- housing

6. Geologic log -- yes
   -- no

7. Construction report -- yes
   -- no

8. Diameter (4 inch minimum for recorder) 6 IN.

9. Aquifer -- single
   -- multiple

10. Hydraulic connection with aquifer

11. Knowledge of pumping effects

12. Range and character of water level fluctuations 5 FT.

13. Length of record 13 yrs

14. Missing record

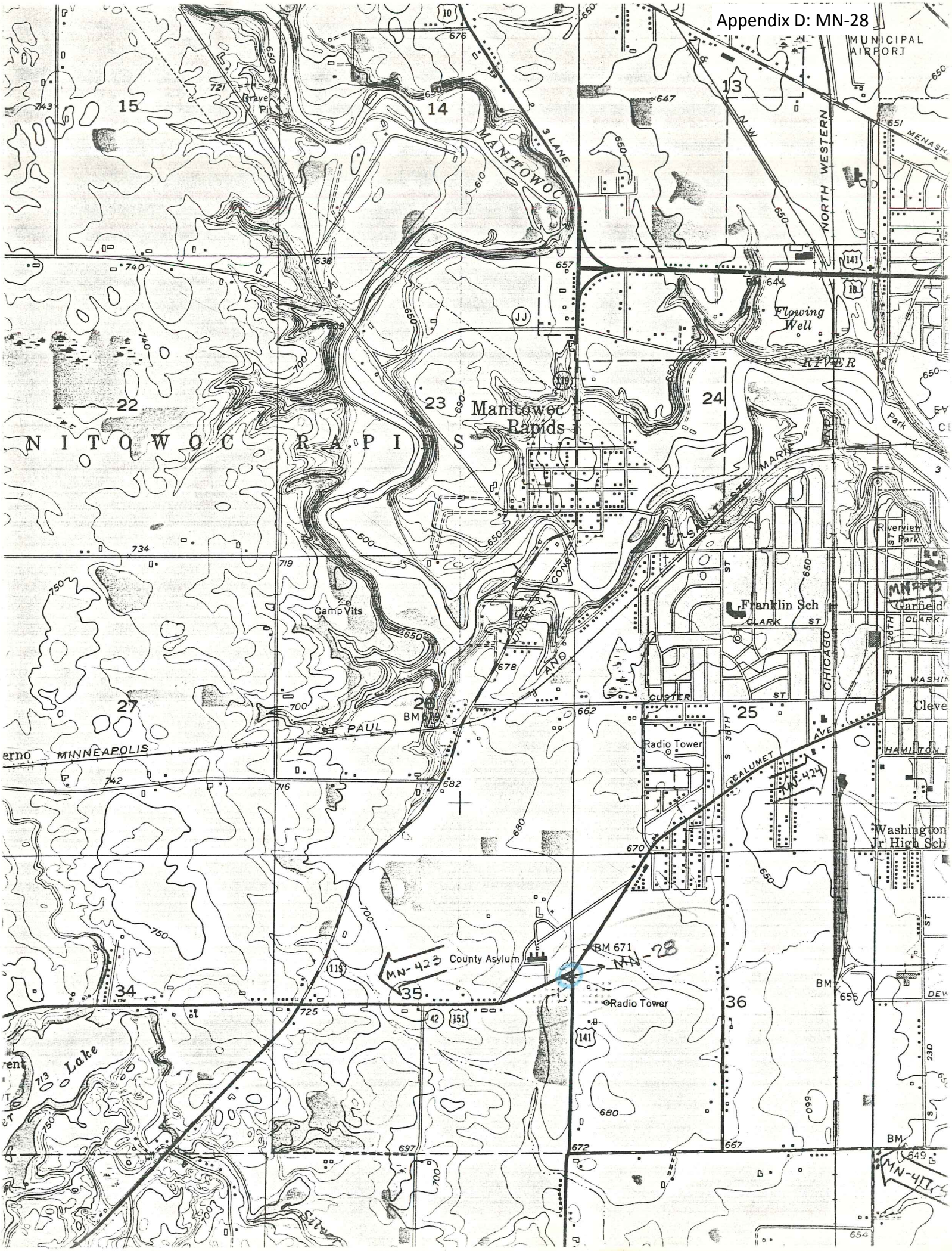
15. Adequacy of current measuring frequency NEED MONTHLY

16. Probability of permanance GOOD

NOTES

Recommendations

Appendix D: MN-28



Appendix D: MN-28

Mn-28

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD

See Instructions on Reverse Side

1. County Manitowoc — Town / Village / City: Manitowoc Rapids (Check one and give name)
2. Location ... T19N R23E (Name of street and number of premises or Section, Town and Range numbers)
3. Owner ☐ or Agent ☐ [illegible]
4. Mail Address Madison, Wis.
5. From well to nearest: Building ... ft. sewer ... ft. drain ... ft. septic tank ... ft. dry well or filter bed ... ft. abandoned well ... ft. No Buildings
6. Well is intended to supply water for: [illegible]

7. DRILLHOLE:

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
12	0	20	8	20	[illegible]
6	132	1927			

8. CASING AND LINER PIPE OR CURBING:

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
10	[illegible]	0	21
6	[illegible] 19.08	0	133

9. GROUT:

Kind	From (ft.)	To (ft.)
Neat Cement	0	21

10. FORMATIONS:

Kind	From (ft.)	To (ft.)
[illegible] Clay	0	5
[illegible] Stony Clay	5	45
[illegible] Gritty Clay	45	120
[illegible]	120	122
[illegible] Clay	122	132
[illegible] Limerock	132	1927

Construction of the well was completed on: Sept 24 1937

11. MISCELLANEOUS DATA:

Yield test: 5 Hrs. at 15 G.P.M.

Depth from surface to water-level: 34 ft.

Water-level when pumping: 34 ft.

Water sample was sent to the state laboratory at: Madison on Sept 24 1937

The well is terminated 14 inches ☒ above, below ☐ the permanent ground surface.

Was the well disinfected upon completion? Yes ✓ No

Was the well sealed watertight upon completion? Yes ✓ No

Signature [illegible] & Son (Registered Well Driller) — [illegible] Iron Ridge, Wis. (Complete Mail Address)

Please do not write in space below

SEP [illegible] 1937 — No. 3826

	10 ml	10 ml	10 ml	10 ml	10 ml
Gas—24 hrs.	+				
48 hrs.					
Confirm	+	+	+	+	0
B. Coli	4				

UNSAFE

Examiner

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD OF HEALTH

See Instructions on Reverse Side

1. County Manitowoc — Town ☐ / Village ☐ / City ☐ Manitowoc Rapids (Check one and give name)

2. Location Jct. Hy 141 & 151 T. 19 N R. 23 E SE,SE,NE, Sec 35
Name of street and number of premise or Section, Town and Range numbers

3. Owner ☒ or Agent ☐ Wis. Hy. Commission
Name of individual, partnership or firm

4. Mail Address Madison, Wis.
Complete address required

5. From well to nearest: Building_____ft; sewer_____ft; drain_____ft; septic tank_____ft; dry well or filter bed_____ft; abandoned well_____ft. No Buildings

6. Well is intended to supply water for: Road Side Park

7. DRILLHOLE:

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
10 ~~6~~	0	20	6 ~~8~~	20	~~50~~ 147
~~6~~	~~50~~	~~147~~			

8. CASING AND LINER PIPE OR CURBING:

Dia. (in.)	Kind	From (ft.)	To (ft.)
10	Steel	0	21
6	Steel 19.18	0	133

9. GROUT:

Kind	From (ft.)	To (ft.)
neat Cement	0	50

10. FORMATIONS:

Kind	From (ft.)	To (ft.)
Red Clay	0	5
Blue Stoney Clay	5	45
Blue Gritty Clay	45	120
Rock Layer Soft	120	122
Flowing Clay	122	132
Dense Lime Rock	132	147

Construction of the well was completed on: Sept 24 19 59

The well is terminated 14 inches ☒ above, below ☐ the permanent ground surface.

Was the well disinfected upon completion? Yes ✓ No_____

Was the well sealed watertight upon completion? Yes ✓ No_____

11. MISCELLANEOUS DATA:

Yield test: 5 Hrs. at 15 GPM.

Depth from surface to water-level: 36 ft.

Water-level when pumping: 36 ft.

Water sample was sent to the state laboratory at: Madison (City) on Sept 24 19 59

Signature E. Sperling & Son (Registered Well Driller) Box 93 Iron Ridge, Wis. (Complete Mail Address)

Please do not write in space below

Rec'd SEP 24 1959 No. 33826

Ans'd

Interpretation UNSAFE

	10 ml	10 ml	10 ml	10 ml	10 ml
Gas—24 hrs.	+				
48 hrs.					
Confirm	+	+	+	+	0
B. Coli	4/5				

Examiner

185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE Mn-19/23/-28

Date ____, 19____ Field No. ____

Record by NMC Office No. ____

Source of data W. G. S. log

1. *Location:* State Wisconsin County Manitowoc
   Map Junction Highways # 141 & # 151
   ____ ¼ ____ ¼ sec. ____ T 19 (N/S) R 23 (E/W)
2. *Owner:* Wis. State Roadside Park Address Manitowoc, Wis.
   Tenant ____ Address ____
   Driller E. Sperling & Son Address ____
3. *Topography* ____
4. *Elevation* ____ ft. above/below ____
5. *Type:* Dug, (drilled), driven, bored, jetted Sept. 19 59
6. *Depth:* Rept. 147 ft. Meas. ____ ft.
7. *Casing:* Diam. 10" to 20', 6" from 0 to 133 in., to ____ in., Type ____
   Depth ____ ft., Finish open hole (133' to 147')
   Chief Aquifer ____ From ____ ft. to ____ ft.
   Others ____
9. *Water level* 36 ft. (rept./meas.) ____ 19____ above/below ____
   ____ which is ____ ft. above/below surface
10. *Pump:* Type ____ Capacity ____ G. M. ____
    Power: Kind ____ Horsepower ____
11. *Yield:* Flow ____ G. M., Pump ____ G. M., Meas., Rept. Est. ____
    Drawdown ____ ft. after 6 hours pumping 15 G. M.
12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ____
    Adequacy, permanence ____
13. *Quality* ____ Temp ____ °F.
    Taste, odor, color ____ Sample Yes/No ____
    Unfit for ____
14. *Remarks:* (Log, Analyses, etc.)
    11) Driller reports no change in WL

ADP SCHEDULE MADE

U. S. GOVERNMENT PRINTING OFFICE 16-26280

Punched & Verified

WRD Exp. (GW)
April 1966

Well No. Mn-19/23/35-28

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

MASTER CARD

NMG 1:24,000

Record by R.M. ERICKSON Source of data FIELD & OFC. Date 6/25/68 Map MANITOWOC

State WISCONSIN (55) County (or town) MANITOWOC (71)

Latitude: 44 04 30 N Longitude: 087 42 04 Sequential number: 1

Lat-long accuracy: (20) T 19 N, R 23 E Sec 35 SE¼, SE¼, NE¼ 4

Local well number: 19N23E35 L Other number: WAYSIDE WELL

Local use: MN0028 WAYSIDE WL Owner or name: WIS. HWY. COMM.

Owner or name: WIS HWY COMM Address: Manitowoc, Wis

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist (67) S

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other (68) H

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (X) Waste, (E) Destroyed (69) W

DATA AVAILABLE: Well data (70) 1 Freq. W/L meas.: (71) Q Field aquifer char. (72)

Hyd. lab. data: (73)

Qual. water data: type: (74)

Freq. sampling: ORIGINAL (75) Pumpage inventory: yes / no, period: (76)

Aperture cards: yes (77)

Log data: WGS LOG (78 79) G

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD (19) Depth well: 147 ft (20 23) 147 Meas. rep. Driller accuracy (24) 3

Depth cased (first perf.): 133 ft (25 28) 133 Casing type: STEEL ; Diam. 6 in (29 30)

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (Q) open end, (P) perf., screen, sd. pt., (S) (T) (W) shored, (X) open hole, other (Z) (31) X

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, other (32) C

Date Drilled: 9/29/59 (33 35) 9 59 Pump intake setting: ft (36 38)

Driller: E. SPERLING (name), IRON RIDGE, WIS. (address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (E) other (39) P; Deep/Shallow (40) D

Power (type): diesel, elec, gas, gasoline, hand, nat gas, wind, LP; H.P. (41) 1 Trans. or meter no.

Descrip. MP 1/4" hole in pump base 1.00 ft above/below LSD, Alt. MP

Alt. LSD: 670 (42 45) 670 Accuracy (source): (47)

Water Level 29.16 ft above/below MP, ft above/below LSD (48 51) 29 Accuracy: TAPE (52)

Date mean: JUNE 29, 68 (53 55) 6 6 8 Yield: 15 gpm (56 60) 15 Method determined (61)

Drawdown: ft (62 64) Accuracy: LOG (65) Pumping period 6 hrs (66 68)

QUALITY OF WATER DATA: Iron ppm (69) Sulfate ppm (70) Chloride ppm (71) Hard. ppm (72)

Sp. Conduct K x 10^6 (73) Temp. °F (74 76) Date sampled 10/20/72 (77 79) Q 7 2

Taste, color, etc.

Well No. Mn-19/23/35-28

Well No. Mn-19/23/35

Latitude-longitude 44 04 30 (d m s) 087 42 04 (d m s)

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD (1) Physiographic Province: CENT. LOW. (20 21) 12 Section: ELS

(22) A Drainage Basin: GRT. LKS. (23 25) 23M Subbasin: L. MICH. (26)

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, swamp, (L) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat (27) F

MAJOR AQUIFER: Silurian (system), S (series), NIAGARA (aquifer, formation, group) (28 29 30 31) 6M

Lithology: Dolomite (32) D Origin: Marine (33) 6 Aquifer Thickness: ft (34)

(35 37) Length of well open to: 14 ft (38 40) 14 Depth to top of: 125 ft (41 43) 125

MINOR AQUIFER: (system), (series), (aquifer, formation, group) (44 45 46 47)

Lithology: (48 49) Origin: (50) Aquifer Thickness: ft

(51 53) Length of well open to: ft (54 56) Depth to top of: ft (57 59)

Intervals Screened:

Depth to consolidated rock: 125 ft (60 63) 125 Source of data: WGS (64) C

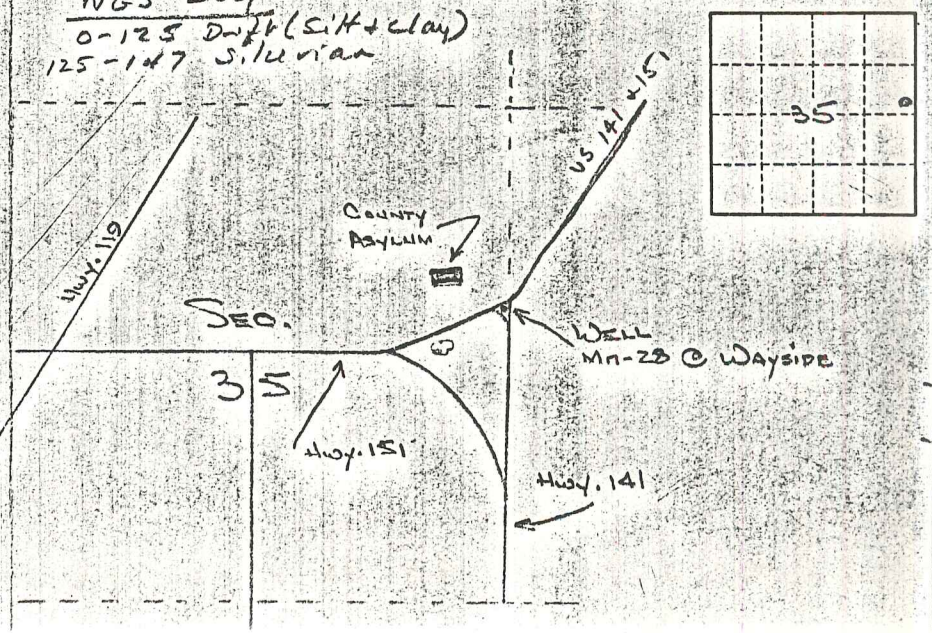
Depth to basement: ft (65 68) Source of data: (69)

Surficial material: Silty clay (70 71) ZP Infiltration characteristics: Very Poor (72) 5

Coefficient Trans: gpd/ft (73 75) Coefficient Storage: (76 78)

Coefficient Perm: gpd/ft^2; Spec cap: gpm/ft; Number of geologic cards: (79)

WGS LOG
0-125 Drift (silt + clay)
125-147 Silurian



MN-19/23E/35-0028

U.S. DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
SITE SCHEDULE

Recorded by L. C. Trotta

Date 12/[illegible]/1976

Check One ✓ English ___ Metric Units

GENERAL SITE DATA

Site Ident No [illegible] (5 … 19) | RG Number R=0 * | Transaction T= A D M V * (add, delete, modify, verified)

Site-Type 2= C D M P T (W) * (collector, drain, multiple, pond, tunnel or shaft, well) | Data Reliability 3= C U L M * (field checked, unchecked, location not accurate, minimal data) | Source Agency 4= [illegible] *

Project No. 5= [illegible] * | District 6= 55 * | State 7= 55 * | County (or town) [illegible] | 8= [illegible] *

Latitude 9= [illegible] * (deg min sec) | Longitude 10= [illegible] * (deg min sec) | Lat-Long Accuracy 11= S (F) T M * (sec, 5 sec, 10 sec, Min)

Local Number 12= MN-19/23E/35-0028 * | Land Net Loc. 13= [illegible] S 35 T 19 R 23E [illegible] * (1/4 1/4 1/4 section, township, range, merid)

Location Map 14= MAN 7.0 W4C * | Scale 15= 24000 *

Altitude 16= 670. * | Method of Measurement 17= A L (M) * (altimeter, level, map) | Accuracy 18= 5 *

Topo Setting 19= D C E (F) H K L O P S T U V * (depression, stream channel, dunes, flat, hilltop, sink, swamp, offshore, pediment, hillside, terrace, undulating, valley flat) | Hydrologic Unit (OWDC) 20= *

Date of First Construction/Completion 21= [illegible]/24/1959 * (month day year) | Use of Site 23= A D E G H Ø M P R S T U (W) X Z * (anode, drain, geothermal, seismic, heat reserv., observation, mine, oil or gas, recharge, repress, test, unused, withdrawal, waste, destroyed)

Use of Water 24= A B C D E F (H) I M N P R S T U Y Z * (air cond., bottling, commercial, dewater, power, fire, domestic, irrigation, medicinal, industrial, public supply, recreation, stock, institution, unused, desal, other)

Secondary Water Use 25= [illegible] * | Tertiary Use of Water 26= * | Depth of Hole 27= 147. * | Depth of Well 28= 147. * | Source of① Depth Data 29= *

Water Level 30= 36.00 * | Data Measured 31= 09/24/1959 * (month day year) | Source① 33= [illegible] *

Method of Measurement 34= A C E G H L M (R) S T Z * (airline, calibrated airline, estimated, pressure gage, calibrated pressure gage, geophysical logs, manometer, reported, steel tape, electric tape, other)

Site Status 37= D F G H Ø P R S T Z * (dry, flowing, nearby flowing, nearby recently flowing, obstruction, pumping, recently pumped, nearby pumping, nearby recently pumped, other)

266 = 1. *
267 = 06/27/1968 *

Source of Geohydrologic Data① 36= [illegible] * | Pump Used 35= * (no)

OWNER IDENTIFICATION

R = 158 * | T= (A) D M * (add, delete, modify) | Date of Ownership 159 # [illegible] * (month day year)

Name: Last 161= WIS. STATE * | First 162= HWY COMM * | Middle Initial 163= *

OTHER SITE IDENTIFICATION NUMBERS

R=189 * | T= A D M * (add, delete, modify) | Ident 190 # [illegible] * | Assigner 191= [illegible] *

New Card Same R & T | ID 190 # N-0028 * | Assigner 191= USGS *

SITE VISIT DATA

R=186 * | T= A D M * (add, delete, modify) | Date of Visit 187# / / * (month day year) | Name of Person 188= *

FIELD WATER QUALITY MEASUREMENTS

R=192 * | T= (A) D M * (add, delete, modify) | Date 193 # 12/07/1972 * (month day year) | Geohydrologic Unit 195 # 350SADL *

New Card Same R thru 195

Temperature 196 # 00010 * | Degrees C 197= 9. *

Conductance 196 # 00095 * | μ Mhos 197= 390. *

Other (STORET) Parameter 196 # * | Value 197= . *

Other (STORET) Parameter 196 # * | Value 197= . *

FOOT NOTES:

① Source of Data Codes:

S D O A R L G Z

USGS, driller, owner, other gov't, other reported, logs, geologist, other

MN-19/23E/35-0028

In SS Data Base verified

GEOHYDROLOGIC UNIT DESCRIPTIONS

R = 90 * | T = A D M * (add, delete, modify) | Depth to Top 91 # * | Depth to Bottom 92 = 125. *

Unit Identifier 93 = * | Lithology 96 = GRET * | Lithologic Modifier 97 = CLAY & SAND *

AQUIFER DATA

R = 94 * | T = A D M * (add, delete, modify) | Depth to Top 91 # * | Date 119 = / / (month day year) * | Water Level 39 = * | % Water Contributed 95 = *

GEOHYDROLOGIC UNIT DESCRIPTIONS 256# 100*

R = 90 * | T = A D M * (add, delete, modify) | Depth to Top 91 # 125. * | Depth to Bottom 92 = * | Unit Identifier 93 = QUSLDL * | Lithology 96 = DLMT * | Lithologic Modifier 97 = *

AQUIFER DATA 256# 100*

R = 94 * | T = A D M * (add, delete, modify) | Depth to Top 91 # * | Date 119 = 09/24/1954 * (95 month day year) | Water Level 39 = 36. * (126) | % Water Contributed 95 = 10.0 * (132)

PERTINENT REMARKS

R = 183 * | T = A D * (add, delete)

185 = C13/WAYSIDE @ JUNCTION HWS 14 & 151 *

185 = C26/QUARTER INCH HOLE IN PUMPBASE *

185 = C203/CHECKED 1975 BY M. A. R. *

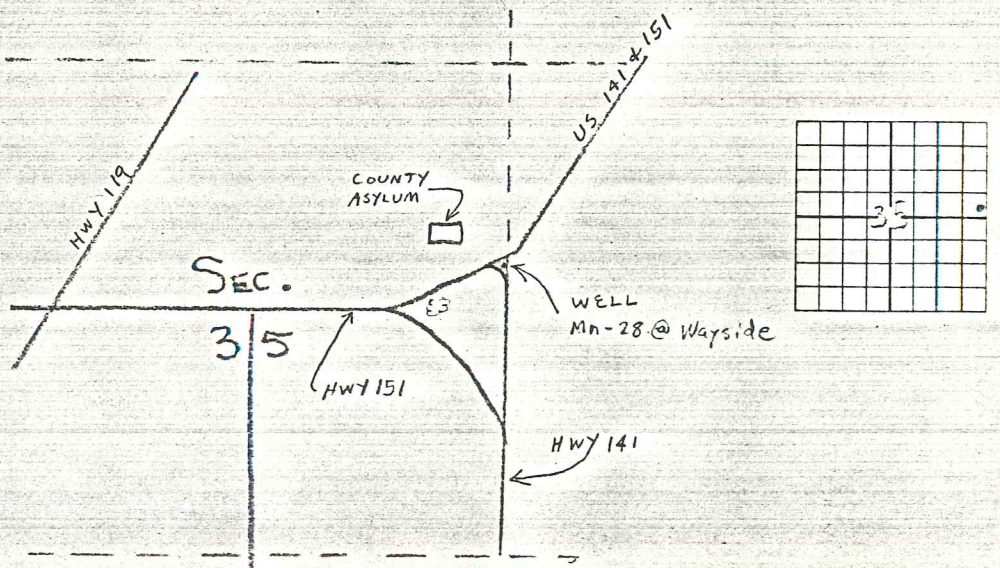
New Card Same R&T

NOTES: WGS Log:

0-125 Drift (silt & clay)

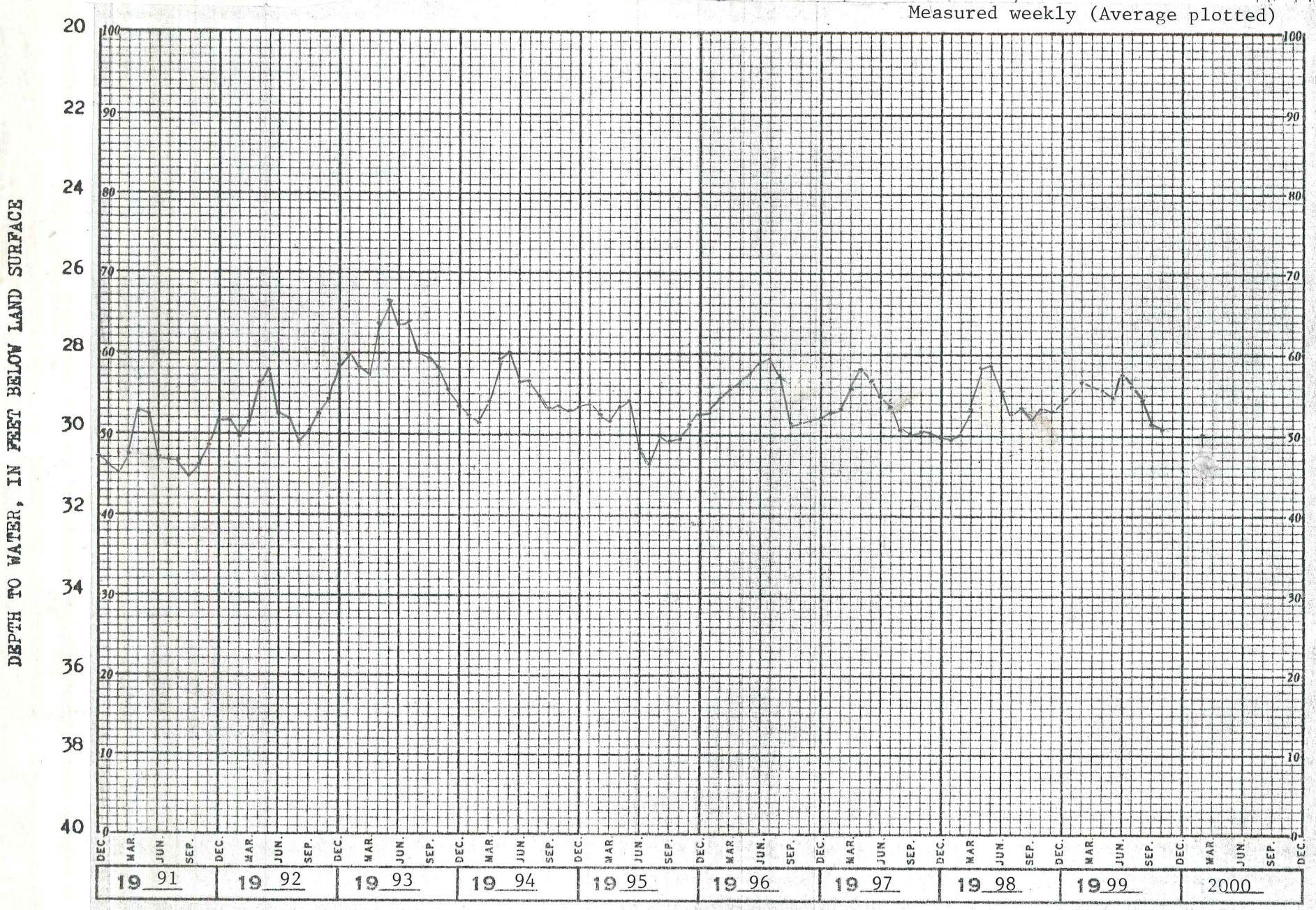
125-147 Silurian Dolomite

DATE	WATER LEVEL (BELOW MP)
06/27/1968	29.16



MN-19/23E/35-0028. Wis. Dept. of Transportation. SE¼NE¼. Drilled domestic artesian well in Niagara Dolomite of Silurian age, diam 6 in, depth 147 ft, cased to 133. Lsd 670 ft above msl. MP ¼-in hole in pump base, 1.00 ft above lsd.

Measured weekly (Average plotted)



WISCONSIN GEOLOGICAL SURVEY, Science Hall, Madison, Wisconsin — Log No. Mn-28

WISCONSIN STATE ROADSIDE PARK, JUNCTION HIGHWAYS #141 & #151, MANITOWOC, WISCONSIN
NW¼,NE¼,SE¼,SE¼,SE¼,NE¼ sec.35,T 19N, R 23E
E. Sperling & Son, Driller, September 1959
Sample Nos. 212545-212575 - Examined by M. E. Ostrom
Altitude = 670' ETM

DRIFT		0- 5	5	Cl & st,mod bn,calcic,ltl V fn-C qtz snd	cem grout
		5- 10	5	Cl & st,mod bn,calcic,ltl V fn-C qtz snd,	12"hole
		10- 15	5	Cl & st,pl bn,calcic,ltl V fn snd,tr wh cht	10"pipe
		15- 20	5	Cl & st,pl bn,calcic,ltl V fn-M gvl,tr snd	20'
		20- 30	10	Cl & st,pl bn,calcic,ltl V fn-fn gvl,ltl mxd snd	21'
		30- 40	10	Cl & st,pl bn, calcic,ltl mxd snd,mostly qtz	8"hole
		40- 45	5	Cl & st,pl bn,calcic,ltl V fn-M gvl,ltl snd	36'
		45- 60	15	Cl & st,pl bn,calcic,ltl mxd V fn gvl,ltl mxd snd,mostly qtz	50'
		60- 65	5	Cl & st,pl bn,calcic,ltl V fn-M gvl,ltl snd	
		65- 75	10	Cl & st,pl bn,calcic,tr mxd snd,mostly qtz	6"hole
		75- 85	10	Cl & st,pl bn,calcic,ltl mxd V fn-M gvl,ltl mxd snd,mostly qtz	6"pipe
		85- 95	10	Cl & st,pl bn,calcic,ltl V fn-fn gvl,ltl mxd snd,mostly qtz	
		95-110	15	Cl & st,pl bn,calcic,tr mxd snd	
		110-115	5	Cl & st,pl bn,calcic,ltl V fn-M gvl,tr mxd snd	
		115-120	5	Cl & st,pl bn,calcic,ltl mxd snd,mostly qtz	
	125	120-125	5	Cl & st,pl bn,calcic,ltl V fn-fn gvl,ltl snd	
NIA		125-140	15	Dol,ol gry,fn-V fn xln,dns,mch mxd snd,mostly qtz,ltl wh cht	133'
	22	140-147	7	Dol,yl gry,fn-V fn xln,dns,mod hd,ltl wh cht	147'

Formations: Drift, Niagara
Tested for 6 hours at 15 gpm with no change in water level.

APPENDIX E OF REFERENCE DOCUMENTS ML-148

Rehab in Photos March, 2017

This is a photo document showing our rehabilitation of the well access

Milwaukee County Parks Right of Entry Permit January, 2017

This the permit for working in the Boerner Botanical Gardens

Original USGS Well Schedule 1946

USGS Well Schedule contains some well construction information and hand-drawn location, includes black-and-white aerial photos

USGS Basic Data and Map 1981

USGS personnel went through in 1980 to combine observation well records

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ø I·ű$₪ fŜØŜfă ∃₪I·LJKŜŘ 2yű2 LJI·LJŜ₪

ML-94 Geological Log 1938

Included for reference due to proximity

ML-148 Geophysical log 2017

Gamma log, Caliper, Single Point Resistivity, Self Potential, Temperature, Fluid Conductivity

During Rehab

Removed existing protective flush-mount

Steel plate with access port on well

Angle grinder used to cut through steel plate on well

Angle grinder does its job

6” steel casing reduced to 4” PVC and raised closer to land-surface

Annular space filled with pea-gravel and new protective flush-mount cemented in place

Ta-da!

After Rehab

Figure 5: The updated access with the cover off

Figure 6: The measure from MP to LSD

Figure 7: The updated access with the cover on

MILWAUKEE COUNTY
DEPARTMENT OF PARKS, RECREATION & CULTURE
9480 Watertown Plank Road, Wauwatosa, Wisconsin 53226
Phone (414) 257-6100 FAX (414) 257-8190

CONSTRUCTION / RIGHT OF ENTRY PERMIT
COUNTY BENEFIT

Date: 09/26/2016
Permit Fee: Waived
Permit Number: 2254
Restoration Bond Amount: Waived

Permittee: Wisconsin Geological and Natural History Survey
Contact: Jacob Krause
Address: 3817 Mineral Point Rd. Madison, WI 53705
Phone (608) 338-6687 jacob.krause@wgnhs.uwex.edu

Contractor: TBD
Contact:
Address:
Phone:

To Enter: Whitnall Park service yard
Location of Cross Streets: 5879 South 92nd Street Hales Corners WI.

Purpose: To gain access to the service yard to properly ~~abandon~~ Renovate & Update an existing monitoring well NO# 41000 148 ~~and install a replacement well in approximat~~ in the same location.

Expiration Date of Permit: 06/01/2017

Conditions:

This Right-of-Entry Permit ("ROE") is issued by the Milwaukee County Department of Parks, Recreation and Culture (the "County") with the express condition that all work by Permittee be performed and completed according to submitted plans, specifications, information and all of the terms and conditions stated herein. Permittee, its agents and contractors agree to comply with all of the following conditions and requirements:

1. Permittee shall furnish to County any and all drawings, details and specifications as appropriate to identify the land to be entered, proposed access routes, proposed vegetation pruning or removal, the location and construction methods for any proposed work, and complete site restoration plan.

2. The County agrees to hold the Permittee harmless from any loss, claim, damage or liability of any kind involving an employee, officer or agent of the County arising out of or in connection with this Agreement except to the extent that it is founded upon or grows out of the acts or omissions of any of the officers, employees or agents of the University of Wisconsin System while acting within the scope of their employment where protection is afforded by ss. 893.80 and 895.46(1) Wis Stats.

3. Permittee shall, to the fullest extent provided for under any environmental laws, rules and regulations, be responsible for any required repair, clean-up, remediation or detoxification arising out of any Hazardous Materials brought onto or introduced into the Project Area or surrounding areas by Permittee, or its agents. Permittee shall hold the County harmless from any liability, cost, damage, claim or injury arising therefrom where protection is afforded by ss. 893.80 and 895.46(1) Wis Stats. Moreover, Permittee shall remediate and restore any affected area to at least the minimum standards as required by the WDNR or other applicable regulatory agencies.

Hazardous Materials" as the term is used herein shall mean any substance: (i) the presence of which requires investigation or remediation under any federal, state or local statute, regulation, ordinance, order, action, or policy; or (ii) which is or becomes defined as a "hazardous waste" or "hazardous substance" under any federal, state, or local statute, regulation, ordinance, or amendments thereto, including without limitation, the Comprehensive Environmenta Response, Compensation and Liability Act (42 U.S.C. §9601 et seq.), or the Resource Conservation and Recovery Act (42 U.S.C. §6901, et seq.); or (iii) which is toxic, explosive, corrosive, flammable, infectious, radioactive, carcinogenic, mutagenic, or otherwise hazardous and is or becomes regulated by any governmental authority, agency, department, commission, board, agency or instrumentality of the United States, the State of Wisconsin, or any political subdivision thereof; or (iv) the presence of which on lands within the Project Area causes or threatens to cause a nuisance upon the Project Area or surrounding area or poses or threatens to pose a hazard to the Project Area or surrounding areas or to the health or safety of persons on or about the Project Area; or (v) which contains gasoline, diesel fuel, or other petroleum hydrocarbons; or (vi) which contains polychlorinated biphenyls (PCBs), asbestos, or urea formaldehyde foam insulation.

"Environmental Regulations" means all applicable past, present, and future statutes, regulations, rules, ordinances, codes, licenses, permits, orders, approvals, plans, authorizations, concessions, franchises, and similar items of all governmental agencies, departments, commissions, boards, bureaus, or instrumentalities of the United States, the State of Wisconsin, and political subdivisions thereof and all applicable judicial and administrative and regulatory decrees, judgments, and orders related to the protection of human health or the environment, including, without limitation: (i) all requirements, including, but not limited to, those pertaining to reporting, licensing, permitting, investigation and remediation of emissions, discharges, releases or threatened releases of Hazardous Materials, chemicals, substances, pollutants, contaminants, or hazardous or toxic substances, materials, or wastes, whether solid, liquid, or gaseous in nature, and (ii) all requirements pertaining to the protection of the health and safety of employees or the public.

4. Permittee shall pay all costs associated with this ROE, including the costs related to obtaining any required permits or approvals required by any other government agencies or adjacent landowners, utilities or easement holders impacted by this work. Existing County owned utilities shall be located and identified by hot-lining prior to the start o proposed work, and properly protected, repaired or replaced if damaged during the work covered under this ROE.

5. Permittee or its agents shall comply with any and all laws, requirements, approvals, and obtain any licenses or permits, required by local municipalities or other regulatory agencies.

6. Permittee shall protect and avoid damage to any part of the Project Area and surrounding areas to ensure the safety of Permitee's or its agent's personnel, County staff and all park users. Permittee shall also provide and install all safety devices, barricades, signs, flag person(s) or other measures as needed to comply.

7. Permittee shall protect existing trees, shrubs, delineated wetlands and wetland plants, and other vegetation located at or near the Project Area and surrounding areas of the construction site that this ROE grants access to.

8. Roadways, parking lots, bicycle/recreation trails, sidewalks, and other County owned property located at or near the Project Area that this ROE grants Permittee access to must be kept clean and free of soil, rock, stone, and debris at all times. No materials or equipment may be placed, stockpiled, or stored on County owned property that is not included in this ROE. County owned and operated roadways, parking lots, bicycle/recreation trails, and sidewalks shall not be obstructed or closed without written permission from County.

9. Construction or work related vehicles and equipment shall not be operated upon County owned roadways, parking lots, bicycle/recreation trails, sidewalks, or surrounding areas of the Project Area not included in this ROE without prior written permission from County.

10. Upon completion of all work Permittee shall restore any and all damage to County owned property included in the ROE and surrounding areas of the Project Area caused by Permittee or its agents. Required repairs or restoration shall be made to a preconstruction condition, or better, at no expense to County and to the County's satisfaction.

11. In the event of an abandonment or non-use of any structures, improvements or facilities on County owned property allowed by this ROE, or if the County requires the relocation or removal of any structure, improvements or facilities, Permittee shall, within sixty (60) days after notification by County, remove or relocate them as directed at no cost to the County.

12. Permittee is required to contact Diggers Hotline (1-800-242-8511) regarding potential utilities located within the Project Area allowed by this ROE a minimum office (5) business days before commencing work.

13. Permittee is required to contact Mr. Gene Andrzeja], Park Maintenance Manager, at phone number (414) 258-2322, regarding potential County utilities located within the Project Area allowed by this ROE a minimum of five (5) business days before commencing work.

14. Permittee is required to contact, Jim Ciha at phone number (414) 257-4884 to schedule a site inspection before the start of any work to approve construction locations, access routes or any required tree or shrub pruning/removal within the area of construction allowed by this ROE a minimum of five (5) business clays before commencing work, and upon completion to approve final restoration of the site.

15.. Permittee is required to contact the Regional Manager listed below a minimum of five (5) business clays before commencing work to provide the anticipated start date and to receive any additional specific instructions. Permittee is also required to contact the Regional Manager upon completion to approve final restoration of the site.

Authorized Parks Department Representative

Jim M. Ciha

Permitttee Approval and Acceptance of Conditions:

Margaret Erickson MARGARET ERICKSON CONTROLLER Date: 10/14/16

Approval upon satisfactory completion of all work:

Parks Regional Manager: Date:_____ South
Regional Manager: Mike Wrench
Location: Parks Administration Building Phone: 414-257-8092
Address: 9480 Watertown Plank Road, Wauwatosa WI 53226

Re: Whitnall Park Service Building Monitoring Well UW language

Krause, Jacob <jacob.krause@wgnhs.uwex.edu>

Tue 1/10/2017 1:28 PM

To:Ciha, Jim <James.Ciha@milwaukeecountywi.gov>;

1 attachments (239 KB)

Milwaukee Co Parks right of entry permit-final.pdf;

Hi Jim,

As requested, here is a description of work we'd like to complete at the Whitnall Park service yard. I've also attached a copy of the permit that our respective legal personnel had agreed to in the past. If you could use that as a template for your changes to the permit date, I would appreciate it, as that would simplify the process for me to submit it on my end. I appreciate you helping us out with this project, and look forward to hearing from you soon.

Best,
Jake Krause

Request for permit date extension and description of work plan:

The Wisconsin Geological and Natural History Survey (UW-Extension) requests an extension of the existing Right of Entry permit for monitoring well maintenance work at Whitnall Park. The original permit was approved through 12/1/2016, and we are requesting an extension through 6/1/2017. The plan for work is as follows:
- Excavate small area around the existing flush-grade manhole cover, which houses the monitoring well.
- Remove the steel cap that was installed on the well in 1965 in order to access the original well top.
- Install a new cap on the well, but with a built in access pipe. This pipe will be used to measure the water level in the well as well as assess the condition of the well in the future. The access pipe will be outfitted with a sealing cap, which will ensure the well is protected from any contamination while not in use.
- Install a new manhole cover to house the monitoring well.
- Asphalt pavement will be replaced surrounding the new manhole cover, ensuring the new surface matches the existing grade of the asphalt surface.
- WGNHS staff will coordinate the work schedule with Milwaukee County Parks Staff (primary contact: Jim Ciha), in order to ensure access to the service yard is not impeded for Parks staff during busy times.

Submitted by: Jacob Krause 1/10/2017

From: Krause, Jacob
Sent: Friday, October 14, 2016 2:30:32 PM
To: Ciha, Jim
Cc: Toomsen, Sarah; Kuglitsch, Paul
Subject: Re: Whitnall Park Service Building Monitoring Well UW language

Jim,

Thanks for getting back to me on this. I asked our Controller to make the recommended change and sign the permit, which she has done. The permit is attached, could you please sign and return the final copy to me?

Thanks and enjoy your weekend,

Jake

From: Ciha, Jim <James.Ciha@milwaukeecountywi.gov>
Sent: Thursday, October 13, 2016 3:12:35 PM
To: Krause, Jacob
Cc: Toomsen, Sarah; Kuglitsch, Paul
Subject: Fw: Whitnall Park Service Building Monitoring Well UW language

Jacob: Please see our Corporation Counsel's comments.

Jim Ciha
Landscape Architect
(414) 257 4884 Direct
(414 257 8190 Fax

Milwaukee County Department of Parks, Recreation and Culture
9480 Watertown Plank Road
Wauwatosa, WI 53226
(414) 257 6100
countyparks.com

From: Kuglitsch, Paul
Sent: Thursday, October 13, 2016 1:16 PM

T 6 R E

ML-148-B

LOG OF WELL

CAMP — WHITNALL PARK, SP-2 (Wisconsin)

P. O. ADDRESS — Hales Corners, Wisconsin

COUNTY — Milwaukee, Wisconsin

LOCATION OF CAMP SITE:

NE 1/4 of the SE 1/4 of Section 32, Township 6N,

Range 21E of the 4th Principal Meridian.

DEPTH		Thickness feet	Depth feet	
0'	Soil and gravel	22	22	
22'	Limestone	18	40	
40'	Limestone	143	183	T. D.
183'	Limestone			

Report mentions from 40' to 83' "Limestone with underlying strata and gravel bearing water." The meaning is not definite.

ML-148-B

Whitnall Boerner Botanical Gardens
5879 S 92nd Street

414-425-1132-O

Lori [redacted] Albano
- director

Julian Westley
Bot. Supervisor not till 30th

.85
March 1935

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES BRANCH MI-6/21/32-148

WELL SCHEDULE

Date June 19, 19 46 Field No. MI-148
Record by G E H Office No.
Source of data Voight - MCRRB

1. *Location:* State Wis. County Mil.
Map
NE ¼ SE ¼ sec. 32 T 6 N/S R 21 E/W
2. *Owner:* Mil. County Address Whitnall Park
Tenant Old C.C.C. Well Address ~~Abraham Well~~
Driller Address
3. *Topography* Top of Hill
4. MP *Elevation* 775.16 ft. above/~~below~~ sea level
5. *Type:* Dug, drilled, driven, bored, jetted 19 33?
6. *Depth:* Rept. ft. Meas. 179.5 ft.
7. *Casing:* Diam. 5 in., to in., Type
Depth 44.43 ft., Finish open
8. *Chief Aquifer* Niagara From ft. to ft.
hers
ater level 31.07 ft. ~~Rept.~~ meas. June 19 1946 ~~above~~/below Top of Casing W. side which is ft. above/~~below~~ surface
10. *Pump:* Type Capacity G. M.
Power: Kind Horsepower
11. *Yield:* Flow G. M., Pump G. M., Meas., Rept. Est.
Drawdown ft. after hours pumping G. M.
12. *Use:* Dom., Stock, PS., RR., Ind., Irr. (Obs.) Abandoned
Adequacy, permanence
13. *Quality* Temp °F.
Taste, odor, color Sample Yes/No
Unfit for
14. *Remarks:* (Log, Analyses, etc.) See Mr. Voight, Mr. Hoover
Well is in building near water tower.

(OVER)

ADP SCHEDULE MADE

In 2K Data Base verified

U. S. GOVERNMENT PRINTING OFFICE 6—7473

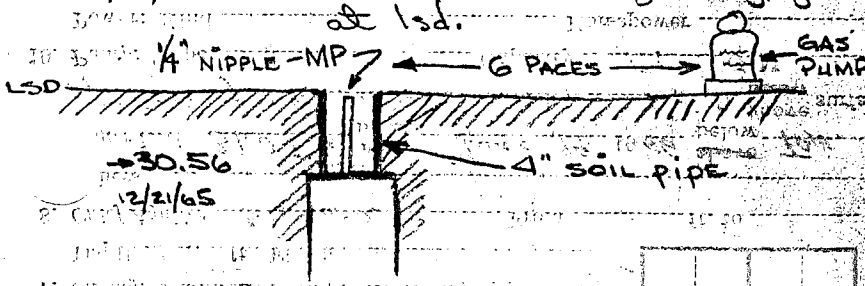
9-17-46 MI-148

Installed Stevens 7 day Recorder #10226-46
Clock #1
12:25 - D/W 32.54

~~M. P. Top of Casing — same as before.~~

Electric log run Jun 1957 From 44 to 179 ft.

12/21/65 → New MP — top of ¼" pipe at lsd.



Appendix E ML 148

ML-148-B

WRD Exp. (C
April 1966

Well No. ML-C/21/32-148

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY (G.E. HENDRICKSON 19 JUN 4C) — WATER RESOURCES DIVISION

Verified ECH

1:24000

MASTER CARD

Record by E.J. DASPIT Source of data Mr. Voight (MCRPB) Date 19DEC67 Map Hales Corners

State WISCONSIN (5 8) County (or town) Milwaukee (M L)

Latitude: 42 56 13 N Longitude: 088 01 43 Sequential number: 1

Lat-long accuracy: 2 T 6 N S, R 21 E W, Sec 32, NE ¼, NE ¼, SE ¼ 4 B & M

Local well number: 06N21E32DAA C Other number:

Local use: MLO148 Owner or name: M.I. Co

Owner or name: WHITNALL PARK Address: Whitnall Park

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist C

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (F) Power, (Fire), (Dom), (Irr), (Ind), (F S), (Rec), (S) Stock, (I) Instit, (U) Unused, (R) Repressure, (Rech) Recharge, (D) Desal-F S, (D) Desal-other, (O) Other — Old ccc well U

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Rec, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdrew, (W) Waste, (D) Destroyed Ø

DATA AVAILABLE: Well data B Freq. W/L meas.: Monthly 1946 → 67 M Field aquifer char.

Hyd. lab. data:

Qual. water data; type:

Freq. sampling: Pumpage inventory: yes / no, period:

Aperture cards: yes

Log data: Electric (Jun 1957) E

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 179.5 ft 180 (Meas) TAPE accuracy 0

Depth cased; (first perf.) 43 ft 43 Casing type: Diam. 5 in 5

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (Q) open end, (P) perf., screen, sd. pt., (S), (T), (V) shoes, (X) open hole, (E) other X

Method Drilled: (A) air rot., (B) bored, (C) cable, (D) dug, (D) hyd rot., (J) jetted, (P) air percussion, rotary, (R) reverse, (T) trenching, (V) driven, (W) wash, (E) other

Date Drilled: M33? 4 3 3 Pump intake setting: ft

Driller: name, address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (O) other N Deep Shallow D

Power (type): nat diesel, elec, gas, gasoline, hand, gas, wind; LP H.P. Trans. or meter no.

Descrip. MP Top of ¼" pipe @ above/below LSD, Alt. MP 774.16 *

Alt. LSD: 774.16 7 7 4 Accuracy: (source) Instr Level of MP 0

Water Level 32.75 ft above/below MP; Ft above/below LSD 3 3 Accuracy: TAPE A

Date meas: 28NOV67 N 6 7 Yield: gpm Method determined

Drawdown: ft Accuracy: Pumping period hrs

QUALITY OF WATER DATA: Iron ppm Sulfate ppm Chloride ppm Hard. ppm

Sp. Conduct K x 10⁶ Temp. °F Date sampled

Taste, color, etc.

Punched ERC In 2K Data Base verified

CHECKED AGAINST DATA SOURCE [illegible] CHECKED [illegible]

Well No. ML-C/21/32-148

Well No. ML-C/21/32

Latitude-longitude 42 d 56 m 13 s N 088 d 01 m 43 s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD Physiographic Province: CENT LOW 1 2 Section: E L S

Drainage Basin: UP MISS 2 6 M Subbasin: L. MICH

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, swamp, (Ø) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat H

MAJOR AQUIFER: Silur system, series S Niagara aquifer, formation, group 6 N

Lithology: Dolomite D Origin: MAJ 6 Aquifer Thickness: ft

Length of well open to: ft Depth to top of: ft

MINOR AQUIFER: system, series aquifer, formation, group

Lithology: Origin: Aquifer Thickness: ft

Length of well open to: ft Depth to top of: ft

Intervals Screened:

Depth to consolidated rock: ft Source of data:

Depth to basement: ft Source of data:

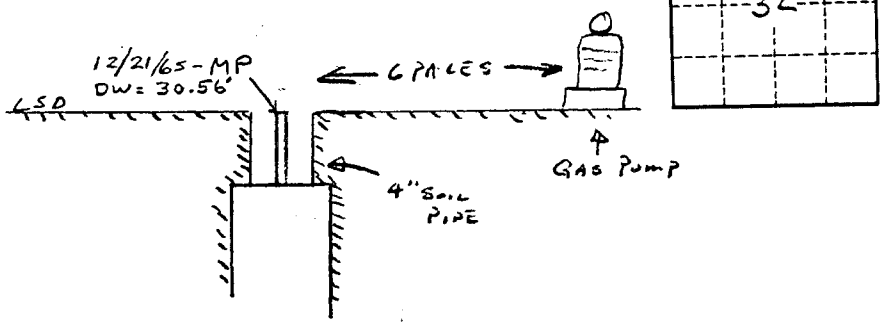
Surficial material: Infiltration characteristics:

Coefficient Trans: gpd/ft Coefficient Storage:

Coefficient Perm: gpd/ft²; Spec cap: gpm/ft; Number of geologic cards:

Recording gage on 17 Sep 46, off May 1947

* MP before 12/21/65 was 1' above lsd & was leveled @ 775.16' above msl

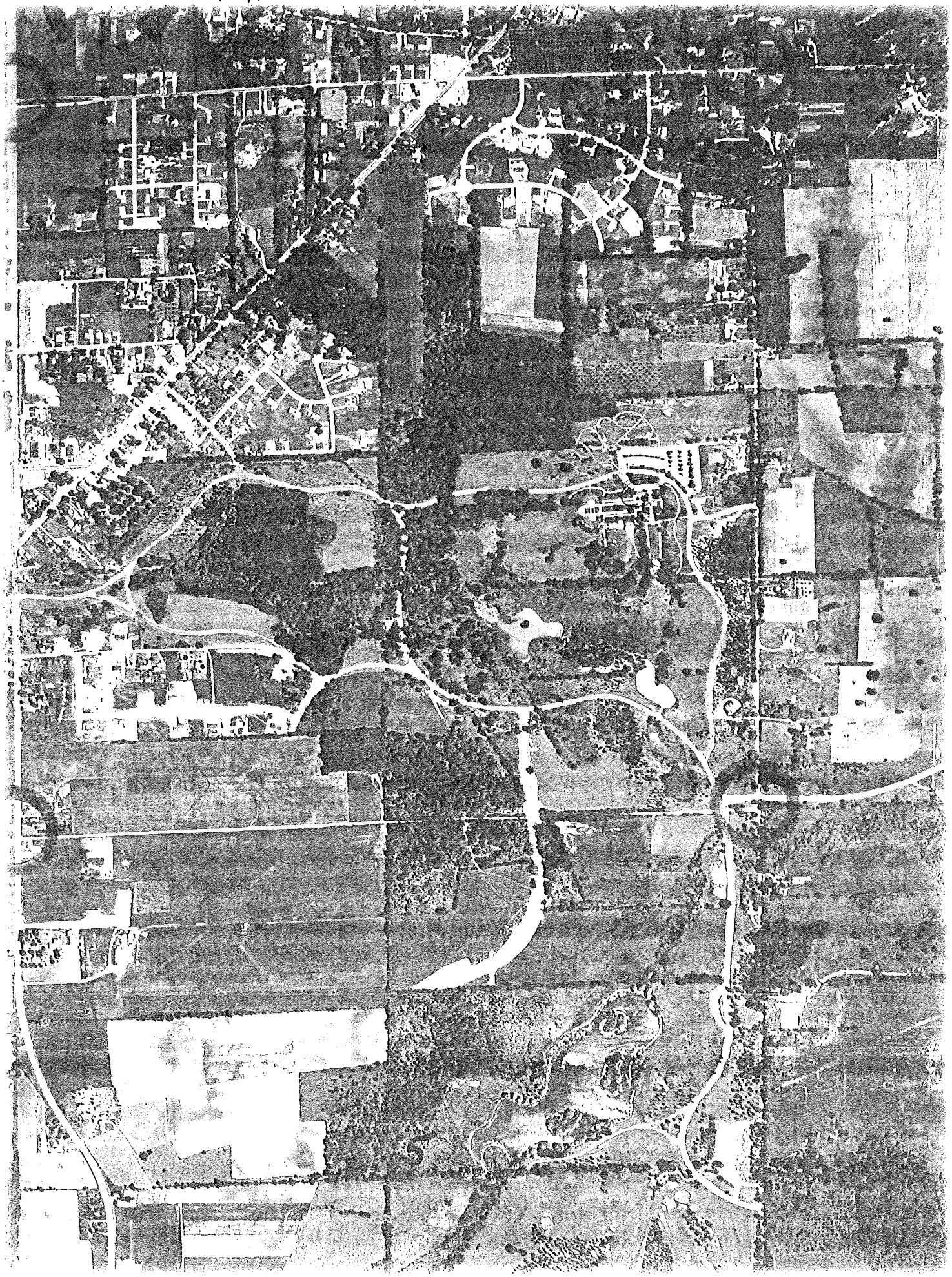


Well No. ML-C/21/32-148

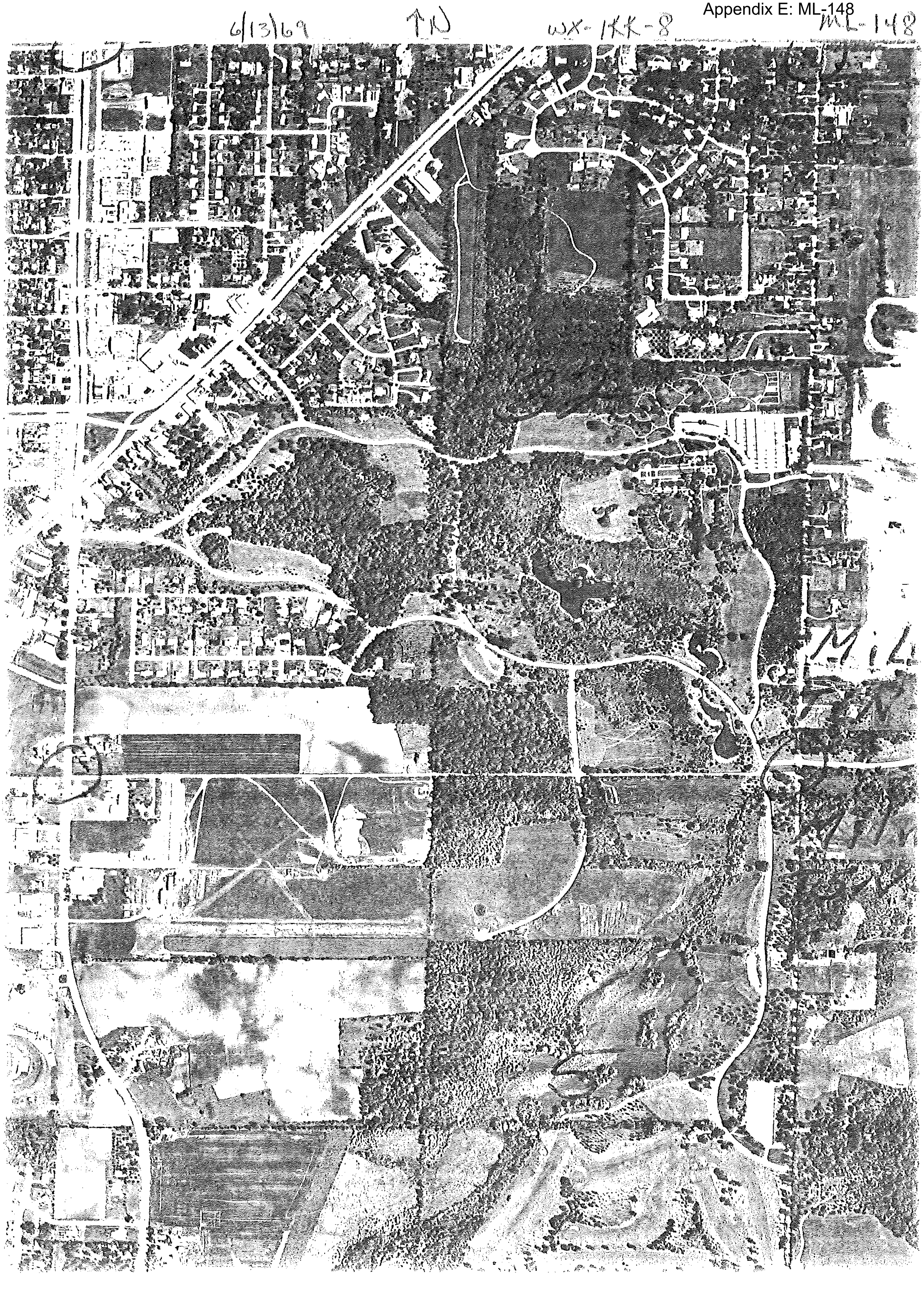
GPO 857-700

Appendix E: ML-148

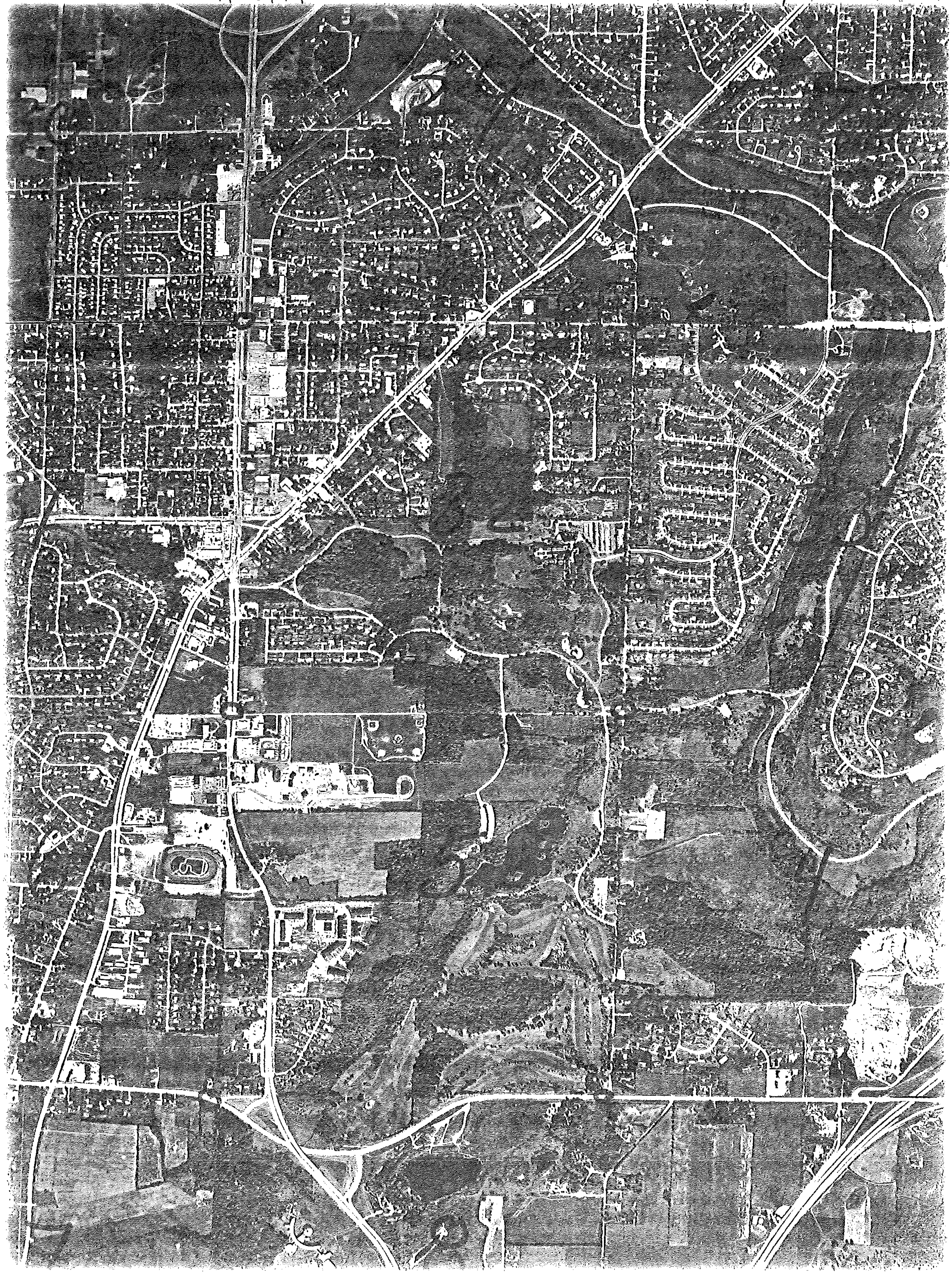
6/24/56 ↑N WX-1R-165 ML-148



200% enlargement


6/13/69
↑N
WX-1KK-8
ML-148
200% enlargement
Mil

9/22/79 ↑N 55079-179-94 ML-148



2008 enlargement

4/12/92 ↑N 5386-177 ML-148

2008 enlargement

Well Name #1 ?

Log No. ML-148-B

Sample Nos.

Owner MILW. CO. PARKS Comm.

County

Address 901 N 9th ST.
MILW. WI. 53233

Township

Location

Remarks

R.I. 3 Elevation 774±5

Quad.

Driller CCC

Map No. 4010

Completed 1933? C.R. Yes/No

Platbook Check (date & page)

Depths 179½

Date Rec'd

Examined by EJ DASPIT

Date

12/19/67

no map

REMARKS:

NW, NE, SE, Sec 32

~~Construction Report~~ only, location not plotted on map.

there is no C.R.

old "CCC well"

placed near ML-94 since that is well #2 and near a hilltop.

6/21/32

7/11/80

BASIC DATA ON WATER-LEVEL OBSERVATION WELL

Well number Mk 148

Owner Milw. County — Whitnall Park (old CCC well - Whitnall Rock)

Location (Co., T/R.sec) T6N, R21E) Sec. 32 NE¼, NE¼, SE¼; 92nd St.

Land surface altitude 774'6"

Drainage basin L. MI CHI GRN — Root R. tributary

distance to the nearest perennial stream: 1,400 ft of the L bank

WELL DATA

Depth 180'

Casing depth 43'

Screened interval open hole

Diameter 5"

Aquifers open to well probably Niagara

Geologic log available? no

Construction report available? no

Use of well unused

Access to measure well

NEAREST SUPPLEMENTAL DATA POINTS

Precipitation stations West Allis - 6 mi NNE
Milwaukee WSO AP - 6.5 mi E
Milwaukee Mt. Mary College - 9.5 mi N

Streamgaging stations
04087220 Root River near Franklin - 4.5 mi SE

Observation wells MI 94 — 700ft W
MI 130 — 5.6 mi NNW
MI 22 — 5.8 mi NNE
MI 85 — 6.1 mi ENE

Other

EXISTING RECORD

Measuring point top of ¼-in. pipe — at the land surface

Measuring equipment tape

Frequency of measurement monthly from 07/23/64 (daily 09/25/46 - 07/13/64)

Period of record -- 1946 to date

Started 06/19/46

Ended

Volume of missing record 4'6"

Recorded by A. Jagiewicz on 3/6/81

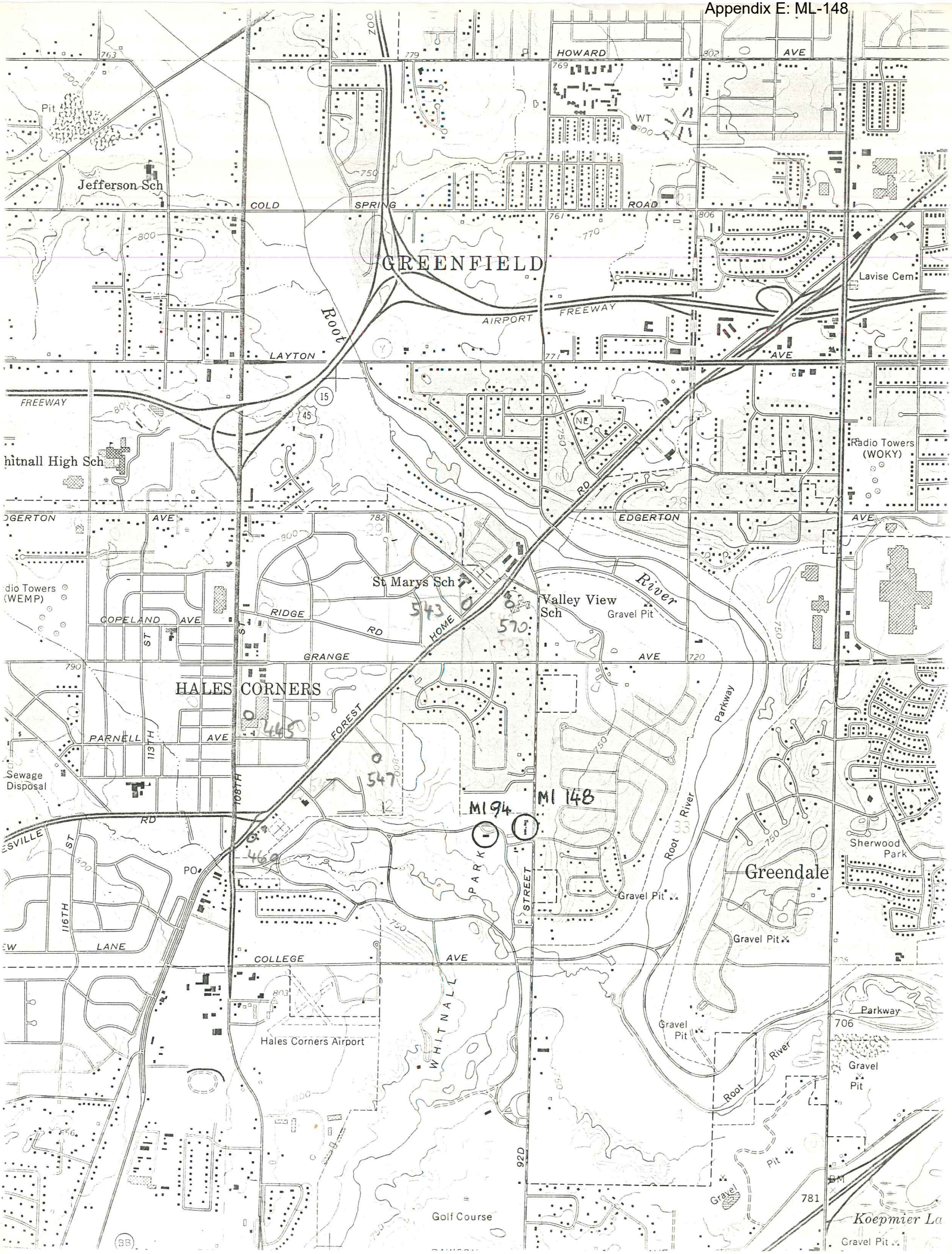
MI 148

LIST OF CRITERIA FOR THE EVALUATION OF
EXISTING OBSERVATION WELLS IN WISCONSIN

1. Areal spacing -- distance from any observation well 700 ft
   -- distance from observation well in same aquifer 5'6 mi
2. Ownership: private -- (public)
3. Use of well unused
4. Access -- physical
   -- owner's permission
5. Condition of well -- casing
   -- housing
6. Geologic log: yes -- (no)
7. Construction report: yes -- (no)
   Well completion date: 1933
8. Diameter (4 in. minimum for recorder) 5"
9. Aquifer: (single) -- multiple
10. Good hydraulic connection with aquifer yes
11. Knowledge of pumping effect no
12. Range and character of w.l. fluctuations large fluct. 7-8 ft; seasonal + long
13. Length of record 34 years
14. Missing record 4.6 %
15. Adequacy of current measuring frequency good
16. Probability of permanence good
17. Recommendations/Improvements

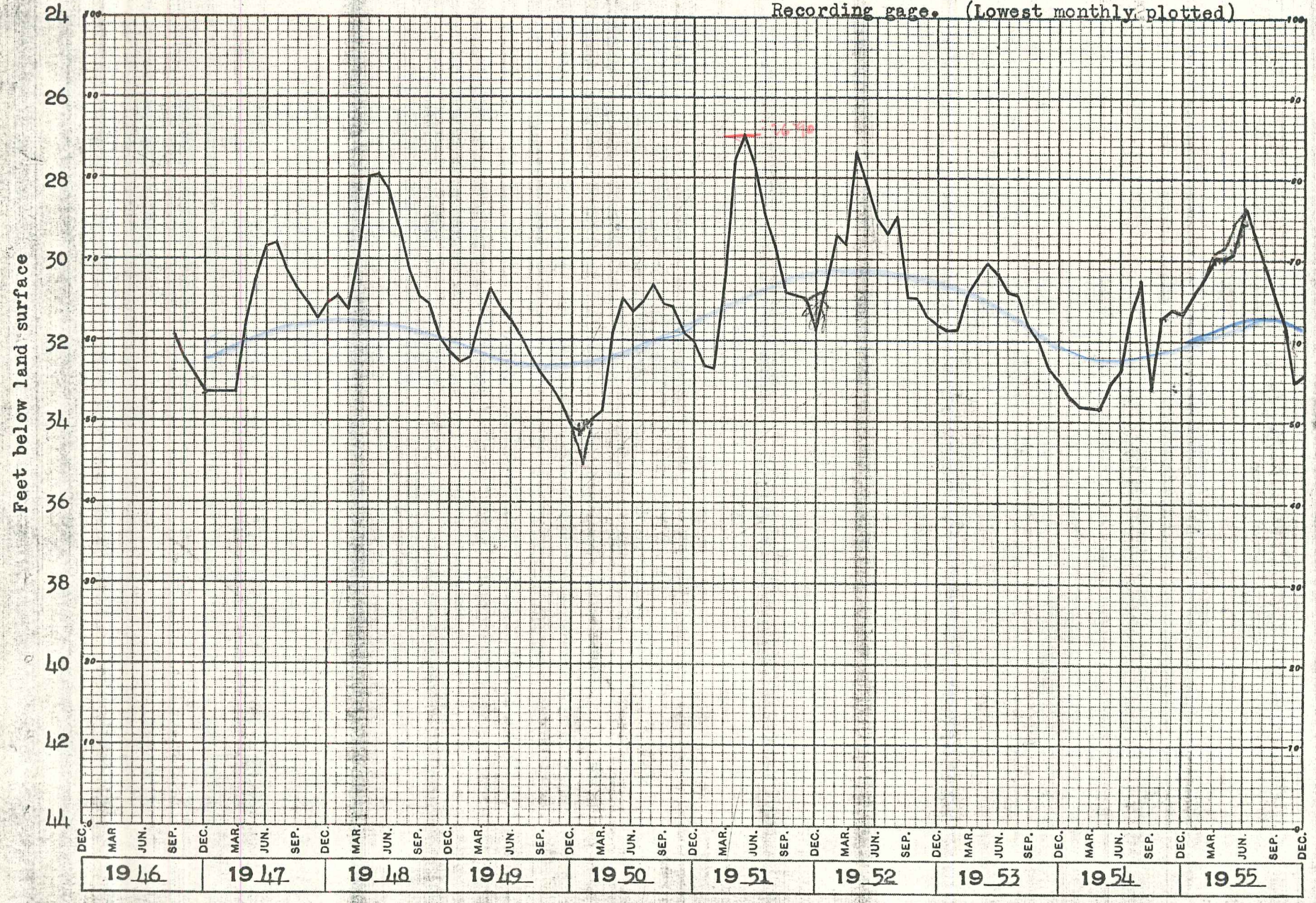
Keep in part w/ MI 94

Evaluated by Alex Jeppson on 3/31/81


HOWARD AVE
Pit
Jefferson Sch
COLD SPRING ROAD
GREENFIELD
WT
Lavise Cem
AIRPORT
FREEWAY
Root
LAYTON AVE
FREEWAY
hitnall High Sch
Radio Towers (WOKY)
EDGERTON AVE
EDGERTON AVE
dio Towers (WEMP)
St Marys Sch
Valley View Sch
Gravel Pit
River
COPELAND AVE
RIDGE RD
HOME
GRANGE AVE
HALES CORNERS
PARNELL AVE
113TH ST
108TH ST
FOREST
Sewage Disposal
M194
M1 148
RD
PARK
STREET
Root River
Parkway
Sherwood Park
Greendale
Gravel Pit
Gravel Pit
PO
116TH ST
LANE
COLLEGE AVE
WHITNALL
Hales Corners Airport
Parkway
Gravel Pit
River
Root
Gravel Pit
Pit
Gravel
92D
Golf Course
BM
781
Koepmier La
Gravel Pit

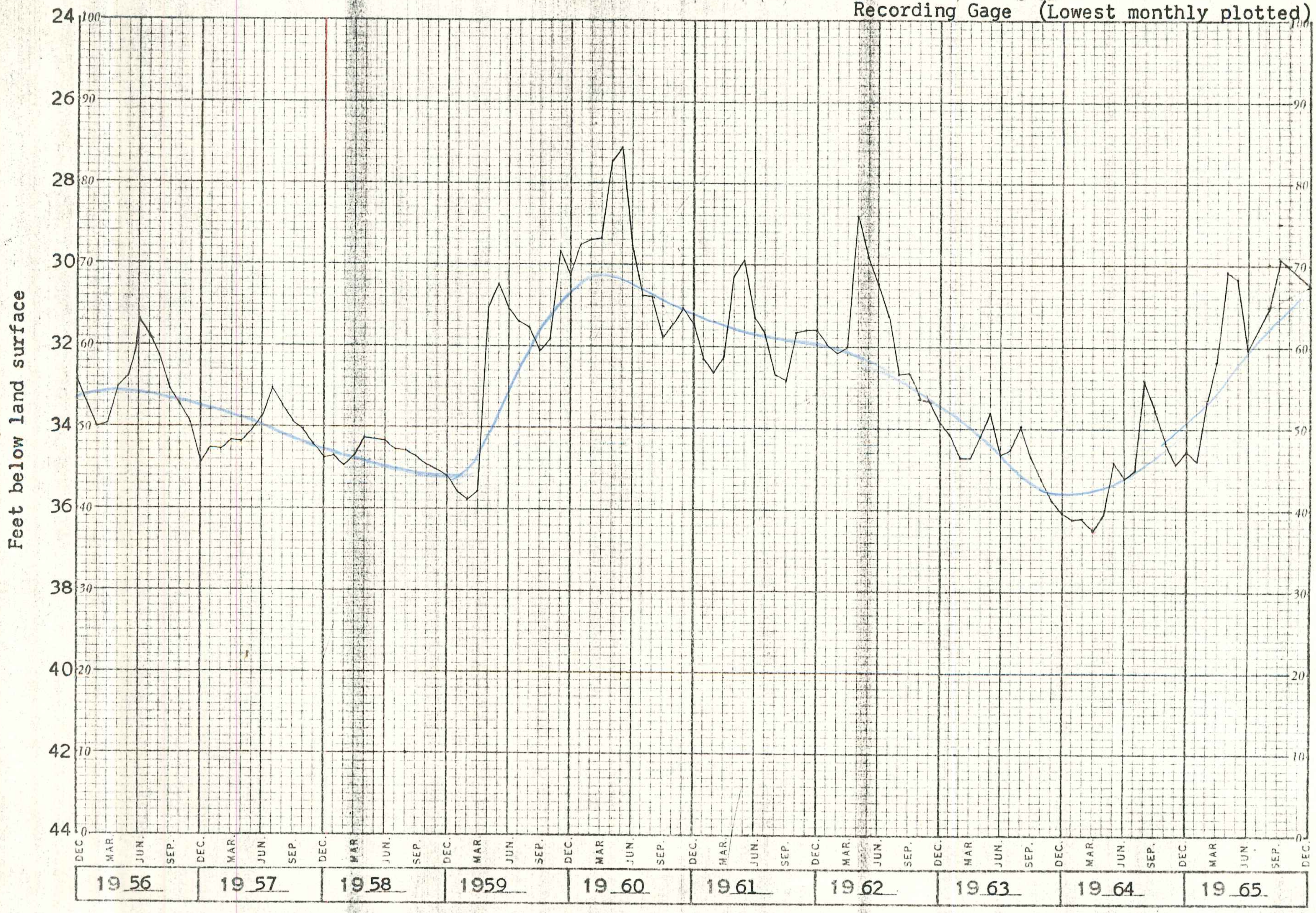
M1 148, Whitnall Park, Milwaukee, Wis. Milwaukee County, NE¼ SE¼ sec. 32, T. 6 N., R. 21 E.
Measuring point 1.0 foot above land surface. Altitude of land surface 774 feet.
Niagara dolomite-water-table. Depth 180 feet. Equipped with recorder.

Recording gage. (Lowest monthly plotted)



M1-6/21/32-148. Milwaukee County. NE$\frac{1}{4}$SE$\frac{1}{4}$. Drilled unused water-table well in Niagara Dolomite, diam 5 in, depth 180 ft, cased to 43. Lsd 774 ft above msl. MP top of casing, 1.00 ft above lsd.

Recording Gage (Lowest monthly plotted)



ML-06/21E/32-0148. Milwaukee Co. NE¼SE¼. Drilled unused water-table well in the Niagara aquifer. Diameter 5 in., depth 180 ft., cased to 43 ft. Lsd 774 ft. above msl. MP top of ¼-in. pipe, at lsd.

Measured (bi-) monthly (All plotted)

M1-94

WELL NO. 2, CHARLES B. WHITNALL PARK, HALES CORNERS, WIS.

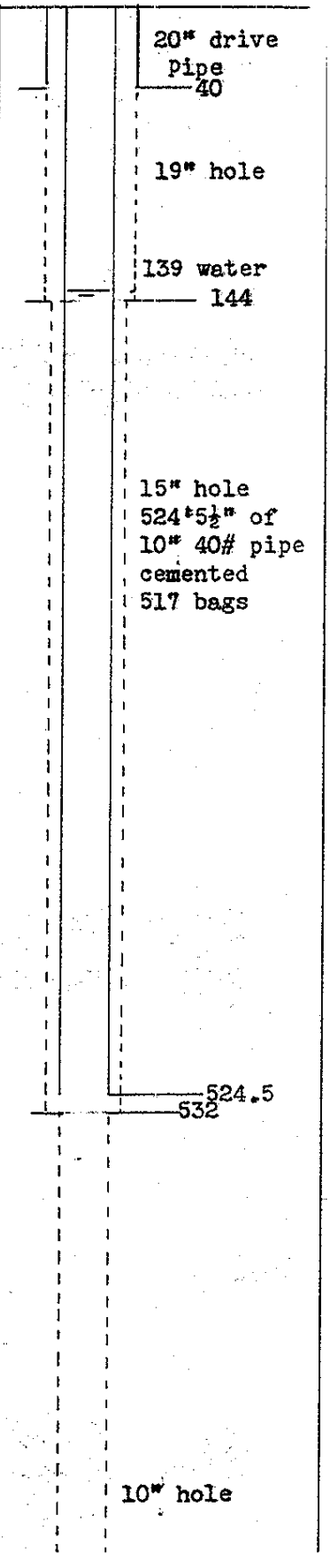
Loc: C, N½, SE¼, NW¼, NE¼SE¼ sec. 32, T. 6 N., R. 21 E.

Gray Drilling Co., Contractors, 1937-38

Samples examined by F. T. Thwaites, Nos. 99485-99709, 102454-102577

Elevation 774'

DR	37	0-37	37		Drift, no samples
NIAGARA	246	37-43	6		Rock, no samples
		43-119	76		Dolomite, light gray
		119-154	35		Dolomite, light gray; chert, white (Waukesha)
		154-188	34		Dolomite, light gray (Byron)
		188-206	18		Dolomite, light gray and pink
		206-234	28		Dolomite, light gray; chert, white (Mayville)
		234-283	49		Dolomite, light gray
RICHMOND	215	283-290	7		Dolomite, blue-gray, blue, shaly, pyritic
		290-320	30		Shale, blue-gray, dolomitic
		320-340	20		Dolomite, blue-gray, gray; shale layers
		340-362	22		Shale, blue-gray, dolomitic
		362-375	13		Shale, brown, dolomitic
		375-417	42		Shale, blue-gray, dolomitic; dolomite, brown, shaly, green specks 385-387
		417-424	7		Dolomite, blue-gray, pink-gray, shaly
		424-498	74		Shale, blue-gray, dolomitic
GALENA-PLATTEVILLE		498-665	167		Dolomite, light gray
		665-675	10		Dolomite, gray, blue specks
		675-695	20		Dolomite, light gray
		695-705	10		Dolomite, gray and blue-gray
		705-750	45		Dolomite, light gray, blue specks



ML-94

Whitnall Park, Hales Corners, p. 2

	750–760	10		Dolomite, light gray, sandstone layers
272	760–770	10		Sandstone, medium to fine, lt.gy, dolomitic
ST PETER	770–915	145		Sandstone, medium to fine, mainly soft, white
145				
EAU CLAIRE	915–935	20		Sandstone, medium to fine, some glauconite, wh.
	935–980	45		Sandstone, medium to fine, light gray, harder than above
	980–1000	20		Sandstone, fine, light gray, dolomitic
	1000–1015	15		Sandstone, fine, lt.gy, pink, dolomitic
	1015–1026	11		Sandstone, fine, pink, dol, glauconitic
	1026–1036	10		Shale, red, dolomitic
	1036–1050	14		Sandstone, medium to fine, lt.pink, dolomitic
	1050–1060	10		Siltstone, gray, very dolomitic
	1060–1070	10		Sandstone, very fine to fine, gray, dolomitic
	1070–1090	20		Sandstone, fine, light pink, dolomitic
	1090–1110	20		Siltstone, red, dolomitic, shaly
200	1110–1115	5		Sandstone, fine to medium, gray, pink, dol.
	1115–1140	25		Sandstone, medium to fine, white, soft
	1140–1145	5		Sandstone, fine to medium, light gray
	1145–1155	10		Sandstone, medium to fine, white
	1155–1181	25		Sandstone, fine to medium, light gray, very dolomitic
	1181–1210	29		No samples
	1210–1235	25		Sandstone, fine to silty, light gray, dol.
	1235–1250	15		No samples
	1250–1265	15		Sandstone, medium to fine, light gray, dol.
	1265–1280	15		Sandstone, med. to silty, gray, white, dol.
	1280–1300	20		Sandstone, medium to fine, white
	1300–1305	5		Sandstone, medium to fine, lt.pink, dolomitic
	1305–1365	60		Sandstone, medium to fine, light gray to white, no sample 1360–1365
	1365–1375	10		Sandstone, medium to fine, gray, pink, dol. l
	1375–1400	25		Sandstone, medium to fine, white
MT SIMON	1400–1410	10		Sandstone, med. to fine, white, pink dol. lay.
	1410–1425	15		Sandstone, medium to fine, white
	1425–1445	20		Sandstone, fine to medium, light gray
	1445–1460	15		Sandstone, medium to fine, white
	1460–1505	45		Sandstone, fine to medium, light gray to white
	1505–1545	40		Sandstone, medium to fine, white
	1545–1555	10		Sandstone, medium to fine, light gray
	1555–1580	5		Sandstone, fine, light gray
	1580–1588	20		Sandstone, medium to fine, white
	1588–1595	15		Sandstone, fine to medium, light gray

Whitnall Park, Hales Corners, p. 3

ML-94

	1595-1645	50		Sandstone, medium to fine, white
	1645-1655	10		Sandstone, fine to medium, light gray
	1655-1665	10		Sandstone, medium to fine, white
	1665-1700	35		Sandstone, fine to medium, light gray to white
	1700-1715	15		Sandstone, medium to fine, white
	1715-1725	10		Sandstone, coarse to fine, light gray
	1725-1740	15		Sandstone, fine to medium, light gray
	1740-1760	20		Sandstone, fine to coarse, light gray
	1760-1780	20		Sandstone, coarse to fine, white
	1780-1785	5		Sandstone, fine to coarse, light gray
	1785-1800	15		Sandstone, fine, light gray
	1800-1810	10		Sandstone, coarse to fine, light gray
	1810-1820	10		Sandstone, fine to medium, light pink
	1820-1830	10		Sandstone, medium, light gray
730	1830-1845	15		Sandstone, fine to medium, light pink

Formations: Drift; Niagara; Richmond (Maquoketa); Galena-Platteville (Black River) (includes Decorah); St. Peter; Eau Claire; Mt. Simon

Tested when 1181 feet deep specific capacity = 1.4 g.p.m.

Geophysical Logs WGNHS Well ID *41000148*

DATE *3/23/2017* **WELL NAME** *ML-148*

LOCATION *250' SW of Boerner Dr. @ 92nd St., Hales Corner, WI*

COUNTY *Milwaukee* **LOGGED BY** *PMChase*

LATITUDE *42.938655* **LONGITUDE** *-88.028985*

LOCATION METHOD *GoogleEarth* **ELEVATION** *776* **ELEVATION METHOD** *DEM*

WELL DEPTH *174* **CASING DEPTH** *42* **DEPTH TO WATER** *30.1*

CASING STICK UP *-0.54* **WUWN** _____ ***File Created on:*** _____ ***by:*** _____

Comments: *Well Construction field represents the well, casing, and water-level as measured on the day of logging.*

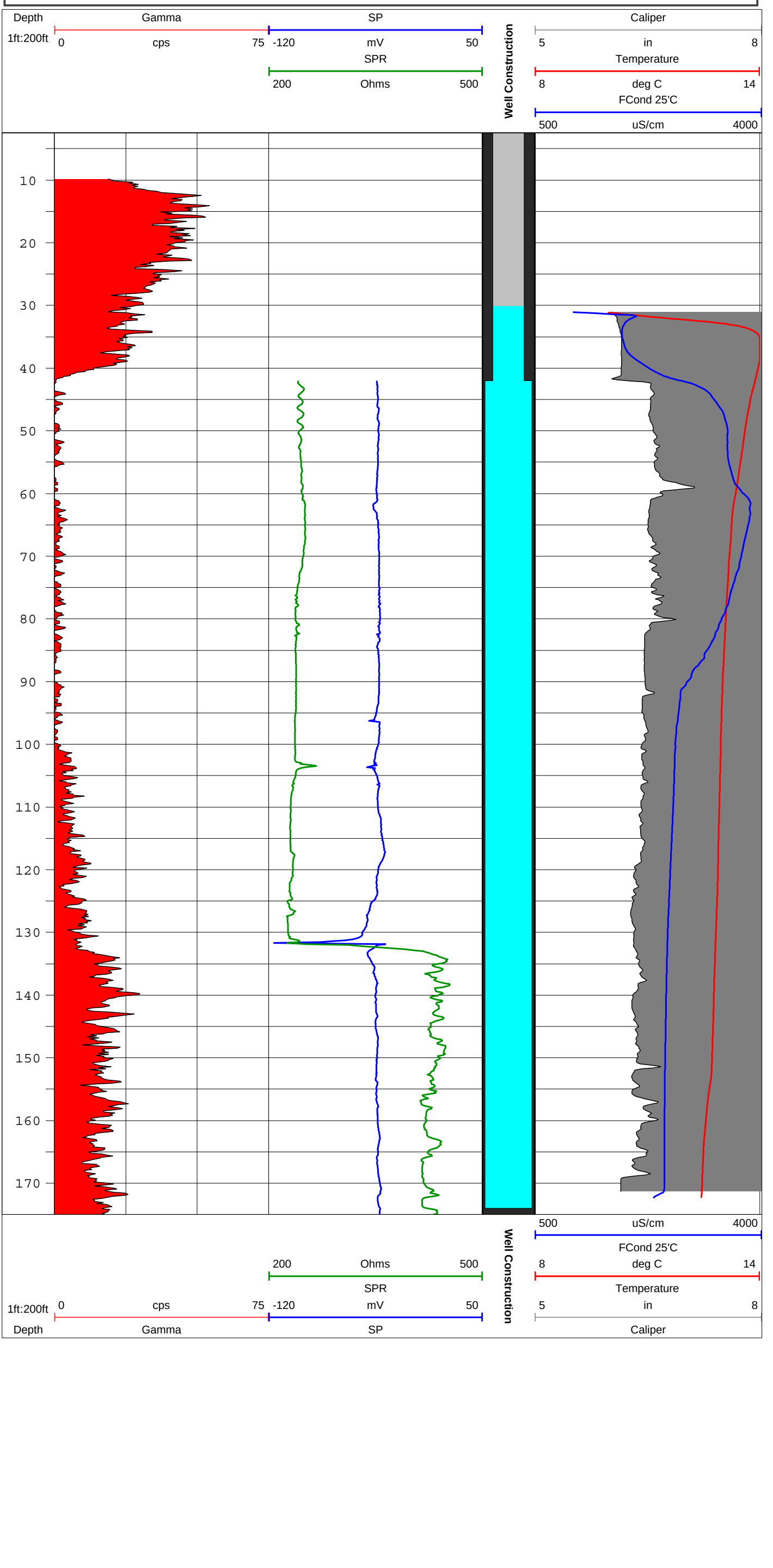
LOGS COLLECTED:

X	Gamma	X	Fluid Conductivity
X	Caliper		Flow Meter- HeatPulse
X	Single Point Resistivity		Flow Meter- Spinner
X	Self Potential		*- flow up is negative, flow down is positive* Optical Borehole Imager
	Normal Resistivity		Acoustic Borehole Imager
X	Fluid Temperature	X	OTHER: *Video*

Unless Noted:

- ***all depths are in feet***
- ***well depth, casing depth and depth to water are interpreted from geophysical log***
- ***datum is the top of casing***

For more information or to obtain collected data not shown please contact us at geodata@wgnhs.uwex.edu



APPENDIX F OF REFERENCE DOCUMENTS
OU-416

OU-416 Video Log notes June, 2016

This is a scan of the notes taken during the video log

USGS Basic Data 1992

USGS Observation Well record from when the well was drilled

Location OU 416 Date 4.26.16

Project / Client USGS GW network well obstructed

Well should be ~740 ft deep
obstructed @ ~148 ft

Last visable casing joint is
@ 137.4 ft cased to @ least
~145 then too much slime
on casing to distinguish

5/2/16
Back to look again w/o
any bottom disturbance before
video
- Casing ends @ ~148 1 1/2' open
dK gray rough open hole then
obstructed w/ what looks like
v. fine grained sediment

Location Lake Delton Date 6.2.16

Project / Client Testwell MSA / City

Back to well after equip repair
see 4.20.16

— Fluid, Temp Cond Dwne
slight wiggle @ ~255

Stick up 1.7' casing = ~209
DTW = ~59
DTB = 409

— Caliper Δ in diameter:
1/2" opening 374, 360 1/4" @ 340
1" @ 320 1/4" @ 224 2.5" @ 220'

— Gamma down mostly <30 cps

— SP, SPR up

— OBI Dwn, OBI 225 dwn

43.599142°, -89.762093

BASIC DATA ON WATER-LEVEL OBSERVATION WELL

Well number Ou 416 Well name

Owner U.S.G.S. (Ron Ronberson)

Location (Co., T/R.sec) T24 N, R18E, Sec. 8, NW/NE/NE/SE 1/4

Land surface altitude 902' Topographic setting sloping (in gravel pit)

Drainage basin Wolf-(Fox) R.

distance to the nearest perennial stream: 4400 ft Black Creek

WELL DATA

Depth ~~740~~ 740

Casing depth 18

Screened interval OPEN

Diameter 6"

Date drilled 9-3-92

Aquifers open to well Jordan - Elk mound

Geologic log available? No

Construction report available? No

Use of well USGS TEST WELL

Access to measure well TOP of CASING

Other logs or data available

NEAREST SUPPLEMENTAL DATA POINTS

Precipitation stations

Streamgaging stations

Observation wells Ou 380 - 12 mi. WSW; Sh 1 - 9.5 N; Bn 13 - 12 mi. E

(Discontinued: Ou 3 - 5.8 mi SSE)

Other

EXISTING RECORD

Measuring point (description) TOP OF CASING LSD: -2.50 Elev.: 906

Measuring equipment STEEL TAPE

Frequency of measurement Recorder TELOG DATA Logger

Period of record --

Started (date) 6/14/95 1st measurement: 95.94 ft LSD (6/14/95)

Ended (date) 9-3-92

Volume of missing record TELOG Data Logger Installed 6-14-95

Recorded by _____ on _____

APPENDIX G OF REFERENCE DOCUMENTS
WW-09

USGS Well Schedule 1964

This appears to be an updated version of the 1947 form

USGS Well Schedule 1947

USGS Well Schedule contains some well construction information and hand-drawn location

WRD Exp. (GW)
April 1966

PLOTTED and VERIFIED
ROLL COMPUTATION Branch

Well No. WW-3/15/33-9

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

WJD & JHG — USGS SCHEDULE — 19 OCT. 64

MASTER CARD

Record by: Earl Skinner — Source of data: FIELD — JHG — Date: 11 JUL. 67 — Map: DELAVAN 1:25000, 1:62,500

State: WISCONSIN [55] — County (or town): WALWORTH [WW]

Latitude: 42 40 04 N — Longitude: 088 44 06 — Sequential number: 1

Lat-long accuracy: 2 — T 3 (N) R 15 (E) — Sec 33 — SE ¼ SE ¼, SW ¼, SW ¼ — 4 (B & M)

Local well number: 03N15E33CCD 4 — Other number:

Local use: WW0009

Owner or name: STEWART BROS. — Address: DELAVAN, WIS. — Owner or name: STEWART BROTHERS

Ownership: County, Fed Gov't, City, Corp or Co, (P) Private, State Agency, Water Dist — P

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other — S

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (X) Waste, (Z) Destroyed — W

DATA AVAILABLE: Well data — Freq. W/L meas.: MONTHLY 1947 → [M] — Field aquifer char.

Hyd. lab. data:

Qual. water data; type:

Freq. sampling: — Pumpage inventory: yes / no, period:

Aperture cards: yes

Log data:

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD — Depth well: 287 ft [287] — Meas. / rept: DRILLER — accuracy [3]

Depth cased (first perf.): 287 ft [287] — Casing type: — Diam. 6 in [6]

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, (X) open hole, (Z) other — O

Method Drilled: (A) air rot., (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other

Date Drilled: 1920 [920] — Pump intake setting: ft

Driller: ACLY (name) — WALWORTH, WIS. (address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other — Z — Deep / Shallow — D

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, (wind) — H.P. [6] — Trans. or meter no.

Descrip. MP: HOLE IN PUMP BASE (1) ft above/below LSD — Alt. MP 966

942±5' — Alt. LSD: ~~965~~ [~~965~~] — Accuracy (source): TOPO 10' [4]

Water Level: 78.34 ft above/below MP — Ft above/below LSD [77] — Accuracy: TAPE [A]

Date meas.: 29 MAY 47 [547] — Yield: 10 gpm [10] — Method determined:

Drawdown: ft — Accuracy: — Pumping period hrs

QUALITY OF WATER DATA: Iron ppm — Sulfate ppm — Chloride ppm — Hard. ppm

Sp. Conduct 518 K x 10⁶ [4] — Temp. 49 °F [49] — Date sampled 8/67 [867]

Taste, color, etc. SLIGHTLY CLOUDY — oil present

CHECKED AGAINST DATA SOURCE EJW 7/13/68 — CHECKED EJW 7/13/68

Well No. WW-3/15/33

Latitude-longitude 42 40 04 (N) 88 44 06

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD — Physiographic Province: CENT. LOWLAND [12] — Section: EASTERN LAKES [A]

Drainage Basin: UPPER MISS. [26R] — Subbasin: ROCK

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat

MAJOR AQUIFER: ORDIVICIAN, MIDDLE [02] — GALENA-PLATTEVILLE [8A] (system, series, aquifer, formation, group)

Lithology: DOLOMITE [D] — Origin: MAR [6] — Aquifer Thickness: ft

Length of well open to: ft — Depth to top of: ft

MINOR AQUIFER: system, series, aquifer, formation, group

Lithology: — Origin: — Aquifer Thickness: ft

Length of well open to: ft — Depth to top of: ft

Intervals Screened:

Depth to consolidated rock: ft — Source of data:

Depth to basement: ft — Source of data:

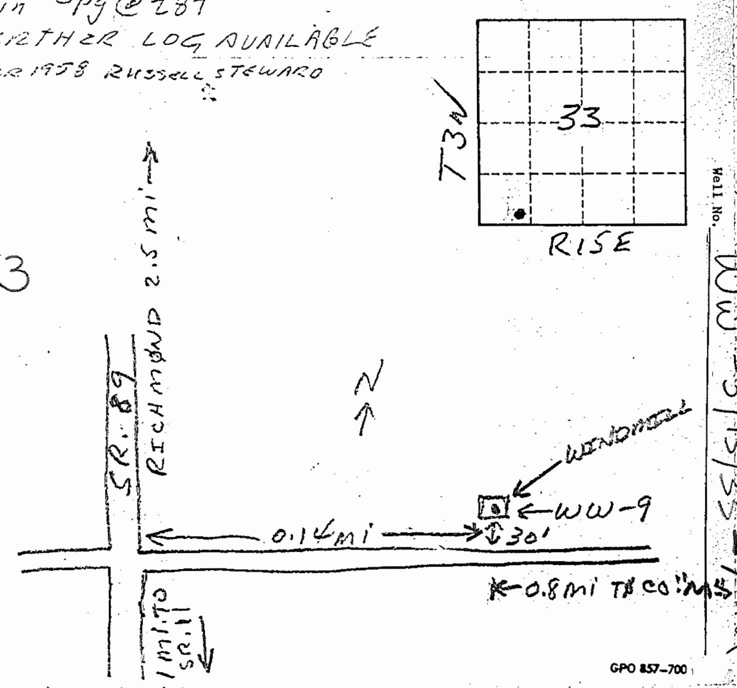
Surficial material: — Infiltration characteristics:

Coefficient Trans: gpd/ft — Coefficient Storage:

Coefficient Perm: gpd/ft² ; Spec cap: gpm/ft; Number of geologic cards:

Finished in Opg @ 287'
NO FURTHER LOG AVAILABLE
NEW OWNER 1958 RUSSELL STEWARD

Topo #53



Well No. WW-3/15/33-9

GPO 857-700

9-185—July 1935
Revised

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

WELL SCHEDULE

Ww-3/15/33-9

Date May 29 + 19 Oct 04, 19 47 Field No. Ww-9

Record by W. J. Drescher J. H. Green Office No.

Source of data Mr. Arthur Stewart + Field

1. *Location:* State Wisconsin County Walworth

Map Delavan 7½' T = Richmond

SW ¼ SW ¼ sec. 33 T 3 N/S R 15 E/W

2. *Owner:* Stewart Bros. Address Delavan

~~Tenant~~ Arthur & Roy Address

Driller Acly Address Walworth

3. *Topography*

4. *Elevation* 961 ft. above/below S.L.

5. *Type:* Dug, drilled, driven, bored, jetted 19 20

6. *Depth:* Rept. 287 ft. Meas. ft.

7. *Casing:* Diam. 6 in., to in., Type

Depth 287 ft., Finish

ief Aquifer From ft. to ft.

Others

9. *Water-level* 78.34 ft. ~~rept~~ meas. 5-29 19 47 ~~above~~ below hole

in pump base which is 1 ft. above/~~below~~ surface

10. *Pump:* Type lift Capacity G. M.

Power: Kind windmill Horsepower

11. *Yield:* Flow G. M., Pump 10 G. M., Meas., Rept., Est.

Drawdown ft. after hours pumping G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs.

Adequacy, permanence

13. *Quality* Temp 49 °F.

Taste, odor, color slightly cloudy Sample ~~Yes~~ No

Unfit for

14. *Remarks* (Log, Analyses, etc.) ADP SCHEDULE MADE

U.S. GOVERNMENT PRINTING OFFICE 6—7473

9-185—July 1935
Revised

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

Ww-3/15/33-9

WELL SCHEDULE

Date 5-29, 19 47 Field No. Ww-9

Record by WJD Office No.

Source of data Mr. Arthur Stewart

1. *Location:* State Wis County Walworth

Map DELAVAN 7½

SW ¼ SW ¼ sec. 33 T 3 N/S R 15 E/W

2. *Owner:* ~~Stewart Bros~~ Address Delavan

Tenant ~~Arthur & Roy~~ SEE BELOW Address

Driller Acly Address Walworth

3. *Topography* Top of hill

4. *Elevation* 965 ft. above/below

5. *Type:* Dug, drilled, driven, bored, jetted 19 20

6. *Depth:* Rept. 287 ft. Meas. ft.

7. *Casing:* Diam. 6 in., to in., Type

Depth 287 ft., Finish

ief Aquifer Gal-Plat clay From ft. to ft.

Others

9. *Water-level* 78.34 ft. ~~rept~~ meas. 5-29 19 ~~above~~ below hole

in pump base which is 1 ft. above/~~below~~ surface

10. *Pump:* Type lift Capacity G. M.

Power: Kind Windmill Horsepower

11. *Yield:* Flow G. M., Pump 10 G. M., Meas., Rept., Est.

Drawdown ft. after hours pumping G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs.

Adequacy, permanence

13. *Quality* ADP SCHEDULE MADE Temp 49 °F.

Taste, odor, color slightly cloudy Sample ~~Yes~~ No

Unfit for

14. *Remarks:* (Log, Analyses, etc.) bottom of well is in rock WJD 12-26-57 DRC

SEPT 30, 1958 NEW OWNER - RUSSELL STEWART

U.S. GOVERNMENT PRINTING OFFICE 6—7473

United States Geological Survey
Groundwater and Streamflow Information Program
National Ground-Water Monitoring Network
Cooperative funding Agreement Proposal – Round II

A. Proposal Information Summary

1. Project Title:
Improving the Wisconsin Groundwater-Level Monitoring Network

Wisconsin Geological and Natural History Survey, Madison, Wisconsin

Project activities will include well maintenance (Objective 4) and well drilling (Objective 5).

2. Technical contacts

Michael Parsen
Wisconsin Geological and Natural History Survey
3817 Mineral Point Rd.
Madison, WI 53705
(608) 262-1705
michael.parsen@wgnhs.uwex.edu

Pete Chase
Wisconsin Geological and Natural History Survey
3817 Mineral Point Rd.
Madison, WI 53705
(608) 262-1705
peter.chase@wgnhs.uwex.edu

3. Authorized Institutional Representative

Jordon Ott, Director of Extramural Support, UW-Extension
Board of Regents of the University of Wisconsin System
University of Wisconsin-Extension
104 Extension Building
432 N. Lake St.
Madison, WI 53706
(608) 890-4534
jordon.ott@uwex.edu

4. Amount Requested
$83,728 - Year 1

5. Proposed Start Date
August 1, 2016

6. Proposed Duration
12 months

7. Data Provider Status
Status = Existing data provider

The Wisconsin Geological and Natural History Survey (WGNHS) and U.S. Geological Survey - Wisconsin Water Science Center (USGS-WIWSC) have jointly operated the Wisconsin Groundwater-Level Monitoring Network since 1946. The Wisconsin Department of Natural Resources (WDNR) provides supplemental support for the network

Although the WGNHS and USGS-WIWSC have collaborated for decades to operate the Wisconsin Groundwater-Level Monitoring Network (WGWMN, this is the first funding request that the applicant is aware of through USGS-NGWMN.

8. Objectives included in proposal
This proposal includes the following two (2) objectives:

Objective 4 – Well maintenance - $45,671 for one year

Objective 5 – Well drilling - $38,057 for one year

B. Proposal

Please prepare a proposal that includes background information about your agency and network, a summary of your planned project, and a detailed description of the project with a separate section for each objective that is part of the project. Existing data providers should include a summary of their involvement in the network.

a. Background information

i. Description of Agency and purpose of monitoring.

The Wisconsin Geological and Natural History Survey (WGNHS) is part of the University of Wisconsin-Extension system. Our mission is as follows:

> *"The WGNHS conducts earth-science surveys, field studies, and research. We provide objective scientific information, about the geology, mineral resources, water resources, soil, and biology of Wisconsin. We collect, interpret, disseminate and archive natural resource information. We communicate the results of our activities through publications, technical talks, and responses to inquiries from the public. These activities support informed decision making by government, industry, business, and individual citizens of Wisconsin."*

The Wisconsin Groundwater-Level Monitoring Network (WGWMN) dates back to 1946, when the Wisconsin State Legislature requested that the WGNHS and U.S. Geological Survey (USGS) formally establish a groundwater monitoring network. The WGWMN is a cooperative monitoring network operated, maintained, and managed by the WGNHS and USGS with additional funding support from the Wisconsin Department of Natural Resources (WDNR).

During the late 1940s and 1950s the WGWMN network rapidly grew to 270 wells, before stabilizing around 200 wells from the 1960s through the 1980s. Beginning in the late 1980s, the number of wells decreased rapidly as funding support decreased and wells were abandoned or fell into disrepair. While the DNR, USGS, and WGNHS have continued to maintain, operate, and actively manage the WGWMN, the total number of long-term monitoring wells is now below 100. The WGWMN also includes 2 spring-gaging stations.

The USGS principal aquifers and areas that are monitored include:

- Sand and gravel aquifers (glaciated regions)
- Silurian-Devonian aquifer system,
- Cambrian-Ordovician aquifer system, and
- Precambrian aquifer system.

The WGNHS and USGS-WIWSC have collaborated for decades to operate, maintain, and manage the WGWMN, which includes dozens of wells in the NGWMN.

ii. Description of the Agency's existing monitoring networks.

The Wisconsin Groundwater-Level Monitoring Network (WGWMN) consists of 93 wells and 2 spring gaging stations. Of these 40 are already included in the NGWMN network and relevant to the needs of the NGWMN.

Figure 1 below shows the locations of all monitoring sites in the WGWMN and the NGWMN:

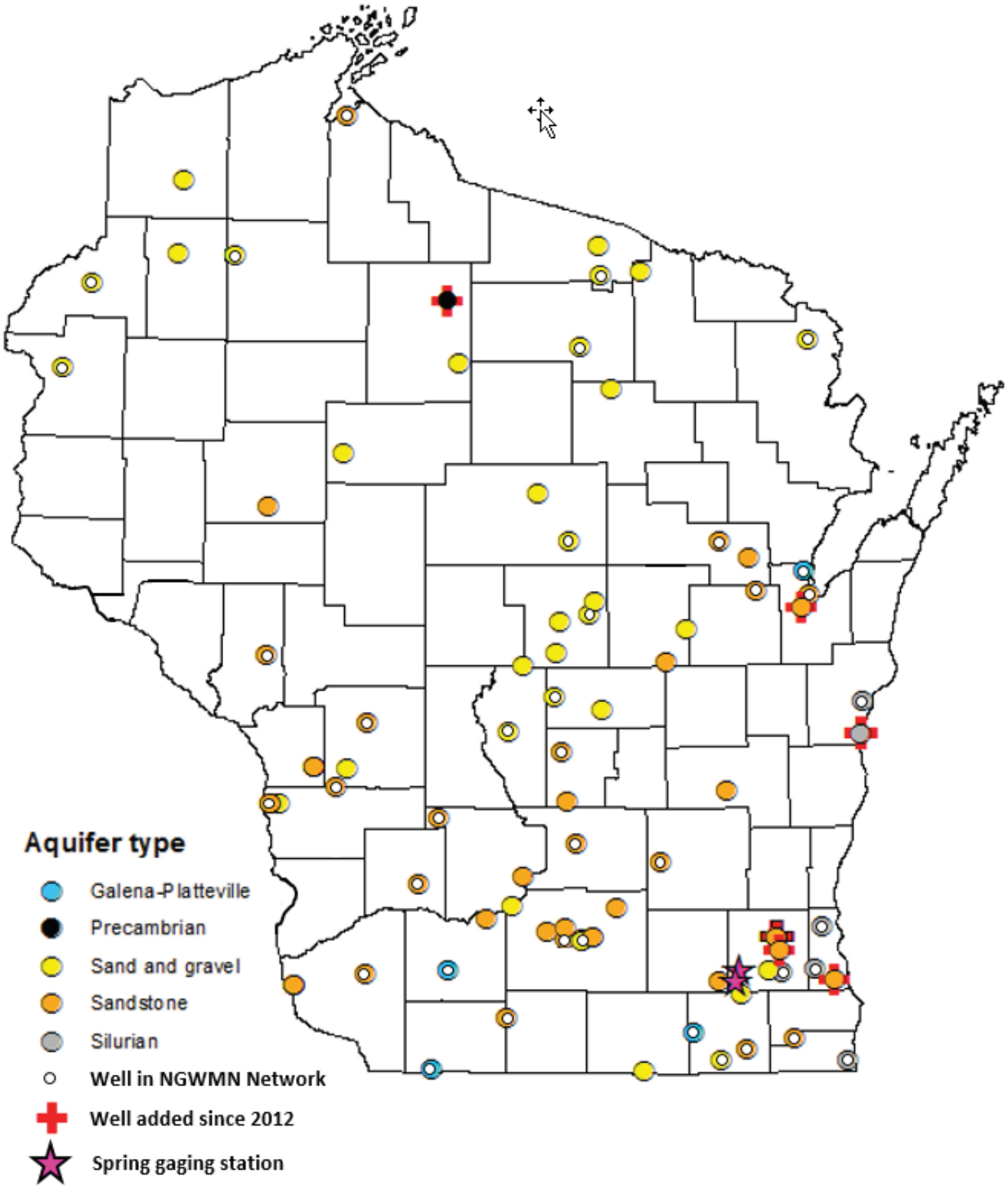


Figure 1: Map showing locations of all monitoring sites in the Wisconsin Groundwater-level Network wells and the NGWMN.

iii. Describe previous projects with the NGWMN.

The WGNHS and USGS-WIWSC have collaborated for decades to operate, maintain, and manage the WGWMN, which includes dozens of wells in the NGWMN.

iv. IT Infrastructure.
The database for the WGWMN is actively managed by staff at the USGS WIWSC, not the Wisconsin Geological and Natural History Survey. We assist the USGS in collecting water-level data and serve in other management roles through this ongoing partnership. The USGS WIWSC uses the USGS National Water Information System (NWIS) database which is publicly available on the internet (http://waterdata.usgs.gov/nwis)

b. Project Summary

The WGNHS is proposing two (2) work components which includes well maintenance and repair (Objective #4) and the drilling of replacement wells (Objective #5).

An explanation of each project component including a detailed work plan and budget is included below in the following section.

c. Project Description

Objective 4: Well maintenance

Work Plan:

Each well in the Wisconsin Groundwater-Level Monitoring Network (WGWMN) had a unique history prior to being incorporated into the WGWMN. Some wells were installed for research purposes and directly brought into the network, while others served as supply wells for decades before entering the WGWMN Network. Due to the diversity of wells in the WGWMN, and the varying condition of each well, there are several well maintenance needs including redevelopment and slug/pump testing to ensure satisfactory connection to the aquifer system. One well has a damaged shelter which is critical for protecting the well during the harsh winter months.

The following section identifies each monitoring well, describes the maintenance and repairs needed, and includes a cost summary for work activities at each well.

A separate budget sheet has been prepared for each objective, Objective 4 - Items A-D, which details the personnel involved, and costs for each component of the project. This budget sheet is included in section D. Activities for all objectives are anticipated to be completed within 1-year of proposal approval.

Objective 4 – Item A
Well 56000046 (Kenosha County – WI)

Site Number: 423214087503801
Site Name: GR-05/02W/06-0005
WGNHS Well ID: 56000046 (aka: KE-46)
Description: This well was drilled in 1940 to a total depth of 135 feet into the Silurian-Devonian aquifer system and has been recording water-level data since 1961. This well needs to have the equipment shelter replaced. Due to the adverse winter conditions this well shelter is critical for maintaining the proper functioning of the well.
Maintenance needs (includes cost):

- Salary: $1,559
- Fringes: $790
- Travel: $958
- Supplies: $750
- Equipment: $0
- Contracts: $0
- Indirects: $1,197
- Total: $5,254

Party responsible for maintenance: The WGNHS will supervise all activities working in close coordination with the USGS WISSC.

Objective 4 – Item B
Well 36000028 (Manitowoc County – WI)

Site Number: 440430087420401
Site Name: MN-19/23E/35-0028
WGNHS Well ID: 36000028 (aka: MN-28)
Description: This well was drilled in 1959 to a total depth of 147 feet into the Silurian-Devonian aquifer system and has been recording water-level data since 1968. Recent field measurements indicate that the bottom 10-feet of the well have filled in with sediment. The maintenance and repair needs for this well include redeveloping the well (to remove sediment from the bottom of the well) and performing slug/pump testing to confirm the well's connection to the aquifer following redevelopment.
Maintenance needs (includes cost):

- Salary: $2,411
- Fringes: $1,222
- Travel: $932
- Supplies: $1,370
- Equipment: $0
- Contracts: $4,000
- Indirects: $2,931
- Total: $12,866

Party responsible for maintenance: The WGNHS will supervise all activities working in close coordination with the USGS-WISSC and a qualified subcontractor. A subcontractor will be hired to perform the well redevelopment.

Objective 4 – Item C
Well 45000416 (Outagamie County – WI)

Site Number: 443353088194201
Site Name: OU-24/18E/08-0416
WGNHS Well ID: 45000416 (aka: OU-416)
Description: This well was drilled in 1992 to a total depth of 740 feet into the Cambrian-Ordovician aquifer system and has been recording water-level data since 1992. This well has recently been identified as having a blockage at roughly 145 feet depth and has several maintenance and repair needs including evaluation and repair of the plugged well, redevelopment of the well, and performing slug/pump testing to confirm the well's connection to the aquifer following redevelopment.
Maintenance needs (includes costs):

- Salary: $3,538
- Fringes: $1,794
- Travel: $1,871
- Supplies: $45
- Equipment: $0
- Contracts: $5,600
- Indirects: $3,790
- Total: $16,638

Party responsible for maintenance: The WGNHS will supervise all activities working in close coordination with the USGS WIWSC and qualified subcontractor. A subcontractor will be hired to unplug the well and perform well redevelopment.

Objective 4 – Item D
Well: 65000009 (Walworth County – WI)

USGS Site Number: 424004088440601
USGS Site Name: WW-03/15E/33-0009
WGNHS Well ID: 65000009 (aka: WW-9)
Description: This well was drilled in 1920 to a total depth of 287 feet into the Silurian-Devonian aquifer system and has been recording water-level data since 1947. Recent field measurements indicate that the bottom 36-feet of the well have filled in with sediment. The maintenance and repair needs for this well include redeveloping the well (to remove sediment from the bottom of the well) and performing slug/pump testing to confirm the well's connection to the aquifer following redevelopment.

Maintenance needs (includes cost):

- Salary: $2,411
- Fringes: $1,222
- Travel: $749
- Supplies: $45
- Equipment: $0
- Contracts: $4,000
- Indirects: $2,486
- Total: $10,913

Party responsible for maintenance: The WGNHS will supervise all activities working in close coordination with the USGS WIWSC and a qualified subcontractor. A subcontractor will be hired to perform the well redevelopment.

All maintenance activities will be documented in the final project report

Objective 5: Well drilling

Work Plan:
Each well in the Wisconsin Groundwater-Level Monitoring Network (WGWMN) had a unique history prior to being incorporated into the WGWMN. Some wells were installed for research purposes and directly brought into the network, while others served as supply wells for decades before entering the WGWMN Network. Well 41000148, which has been collecting data since 1946, provides critical water-level monitoring data but is in need of replacement due to the current construction of the well. The only access to the water-level in this well is a ¼ inch access pipe, which makes it impossible to evaluate and service the well. The goal of this objective is to first over-drill and completely abandon the existing well before drilling a new replacement well at the same site.

The following section identifies the monitoring well, describes the proposed well drilling needs, and includes a cost summary for this work activity.

A separate budget sheet has been prepared for this objective, Objective 5 – Item A, which details the personnel involved, and costs for each component of the project. This budget sheet is included in section D. Activities for this objective is anticipated to be completed within 1-year of proposal approval.

Objective 5 – Item A
Well 41000148 (Milwaukee County – WI)

Site Number: 425613088014301
Site Name: ML-06/21E/32-0148
WGNHS Well ID: 41000148 (aka: ML-148)
Description: This well was drilled in 1933 to a total depth of 180 feet into the Silurian-Devonian aquifer system and has been recording water-level data since 1946. This well has a 5-inch diameter casing and is cased to 43-feet depth with an open hole to 180-feet; however, a ¼-inch open pipe has been cemented into the 5-inch casing and serves as the only access pipe to the aquifer. Due to the very small ¼-inch access pipe, we have not been able to evaluate the condition of the well, service the well, or perform aquifer testing.

We are seeking funding to replace this network well with a new well at the same site which would provide a high-quality monitoring well for years to come and allow us to perform routine maintenance and hydraulic tests to confirm the connection of this well to the surrounding aquifer system. Due to the very small diameter of this well, we have not been able to evaluate the condition the well, service the well, or perform aquifer testing.

Well drilling needs (includes cost):

- Salary: $4,258
- Fringes: $2,159
- Travel: $1,736
- Supplies: $45
- Equipment: $0
- Contracts: $21,190
- Indirects: $8,669
- Total: $38,057

The existing well would be overdrilled using air rotary and abandoned in compliance with Wisconsin administrative code requirements. The new well would be drilled using air rotary 6-in diameter casing with 2-inch interior diameter schedule 40 PVC. Following installation of the new well, it would be developed and slug/pump testing would be performed to ensure the well is in hydraulic connection to the surrounding aquifer.

Party responsible for maintenance: The WGNHS will supervise all abandonment and drilling activities working in close coordination with the USGS WIWSC. A qualified subcontractor will be hired to perform the over drilling, abandonment, new well drilling, development of the new well.

C. Budget Summary

Indirect cost rate: 29.5% (See negotiated rate sheet, Appendix A)

Budget summary Year 1

Category	Federal $	Agency in-kind $	Total $
1. Salary (wages, fringe)	21,364	0	21,364
2. Travel	6,246	0	6,246
3. Supplies	2,255	0	2,255
4. Equipment	0	0	1,325
5. Contracts	34,790	0	34,790
6. Total Direct Costs (items 1-5)	64,655	0	64,655
7. Indirect cost	19,073	0	19,073
8. Total Cost (items 6 and 7)	83,728	0	83,728

In-kind services percent: 0%

Appendix A, Negotiated Rate Agreement

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN: 1396006492A1

DATE:04/27/2015

ORGANIZATION:

University of Wisconsin - Madison and Extension

21 North Park Street
Suite 6401
Madison, WI 53715

FILING REF.: The preceding agreement was dated 06/18/2014

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: INDIRECT COST RATES

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

	EFFECTIVE PERIOD				
TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
PRED.	07/01/2013	06/30/2017	53.00	On Campus	Organized Research
PRED.	07/01/2013	06/30/2017	50.00	On Campus	Instruction
PRED.	07/01/2013	06/30/2017	36.00	On Campus	Public Service
PRED.	07/01/2013	06/30/2017	29.50	On Campus	Ext. Public Service
PRED.	07/01/2013	06/30/2017	37.00	On Campus	Primate Ctr Rate (A)
PRED.	07/01/2013	06/30/2017	16.00	On Campus	Primate Ctr Rate (B)
PRED.	07/01/2013	06/30/2017	26.00	Off Campus	All Programs
PROV.	07/01/2017	06/30/2019			Use same rates and conditions as those cited for fiscal year ending June 30, 2017.

*BASE

ORGANIZATION: University of Wisconsin - Madison and Extension
AGREEMENT DATE: 4/27/2015

Modified total direct costs, consissting of all salaries and wages, fringe benefits, materials, supplies, services, travel and subgrants and subcontracts up to the first $25,000 or each subgrant or subcontract(regardless of the period covered by the subgrant or subcontract). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, tuition remission, rental costs of off-site facilites, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

(A) All Primate Center.

(B) Non P.51 Core grants only.

ORGANIZATION: University of Wisconsin - Madison and Extension
AGREEMENT DATE: 4/27/2015

SECTION I: FRINGE BENEFIT RATES**

TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
FIXED	7/1/2014	6/30/2015	33.70	All	(1)
FIXED	7/1/2014	6/30/2015	46.50	All	(2)
FIXED	7/1/2014	6/30/2015	24.50	All	(3)
FIXED	7/1/2014	6/30/2015	23.30	All	(4)
FIXED	7/1/2014	6/30/2015	15.20	All	(5)
FIXED	7/1/2014	6/30/2015	15.90	All	(6)
FIXED	7/1/2014	6/30/2015	7.80	All	(7)
FIXED	7/1/2014	6/30/2015	4.00	All	(8)
FIXED	7/1/2015	6/30/2016	37.00	All	(1)
FIXED	7/1/2015	6/30/2016	49.70	All	(2)
FIXED	7/1/2015	6/30/2016	23.90	All	(3)
FIXED	7/1/2015	6/30/2016	23.90	All	(4)
FIXED	7/1/2015	6/30/2016	15.90	All	(5)
FIXED	7/1/2015	6/30/2016	16.40	All	(6)
FIXED	7/1/2015	6/30/2016	9.10	All	(7)
FIXED	7/1/2015	6/30/2016	2.40	All	(8)

ORGANIZATION: University of Wisconsin - Madison and Extension
AGREEMENT DATE: 4/27/2015

PROV.	7/1/2016	6/30/2018	Use same rates and conditions as those cited for fiscal year ending June 30, 2016.

** DESCRIPTION OF FRINGE BENEFITS RATE BASE:

Salaries and wages of faculty and staff including vacation, hoiday abd sick leave pay and other paid absences of only the faculty and staff. Rate does not apply to student employees, research or teaching assistants.

(1) Regular Faculty and Academic Staff
(2) Classified and UWEXT Permanent Staff
(3) Research Assistants, Project Assistants, Teaching Assistants, Pre-Doc Fellows and/or Trainees
(4) Research Associates and Grad Interns
(5) Post-Doc Fellows and/or Trainees
(6) Limited Term Employees (LTE's)
(7) Ad Hoc Program Specialists, Undergraduate Assistants and Undergraduate Interns
(8) Student Hourly Employees

Fringe Benefit rates are combined rates for Madison and Milwaukee Campuses and are applied to both the campuses. These Fringe Benefit rates are also included on the University of Wisconsin, Milwaukee rate agreement.

ORGANIZATION: University of Wisconsin - Madison and Extension
AGREEMENT DATE: 4/27/2015

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are charged using the rate(s) listed in the Fringe Benefits Section of this Agreement. The fringe benefits included in the rate(s) are listed below.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences.

OFF-CAMPUS DEFINITION: For all activities performed in facilities not owned by the institution and to which rent is directly allocated to the project(s) the off-campus rate will apply. Grants or contracts will not be subject to more than one F&A cost rate. If more than 50% of a project is performed off-campus, the off-campus rate will apply to the entire project.

Equipment Definition -
Equipment means an article of nonexpendable, tangible personal property having a useful life of more than one year and an acquisition cost of $5,000 or more per unit.

FRINGE BENEFITS:

FICA
Retirement
Disability Insurance
Worker's Compensation
Life Insurance
Unemployment Insurance
Health Insurance
Severance Allowance
ERA Administration
Income Continuation Insurance

Your next fringe benefit proposal based on actual costs for the fiscal year ending 06/30/15 is due in our office by 12/31/15. Your next F&A proposal based on actual costs for the fiscal year ending 06/30/16 is due in our office by 12/31/16.

ORGANIZATION: University of Wisconsin - Madison and Extension

AGREEMENT DATE: 4/27/2015

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Office of Management and Budget Circular A-21, and should be applied to grants, contracts and other agreements covered by this Circular, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:

University of Wisconsin - Madison and Extension

(INSTITUTION)

(SIGNATURE)

Kim Moreland

(NAME)

Associate Vice Chancellor for Research Administration

Research & Sponsored Programs

(TITLE)

5-8-15

(DATE)

ON BEHALF OF THE FEDERAL GOVERNMENT:

DEPARTMENT OF HEALTH AND HUMAN SERVICES

(AGENCY)

Daryl W. Mayes -S Digitally signed by Daryl W. Mayes -S DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, 0.9.2342.19200300.100.1.1=2000131669, cn=Daryl W. Mayes -S Date: 2015.05.05 16:12:01 -04'00'

(SIGNATURE)

for Arif Karim

(NAME)

Director, Cost Allocation Services

(TITLE)

4/27/2015

(DATE) 5121

HHS REPRESENTATIVE: Shon Turner

Telephone: (214) 767-3261