



Madison Water Utility

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January 7, 2021

NOTICE OF ADDENDUM ADDENDUM #1

CONTRACT # 9006 WELL 18 TREATMENT

Revise and amend the contract document(s) for the above project as stated in this addendum, otherwise, the original document shall remain in effect.

CHANGES TO THE PROPOSAL

- ADD: Attached "Mechanical and Chemical Rehabilitation Plan" – (9 pages)

Please acknowledge this addendum on page E1 of the contract documents and/or in Section E: Bidder's Acknowledgement on Bid Express.

Electronic version of these documents can be found on the Bid Express web site at:

<http://www.bidexpress.com>

If you are unable to download plan revisions associated with the addendum, please contact the Engineering office at 608.266.4751 to receive the materials by another route.

Sincerely,

MADISON WATER UTILITY

Alan L. Larson, PE, BCEE
Chief Engineer and Asst GM

Mechanical and Chemical Rehabilitation Plan

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SECTION 1 – GENERAL

Well Details

1. Address: 1925 South Park Street, Madison, WI
2. Line shaft pump with 12-inch flanged column pipe; 2,200 gpm capacity
3. Pump Setting = 328 feet
4. Original Static Water Level = 71 feet
5. Current Static Water Level = 152 feet
6. Cased depth = 251 feet (noted as 30-inch diameter)
7. Total depth = 808 feet (noted as 29-inch diameter open borehole)
8. Borehole volume = 22,746 gallons
9. Treatment volume = 28,400 gallons (1.25 borehole volumes)

Overview and Treatment Descriptions

Scope: The scope of work for rehabilitation of the well generally consists of the following tasks:

1. Madison Water Utility (MWU) will perform the initial pump test
2. MWU will pull and inspect the existing well pumping equipment
3. Televising the well
4. Mechanical treatment of the well
5. Chemical treatment of the entire well in three steps
6. Intermediate and final purging of treatment from the well
7. MWU will re-install the well pump
8. MWU will perform a post-treatment pump test
9. MWU will disinfect and test the well to put it back in service.

Mechanical Treatment Details: Mechanical treatment of the well occurs prior to chemical treatment to increase effectiveness of biofilm removal and reduce chemical treatment requirements. Mechanical treatment involves use of a stiff wire-bristle brush fully contacting the inner circumference of the cased region and use of an air impulse generator (AIG) – use of a plastic bristle brush is not allowed.

General details of this step include the following:

1. Brush the full wetted length of casing plus the upper 25 feet of open borehole for 30 passes. A single pass includes one cycle of brushing in the well, from the water surface (about 152 feet) to 25 feet below the casing (about 276 feet) and back to the water surface.
2. Install a temporary 250 gpm recirculation pump in the well, set at about 80 feet below static water level (about 232 feet), with 4" discharge to the surface. Size pump for the installed system to achieve desired flows under the various conditions specified. Pump shall be capable of delivering a range of flows from 100 gpm to 250 gpm using a variable frequency drive or a throttling valve.
3. Limits for water disposal are:
 - a. 100 gpm for sanitary sewer disposal.
 - b. 250 gpm, <40 ppm of TSS for storm sewer disposal, and no detectable chlorine.
4. MWU to provide traffic control when discharging to either sanitary sewer or storm sewer. Schedule work as required to accommodate traffic control.

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5. Perform AIG treatment of the borehole from 276 feet (25 feet below casing) to 805 feet for one pass. Additional passes may be required and will be paid for by supplemental bid prices for actual quantities.
 - a. A single pass is considered to include BOTH directions of AIG treatment, down and up, for two exposures of the borehole to AIG. If Contractor only perform AIG in upward motion, then a single pass will consist of two upward runs of AIG.
 - b. Impulse pressure should set at 2,500 psi . Do not increase AIG pressure above the pressure that could cause damage to the well or borehole. Well has previously had AIG of up to 3,000 psi.
 - c. Atmospheric air or nitrogen can be used as the impulse generating gas.
 - d. AIG shall be fired at a rate of three shots per foot of borehole while traveling at 5 feet per minute.
 - e. AIG air chamber shall be a minimum of 8" in diameter with a volume of at least 262 cubic inches.
 - f. After each AIG pass, pump debris from well at 250 GPM for 120 minutes or until discharge water is clear, whichever is greater, discharging water to a combination filter bag and temporary tank or dumpster for solids removal with overflow to storm sewer. Discharge limits to the storm sewer is 40 ppm of TSS and no detectable chlorine. Monitor flow rate and drawdown during each post-AIG discharge event every 30 minutes, collecting a 250 mL sample of the discharge water at 5 minutes, 60 minutes and 115 minutes post initiation of purging. Submit samples to WQI within 24 hours of sample collection.
 - g. AIG of more than one pass will be based on results of previous AIG pass. In general, if the AIG pass generates little discolored debris or primarily turbid water with clean sand, AIG will be complete.
 - h. Air lift or bail debris from the well. Properly dispose of air lifted or bailed solids along with solids collected during pump off events performed after each AIG pass.

Mixing Details: Install a recirculation tremie to the bottom of the well for mixing and monitoring of rehabilitation chemicals.

General details of this include the following:

1. Install a 4" recirculating tremie from the surface to 800 feet (bottom of well), which is used for recirculation and could be used for airlifting of debris.
2. Use temporary 250 gpm recirculation pump previously set in the well.
3. On the 4" surface piping from pump, install a check valve, throttling valve, smooth sample tap, and flow meter, and then a 4" return line to allow recirculation of flow from the pump to the tremie that goes to the bottom of the well.
4. When mixing and injecting chemical treatment for the entire well:
 - a. Throttle the flow or operate the temporary pump using a VFD to control flow rate at about 185 gpm.
 - b. Discharge 160 gpm to the bottom of the well through the 4" recirculation line.
 - c. Free-fall discharge about 25 gpm to above the pump.
 - d. Recirculation will turnover/mix the borehole volume every 120 minutes of pumping.

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Chemical Treatment Details: Chemical treatment of the well consists of an *acid-based treatment* step, a *chlorine treatment* step, and a *chlorine-based treatment* step. Chemical treatment shall be initiated within 5 calendar days of completion of mechanical treatment.

General details of this step include:

1. Ensure well house is properly ventilated as chemical treatment may give off a sulfide smell or volatile organic vapors, which may be hazardous to health.
2. Treat 1.25 borehole volumes when treating the entire well to target treatment of the well and nearby aquifer. Chemical injection will be a two-step process:
 - a. Inject the first 1.0 borehole volumes of chemical during mixing of the borehole to achieve the specified concentration over one borehole recirculation time.
 - b. Inject the next 0.25 borehole volumes of chemical into the well to treat the nearby aquifer with the recirculation pump off, injecting chemical into water added to the well from the system. Add water to the well at the same rate that water was being recirculated in the well.
3. Monitor chemical usage and observations on the attached data form.

Intermediate Purge: General details of this step include the following:

1. For those steps requiring a purge of spent chemical treatment from the well, purge 3 borehole volumes at 100 gpm to sanitary sewer, neutralizing as necessary. For this step, purging will take the following amount of time:
 - a. Approximately 11 hours and 30 minutes for the entire well.
 - b. Once started, each treatment shall be completed in a single day.
2. Between acid treatment and chlorine-based treatment, the well should be pumped to waste for 24 hours, with the first 30,000 gallons sent to sanitary sewer at a rate not to exceed 100 gpm. Following the first 30,000 gallons, discharge water to the storm sewer at 250 gpm.
3. Neutralize remnant acidity, if below 5.5 su, with caustic soda.
4. Neutralize remnant chlorine, if any, with sodium bisulfite.
5. When purging the well, add 75 gpm of system water to the tremie and free-fall 25 gpm into the well above the pump. This approach will ensure the entire borehole is rapidly purged of remnant chemical and discolored water.

Final Purge: After chemical treatment is complete, pump the well at 250 gpm for 24 hours to storm sewer. Follow Intermediate Purge procedure to rid well of remnant chemical before starting final purge. When performing the final purge, allow 25 gpm to be recirculated to the bottom of the well and 10 gpm to free fall above the pump, discharging the remaining 215 gpm to waste.

Follow Up Maintenance: To be determined after well rehabilitation and follow up testing.

SECTION 2 – EXECUTION

Step 1: Initial Pump Test, Pull Pump and Televising of Well

1. **Madison Water Utility Task:** Using the existing pump, perform an initial pump test for one hour to document initial pumping conditions. During the test, note discharge rate, discharge pressure and drawdown every 2 minutes for the first 10 minutes, then every 10 minutes thereafter.

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2. Madison Water Utility Task: Pull well pump. Inspect discharge head, pump, shaft, spider bearings, column pipe and couplings for wear.
 - a. Obtain exterior scrapings of the column pipe at 20 feet above the pump for mineral and biofilm analyses. Assessment of this material will help determine the extent of acid treatment needed and the potential for ongoing issues.
 - b. Obtain exterior scrapings of the pump shaft at 20 feet above the pump for mineral and biofilm analyses. Assessment of this material will help determine the extent of acid treatment needed and the potential for ongoing issues.
 - c. Pressure wash column pipe (inside and outside), pump shaft, and pump to remove biofilm and scale and to allow for inspection (unless obviously damaged and in need of replacement).
 - d. Provide inspection report, recommendations and costs for necessary repairs or replacements within 3 business days of pump removal.
 - e. Provide pictures of the column pipe, especially below the pumping water level.
3. Televisе borehole to assess/document the current condition of the casing, casing seal, and borehole.
4. Provide video file of inspection in digital format for records.

Step 2: Mechanical Treatment

1. Install temporary pump and associated piping.
2. Perform the mechanical treatment of the well.
3. After mechanical treatment, install tremie and equipment for mixing of the well during chemical rehabilitation.

Step 3: Acid Treatment of Entire Well (min. 24 hours contact time)

1. Chemicals:
 - a. Inhibited NSF 60 20-degree Baume HCl (31% strength) – 6,400 mg/L, pH of 0.7 su.
 - b. Initial strength treatment:
 - i. 590 gallons of inhibited HCl
 - ii. Mix chemical into water recirculated in the well over one borehole volume recirculation time.
 - iii. Add chemical to water as it is added from the system into the well for 0.25 borehole volumes.
 - iv. Chemical addition rate: 590 gal over 150 min of addition (1.25 borehole volumes) equates to 3.9 gpm.
 - c. Supplemental treatment:
 - i. 295 gallons of HCl
 - ii. Mix chemical into water recirculated in the well over one borehole volume recirculation time (295 gal over 120 min = 2.5 gpm).
2. Add initial strength treatment to the well. Mix the well continuously during working hours, monitoring pH and odor every 30 minutes of mixing. Let well sit unmixed overnight. Measure pH using a calibrated pH sensor.
 - a. For odor assessment, waft the sample (**don't directly sniff**) to determine if it has a fruity, sweet, musty, pungent, "swimming pool" or metallic odor.

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- b. If pH rises above 3 su within the first 8 hours of mixing an *initial strength treatment*, at the time point of rise add supplemental treatment and continue to mix and monitor for an additional 24 hours.
- c. If pH rises above 3 su within the first eight (8) hours of mixing a supplemental treatment, or if the solution becomes excessively dirty, perform an *intermediate purge* and start with a fresh batch of *initial strength treatment*.
- d. When pH stays below 3 su for 24 hours, treatment is complete. Deflate the packer and mix the acid treatment throughout the entire well until pH stabilizes at above 5.5 su.
- e. Perform an *intermediate purge*.

Step 4: Chlorine Treatment of Entire Well (minimum 24 hours contact time)

1. Chemicals:
 - a. 12.5% NSF 60 NaOCl – 3,750 mg/L dose.
 - b. Initial strength treatment:
 - i. 850 gallons of 12.5% NaOCl
 - ii. Mix chemical into water recirculated in the well over one borehole volume recirculation time.
 - iii. Add chemical to water as it is added from the system into the well for 0.25 borehole volumes.
 - iv. Chemical addition rate: 850 gallons over 150 minutes of addition (1.25 borehole volumes) equates to 5.7 gpm.
 - c. Supplemental treatment:
 - i. 425 gallons of 12.5% NaOCl
 - ii. Mix chemical into water recirculated in the well over one borehole volume recirculation time (425 gallons over 120 min = 3.5 gpm).
2. Add *initial strength treatment* to the well. Mix the well continuously during working hours, monitoring pH, odor and free and total chlorine residual every 30 minutes during mixing. Measure pH using a calibrated pH sensor. Measure chlorine using a calibrated device to report to the nearest 10 mg/L total chlorine and free chlorine.
 - a. For odor assessment, waft the sample (**don't directly sniff**) to determine if it has a fruity, sweet, musty, pungent, "swimming pool" or metallic odor.
 - b. If free chlorine drops below 300 mg/L within the first 4 hours of mixing an *initial strength treatment*, perform an *intermediate purge* of the treatment from the well at the point of decline and retreat the well with an *initial strength treatment*.
 - c. If free chlorine drops below 300 mg/L within the first 8 hours of mixing an *initial strength treatment*, add *supplemental treatment* at the time point of decline and continue to mix and monitor for an additional 24 hours.
 - d. After 24 hours of mixing and monitoring of the initial treatment or the supplemental treatment, treatment step is complete.
 - e. Perform an *intermediate purge* of the treatment from the well.

Step 5: Chlorine-Based Treatment Step of Entire Well (min. 24 hours contact time)

1. Chemicals:
 - a. Clearitas 110, Blue Earth Products, NSF 60 – 3,333 mg/L dose.

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- b. 12.5% NSF 60 NaOCl – 1,250 mg/L dose.
 - c. 70% NSF 60 glycolic acid – 2,500 mg/L dose.
 - d. Initial strength treatment:
 - i. 102 gallons of 70% glycolic acid
 - ii. 95 gallons Clearitas 110 (add downstream of glycolic acid)
 - iii. 284 gallons of 12.5% NaOCl (add downstream of Clearitas 110)
 - iv. Mix chemical into water recirculated in the well over one borehole volume recirculation time.
 - v. Add chemical to water as it is added from the system into the well over 0.25 borehole volumes.
 - vi. Chemical addition rates:
 1. 102 gallons glycolic acid over 150 minutes of addition equates to 0.68 gpm.
 2. 95 gallons Clearitas over 150 minutes of addition equates to 0.63 gpm.
 3. 284 gallons sodium hypochlorite over 150 minutes of addition equates to 1.9 gpm.
 - e. Supplemental treatment:
 - i. 51 gallons of 70% glycolic acid
 - ii. 47.5 gallons Clearitas 110
 - iii. 142 gallons of 12.5% NaOCl
 - iv. Mix chemical into water recirculated in the well over one borehole volume recirculation time.
 - v. Add chemical to water as it is added from the system into the well.
 - vi. Chemical addition rates:
 1. 56 gallons glycolic acid over 150 minutes of addition equates to 0.34 gpm.
 2. 47.5 gallons Clearitas over 150 minutes of addition equates to 0.31 gpm.
 3. 142 gallons sodium hypochlorite over 150 minutes of addition equates to 0.95 gpm.
2. Add initial strength treatment to the well. Mix the well continuously during working hours, monitoring pH, odor and free and total chlorine residual every 30 minutes during mixing. Measure pH using a calibrated pH sensor. Measure chlorine using a calibrated device to report to the nearest 10 mg/L total chlorine and free chlorine.
- a. For odor assessment, waft the sample (**don't directly sniff**) to determine if it has a fruity, sweet, musty, pungent, "swimming pool" or metallic odor.
 - b. If free chlorine drops below 300 mg/L within the first 4 hours of mixing an initial strength treatment:
 - i. If pH is below 6 su and minimal or no color is present, add supplemental treatment.
 - ii. If pH is above 6 su or the water is yellow or excessively dirty, perform an intermediate purge of the treatment from the well and retreat the well with an initial strength treatment.
 - c. If free chlorine drops below 300 mg/L within the first 8 hours of mixing an initial strength treatment:
 - i. If pH is below 6 su and minimal or no color is present, add supplemental treatment.

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- ii. If pH is above 6 su or the water is yellow or excessively dirty, perform an intermediate purge of the treatment from the well and retreat the well with an initial strength treatment.
- d. If free chlorine drops below 300 mg/L within the first eight (8) hours of mixing a supplemental treatment, or if the solution becomes excessively dirty, continue mixing until chlorine is completely consumed, perform an intermediate purge and start with a fresh batch of initial strength treatment.
- e. When free chlorine stays above 300 mg/L for 24 hours, treatment is complete.
- f. Perform a final purge of the well.
- g. Following the final purge of the well, Contractor will remove the temporary pump and other fittings/piping used in the treatment step and demobilize from the site.

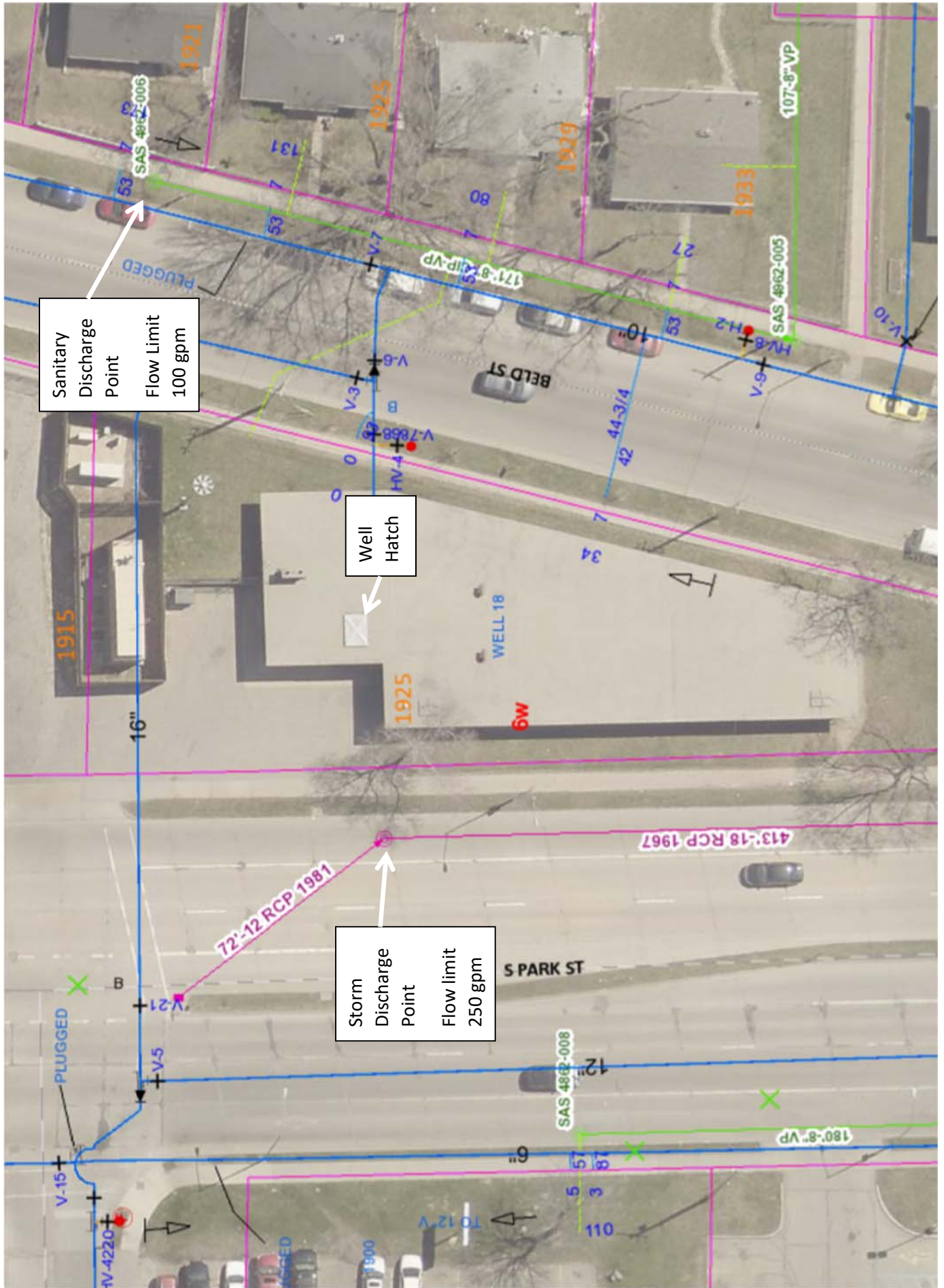
Step 6: Install Pump, Final Pump Test, and Sampling – MWU Task

1. MWU Staff will chlorinate the well to 100 mg/L for final chlorination before reinstallation of well pump (DNR requirement).
2. MWU staff will reinstall well pump, spraying all components with 200 mg/L chlorine solution as they are installed
3. MWU Staff will pump the well to storm sewer for a minimum of 8 hours, dechlorinating as necessary. Note discharge rate, discharge pressure and drawdown every 2 minutes for the first 10 minutes, then every 10 minutes thereafter.
4. The first bacteria sample can be collected no sooner than 30 minutes after chlorine is no longer detectible.
5. MWU Staff will collect two safe samples a minimum of 8 hours apart before returning the well to service.



Well 18 – 1925 South Park Street - Chemical treatment of the well bore hole to restore lost production capacity

- Multiple discharges during the multi-step process to sanitary or storm sewer @ 250 gpm for up to 24 hours.
- Pumping process is 100 gpm maximum to sanitary sewer followed by 250 gpm to storm sewer
- MWU to provide traffic control during disposal operations
- All chemicals will be neutralized or purged prior to discharge to the storm sewer resulting in an untreated well water discharge.
- Sediment will be removed with filter bags and settling tanks.



Sanitary
Discharge
Point
Flow Limit
100 gpm

Well
Hatch

Storm
Discharge
Point
Flow limit
250 gpm