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PREPARED FOR

MILLER BREWING COMPANY

Reynolds Can Plant Site
Fulton, New York

REMEDIAL DESIGN REPORT

MALCOLM PIRNIE

MARCH 1995
REVISED MAY 1995

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MILLER BREWING COMPANY

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Liverpool, NY 13088

1028-268

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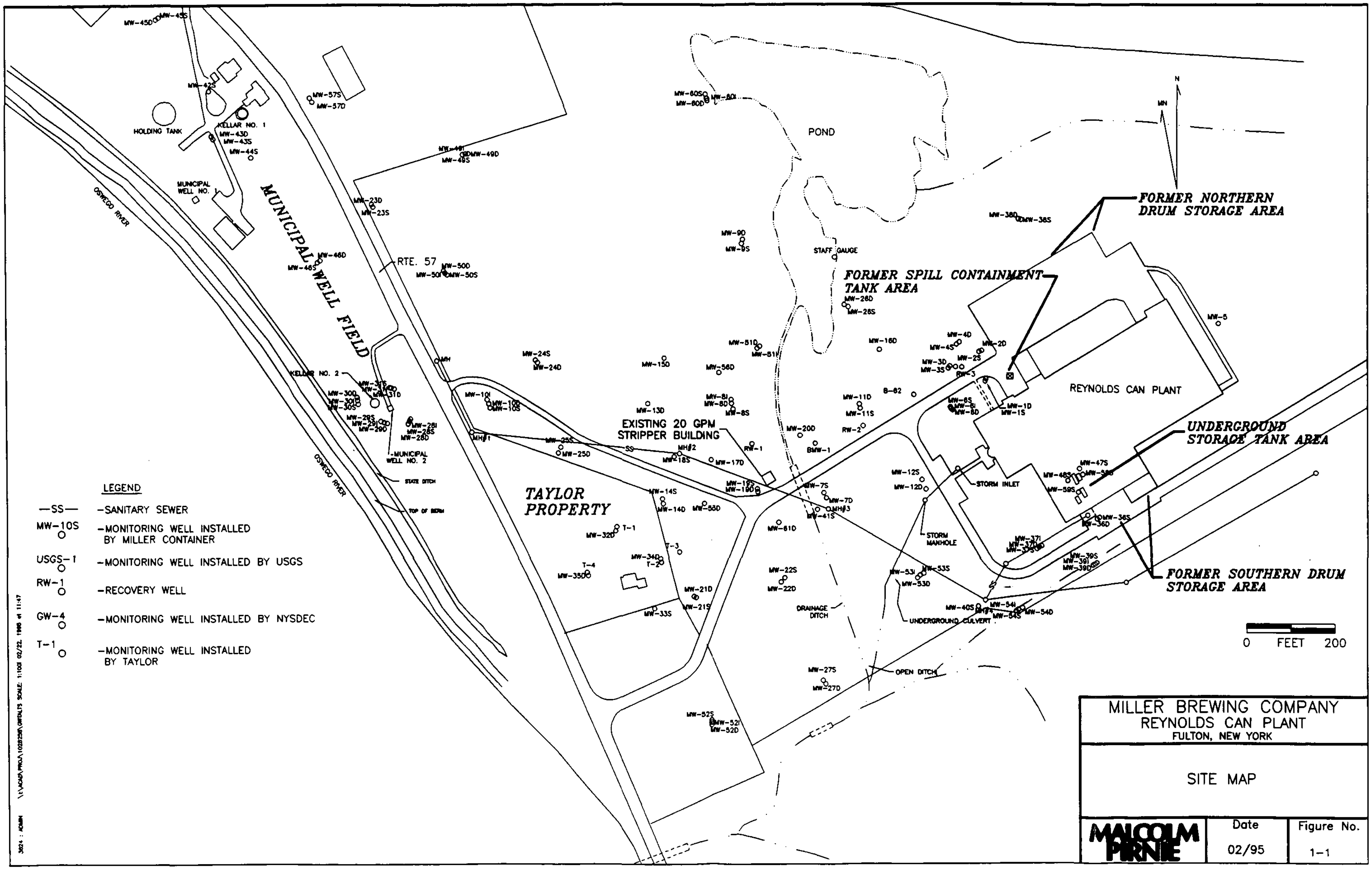
1.0 INTRODUCTION

1.1 SITE HISTORY AND BACKGROUND INFORMATION

From 1976 through 1993, the Miller Brewing Company (Miller) operated a can-making facility (the "Can Plant") in the Town of Volney, Oswego County, New York. The Can Plant was sold to Reynolds Metals Company in November 1993, and Miller retained responsibility for environmental contamination that emanates from identified sources on the property. Through the performance of detailed site investigations, several source areas of volatile organic compound (VOC) contamination have been identified. The Can Plant is listed on the New York State Department of Environmental Conservation (NYSDEC) list of Inactive Hazardous Waste Sites (Registry No. 7-38-029).

The Can Plant is located about 1200 feet southeast of the City of Fulton municipal boundary and approximately 1500 feet east of the Oswego River. The Can Plant is situated on approximately 40 acres of land (the "site"). The Oswego River is located hydraulically downgradient of the Can Plant and the site. Adjacent to the Oswego River in the vicinity of the site are several City of Fulton municipal wells, three of which are currently in use. Two of the active municipal wells, Municipal Well No. 2 (M-2) and Kellar Well No. 2 (K-2), are located between the Can Plant and the river. The third municipal well, Kellar Well No. 1 (K-1), is located about 700 feet north of M-2 and K-2. Details of the site and part of the surrounding area are shown on Figure 1-1.

A 500-gallon steel underground storage tank (UST), known as the spill containment tank, was installed on the north side of the Can Plant when the Can Plant was constructed in 1976. This tank was replaced with a 500-gallon concrete tank in 1978. No evidence of contamination was noticed when the steel tank was excavated and replaced; however, during the removal of the concrete tank and associated piping in 1986, relatively high levels of VOCs were detected in samples of soil and water collected from outside the tank. Miller notified the NYSDEC and hired an engineering firm to conduct a hydrogeologic investigation in the vicinity of the former tank. During this investigation, Miller discovered that some of the same VOCs detected near the spill containment tank had also been detected in M-2. Therefore, additional hydrogeologic investigations were conducted to determine the extent of contamination due to the leakage from the former spill containment tank. During 1987, an interim remedial measure (IRM) was designed to contain and treat


MUNICIPAL WELL FIELD
RTE. 57
POND
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 2
OSWEGO RIVER
STAFF GAUGE
FORMER NORTHERN DRUM STORAGE AREA
FORMER SPILL CONTAINMENT TANK AREA
REYNOLDS CAN PLANT
UNDERGROUND STORAGE TANK AREA
FORMER SOUTHERN DRUM STORAGE AREA
EXISTING 20 GPM STRIPPER BUILDING
TAYLOR PROPERTY
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T-1 -MONITORING WELL INSTALLED BY TAYLOR
MILLER BREWING COMPANY
REYNOLDS CAN PLANT
FULTON, NEW YORK
SITE MAP
MALCOLM PIRNIE
Date
02/95
Figure No.
1-1

contaminated groundwater resulting from the spill containment tank leak. Three groundwater recovery wells and an air stripping treatment system designed to operate at a maximum flow of 20 gallons per minute (gpm) were constructed and went on line in June 1988.

After the air stripping treatment system began operating, the concentration of VOCs in M-2 dropped off; however, VOCs eventually reappeared at M-2 and began appearing at nearby K-2. Due to the occurrence of VOC contamination at the two downgradient municipal wells, the NYSDEC required an RI to: identify contaminant source areas at the site; define the extent, flow path, and rate of travel of downgradient contaminant plumes; and determine the relationship of identified contamination to the municipal wells.

Through the performance of RI work tasks, additional source areas of contamination and three additional plumes of groundwater contamination were identified on the site. Contamination emanating from the site was linked to the contamination at the two downgradient municipal wells, M-2 and K-2. These wells were eventually taken out of service because VOC levels exceeded drinking water standards. VOC and gasoline-type groundwater contamination were also found in the vicinity of and at the third municipal well, K-1; however, the contaminant levels in this well have been below drinking water standards and the contamination does not appear to be attributable to sources on the site based on groundwater flow patterns and the identity and occurrence of the contamination. An Order on Consent (#A702659106) was executed by Miller, the City of Fulton, and the NYSDEC during August, 1991.

While a long-term treatment system to treat the water pumped from the municipal wells was being designed and constructed, an IRM was implemented to treat water from M-2 and K-2 prior to discharge to the Oswego River. The IRM consisted of a 20,000-pound, portable granular activated carbon (GAC) treatment system. A separate GAC system was constructed as a precautionary measure to treat K-1 water in the event that contaminant levels in this well exceeded drinking water standards during construction of the long-term treatment system. The K-1 GAC system was never used since the contaminant levels in K-1 did not exceed drinking water limits during construction of the City of Fulton Water Treatment Facility (WTF).

The City of Fulton WTF incorporated provisions for treatment of water from K-1, M-2, and K-2. This system went on line in July, 1992 and consists of a one-million gallon per day (1 mgd) packed column air stripping unit with GAC treatment for the exhaust gases.

The water is treated to remove VOCs to below detection limits and is then used as part of the municipal water supply.

The RI Report for the site was completed and submitted to the NYSDEC in July 1993. The NYSDEC approved the RI Report with reservations in October, 1993, with a request for additional soil sampling and analysis to support the RI conclusion that three of the four identified soil source areas did not require remediation. This conclusion was based on available soil analytical data which showed soil contaminant levels in three areas to be below the soil clean-up goals and one area (Southern Operable Unit soil) to be above the soil clean-up goals. The soil clean-up goals were calculated in accordance with the NYSDEC TAGM (REF 1). The NYSDEC also requested additional investigation in the area east of the Taylor property to locate the source of contamination found in the vicinity of MW-21S. It was concluded in the RI Report that the source for the contamination in this area was localized, but had not been pinpointed.

During the period February through June 1994, additional field work was performed at the site in accordance with NYSDEC requests. The investigation was summarized in the RI Report Addendum, dated July 1994. The conclusions presented in the RI Report were not altered by the data collected during 1994; however, the additional information was used to more accurately delineate the extent of groundwater contamination along the southern edge of the northern groundwater operable unit and to reduce the area of contaminated soil in the southern operable unit which was defined in the RI Report as requiring remediation.

During July 1994, the Feasibility Study (FS) Report for the site was submitted to the NYSDEC. The FS Report was reviewed by the NYSDEC and a revised FS Report, based on NYSDEC comments dated August 30, 1994, was submitted to the NYSDEC during September 1994.

The FS Report presented the results of the investigation to determine what actions should be taken to address contamination emanating from on-site sources. Remedial alternatives were formulated and screened on a preliminary basis, and the surviving alternatives were combined to address the site as a whole. The combined alternatives were analyzed in detail, and a final combined alternative was recommended for implementation at the site. The revised FS Report was accepted by the NYSDEC on September 28, 1994, and the preferred remedy for the site was identified in the November 1994 NYSDEC Proposed Remedial Action Plan.

On December 7, 1994, a public meeting was held to present the findings of the RI/FS and the Proposed Remedial Action Plan. During the public meeting, a request was made for an extension of the public comment period through January 15, 1995. The comment period was ultimately extended a second time and ended on February 1, 1995. The NYSDEC is currently reviewing the comments received, and a Record of Decision is expected on or about March 8, 1995.

1.2 PURPOSE AND SCOPE

The purpose of this report is to present and explain the basis of design and functional responsibilities for the Proposed Remedial Action Plan (PRAP) issued in November 1994 by the NYSDEC. This report also includes:

- Design criteria for the groundwater collection system, groundwater treatment system, soil vapor extraction system, and process building and utilities that will comprise the Reynolds Can Plant remediation treatment system (Section 2.0).
- The minimum design/build contractor requirements for operation, maintenance, and monitoring (OM&M) for the Reynolds Can Plan treatment system, including the preparation of contingency plans for the treatment system and monitoring wells after the treatment system commences operation (Sections 3.0 and 4.0).
- An outline of the operation, maintenance, and monitoring requirements for the City of Fulton Water Treatment Facility (WTF). It is Miller Brewing Company's intent to incorporate these OM&M requirements into the design/build contractor's responsibilities (Sections 3.0 and 4.0).
- The minimum requirements in outline form for a Health and Safety Plan and Quality Assurance/Quality Control Plan that will be required during remedial construction, and OM&M activities (Sections 5.0 and 6.0).
- A proposed project design and construction schedule (Section 7.0).

The final basis of design will be contained in a construction specification/solicitation document to be developed in accordance with this report by a prequalified Design/Builder/Operator (contractor) to be selected by Miller Brewing Company.

1.3 PREFERRED REMEDIAL APPROACH

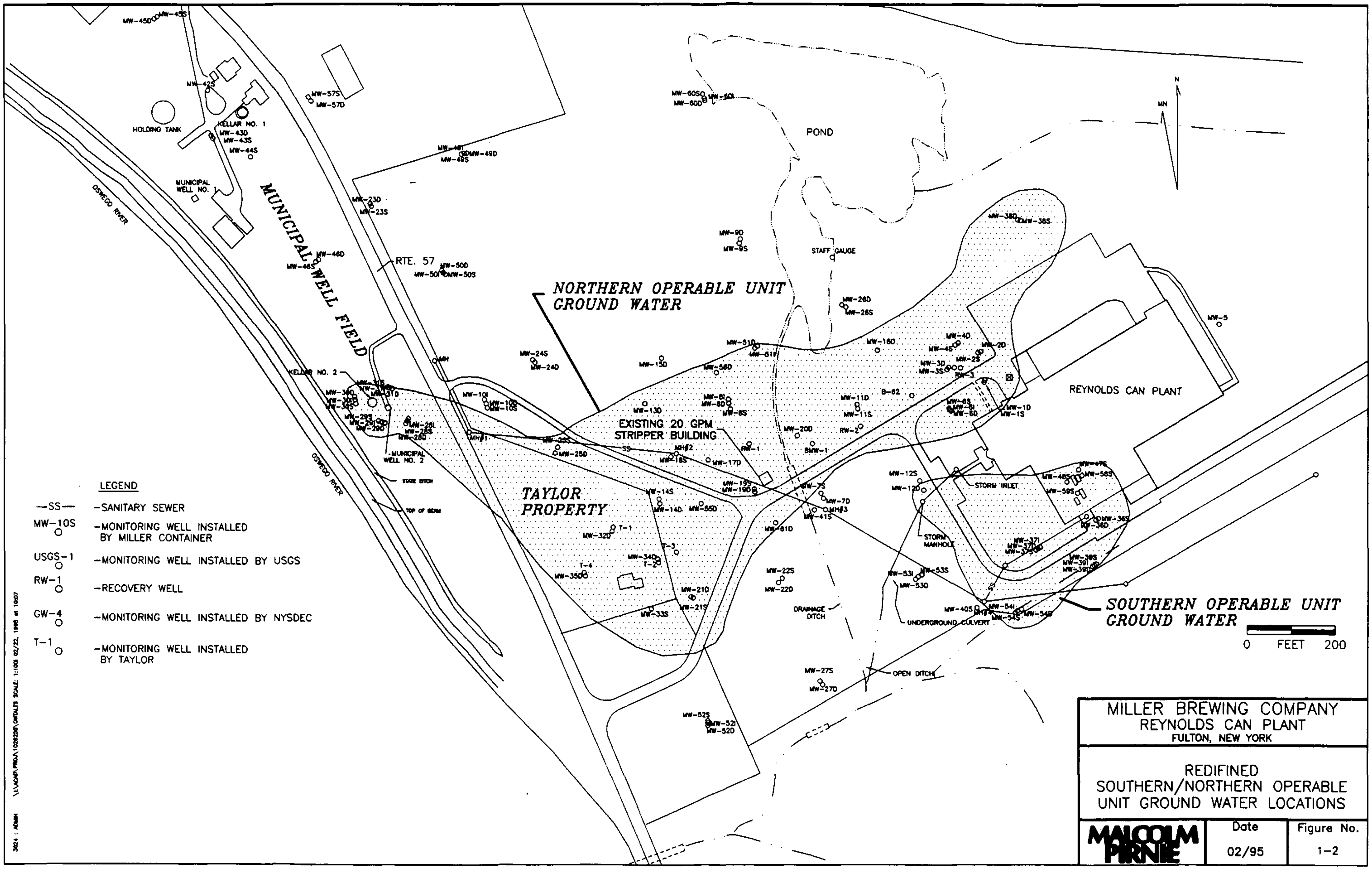
As the remedial investigation phase of this project was being completed, remedial action objectives were established in the feasibility study. These objectives were established to protect human health and the environment based on the use of applicable standards, criteria, and guidelines (SCGs) or applicable or relevant and appropriate requirements (ARARs), and are described in the FS. As a result of the Human Health Risk Assessment, no pathways of concern were identified as possible exposure scenarios for the Northern and Southern Operable unit soils. A summary of SCGs/ARARs is provided in Appendix A. The soil remedial objectives for this site were set based on appropriate soil cleanup goals and levels contained in the NYSDEC January 24, 1994 TAGM 4046 .(REF. 1). The groundwater treatment objectives for this site will be determined based on the State Pollutant Discharge Elimination System (SPDES) effluent quality requirements for surface discharge of treated groundwater to the Oswego River.

Soil contamination at the site was determined to present little risk associated with human health. Thus, the specific objective for remediation of the contaminated soil medium was to treat on-site soil contaminants to concentrations that prevent the future release of contaminants to the groundwater or surface water in levels exceeding the SCGs/ARARs. These levels represented concentrations which would be protective of groundwater/drinking water quality for its best current use.

The remedial action objectives for cleanup of the contaminated groundwater at the site were:

1) To reduce remaining VOC levels in groundwater to their respective SCGs/ARARs (drinking water MCLs/Class GA values) goals.
2) To minimize the migration of overburden groundwater contaminants in the Northern and Southern Operable Units beyond the site boundary at levels in excess of applicable SCGs/ARARs goals.

Based on the results of the RI/FS, the NYSDEC has proposed a preferred remedial approach for the site. The preferred remedy consists of the installation of groundwater extraction wells to supplement or replace recovery wells that exist on site. These recovery wells will be located to contain and collect contaminated groundwater in the northern and southern groundwater plume areas (Figure 1-2). Groundwater from the recovery wells will be pumped to a central treatment facility where it will be treated by an air stripping process.


MUNICIPAL WELL FIELD
NORTHERN OPERABLE UNIT GROUND WATER
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EXISTING 20 GPM STRIPPER BUILDING
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MILLER BREWING COMPANY
REYNOLDS CAN PLANT
FULTON, NEW YORK
REDIFINED
SOUTHERN/NORTHERN OPERABLE UNIT GROUND WATER LOCATIONS
MALCOLM PIRNIE
Date 02/95
Figure No. 1-2

The treated water will be passed through granular activated carbon (GAC) to remove residual contamination and will then be discharged via an underground pipe to the Oswego River. The level of treatment required prior to discharge to the Oswego River will be determined by the NYSDEC; however, based on conversations with the NYSDEC, existing or previous discharge limits from the municipal wells to the Oswego River have been used as the basis of estimating the approximate discharge limits that are used in this report. Groundwater from two recovery wells located under the Can Plant in the southern source area will be routed through an oil/water separator prior to air stripping. Air emissions from the air stripping treatment system will pass through a vapor phase GAC filter prior to discharge to the atmosphere.

A vapor extraction system will be installed in the portion of the southern source area located beneath the Can Plant to remediate contaminated soils around the four abandoned in-place underground tanks in this area. Dewatering of the granular backfill material that surrounds the tanks will be required to facilitate the vapor extraction process. Recovered vapors from the vapor extraction system will be passed through a separate GAC system prior to discharge.

Water level and water quality monitoring will be performed to assess the effectiveness of the groundwater recovery and vapor extraction system.

Miller has requested that NYSDEC incorporate flexibility into the Record of Decision to allow testing of alternate remedial techniques if it is determined that the alternate techniques may be able to expedite site clean-up. For example, during February 1995, Miller conducted a pilot study to determine if the application of air sparging coupled with soil vapor extraction (AS/SVE) could be applied at the site. The results of the AS/SVE pilot testing were mixed and are summarized below. Other technologies may also be pilot tested if conditions warrant a site investigation.

The AS/SVE pilot study was performed in the vicinity of recovery well RW-3, which is located generally downgradient of the former spill containment tank. NYSDEC reviewed and approved the pilot study work plan prior to conducting the test. The air sparging component worked well since air applied at the base of the contaminated aquifer rose vertically and was not significantly impeded by any low permeability lenses. In addition, the volatile organic concentrations in the sparged air were much higher than background conditions which were monitored before the air was applied. A minimum of 2.5 lbs/day of VOCs were liberated from the saturated zone in the test area during the AS test. In comparison, RW-3 collects an average of approximately 0.1 lbs/day as a result of the groundwater recovery operation (based on 1994 data). While the AS technology proved to be effective in removing VOCs from the saturated zone in the test area, the recovery of the liberated VOCs in the unsaturated zone was not totally effective using the pilot test SVE designed system. During the SVE test, vacuums as high as 5 inches Hg failed to induce measurable response at the surrounding monitoring points, and no measurable flow was evident at the vacuum extraction well head. At the applied vacuum, the water table was pulled upward into the vacuum well and into a less permeable, clay matrix fill zone. This rise in water table elevation sealed off the more permeable natural soils that occur below the fill zone. If the sparged vapors are not recovered by the SVE system, the vapors will spread laterally below the lower permeability fill zone and could result in the spreading of contamination. An effective SVE system is therefore a key component of the AS process in the former spill containment tank area and in other source areas where the recovery of the liberated VOCs is paramount.

Future pump and treat activities that will be implemented at the site will result in increased drawdown around RW-3 and the development of a more extensive unsaturated zone around each recovery well. This may make the SVE system effective in the dewatered zone in the RW-3 area and in other source areas; however, the most effective design of a SVE system will occur after the development of the drawdown in the source areas has taken place. Therefore, the incorporation of this technology at the site will be assessed after the pump and treat technology has commenced operation.

2.0 DESIGN CRITERIA

2.1 GROUNDWATER COLLECTION SYSTEM

2.1.1 General

The operational goal of the groundwater collection system is to intercept and contain the defined northern and southern operable soil unit groundwater contaminant plumes such that the residual contamination in the operating municipal wells remains below the design parameters of the City of Fulton WTF. Containment of the portions of the plume areas where contaminant levels exceed the influent design parameters of the City of Fulton WTF is vital to the protection of the municipal supply. Therefore, the ability to intercept and contain groundwater contamination occurring in the northern and southern groundwater operable units is paramount. The following paragraphs and subsections summarize how containment and control of the northern and southern operable unit groundwater plumes will be achieved through the installation and operation of 13 groundwater recovery wells.

Hydrogeologically, the site conditions are complex. Numerous laterally and vertically discontinuous unconsolidated geologic units occur below the site. These units create unconfined, semiconfined and/or confined aquifer conditions. In addition, there are four different known source areas of soil contamination which have resulted in overlapping and isolated downgradient groundwater plumes. (Three of these soil source areas no longer contain soil contamination at levels requiring remediation). The groundwater plume located on the north side of the site ("the northern operable unit groundwater") is the result of contamination emanating from soil contaminant source areas in the former spill containment tank area, the northern drum storage area, and the area east of the Taylor property. The groundwater plume located on the south side of the site ("the southern operable unit groundwater") is the result of contamination emanating from contaminated soil in the southern drum storage area and the area around the abandoned underground tanks below the south side of the Can Plant.

The northern and southern operable unit groundwater plumes were defined based on data collected during the RI/FS process. Groundwater quality data from November 1994, when a comprehensive round of sampling and analysis was performed, were used to check the delineation of the plumes as presented in the FS Report. From the evaluation of the November 1994 analytical data, it has been concluded that the northern operable unit groundwater plume should be expanded to encompass monitoring wells MW-25S,D and MW-51I. Therefore, the delineation of the groundwater plume in this area has been modified slightly from that shown in the FS. The current delineation of the northern operable unit groundwater plume is shown on Figure 1-2. The delineation of the southern operable unit groundwater plume did not change based on the November 1994 data. The delineation of this plume is also shown on Figure 1-2.

Recovery wells have been proposed for several areas of the site to address the groundwater contamination in the two plume areas. These areas include the contamination source areas where contaminant concentrations are generally greatest and downgradient areas where groundwater contaminant plumes must be cut off before further migration of contaminated groundwater results in an exceedance of the design criteria for the City of Fulton WTF.

The approximate locations of the groundwater recovery wells which will be installed at the Can Plant site to facilitate the containment and removal of the groundwater contamination occurring in the two plume areas are described below. Rationale for their locations is also provided. In addition, recovery well design criteria are provided.

2.1.2 Recovery Well Locations and Design Criteria

2.1.2.1 Recovery Well Locations

A two-dimensional, finite-difference numerical model (Flowpath) was used to determine:

- the effect of adding recovery wells at the site to enhance plume capture and remediation, and
- the optimum number and location of recovery wells that might be required to address the groundwater contamination in the two plume areas.

The modeling goals were accomplished by modeling the groundwater plume source areas separately. This approach was used because the local hydrogeologic conditions at each plume source area are less complex than the entire site when considered as a whole. This approach, however, does not take into account the influence that pumping at one source area might have on adjacent source areas where pumping is also occurring. An overlapping influence of pumping from adjacent source areas would cause the drawdown between the source areas to be somewhat greater than predicted by the models. However, based on the observed drawdown at operating pumping wells and the distances between the modeled wells in the individually modeled areas, it is likely that the effects of such overlap would not significantly affect model predictions.

Three areas were modeled: the Northern Drum Storage Area and the Former Spill Containment Tank Area; the Southern Source Area; and the area East of the Taylor property in the vicinity of MW-21S and MW-14D. A fourth area of interest, the Area North of RW-1, could not be modeled using Flowpath because of the complex hydrogeologic conditions present in this area. Since a recovery well (RW-1) is located in this area, the image well theory was used to estimate the effects of adding an additional recovery well in this area.

Two simulations were run for each modeled area, one representing existing conditions and one representing predicted conditions after adding one or more pumping wells. The "existing conditions" simulations were used to calibrate the models. Values of estimated parameters (hydraulic conductivity, recharge, and aquifer thickness) were varied, within reasonable limits, to achieve estimated head values that were similar to those observed at the site and to ensure that the models were not overly sensitive to changes in the estimated parameters. Collected data, including those provided by slug tests and pumping tests, subsurface drilling, groundwater level measurements, and the City of Fulton meteorological station, were used to define the limits that were considered "prudent and reasonable".

For simulations where the effect of adding pumping wells was predicted, capture zones for proposed pumping wells were also estimated using the capture zone utility in Flowpath. The time interval that the capture zones represent is one year. Observed drawdowns based on several years of existing water level data were used to depict the capture zone in the vicinity of each of the three existing recovery wells (RW-1, RW-2, and RW-3).

The following paragraphs summarize the model results. Detailed information about the conceptual models used to create the computer models, the selection of boundary conditions, establishment of model grids, and calibration of the models is contained in Appendix B of the September 1994 FS Report.

2.1.2.1.1 **Northern Drum Storage Area and Former Spill Containment Tank Area**

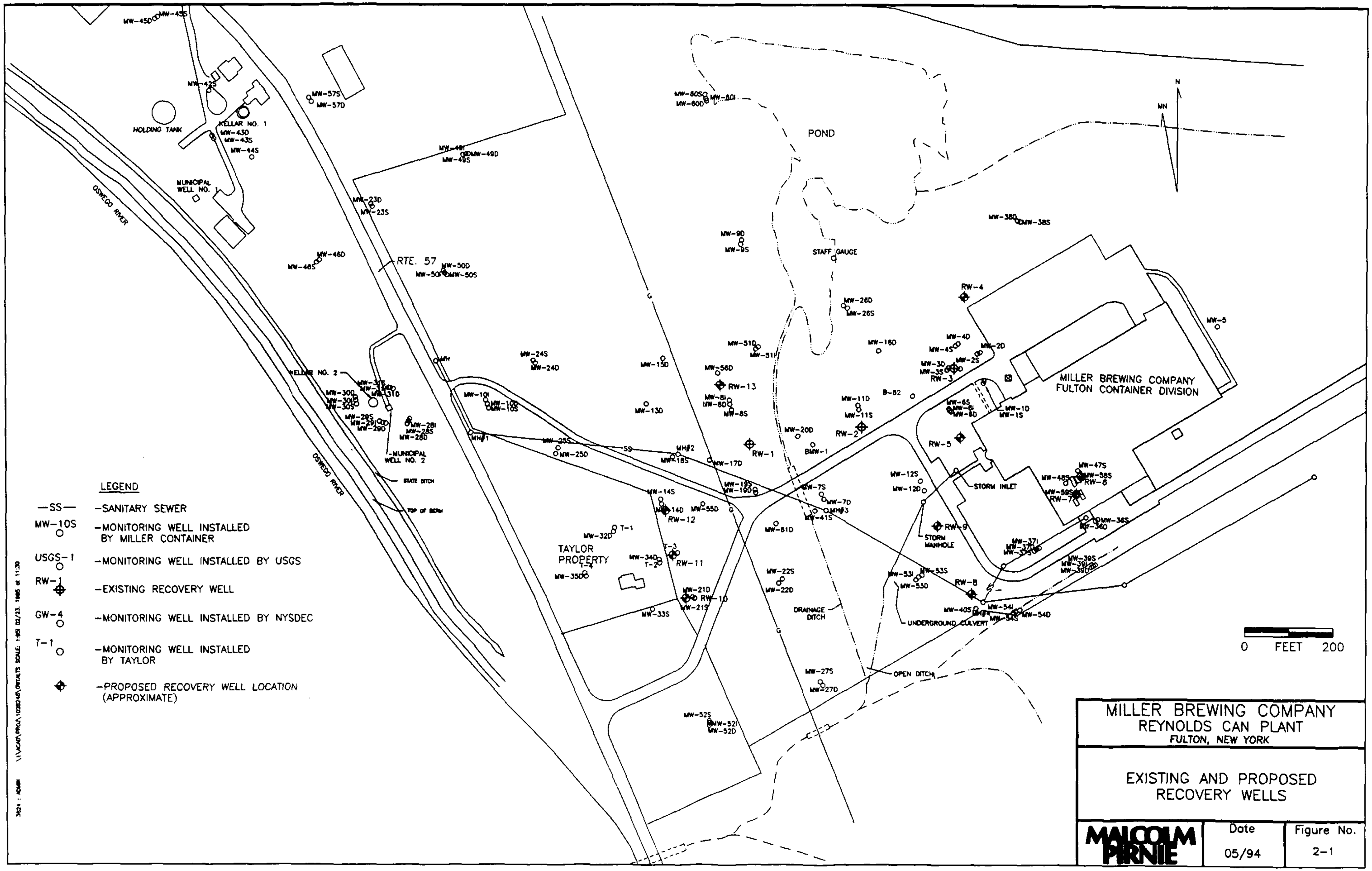
This area was modeled to determine where recovery wells should be located to:

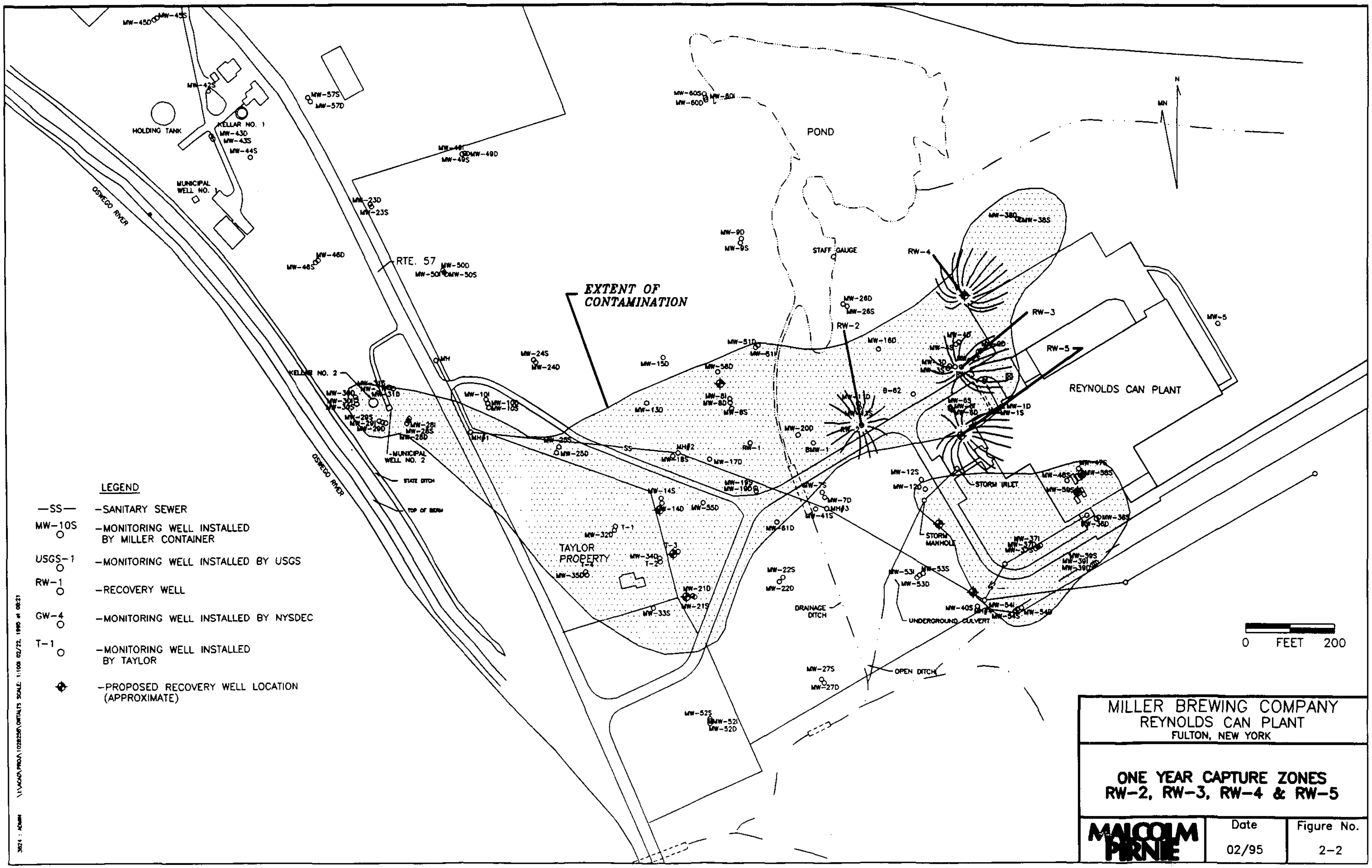
- collect contaminated groundwater originating from the Northern Drum Storage Area, thereby enhancing cleanup in this area, and
- collect contaminated groundwater in the area south of RW-3, including the area around and to the south and southeast of monitoring well cluster MW-6S,I,D.

The modeled area contains two existing pumping wells, RW-2 and RW-3. The recovery wells were assumed to be fully penetrating and have the following discharge rates: RW-2 = 2160 gal/day (1.5 gpm), RW-3 = 2880 gal/day (2 gpm), simulated wells = 2880 gal/day. The rates used for RW-2 and RW-3 are the actual set point pumping rates for those wells. Proposed recovery wells were simulated in the model after it was calibrated to the existing site conditions. The locations of the proposed recovery wells were varied to obtain optimum coverage of the plume area with the minimum number of recovery wells. One proposed recovery well was located to the north of RW-3, to simulate the effect of pumping near the Northern Drum Storage Area. The other proposed recovery wells were located south of RW-3 and MW-6 S,I,D, to estimate the effect pumping would have in this area. The aquifer was assumed to be unconfined. The locations of the existing and proposed recovery wells are shown on Figure 2-1.

The existing conditions model provided heads that are in general agreement with those observed in monitoring wells in the area. The size and shape of the drawdown cones produced by pumping wells RW-2 and RW-3 in the model are similar to those observed at the site for these wells.

The results of the predictive model suggest that capture of the plume originating in the Northern Drum Storage and Former Spill Containment Tank Areas on the north side of the Can Plant will be enhanced by the addition of the two recovery wells (RW-4 and RW-5) shown on Figure 2-2. According to available data, if the recovery wells are constructed to optimize the effective screened area in the wells, greater volumes of groundwater will probably be recoverable from the new wells. Data from RW-3 at the time of its replacement (using a large diameter borehole and an extensive gravel pack) indicated that an average of about 10 gpm could be produced from the well. Due to iron bacteria problems in the existing recovery wells, these wells should be replaced when the proposed recovery wells are


LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -EXISTING RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
-PROPOSED RECOVERY WELL LOCATION (APPROXIMATE)
OSWEGO RIVER
HOLDING TANK
KELLAR NO. 1
MUNICIPAL WELL NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 2
STATE DITCH
TOP OF BERM
RTE. 57
POND
STAFF GAUGE
TAYLOR PROPERTY
DRAINAGE DITCH
OPEN DITCH
UNDERGROUND CULVERT
STORM INLET
STORM MANHOLE
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
RW-1
RW-2
RW-3
RW-4
RW-5
RW-6
RW-7
RW-8
RW-9
RW-10
RW-11
RW-12
RW-13
MN
N
0 FEET 200
MILLER BREWING COMPANY
REYNOLDS CAN PLANT
FULTON, NEW YORK
EXISTING AND PROPOSED RECOVERY WELLS
MALCOLM PIRNIE
Date 05/94
Figure No. 2-1



MILLER BREWING COMPANY
REYNOLDS CAN PLANT
FULTON, NEW YORK
ONE YEAR CAPTURE ZONES
RW-2, RW-3, RW-4 & RW-5
MALCOLM PIRNIE
Date
02/95
Figure No.
2-2
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
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installed. The drilling techniques should be similar to those used when the RW-3 replacement well was installed; however, the materials of construction should be modified to include PVC riser pipe and FRP screen. The replaced recovery wells and the simulated recovery wells will then be able to be pumped near the 10 gpm pumping rate to achieve optimum plume management.

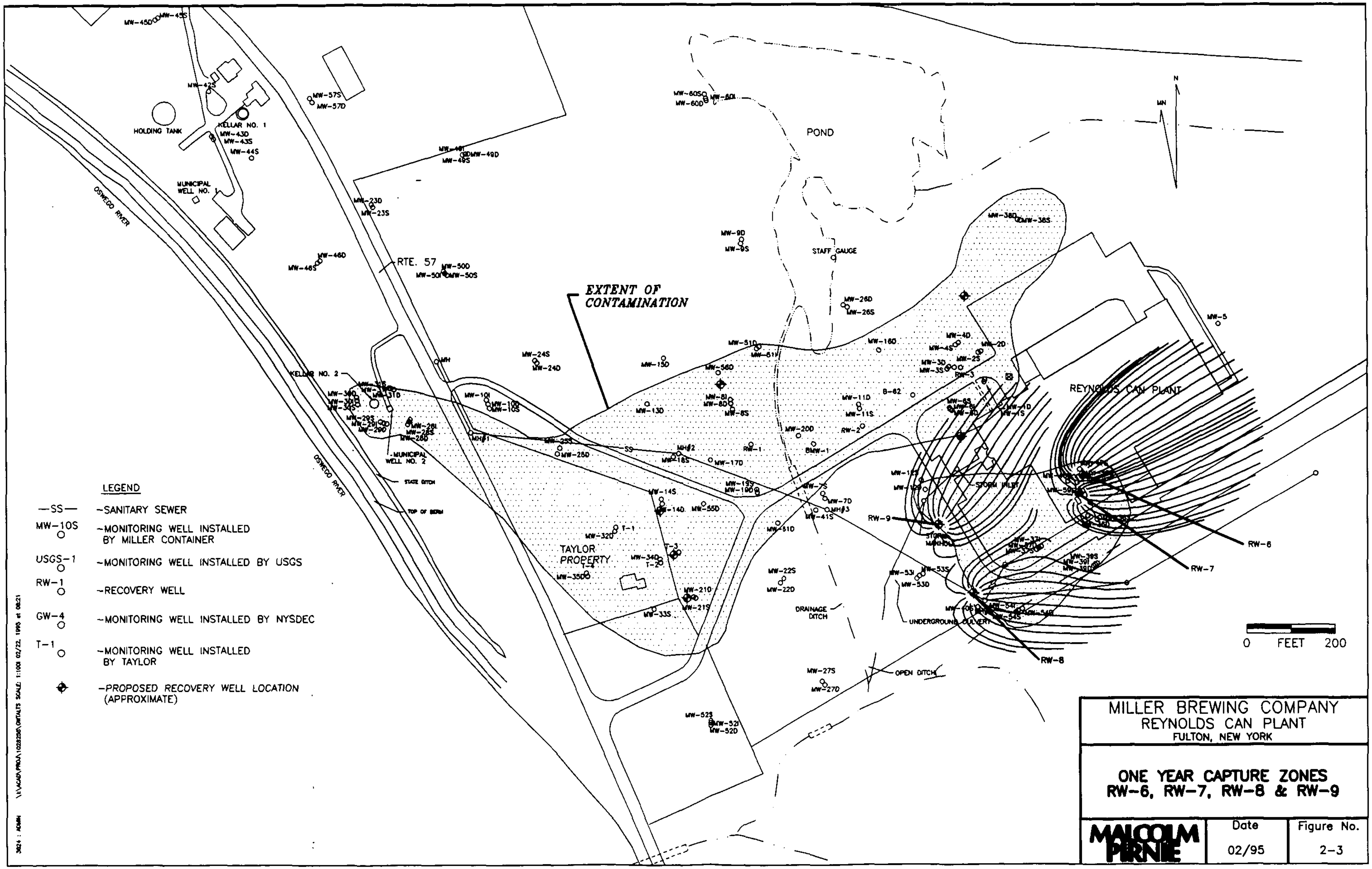
The one-year capture zones predicted for the four recovery wells in this area are shown on Figure 2-2. As discussed previously, the capture zones depicted are based on a model which assumes that pumping at other site areas will not affect the modeled area. The shape and orientation of capture zones will change if the modeled area is influenced by pumping at other areas of the site, but the size of the capture zones will not decrease. Interference by a pumping well or wells located outside the modeled area will enhance capture.

2.1.2.1.2 Southern Source Area

This area was modeled to determine where recovery wells should be located to collect contaminated groundwater emanating from the Former Southern Drum Storage Area and the area in the vicinity of the abandoned underground tanks located below the southeast corner of the Can Plant.

Four proposed recovery wells were added for the pumping simulation. Two of these wells were located near existing monitoring wells MW-58S and MW-59S (RW-6 and RW-7, respectively), to simulate using these wells as recovery wells. The remaining two proposed recovery wells (RW-8 and RW-9) were placed at strategic locations downgradient of the source area to cut off contaminant plume migration from the area. The proposed optimum locations of the simulated recovery wells are shown on Figure 2-1. The pumping rate selected for the model at each of these wells was 14,400 gpd (10 gpm); however, the yield of RW-8 and RW-9 may be higher (10 to 20 gpm) with proper well-construction techniques.

The existing conditions model was in general agreement with observed heads in wells that are not affected by pumping at existing wells. The predictive model showed drawdown cones that appear reasonable in extent and depth based on the observed gradient and hydraulic conductivity of the area. The one-year capture zones are shown on Figure 2-3, and are much larger than those predicted by the model for the Northern Drum Storage Area and Former Spill Containment Tank Area (Figure 2-2). This is due to the relatively higher hydraulic conductivity of the southern source area. The capture zone of the


MILLER BREWING COMPANY
REYNOLDS CAN PLANT
FULTON, NEW YORK
ONE YEAR CAPTURE ZONES
RW-6, RW-7, RW-8 & RW-9
MALCOLM PIRNIE
Date
02/95
Figure No.
2-3
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
-PROPOSED RECOVERY WELL LOCATION (APPROXIMATE)
0 FEET 200
EXTENT OF CONTAMINATION
POND
REYNOLDS CAN PLANT
TAYLOR PROPERTY
OSWEGO RIVER
RTE. 57
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
STAFF GAUGE
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
STATE DITCH
TOP OF BERM
RW-6
RW-7
RW-8
RW-9
N
MN

northernmost simulated well (RW-9) extends farther northward than would be expected if the proposed recovery well in the vicinity of MW-6S,I,D (RW-5) was installed and pumping. The reason for this is that the southern area model does not consider the effects of pumping at the northern wells. An attempt was made to model both the northern area and southern area together; however, there were not enough data on the distribution of hydraulic conductivity in the area between the northern and southern plume areas (beneath the Can Plant) to obtain reliable results from the "combined" model.

2.1.2.1.3 Area East of the Taylor Property in the vicinity of MW-21S and MW-14D

This area was modeled to determine the best location for recovery wells to intercept and contain the plume of groundwater contamination that apparently originates in the area east of the Taylor property and is connected to the contamination found at municipal wells M-2 and K-2.

The existing conditions model for this area was slightly more complex than the first two modeled areas. One added complexity was the presence of the two downgradient City of Fulton municipal wells (K-2 and M-2). Because this well pair withdraws a relatively large quantity of water from the modeled aquifer, and because minimizing contaminant migration toward this well pair is a priority, it was included in the overall model developed for this area. These wells were modeled as one pumping well in the simulation because the two wells fell in the same model cell. The pumping rate used for the pumping well simulating K-2/M-2 was 136,800 gpd (95 gpm), which is the approximate average combined pumping rate for the wells.

A second complexity was the presence of a "till ridge" in the subsurface, located just east of the Taylor property. To simulate the effects of the till ridge, the aquifer thickness was decreased in an area approximating the ridge.

A final complexity was a marked change in hydraulic conductivity across the modeled area. The hydraulic conductivity is observed to increase dramatically along the river.

The predictive portion of the modeling task in this area was designed to take advantage of the buried till ridge, which is oriented perpendicular to groundwater flow and occurs between the southern source area and K-2/M-2. For the model, three wells pumping at a rate of 21,600 gpd (15 gpm) each were located along the western side of the top of the ridge. The locations of the recovery wells (RW-10, RW-11, and RW-12) are shown on Figure 2-1. The advantages associated with the location of the recovery wells along the till ridge are as follows:

- The decreased saturated thickness and the lower hydraulic conductivity along the till ridge relative to the area between the till ridge and the Oswego River result in lower transmissivity along the ridge.
- Since the transmissivity is lower along the ridge, the volume of groundwater required to be pumped to cut off the migration of the plume from this area can be minimized. The closer the recovery wells are located to the Oswego River, the greater will be the saturated thickness, hydraulic conductivity, and, therefore, transmissivity.
- The lower required pumping rates will result in less "competition" for the water available in this area. Since municipal wells M-2 and K-2 receive a percentage of their supply from this area, lower quantities of water removed as part of the remediation will mean more water available for M-2 and K-2.
- A significant portion of the most contaminated part of the plume will be addressed with the recovery wells situated along the till ridge.
- The City of Fulton Water Treatment Facility was designed to treat the types of groundwater contaminants found in the area of the Taylor property and east of the Taylor property (in the vicinity of MW-21S and MW-14D) at concentrations that exceed those detected in that area to below a detection limit of 0.5 ug/l.
- A property access agreement would not be necessary if the recovery wells remain on Reynolds Metals Company property.

The heads predicted by the existing conditions model were in general agreement with observed heads in the area, except for the northwest portion of the modeled area. This area has lower than predicted heads due to the influence of municipal well K-1. The effects of K-1 do not influence contaminant migration in the source area located east of the Taylor property as long as K-2/M-2 remain in operation, so it was not considered important to try to incorporate the effects of pumping at K-1 in the model.

Heads predicted by the pumping simulation appear reasonable based on our knowledge of the site. The capture zones predicted for the wells are shown on Figure 2-4. The simulation suggests that three wells pumping at 15 gpm each and located along the till ridge would prevent further migration of contamination west of the wells toward the K-2/M-2 well pair.

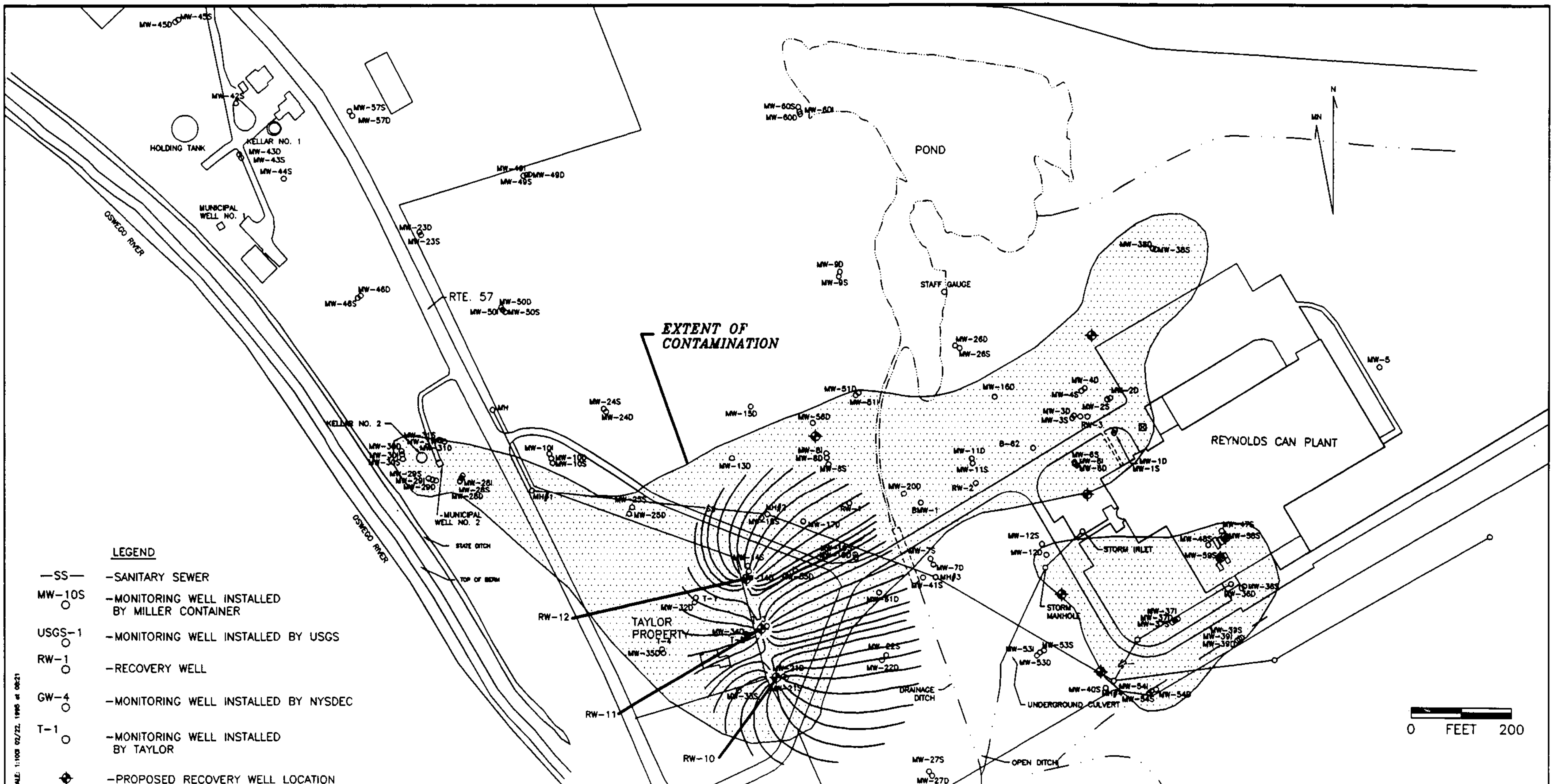
2.1.2.1.4 Area North of RW-1

Estimating the effect of an additional pumping well (or wells) in the area was accomplished using the image-well theory. This method assumes that the drawdown cone developed by a new pumping well will have similar dimensions to the cone developed by existing well RW-1. On a map, the contoured drawdown cone developed by RW-1 is simply positioned where another pumping well is proposed. At the point where contours from the proposed well and RW-1 overlap, the drawdown will be cumulative, i.e., the sum of the two individual contours. The result is a map predicting the effect of adding another pumping well that is pumping at the same rate as RW-1. A measure of conservatism is built into this method because the yield at RW-1 is greater than the present pumping rate of seven to eight gpm. If both wells were pumped at a greater rate, the area of capture would be greater.

The capture zone (Figure 2-5) shows that this proposed well (RW-13) would capture the contamination that appears to be bypassing well RW-1 to the north.

2.1.2.1.5 Synopsis of Recovery Well Locations and Pumping Rates

The numerical modeling effort has suggested that control of the northern and southern operable unit groundwater plumes may be possible using a total of 13 recovery wells. Two of the simulated recovery wells (RW-6 and RW-7) will be converted from existing wells MW-58 and MW-59. The three existing recovery wells (RW-1, RW-2, and RW-3) will be replaced with new wells using alternate construction materials and drilling techniques that will optimize withdrawal rates. It is estimated that a total of 13 recovery wells (including the three replacement wells and two converted monitoring wells) will be utilized at the site to contain the two groundwater plume areas.



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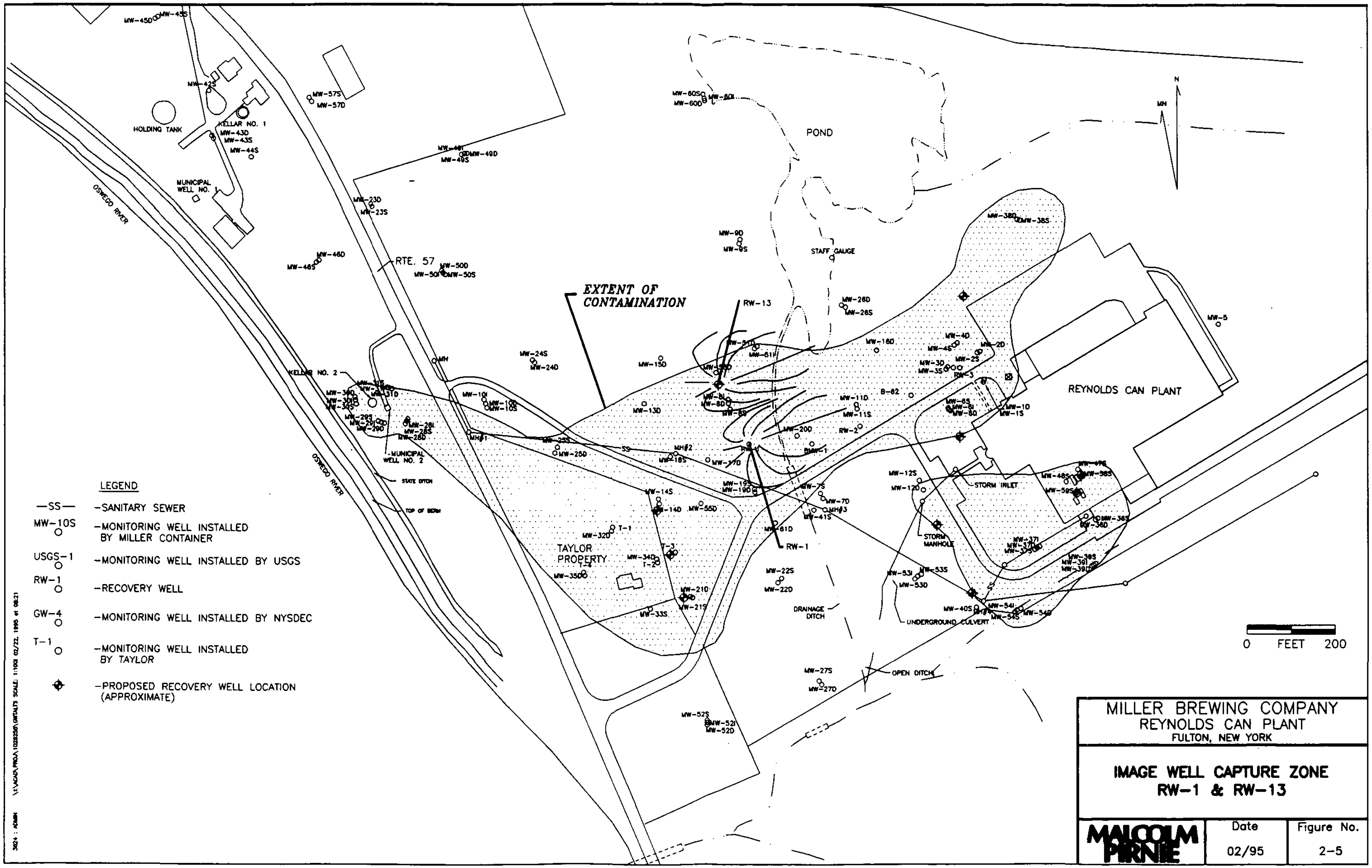
ONE YEAR CAPTURE ZONES RW-10, RW-11, & RW-12

MALCOLM PIRNIE

Date	Figure No.
02/95	2-4



MILLER BREWING COMPANY
REYNOLDS CAN PLANT
FULTON, NEW YORK

IMAGE WELL CAPTURE ZONE
RW-1 & RW-13

MALCOLM PIRNIE

Date	Figure No.
02/95	2-5

A measure of conservatism was built in to each model by selecting conservative values for estimated parameters, when plausible; however, conditions in the subsurface are more complex than represented by the models. Therefore, the pumping rates and associated effects of additional pumping wells will differ from those predicted by the models. Because every effort was made to use reasonable assumptions and estimated values, the model results should be interpreted as providing the best available approximation of aquifer response to new stresses, without collecting more field data.

The pumping rates used for the proposed wells in the models represent conservative estimates based on the existing data for the site. Where possible, pumping rates were based on existing recovery well data. According to notes taken at the time of replacement of recovery well RW-3, this well may be able to produce an average of 10 gpm, although it is currently only being pumped at a rate of about two gpm. Although the northern area model used rates of two gpm for RW-3 and the two simulated wells, maximum plume control may require pumping these three wells at their capacity, which may be around 10 gpm each with proper well-construction techniques. If the yield of pumping wells turns out to be considerably less than estimated, the capture zones developed by the wells will be smaller and additional wells may be necessary to accomplish the goals of the pumping.

2.1.2.2 Recovery Well Installation Techniques

Each new and replacement recovery well will be installed by augering to the water table with a large diameter (> 14-inch I.D.) auger. Fourteen-inch steel casing will then be driven to the top of lodgement till. The interior of the 14-inch casing will then be drilled out with a 12-inch tricone roller bit. After the total depth of the 14-inch casing has been reached with the roller bit, a recovery well will be telescoped inside the 14-inch casing. The screened section of the well will consist of 6.5-inch I.D. fiberglass reinforced plastic. The slots will be continuously wound and 0.030 inch in diameter. The continuous slot construction will provide a maximized opening and thereby reduce entrance velocity for greater hydraulic efficiency. The riser pipe will be constructed of Schedule 80 PVC. A coupling (8-inch O.D.) will be used for the transition from the threaded FRP to the PVC. The riser pipe will extend from the top of the screened section to approximately two feet above land surface. As the 14-inch steel casing is removed from the borehole, a gravel pack (Morie #1 gravel or similar) will be emplaced in the annulus between the borehole and the well. The gravel pack will extend from the bottom of the screened section to the water table. The emplacement of the extensive gravel pack will ensure a maximum effective screened interval in each recovery well. All drill cuttings generated form recovery well installation will be disposed on-site in accordance with NYSDEC TAGM HWR-89-4032. The cuttings will be placed on the ground surface in the area within the anticipated cone of influence around the pumping wells and covered with a minimum of 6-inches of compact soil capable of supporting vegetative growth.

2.1.2.3 Recovery Well Design Criteria

The approximate recovery well locations are shown on Figure 2-1. The actual recovery well locations will be determined and staked at the site by the contractor based on the final design document which will be approved by Miller and the NYSDEC. Recovery well design criteria, based on the estimated recovery well locations and available information on the subsurface geologic characteristics in the vicinity of each recovery well, are listed in Table 2-1. A general discussion of the recovery well installation techniques is provided below. It will be the responsibility of the contractor to verify the subsurface geologic conditions at each recovery well location through the collection of continuous split spoon samples or some other suitable method. In the event that the geologic conditions are different than anticipated at any given location, it will also be the responsibility of the contractor to notify Miller of the need to modify the design criteria.

The approximate pumping rate at each recovery well is also listed in Table 2-1. It will be the responsibility of the contractor to perform specific capacity tests at the recovery wells to verify flow rates, and to perform pumping tests to ensure that the optimum drawdown required to control the groundwater contaminant plumes is achieved. The optimum drawdown will not necessarily be the maximum achievable drawdown in each recovery well. On the contrary, inorganic analyses on samples collected in each of the proposed recovery well areas indicate that alkalinity, chloride, and dissolved iron and manganese concentrations are relatively high and will likely cause blinding of the gravel pack and screen if the wells are pumped at too high a rate. The best way to control the precipitation of metals and the build up of iron bacteria is to minimize the groundwater entrance velocity into each well screen and to avoid cyclical pumping. This will be achieved by maintaining a relatively constant but minimum optimal drawdown at each recovery well. A tabulation of the inorganic water quality data collected recently at the site is provided in Appendix B.

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TABLE 2-1
Recovery Well Design Criteria and Approximate Pumping Rates

RECOVERY WELL DESCRIPTION	ESTIMATED TOTAL DEPTH (FEET)	APPROXIMATE SCREENED INTERVAL	APPROXIMATE SAND PACK INTERVAL	ESTIMATED HIGH-END FLOW RATE (GPM)	MODELED FLOW RATE (GPM)
RW-1[1]	367[2] − 293[3] = 74	303 − 293 = 10	328 − 293 = 35	12	8
RW-2[1]	371 − 287 = 84	297 − 287 = 10	361 − 287 = 74	10	1.5
RW-3[1]	375 − 316 = 59	326 − 316 = 10	360 − 316 = 44	10	2
RW-4	371 − 320 = 51	330 − 320 = 10	361 − 320 − 41	10	2
RW-5	379 − 318 = 61	328 − 318 = 10	360 − 318 = 42	10	2
RW-6[4]	381.1[5] − 341.6 − 39.5[6]	371.6 − 346.6 = 25[7]	373.6 − 341.6 = 32	20	10
RW-7[4]	381.1[5] − 341.6 = 39.5[6]	371.6 − 346.6 = 25[7]	373.6 − 341.6 = 32	20	10
RW-8	370 − 305 = 65	315 − 305 = 10	361 − 305 = 56	20	10
RW-9	373 − 316 = 57	326 − 316 = 10	361 − 316 = 45	20	10
RW-10	377 − 339 = 38	344 − 339 = 5	356 − 339 = 17	25	15
RW-11	375 − 330 = 45	340 − 330 = 10	355 − 330 = 25	25	15
RW-12	376 − 326 = 50	336 − 326 = 10	353 − 326 = 27	25	15
RW-13	366 − 298 = 68	308 − 298 = 10	333 − 298 = 35	12	8
			TOTALS	219	108.5

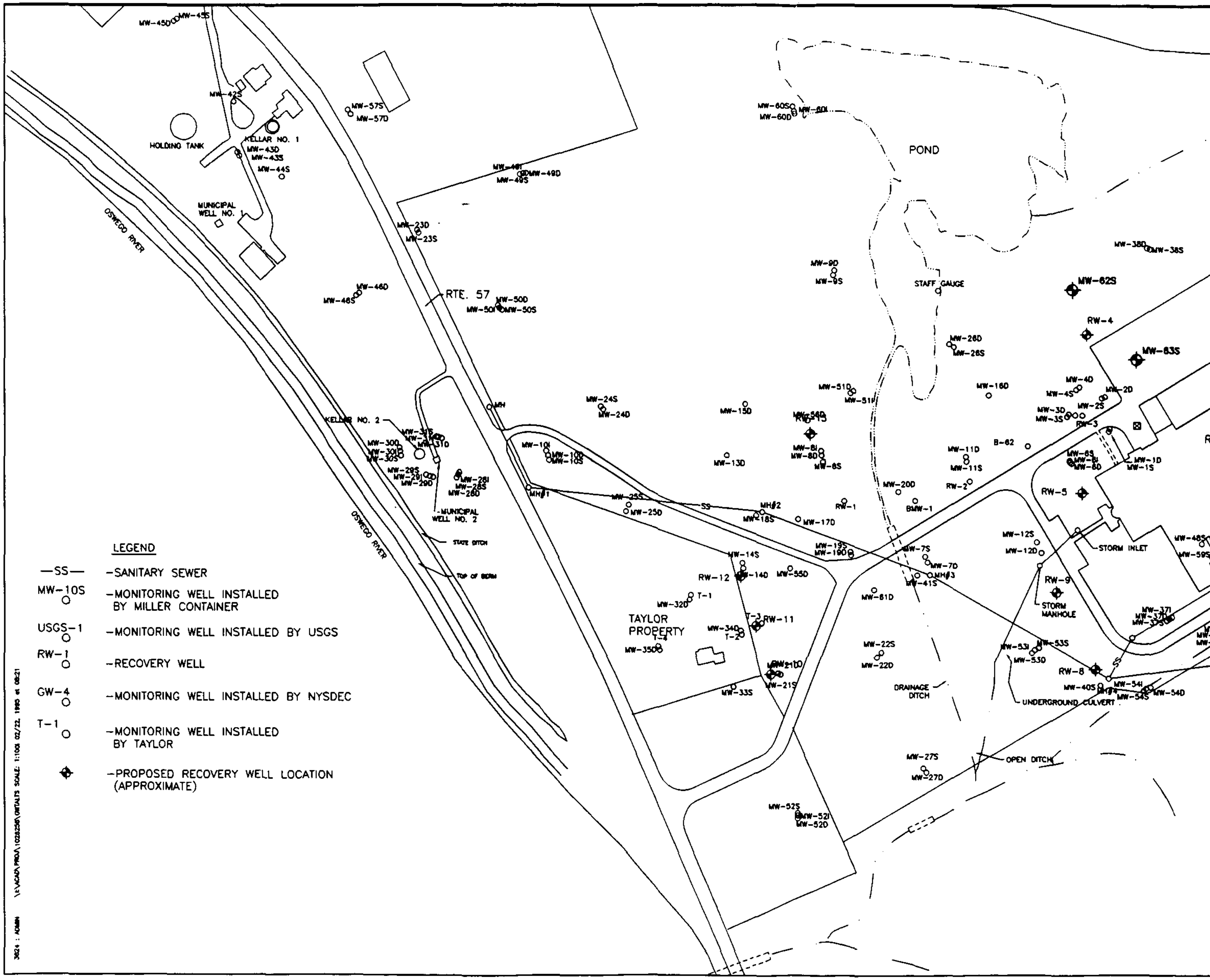
Note[1] = Replacement Recovery Wells
Note[2] = Approximate Land Surface Elevation (Ft. Above MSL)
Note[3] = Approximate Top of Lodgement Till Elevation
Note[4] = 6-inch PVC Well Installed
Note[5] = Can Plant Floor Elevation
Note[6] = Bottom 5 Feet is a Blank PVC Casing Section
Note[7] = Bottom 10 Feet of Screen Consists of 0.01 Inch Slots, Upper 15 Feet of Screen − 0.02 Inch Slots

Monitoring points will have to be added in the vicinity of the RW-4 recovery well to enable water level measurements and water quality sampling to verify performance of this recovery well. The monitoring wells that will be installed are shown on Figure 2-6.

Since the water recovered during well development and during the specific capacity and pumping tests will be contaminated, it will be necessary to determine a suitable discharge point prior to developing the wells and performing the tests. Treatment of the water prior to discharge will also be required. One alternative is to contain the water recovered on site during the specific capacity and pumping tests in tankers and to slowly pump the recovered water through the existing on-site air stripper (20 GPM) for treatment prior to disposal to the City of Fulton sanitary sewer. Under this scenario, the City of Fulton Sewer Use Permit discharge limits (for water quality and flow) will have to be met. The well development water will require an intermediate treatment steps prior to introduction into the existing on-site air stripper. Due to the potential for high total suspended solids, the development water will need to be pumped into a temporary lined pool or frac tank to allow the solids to settle prior to treatment. The solids derived will need to be analyzed to determine an appropriate disposal method. Additionally, development water from pumping wells on the south side of the Can Plant (i.e., RW-6, RW-7, RW-8, and RW-9) will need to undergo activated carbon pretreatment, since the ketones present at these locations will not be appreciably treated in the air stripper and are not included on the existing sewer use permit. The existing 20 GPM air stripper system presently operating at the site will be continued during the installation of the new groundwater collection system and treatment facility. This will allow for the additional treatment of contaminated water during recovery well development and specific capacity and pumping tests. The contractor will establish in a construction schedule the necessary time frames involved for each task of this operation. From the schedule a pre-determined date will be utilized to discontinue and dismantle the existing on-site stripper system.

2.1.3 Collection System Equipment and Instrumentation

The groundwater extraction system will consist of thirteen recovery wells (nine wells in the Northern Operable Unit groundwater plume and four wells in the Southern Operable Unit groundwater plume) which will be continuously pumped through an underground piping system to a groundwater treatment facility. The approximate location of the groundwater treatment facility is shown on Figure 2-7. This location has been changed from



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FULTON, NEW YORK

PROPOSED MONITORING WELL LOCATIONS NEAR RW-4

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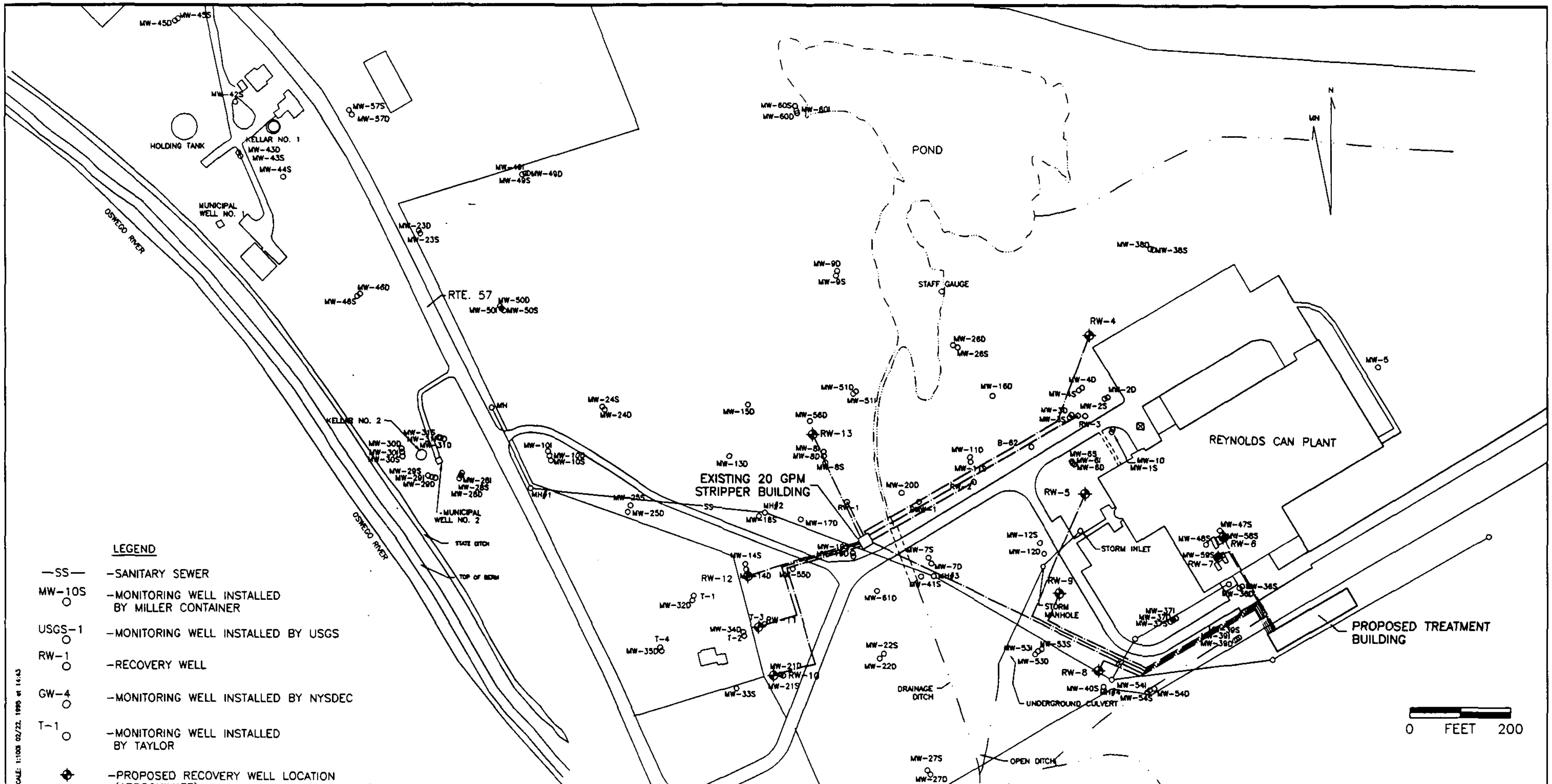
Date	Figure No.
02/95	2-6



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RECOVERY WELL PIPING ROUTE
AND APPROXIMATE
TREATMENT BUILDING LOCATION

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Date	Figure No.
02/95	2-7

the location presented in the FS report. Submersible, simplex pumps will be installed in each recovery well, with each pump conforming to the specifications outlined in Appendix C. The collection system piping will consist of single-walled high density polyethylene (HDPE) with heat welded joints and fittings. The piping from each recovery well will be routed to the treatment facility. Piping from recovery wells 1, 2, 3, 4, 10, 11, 12, and 13 will be manifolded in the existing 20 GPM stripper building, thus reducing the total piping required. The piping route and manifold system is shown on Figure 2-7. Each individual recovery well system will have line valves and controls to throttle and record flow rates. These conveyance lines will have in-line flow meters and totalizers to monitor and record separate flows. In addition, and to facilitate sampling of each recovery line, the influent line will have a sample tap to allow for the collection of samples from individual recovery wells. Upon entry into the treatment facility, the piping conveyance system will transition to schedule 80 PVC pipe.

With the exception of the Southern Source Area, the contaminants at the Reynolds Can Plant Site are generally limited to the saturated zone. However, the contractor will be required to spot-check the soils generated during the trenching operations of the collection system piping by obtaining samples for head space analysis at 25 foot intervals along each trench. This will involve partially filling a glass jar with an aliquot of soil, which will be covered with foil wrap. After approximately 1/2 hour, the foil will be penetrated with a photoionization detector (PID) probe and the concentration of VOCs in the headspace gas will be recorded. If readings are above background by greater than 5 ppm, the sample will be analyzed by an NYSDOH ELAP-certified laboratory for volatiles (USEPA 601/602 and xylenes) as well as total carbon content. Detections of VOCs above soil clean-up goals (NYSDEC TAGM 4046) will be discussed with NYSDEC and may necessitate remedial measures prior to backfilling and/or off-site disposal of the affected soils at a permitted TSDF.

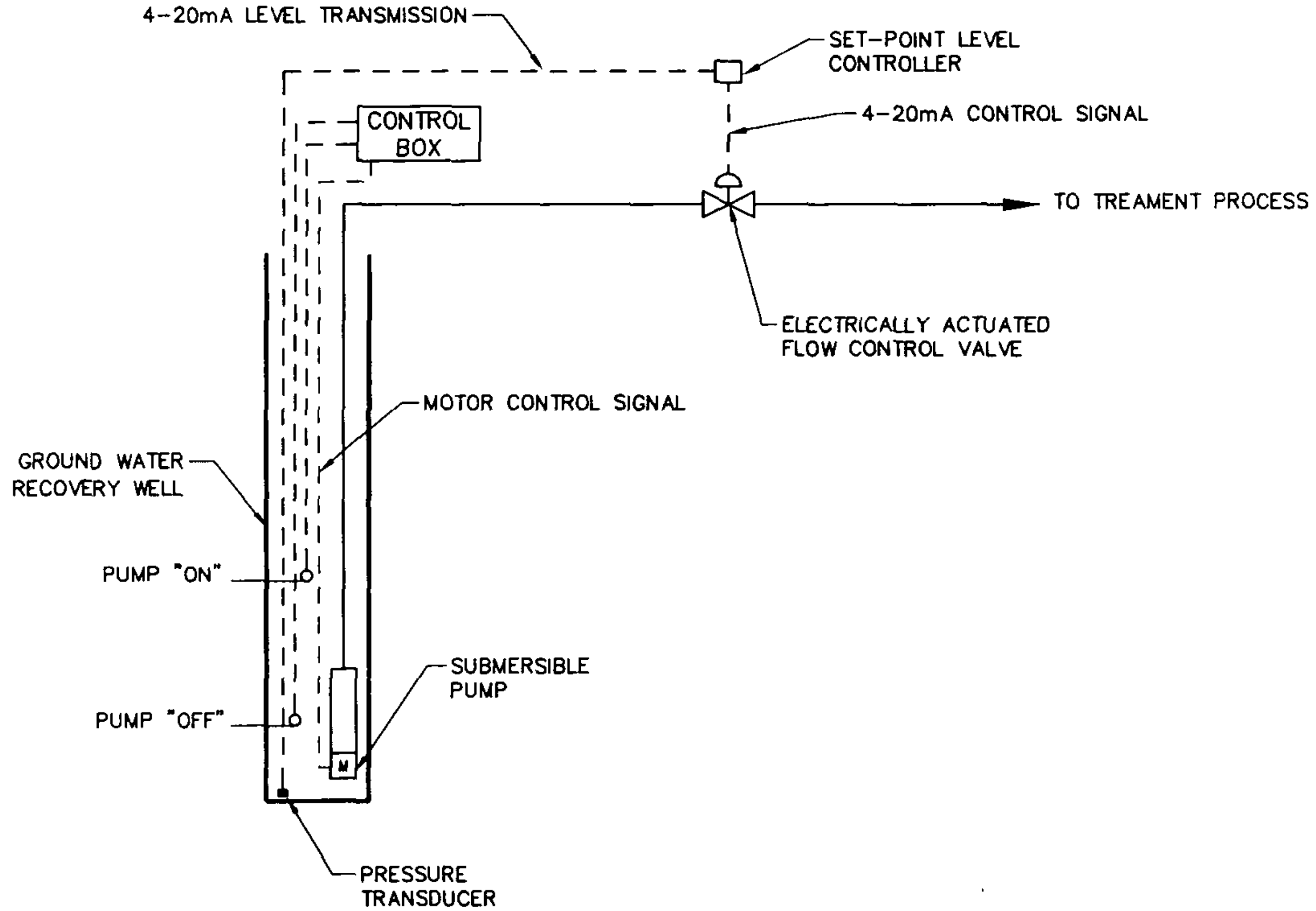
To monitor and control the water level in each recovery well, a level control system will be installed to allow for the regulation and manipulation of selected set-point levels. A level transducer installed in each well will transmit instantaneous level information to a set-point controller. The set-point controller will activate and control flow regulating valves in each pipe line to control the water level in each well. As groundwater recharge increases at the recovery well, the pump's discharge flow is increased to maintain the desired set-point level. Inversely, as groundwater recharge decreases, the recovery well pump's discharge flow is decreased to maintain the desired set-point level. The electrically actuated valves for the manifolded recovery well system will be located in the 20 GPM stripper building while the remaining recovery well system flow control valves will be located in the treatment facility. The set-point controllers for all recovery well systems will be located in the treatment facility. Figure 2-8 is a schematic illustrating the layout of the control logic associated with the set-point level control system.

In the event of a malfunction in the level control system, each recovery well will have separate "on/off" electrodes or pressure switches controlling the recovery well pump. The "off" electrode will be positioned at an elevation above the submersible pump to allow for the proper amount of submersion to protect the pump from overheating. A high level alarm will be actuated in the event of a malfunction with alarm relays annunciated at the facility PLC.

2.2 GROUNDWATER TREATMENT SYSTEM

2.2.1 General Process Description

The conceptual groundwater treatment system process is illustrated schematically on Figure 2-9. Collected groundwater will be conveyed to the treatment system via buried HDPE pipelines. As discussed in Section 2.1, groundwater flow to the treatment system will be regulated based on the elevation of the water level in each pumping well relative to the elevation of water levels in adjacent monitoring wells. Previous monitoring at wells located beneath the Can Plant near the abandoned underground tanks indicates that the water pumped from two recovery wells (RW-6 and RW-7) and three USTs will contain oil. Therefore, flow from these recovery wells and USTs will be conveyed to the treatment process in separate force mains and passed through an oil/water separator. The aqueous discharge from the oil/water separator and the incoming groundwater from the remaining pumping wells will then be combined and passed through a pre-filtration system to effectively remove gross particulates. However, the specifications will allow the contractor to provide recommendations and bids for alternate solids removal systems (e.g., multi-media filters with a filter press, settling tank with bag filter system, etc.). After filtration the water will flow by gravity to a process feed tank, where a linear polyphosphate sequestering agent will be added. The sequestering agent will complex with iron, manganese, and hardness (calcium and magnesium) ions, thus minimizing scale build-up in the process equipment.



NOT TO SCALE

MALCOLM PIRNIE

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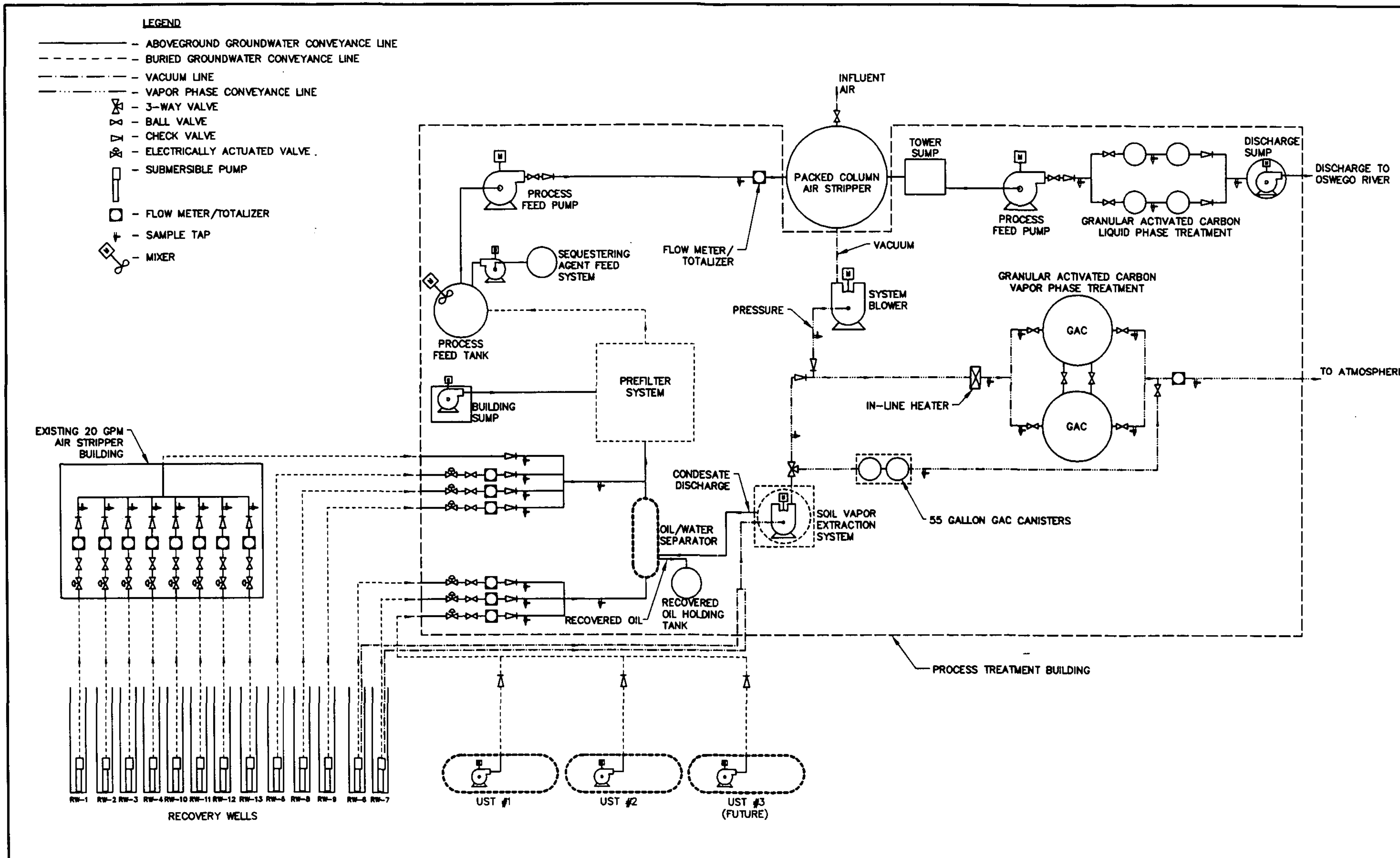
RECOVERY WELL SET-POINT LEVEL CONTROL SYSTEM SCHEMATIC

MALCOLM PIRNIE, INC.

FIGURE 2-8

3624 : ADMIN \\I:\\ACAD\\PROJ\\1028248\\SPLC-DTL SCALE: 1:1i 02/14, 1995 at 13:51



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SCHEMATIC GROUNDWATER TREATMENT SYSTEM LAYOUT

MALCOLM PIRNIE, INC.

FIGURE 2-9

3624 : ADMIN \I:\ACAD\PROJ\1028248\GWSYSPFD SCALE: 1:1i 05/05, 1995 at 09:28

The process feed tank will also provide equalization storage to allow for batch treatment system operation if groundwater production drops-off significantly or when groundwater quality improves within the source areas to the point that pumping wells can be shut down. In addition, process or floor washdown water collected in the building sump will be pumped to the pre-filtration system for subsequent treatment. The contractor will be required to configure the process flows through both the feed tank and the pre-filtration system so as to minimize volatilization in these vessels (e.g., the tanks should fill from the bottom up, or should be fitted with downcomers to mitigate volatilization due to splashing/turbulence). In addition, the tanks will be furnished with covers to prevent loss of vapors to the atmosphere within the process enclosure.

From the process feed tank, the water will be pumped on a continuous basis through a bag or cartridge filter to remove particulates (such as silts) which could foul the stripper or granular activated carbon beds. Oil adsorbing bags or cartridges may be used to supplement the oil/water separator and/or remove trace oils from the flow not treated by the separator. Flow control from the feed tank will be regulated based on tank level by an automatic valve on the discharge side of the process feed pump. Filtered water will pass to a packed column air stripper, which will effect the removal of volatile organic compounds (VOCs) from the groundwater via countercurrent contact with an airstream. Stripper air will be drawn from outside the treatment system enclosure and discharged through a vapor-phase carbon unit prior to release to the atmosphere. After the stripper, the partially treated water will be pumped through an aqueous carbon treatment system to remove residual volatile organic contamination. Flow from the stripper sump will be regulated in a similar manner as the process feed pump; however, the discharge rate will be regulated based on the stripper sump elevation. To ensure that the carbon remains wetted at all times, a stand pipe and siphon break will be installed on the carbon discharge line. Treated effluent from the carbon unit will be collected in a final discharge sump prior to being pumped (or gravity discharged depending on the treatment building location) via an underground pipe or open ditch to the Oswego River. A flow meter and totalizer will be installed on the air stripper influent line to monitor the flow through the treatment process.

The treatment system operation will be monitored and controlled by a programmable logic controller (PLC). The PLC will be a packaged system that will monitor and regulate the process flows, and monitor other critical parameters such as filter and activated carbon pressure, indicating the need for changeout/backwashing. The treatment system PLC will be tied in with the collection system PLC such that the collection system will be deactivated if any of the treatment equipment experiences major failure (deactivation of the collection system will also trigger shut-down of the SVE system). The collection system will be automatically re-activated once the treatment equipment failure is corrected.

2.2.2 Contaminant Loadings

The groundwater treatment system will be designed to reduce VOCs to below acceptable SPDES discharge limits prior to discharge to the Oswego River. To predict the VOC concentrations at the head of the system, the groundwater capture zone around each recovery well was first estimated. The highest VOC concentrations observed in the monitoring wells within the capture zone, based on all past sampling events, were then multiplied by the anticipated production rate from each pumping well to obtain combined VOC loadings, which were then divided by the total anticipated groundwater production rate to obtain weighted concentrations. A summary of the anticipated maximum VOC concentrations and estimated loadings at the head of the treatment system, based on the maximum concentrations detected at each selected monitoring well, is presented in Table 2-2. The data used to determine the weighted loadings are included as Appendix D. These concentrations (with the exception of the ketones) and the estimated 220 gpm maximum groundwater flow rate will form the basis of the air stripper design. As indicated in Table 2-2, acetone, MIBK and MEK concentrations are expected in the untreated groundwater. Since ketones are difficult to strip due to their high solubility, activated carbon adsorption will be employed to treat these parameters.

2.2.3 Treatment and Environmental Permitting Requirements

The remedial activities at the Reynolds Can Plant site will be performed under Order on Consent, therefore it may not be necessary to secure formal environmental permits for the work. However, compliance with equivalent permit limits will still be required. The NYSDEC has stated that the SPDES discharge limits for the City of Fulton WTF, in conjunction with the discharge limits that were established for the temporary discharge of K-2/M-2 and K-1 municipal well water to the Oswego River, should be used as a guide for estimating the future discharge limits for this treatment facility. The limits established for these referenced discharges are listed on Table 2-3. The anticipated treatment system discharge limits for the Reynolds Can Plant treatment system are listed

Miller Brewing Company
Table 2–2
REYNOLDS CAN PLANT SITE REMEDIATION
"Average" and Maximum Influent VOC Concentration

CONTAMINANT	Average of Maximum Concentrations ug/l	Maximum Concentrations ug/l	Estimated Loading 1 lbs/day	Estimated Loading 2 lbs/day
METHYLENE CHLORIDE	308.7	716.9	0.8113	1.8841
1,1–DICHLOROETHYLENE	265.2	646.7	0.6968	1.6996
1,1–DICHLOROETHANE	255.5	582.9	0.6715	1.5318
1,1,1–TRICHLOROETHANE	1200.3	4365.5	3.1544	11.4726
TRICHLOROETHYLENE	133.1	320.1	0.3498	0.8412
TETRACHLOROETHYLENE	390.0	1316.3	1.0248	3.4591
c–1,2–DICHLOROETHYLENE	4762.7	10097.5	12.5164	26.5362
TOLUENE	14.3	77.9	0.0377	0.2049
ETHYL BENZENE	3.4	13.9	0.0091	0.0364
TOTAL XYLENES	19.1	120.2	0.0503	0.3160
1,2–DICHLOROETHANE	0.7	4.4	0.0020	0.0115
t–1,2–DICHLOROETHYLENE	2.8	19.3	0.0074	0.0508
CARBON TETRACHLORIDE	9.4	37.4	0.0246	0.0984
DIBROMOCHLOROMETHANE	0.2	2.7	0.0006	0.0071
ACETONE	165.1	550.7	0.4340	1.4472
MIBK	54.8	219.2	0.1440	0.5760
MEK	0.6	2.3	0.0015	0.0060
CHLOROFORM	1.2	2.9	0.0032	0.0076
VINYL CHLORIDE	2.6	3.8	0.0068	0.0099
DICHLORODIFLUOROMETHANE	0.2	1.4	0.0005	0.0037
1,1,2–TRICHLOROETHANE	0.2	1.4	0.0005	0.0036
BENZENE	0.0	0.2	0.0000	0.0005
BROMODICHLOROMETHANE	0.0	0.1	0.0001	0.0004
1,2–DICHLOROPROPANE	0.1	0.4	0.0002	0.0010

Notes: Sum total of weighted loading, in ug/l and lbs/day, from all RWs.
See Appendix D for weighted loading backup data.
1) Estimated Loading based on "average" of maximum concentrations.
2) Estimated Loading based on maximum detected concentrations.

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MILLER BREWING COMPANY
TABLE 2-3
REYNOLDS CAN PLANT SITE REMEDIATION
CITY OF FULTON MUNICIPAL WELLS
HISTORICAL AND CURRENT SPDES EFFLUENT LIMITS (μg/l)

Parameter	Kellar Well 1 [1]	Kellar Well 2 & Municipal Well 2 [2]	Kellar Wells 1, 2 & Municipal Well 2 [3]
benzene	10 μg/l	10 μg/l	10 μg/l
1,2-dichloroethane	30 μg/l	30 μg/l	30 μg/l
1,2-dichloropropane	30 μg/l	30 μg/l	10 μg/l
ethylbenzene	10 μg/l	10 μg/l	10 μg/l
1,1,2,2-tetrachloroethane	30 μg/l	30 μg/l	10 μg/l
toluene	10 μg/l	10 μg/l	10 μg/l
1,1,1-trichloroethane	10 μg/l	10 μg/l	10 μg/l
trichloroethene	10 μg/l	10 μg/l	10 μg/l
chloroform	30 μg/l	30 μg/l	10 μg/l
1,1-dichloroethane	30 μg/l	30 μg/l	10 μg/l
tetrachloroethene	30 μg/l	30 μg/l	10 μg/l
1,1,2-trichloroethane	30 μg/l	30 μg/l	10 μg/l
1,3-dichlorobenzene	10 μg/l	10 μg/l	10 μg/l
1,1-dichloroethene	30 μg/l	30 μg/l	10 μg/l
xylenes, total	10 μg/l	10 μg/l	10 μg/l
methylene chloride	30 μg/l	NL	NL
zinc, total	NL	1000 μg/l	1000 μg/l
bromochloromethane	50 μg/l	50 μg/l	10 μg/l
naphthalene	10 μg/l	10 μg/l	10 μg/l
cis-1,2-dichloroethene	10 μg/l	10 μg/l	10 μg/l
trans-1,2-dichloroethene	10 μg/l	10 μg/l	10 μg/l
ACTION LEVELS			
iron, total	NL	0.40 lb/d	NL
copper, total	NL	0.55 lb/d	NL

NOTES:
NL = no limit given for this parameter
1) Kellar Well 1 limits from 1991 Consent Order #A702659106 for temporary treatment system
2) Kellar Well 2 & Municipal Well 2 limits from 1991 Consent Order #A702659106 for temporary treatment system
3) Kellar Well 1, Kellar Well 2 & Municipal Well 2 limits from 07/17/92 - 06/30/97 SPDES Permit (SPDES No. NY024 3931)

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TABLE 2-4
MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION
ANTICIPATED CAN PLANT TREATMENT SYSTEM DISCHARGE LIMITS

Parameter	Maximum Effluent Concentration (ug/l)
benzene	10
1,2-dichloroethane	30
1,2-dichloropropane	10
ethylbenzene	10
1,1,2,2-tetrachloroethane	10
toluene	10
1,1,1-trichloroethane	10
trichloroethene	10
chloroform	10
1,1-dichloroethane	10
tetrachloroethene	10
1,1,2-trichloroethane	10
1,3-dichlorobenzene	10
1,1-dichloroethene	10
xylenes, total	10
methylene chloride	30
bromochloromethane	10
napthalene	10
cis-1,2-dichloroethene	10
trans-1,2-dichloroethene	10
Other VOCs	10
oil & grease	15 mg/l
zinc, total	1000 ug/l
Action Levels	
iron, total	0.40 lb/day
copper, total	.55 lb/day

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on Table 2-4. These limits are subject to modification, but will be considered the maximum allowable concentrations in the process outfall pending further review of the remedial design by NYSDEC. Section 3.0 presents a summary of the operational, maintenance, and monitoring requirements to assure compliance with the equivalent SPDES limits. As NYSDEC currently requires approximately six months to review a SPDES permit application and issue discharge limits and monitoring requirements, it will be the responsibility of Miller Brewing Company (or their engineering consultant) to secure the equivalent SPDES permit for the process outfall. In addition, Miller Brewing Company will obtain Army Corps of Engineer (ACOE) and/or New York State Department of Transportation (NYSDOT) approval for construction of the treatment process outfall structures in the Oswego River.

For the process emissions from the air stripper, it will be necessary to obtain an equivalent 6 NYCRR Part 212 permit to construct/certificate to operate. This will require presentation of specific information as to the configuration of the process enclosure and emissions stack, as well as engineering calculations supporting the predicted contaminant loadings to the atmosphere. Furthermore, stack testing may be required at start-up to demonstrate conformance with the loadings presented in the permit application. Since the air stripper, emissions controls, and treatment system and enclosure will be procured through performance-based specifications, this information will be dependent on the contractor's selected equipment. Therefore, obtaining an equivalent emissions permit, including any stack testing, will be the responsibility of the contractor.

As a means for pre-screening a conceptual process emission point to determine whether it will be acceptable to the NYSDEC Division of Air Resources, the Standard Point Source Method presented in Appendix B of the 1994 Air Guide-1 should be performed by the contractor using design-specific air stripper data to compare predicted ambient air impacts to short-term and annual guidance concentrations (SGCs and AGCs) presented in Appendix C of Air Guide-1. The SGCs and AGCs for the anticipated volatile organic contaminants at the head of the treatment system are presented in Table 2-5. Successful procurement of an equivalent permit to construct/certificate to operate generally requires that the calculated impacts from the source meets the SGC and AGC limits as well as the other requirements contained in 6 NYCRR Part 212. Based on the contaminant loadings

Table 2-5
Miller Brewing Company
Reynolds Can Plant Site Remediation
Engineering Design Report
Summary of Annual and Short-term Guidance Concentrations for Anticipated Volatile Organic Contaminants in Air*

CONTAMINANT	SHORT-TERM GUIDANCE CONC. (SGC) (ug/cu. m)	ANNUAL GUIDANCE CONC. (AGC) (ug/cu. m)
Methylene Chloride	41000	27
1,1-DCE	2000	0.02
1,1-DCA	190000	500
1,1,1-TCA	450000	1000
TCE	33000	0.45
PCE	81000	0.075
c-1,2-DCE	190000	1900
Toluene	89000	2000
Ethyl Benzene	100000	1000
Total Xylenes	100000	300
1,2-DCA	0.95	0.039
t-1,2-DCE	-	360
Carbon Tetrachloride	1300	0.07
Dibromochloromethane	-	-
Acetone	140000	1400
MIBK	48000	480
MEK	140000	300
Chloroform	980	23
Vinyl Chloride	1300	0.02
Dichlorodifluoromethane	-	-
1,1,2-TCA	13000	0.06
Benzene	30	0.12
Bromodichloromethane	-	0.02
1,2-Dichloropropane	83000	0.15

* From NYSDEC 1991 Air Guide-1, Appendix C

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discussed in Section 2.2.2, preliminary screening of the air stripper emissions indicates that the AGCs will be exceeded for tetrachloroethylene and 1,1-dichloroethene unless emissions controls are implemented. Therefore, vapor-phase activated carbon will be specified for the stripper exhaust.

2.2.4 Treatment System Equipment and Instrumentation

The basis of design for the major groundwater treatment system equipment is presented in this section. In general, the equipment will be selected and procured by the contractor based on performance and/or technical specifications to be prepared during the final design phase of the project.

2.2.4.1 Oil/Water Separator

The oil/water separator will be designed to remove oils from groundwater collected from the Southern Operable Unit, specifically pumping wells RW-6 and RW-7, and pumping water from three underground storage tanks. The groundwater from these locations contain both emulsified and non-emulsified oil. Therefore, the separator will be specified as a coalescing plate-type unit with an acid emulsification removal system, configured for a maximum 60 gpm flow. Removed oil will be transferred to a holding tank to await off-site disposal. Treated water will flow by gravity to the process feed tank. As indicated in Table 2-6, the design criteria for this unit will be removal of all oil to the anticipated equivalent SPDES discharge limit of 15 mg/l oil and grease, which will be the treatment objective for the oil/water separator alone (i.e., the benefits of dilution from the other pumping wells and secondary treatment through the activated carbon should not be considered in the design of the separator). In addition, the anticipated temperature of the influent stream and the specific gravity of the oil may also be required by the oil/water separator manufacturer. As these data are not currently available, it will be the selected contractor's responsibility to collect any samples necessary for sizing the oil/water separator equipment.

2.2.4.2 Pre-Filtration System

The pre-filtration system will be designed to remove particulates from the combined Southern and Northern Operable Unit groundwater plumes (i.e., 220 gpm flow). The removal efficiency of the system will be optimized to prevent fouling or potential clogging of the air stripper and GAC beds during the start-up period, since the solids content and

TABLE 2-6

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

SUMMARY OF MAJOR GROUNDWATER TREATMENT EQUIPMENT BASIS OF DESIGN

Treatment Unit	Performance Criteria	Design Data
Oil/Water Separator	Removal of all oil and grease to 15 ppm, coalescing plate-type unit	Maximum influent flow rate - 60 gpm Maximum influent temp - 60°F Minimum influent temp - 40°F Anticipated influent oil concentration - to be determined by contractor Oil specific gravity - to be determined by contractor
Bag Filter Unit	Removal of suspended solids to mitigate stripper and carbon fouling	Max influent flow rate - 220 gpm
Sequestering Agent Feed System	Complexing of iron, magnesium and hardness to mitigate scale build-up and fouling	Soluble iron concentration - 0.18 ppm Soluble magnesium concentration - 48 ppm Hardness concentration - 480 ppm Process flow - 220 gpm
Air Stripper	Removal of all VOCs in untreated groundwater (except ketones) to required discharge limits (Table 2-4)	Influent concentrations - See Table 2-2 Process flow - 220 gpm
Vapor Phase Carbon	Adsorption of VOCs in stripper exhaust to meet emissions limits in permit	Groundwater influent concentrations - See Table 2-2 Process flow - 220 gpm Air flow rate based on contractor-selected stripper design
Liquid Phase Carbon	Adsorption of non-strippable VOCs to meet discharge limits	Process flow - 220 gpm Influent concentrations based on contractor-selected air stripper design

particle-size distribution of the suspended solids in the groundwater may vary as the wells develop with time. The contractor will be required to provide a filtration system which consists of any single filtration component or combination thereof and meets the general performance requirements. The system(s) will also provide for long-term integrity such that the integrity of the entire treatment system is maintained.

2.2.4.3 Sequestering Agent Feed System

The sequestering agent feed system will consist of a storage vessel (e.g., 55-gallon drums) and duplex metering pumps (1 duty, 1 standby) with automatic frequency adjustment made by the PLC based on the flow through the process. Stroke length will be manually adjusted and will be specified with a 10:1 turndown ratio. Activation/deactivation of the metering pumps will be tied in with the tank level controls to facilitate batch operation (if desired).

The linear polyphosphate sequestering agent dosage will be initially based on manufacturer recommendations, and will be adjusted as necessary based on visual observations of scaling and the water quality data and flows recorded during the treatment system monitoring program. Assuming influent inorganic concentrations of iron, manganese and hardness as presented in Table 2-6, and a total maximum flow rate of 220 gpm, the recommended dosage of sequestering will be determined by the contractor. The contractor will be responsible for the selection, procurement, installation, operation, and maintenance of the sequestering agent and feed system under the performance specification. Therefore, alternative manufacturer's products will be acceptable.

2.2.4.4 Air Stripper

To maximize flexibility and cost savings potential, the air stripper design will be the contractor's responsibility under a performance specification. The contractor will, however, be required to furnish a packed-column-type air stripper fitted with a stack-mounted blower. Air will be drawn through the column by way of negative pressure induced by the blower, which will augment volatilization due to the lower air pressure within the column. The packed column will be located outside and adjacent to the process building. The air blower should be located inside the building and connected to the packed column via an air duct.

The primary design criteria will be the removal of volatile organic contaminants, with the exception of the ketones, from the anticipated influent groundwater concentrations identified in Table 2-2 to comply with the process outfall permit concentrations identified in Table 2-5. Liquid-phase activated carbon adsorption will be acceptable as a means for removing the remaining acetone, methyl-isobutyl ketone (MIBK), and methyl ethyl ketone (MEK) to the required effluent concentrations, as these parameters are highly soluble and cannot be easily removed through air stripping. The air stripper and stack will be constructed of corrosion-resistant materials such as PVC or FRP.

Additional stripper design criteria to be specified include the requirement for construction of a good engineering practice (GEP) emissions stack for the final exhaust from the treatment system, which is defined as a minimum stack height of 2.5 times the process building height. Since the NYSDEC Division of Air Resources allows for a maximum reduction in the calculated ambient air impacts from a GEP stack, specification of a GEP stack will facilitate procurement of an equivalent permit to construct/certificate to operate for the stripper. Furthermore, construction of a GEP stack will increase the potential for eliminating the emissions controls if the VOC concentrations in the groundwater decline with time. The process feed pump, the stripper discharge pump, and the stripper blower will be specified as single-speed units furnished in duplex (1 duty, 1 standby). An air flow meter and a manually-adjusted damper will also be specified on the stripper blower to regulate and monitor air flow. The stripper will be designed to operate continuously, but will be furnished with the required controls to start and stop the blower and the various process pumps as necessary for batch operation. The stripper control panel will have adequate input and output relays to facilitate batch operation. A summary of the key design criteria is presented in Table 2-6.

2.2.4.5 Vapor-Phase Activated Carbon

Vapor-phase activated carbon will be used to meet air emissions limits for the stripper exhaust. A minimum of one primary vessel and one secondary vessel will be specified to ensure continued operation if breakthrough occurs and pending a scheduled regeneration period. Selection and procurement of the carbon treatment unit will be the responsibility of the contractor based on these criteria and the anticipated concentrations of the VOCs in the stripper air stream. Since there is a potential for removal of the activated carbon from the system if the VOC concentrations in the groundwater decrease, the carbon vessel will be specified as a leased unit. Regeneration will be performed on-site or off-site by the carbon supplier at the discretion of the contractor. A pre-heater may be used by the contractor if he is able to demonstrate a cost savings in regeneration and related fees that off-set the capital and operating cost for the pre-heater within a reasonable time frame (e.g., two years). Exhaust from the vapor-phase carbon vessel will be vented through a GEP stack, fitted with emissions testing locations. The carbon vessel will be constructed of non-corrodible materials and will be skid or trailer-mounted to facilitate removal from the process building for regeneration.

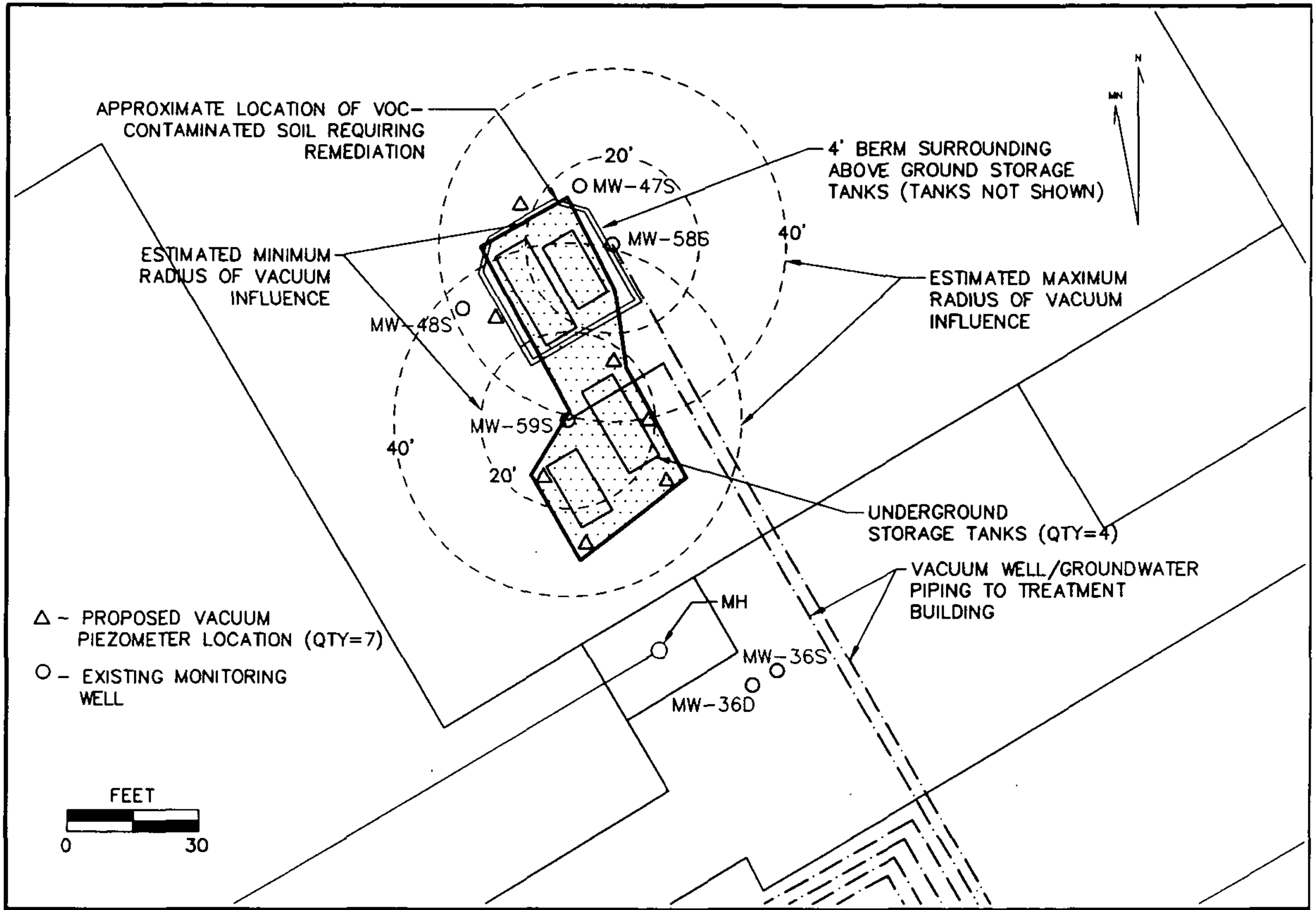
2.2.4.6 Liquid-phase Activated Carbon

Liquid-phase activated carbon will be used to meet SPDES discharge limits for the less effectively-stripped compounds (i.e., MIBK, MEK and acetone). A minimum of one primary vessel and one secondary vessel will be specified to ensure continued operation if breakthrough occurs and pending a scheduled regeneration period. Selection and procurement of the liquid-phase carbon treatment unit will be the responsibility of the contractor based on these criteria and the anticipated concentrations of the VOCs in the stripper discharge water. Carbon regeneration will be performed off-site by the carbon supplier. If multiple carbon units are used in series to meet the SPDES limits, the units will be plumbed such that when the lead vessel is spent, the secondary vessel becomes the lead vessel, and the lead vessel is removed for regeneration. The carbon vessel(s) will be constructed of non-corrodible materials and will be skid or trailer-mounted to facilitate removal from the process building for regeneration. A standpipe and siphon break will be constructed on the discharge from the carbon beds to ensure constant wetting. Additionally, pressure gauges on the inlet and exit sides of the vessel(s) will be specified to monitor solids blinding. A backwash pump from the treated water discharge tank will be used to backwash solids from the carbon to the head of the process.

2.3 SOIL VAPOR EXTRACTION SYSTEM

2.3.1 General

A soil vapor extraction (SVE) system will be installed and operated to remediate approximately 1630 square feet of VOC-contaminated subsurface soils beneath the southern portion of the Reynolds Can Plant (see Figure 2-10). As a result of past disposal practices,



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MALCOLM PIRNIE

MILLER BREWING COMPANY / REYNOLDS CAN PLANT

SOIL VAPOR EXTRACTION SYSTEM LAYOUT AND PROPOSED VACUUM PIEZOMETER LOCATIONS

MALCOLM PIRNIE, INC.

FIGURE 2-10

VOCs and oil have been detected in the soils within this area at a depth up to 15 feet below the Can Plant floor. The VOCs present in the soils and the range of concentrations are presented in Table 2-7. In addition, Table 2-7 presents the soil cleanup criteria for the VOCs based on NYSDEC TAGM 4046 (Ref. 1).

An SVE pilot test was performed for the soils beneath the Reynolds Can Plant building as well as subsurface soils in the adjacent parking area in July, 1992 as part of the Feasibility Study for the site. Subsequently, NYSDEC agreed that the soils beneath the parking area would not require remediation. A copy of the pilot test report is presented in Appendix F.

The SVE system will incorporate two (2) dual extraction wells (i.e., RW-6 and RW-7) that will be used as both groundwater pumping and vapor extraction points. These 6-inch wells are screened from approximately 9.5 feet to 34.5 feet below the building floor, and will be fitted with submersible pumps to collect contaminated groundwater in the underlying aquifer. Two additional extraction wells in the Southern Operable Unit (i.e., MW-47S and MW-48S) have also been designed as dual extraction wells, however, based on the results of the pilot study, it does not appear that the use of these wells as vapor extraction points will be necessary. The well heads at RW-6 and RW-7 will be manifolded together with PVC piping, and a vacuum will be induced on the wells with a centrifugal or rotary vane blower. The removed air will be passed through an air/water separator, followed by an activated carbon bed to adsorb the vapor-phase VOCs prior to exhaust through the groundwater treatment system stripper stack. Water in the air/water separator will be periodically discharged to the groundwater treatment system. Vacuum gauges and sample ports will be installed on the vacuum lines from both wellheads and on both sides of the granular activated carbon bed. Air flow meters will also be installed on the wellheads. A schematic of the SVE system is shown on Figure 2-11.

To assist in monitoring the effectiveness of the SVE system, piezometers will be installed at approximately six locations around the perimeter of the soil source area as shown in Figure 2-10. The piezometers will be screened at varying depth intervals in the unsaturated overburden and will be fitted with vacuum ports to allow for spot-monitoring of the vacuum at each location with a manometer, thereby providing an indication of the area influenced by the vacuum.

TABLE 2-7
MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION
SOUTHERN OPERABLE UNIT SOILS
CONTAMINANT CONCENTRATIONS AND CLEAN-UP LEVELS

COMPOUND	RANGE OF DETECTED CONCENTRATIONS (ug/kg)	SOIL CLEAN-UP LEVEL (ppb) (1)
1,1-Dichloroethane	3-180	358
c-1,2-Dichloroethylene	750	585
Methylene Chloride	8-700	251
Tetrachloroethylene	12-5700	4350 (2)
1,1,1-trichloroethane	17-7000	1816
Trichloroethylene	12-12000	1505
Benzene	800	139
Toluene	92-460	3585
Acetone	22-81	263
1,1-Dichloroethylene	5	777
Methyl Isobutyl Ketone	14-67	2270
Methyl Butyl Ketone	8-220	1673
Methyl Amyl Ketone	45-2900	(3)
4-Methyl-2-Pentanol	11	(3)
alpha Pinene	20	(3)
Phenanthrene	39	50000
Hepta Methyl Ketone	810	(3)

(1) Soil clean-up levels were determined in accordance with NYSDEC Technical and Administrative Guidance Memorandum on Determination of Clean-Up Levels, dated January 24, 1994, and are based on soil percent organic carbon content of 2.39%. This value is the average organic content of the soil in the southern operable unit, as determined through soil sampling and analysis.

(2) Limit calculated using partition coefficient (Koc) of 364ml/g, which was obtained from Exhibit A-1 of the USEPA Superfund Public Health Evaluation Manual. Although this manual is recommended in the NYSDEC Guidance Memorandum as the source from which Koc values should be obtained, the value of 364 ml/g differs from the one used by the NYSDEC (277 ml/g) in determining their recommended clean-up objective.

(3) No ground water/drinking water standard exists for this compound, thus no soil clean-up level can be calculated.

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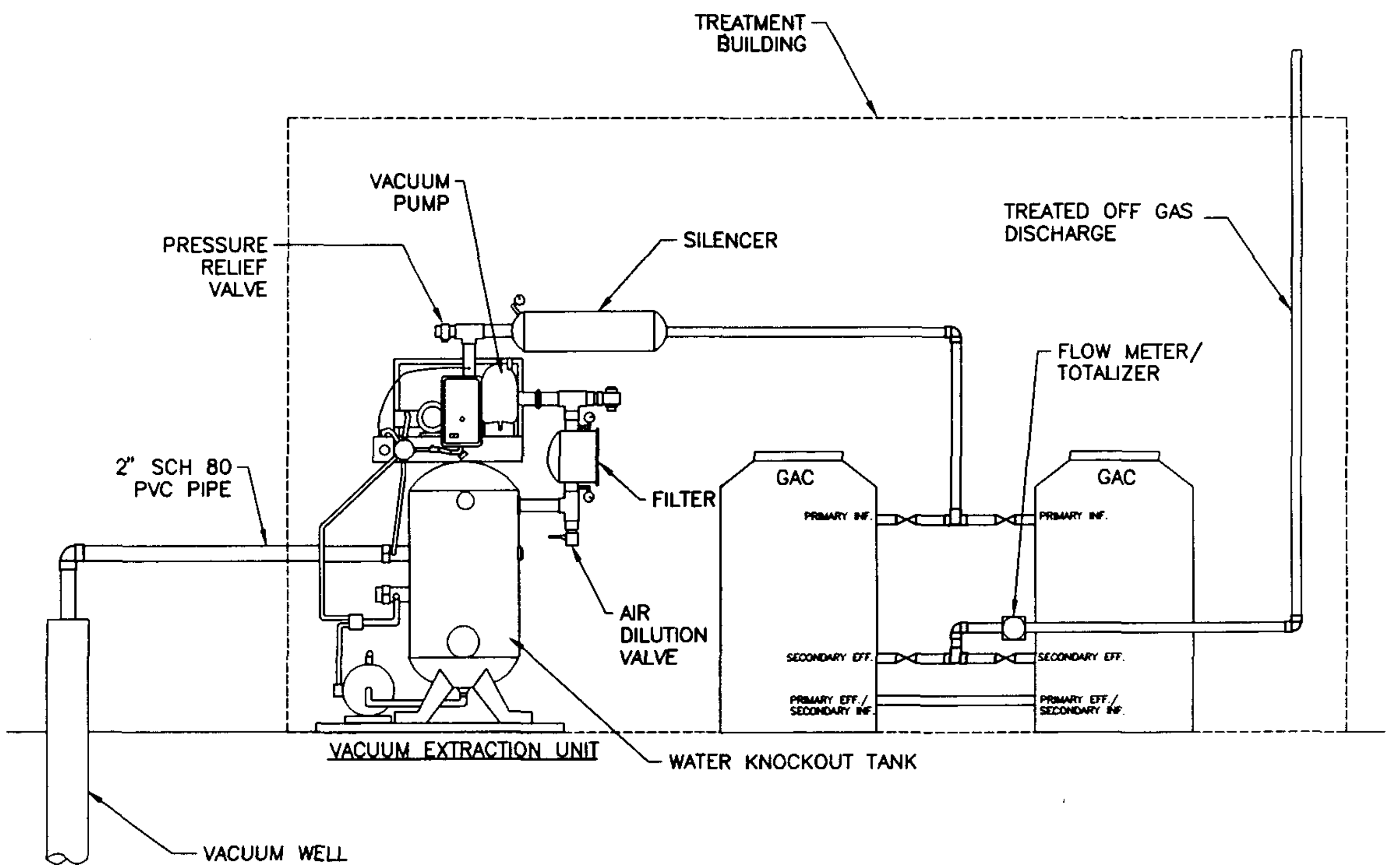

MALCOLM PIRNIE

MILLER BREWING COMPANY–REYNOLDS CAN PLANT

SOIL VAPOR EXTRACTION SYSTEM SCHEMATIC

MALCOLM PIRNIE, INC.

FIGURE 2–11

An issue that will have to be addressed prior to start-up of the SVE system is the presence of an unknown water source that recharges the gravel fill beneath the Reynolds Can Plant. Currently, there are four (4) abandoned underground tanks beneath the southern portion of the building, three of which were formerly used for oily waste storage. To collect oil attributable to prior leakage from these units, three of the tanks were perforated and two were fitted with oil collection sumps. The oily waste treatment tank was not fitted with a collection sump due to the occurrence of large volumes of water in this tank after the tank was perforated. Another sump is located in the general vicinity of all four tanks. Oil is periodically pumped from the sumps and containerized for disposal under the guidance of NYSDEC's Division of Spills Management. In addition to the oil, however, significant volumes of water regularly accumulate in one of the perforated tanks, the oily waste treatment tank. Based on the elevated temperature of the water in nearby monitoring well MW-48S (approximately 70 °F), it is possible that the water is originating from a process line within Reynold's facility. The water found in the tank may also be the combined result of leaks from more than one process line, or from a process line plus the fire loop or some other force main that can be found in the area. To date, the source of the leakage has not been determined, although several attempts to do so have been made.

Assuming that the condition is not corrected prior to construction of the SVE system, the contractor will have to incorporate provisions to remove and treat the water to ensure that the unknown water source does not impede the effectiveness of the SVE system. These provisions will include: installing the sump in the oily waste treatment tank to a depth coincident with the bottom of the fill material in this area to effectively pump the water from the oily waste treatment tank and dewater this area. The pumped water would have to be sent to the oil/water separator in the treatment building prior to treatment. Although the pumping wells can be used to remove groundwater beneath the Southern Operable Unit soils, the compact soils below the tanks appear to restrict migration of the "process" water to the groundwater table. Despite the relatively high temperature of the water in MW-48S, it appears that the wells in this area receive only a small amount of recharge from the water in the gravel backfill. This is evidenced by the difference in water levels measured at the tank and in the monitoring wells. The water level in the tank is several feet above the water table in this area. The final contract design documents will specify the required measures to be undertaken with respect to this issue.

Based on the rate of refilling that has been observed at the oily waste treatment tank after it is periodically emptied, we estimate that the recharge occurs at a rate of less than 5 gpm. The treatment system maximum design flow rate of 220 gpm is based on high end flow from each recovery well. These recovery well flow rates are conservative, and it is unlikely that each well will be able to produce the estimated maximum. Therefore, the treatment system design flow rate of 220 gpm will be able to accommodate a 5 gpm rate of flow from the gravel backfill material.

2.3.2 Contaminant Removal

The SVE system will be designed to remove VOCs in Southern Source Area unsaturated overburden beneath the Reynolds Can Plant. At a minimum, the goal of the SVE remediation effort is to reduce the contaminant concentrations to the soil cleanup levels presented in Table 2-7 and prevent the release of contaminants to the groundwater.

Based on the estimated area and depth of the contamination (i.e., 1630 square feet by 15 feet deep), the volume encompassed by the Southern Operable Unit soils is approximately 906 cubic yards. However, as discussed in Section 2.3.1 there are four (4) abandoned underground tanks present beneath the Southern portion of the Reynolds Can Plant building, which have a combined volume of 28,000 gallons (139 cubic yards). This leaves roughly 770 cubic yards of soil to be remediated, or 1040 tons assuming an average density of 1.35 tons/cubic yard. For the purpose of estimating the initial mass of VOCs that are present in the Southern Operable Unit soil, the initial (pre-remediation) VOC concentrations were assumed to be the maximum values presented in the ranges in Table 2-7.

On this basis, the maximum initial masses of the individual VOCs in the Southern Operable Unit Soils are presented in Table 2-8.

After the Southern Source Area soils are remediated and the SVE system is shut-down, the contractor will be responsible for obtaining bids to formally close the four (4) abandoned underground tanks beneath the southern portion of the Can Plant.

2.3.3 Environmental Permitting Requirements

For the process emissions from the SVE system, the contractor will be required to obtain an equivalent 6 NYCRR Part 212 permit to construct/certificate to operate. Since it is proposed that the process exhaust from this system be emitted in the same stack as the

TABLE 2-8
MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION
SOUTHERN SOURCE AREA SOIL
MASS OF IN-PLACE VOCs

COMPOUND	UPPER RANGE OF DETECTED CONC. (ug/kg)	SOIL MASS (kg)	MAXIMUM CONTAMINANT MASS	
			kg	lb
1,1-Dichloroethane	180	943738.7	1.70E-01	0.374
c-1,2-Dichloroethylene	750	943738.7	7.08E-01	1.560
Methylene Chloride	700	943738.7	6.61E-01	1.456
Tetrachloroethylene	5700	943738.7	5.38E+00	11.856
1,1,1-trichloroethane	7000	943738.7	6.61E+00	14.560
Trichloroethylene	12000	943738.7	1.13E+01	24.960
Benzene	800	943738.7	7.55E-01	1.664
Toluene	460	943738.7	4.34E-01	0.957
Acetone	81	943738.7	7.64E-02	0.168
1,1-Dichloroethylene	5	943738.7	4.72E-03	0.010
Methyl Isobutyl Ketone	67	943738.7	6.32E-02	0.139
Methyl Butyl Ketone	220	943738.7	2.08E-01	0.458
Methyl Amyl Ketone	2900	943738.7	2.74E+00	6.032
4-Methyl-2-Pentanol	11	943738.7	1.04E-02	0.023
alpha Pinene	20	943738.7	1.89E-02	0.042
Phenanthrene	39	943738.7	3.68E-02	0.081
Hepta Methyl Ketone	810	943738.7	7.64E-01	1.685
Total Mass of VOC's			3.00E+01	66.025

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air stripper, preparation of one permit application covering both sources will be required. Thus, specific permit information as to the configuration of the process enclosure and stack will be identical for the SVE system and air stripper. However, a separate set of engineering calculations supporting the predicted contaminant loadings to the atmosphere and the effectiveness of the SVE emissions controls (i.e., vapor-phase carbon) will be necessary. Furthermore, testing of the treated SVE system emissions may be required at start-up to demonstrate conformance with the loadings presented in the permit application.

As discussed in Section 2.2.3, pre-screening of the conceptual process emission point to determine whether it will be acceptable to the NYSDEC Division of Air Resources should be performed by the contractor prior to submission of the equivalent permit application. Although it is anticipated that the potential SVE system emissions will be significantly less than the air stripper, the Air Guide-1 screening referenced in Section 2.2.3 should incorporate this source as well as the stripper exhaust. Based on the contaminant concentrations detected during the SVE pilot test program (see Appendix F) it is feasible that the AGCs could be exceeded for several of the parameters unless emissions controls are implemented. Therefore, a separate vapor-phase activated carbon will be specified for the SVE system exhaust.

2.3.4 SVE System Equipment and Piezometers

The basis of design for the major SVE system equipment and piezometers is presented in this Section. Selection, procurement, and installation of the equipment and piezometers will be the responsibility of the contractor based on the performance specifications. For the purpose of equipment sizing, the final contract design documents will establish a goal of one year for achieving the soil cleanup levels presented in Table 2-7, based on the extent of contamination and the contaminant loadings presented in Section 2.3.2.

2.3.4.1 Blower

The SVE system blower will be sized and selected by the contractor on the basis of the soil characteristics and the extent of the Southern Source Area contamination, assuming a one-year remediation schedule and vacuum extraction at RW-6 and RW-7. Pertinent soil characteristics were determined during the RI/FS and the SVE pilot study, and are presented in Table 2-9. The blower will be housed in the groundwater treatment building,

TABLE 2-9

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

SUMMARY OF MAJOR SOIL VAPOR EXTRACTION EQUIPMENT BASIS OF DESIGN

Treatment Unit	Performance Criteria	Design Data[1]
Blower	Removal of VOCs to clean-up goals within one - year (see Table 2-7)	Soil concentrations and masses per Tables 2-7 and 2-8.
		Estimated soil volume - 770 cubic yards.
		Moisture content of soils - 10%
		Soil porosity - 30%
		Air permeability: 1.4 x 10^{-7} cm^2 to 3.7 x 10^{-8} cm^2
		Vapor extraction from RW-6 and RW-7
Vapor Phase Carbon	Adsorption of VOCs in SVE exhaust to meet emissions limits in permit	Soil concentrations and masses per Tables 2-7 and 2-8.
		Air flow rate based on contractor-selected blower.
Air/Water Separator	Knock-out of condensed water vapor to ensure effective carbon and blower performance.	Moisture content of soils - 10%
		Air flow based on contractor selected blower.
Piezometers	Designed and located to effectively monitor influence of vacuum within Southern operable unit soils.	Vapor extraction from RW-6 and RW-7.

(1) Data for Southern operaable unit soils is based on pilot test results - see Appendix F.

and will be designed to operate continuously. The blower motor will be activated manually, but will shut-down if the high/high level alarm on the air/water separator tank is activated or if the collection system pumps at RW-6 and/or RW-7 are deactivated. A bleed valve on the inlet to the blower will be used to regulate the vacuum applied to the system.

2.3.4.2 Air/Water Separator

The air/water separator will consist of a steel knock-out tank fitted with an epoxy liner or other non-corrodible material. As humid air from the vacuum extraction wells is pulled through the separator, condensed water will accumulate in the tank bottom and air will exit from the top of the vessel. An entrainment separator located near the tank outlet will effect further condensation of water vapor remaining in the air stream. When the tank level reaches a pre-determined set point, a discharge pump will be activated and the water will be pumped to the oil/water separator, where it will be combined with the groundwater from RW-6 and RW-7 and processed through the groundwater treatment system. The air/water separator discharge pump will shut-down when the tank reaches low level. A high/high level alarm in the tank will deactivate the blower in the event that the discharge pump fails. A vacuum gauge and sample port will be installed upstream of the air/water separator to monitor VOC concentrations in the untreated vapor and to monitor the vacuum at the head of the unit.

2.3.4.3 Vapor-Phase Carbon

Vapor-phase activated carbon will be used to meet air emissions limits for the SVE system exhaust. A minimum of one primary vessel and one secondary vessel 55-gallon canisters will be specified to ensure continued operation if breakthrough occurs and pending a scheduled regeneration period. Selection and procurement of the carbon treatment unit(s) will be the responsibility of the contractor based on conformance with the emissions limits and the anticipated loading of VOCs in the SVE system air. Regeneration will be performed either on-site or off-site, depending on which method offers the greater cost savings potential. Air drawn through the vapor-phase carbon vessel will be vented through the stripper stack. Piping to the vapor-phase carbon unit(s) will be fitted with sample ports upstream and downstream of each carbon vessel, as well as gauges to measure the vacuum imparted across the units. The carbon vessel will be constructed of non-corrodible materials and will be skid-mounted to facilitate removal from the process building for regeneration.

2.3.4.4 Piezometers

Based on the results of previous investigations conducted at the site, VOC contaminated soil requiring remediation is limited to the vicinity of the underground tanks beneath the Can Plant. More specifically, contamination appears to be concentrated in the gravel backfill which surrounds the tanks and extends to a depth of approximately 15 feet below the floor of the Can Plant. Piezometers will be installed inside the plant at the approximate locations shown in Figure 2-10 to provide points for monitoring subsurface vacuum influence and soil vapor contaminant concentrations within the area requiring remediation. Thus, the piezometers will provide the means to verify that the entire designated area of contamination is influenced by the SVE system and to monitor the progress of soil remediation.

A truck-mounted rig will be utilized to install the piezometers to depths of up to 15 feet below grade. The rig should be capable of driving the piezometers into the ground as well as augering a hole, if necessary, after the concrete flooring has been drilled out. It is anticipated that two piezometers, one shallow and one deep, will be installed at each location shown in Figure 2-10. Each shallow piezometer will be installed to a depth of approximately eight feet below grade, and each deep piezometer will be installed to a depth of approximately 14 to 15 feet below grade. All piezometers are expected to be 3/4-inch diameter pipe, with the bottom one foot section perforated or slotted. A sand pack will be emplaced in the annulus between the piezometer and borehole in the interval covering the sand pack area. A hydrated bentonite seal will be emplaced above the sand pack. Curb boxes will be installed at each location so that all piezometers will be below grade. Ample space will be left in the curb box to allow connection of each piezometer to a manometer for vacuum measurement.

The exact locations and depths of the piezometers may vary somewhat, depending on the location of any subsurface utilities or piping that exist and any other subsurface features which may be encountered during drilling. Preliminary piezometer locations will have to be reviewed by Reynolds Metals Company prior to piezometer installation to verify the location of subsurface structures.

All drill cuttings will have to be placed in 55-gallon drums for testing and appropriate off-site disposal.

2.4 PROCESS BUILDING AND UTILITIES

The treatment system/process will be totally enclosed in a metal-framed, pre-engineered building constructed on a cast-in-place concrete foundation system of footings, walls, and slab on grade. The building will measure approximately 20 feet X 40 feet and will be approximately 12 feet in height at the peak. The foundation walls will be extended approximately 6 inches above the grade slab and be integrally tied to the floor slab to act as a secondary containment system for the building. The contractor will be responsible in obtaining soil boring information for the proper design of the treatment building foundation system. The exterior of the facility will be finished with metal siding and roofing material which will blend with the general character of the neighboring properties. The contractor will be responsible for obtaining all necessary project permits for and including building construction, material hauling, and work in areas such as roads, rights-of-way, and railroads. In addition, the Design/Builder/Operator must strictly adhere to and comply with all requirements of the Order on Consent issued by the NYSDEC and any other applicable regulations stated therein.

The floor/base slab will be sloped such that any water spilling onto the floor will be directed to a floor trench/drain system and empty into a collection sump for proper disposal. The floor slab will be placed within the foundation walls with raised concrete pads for the support of floor bearing equipment. The packed tower unit housing the carbon treatment vessel will be supported by an independent concrete footing and pad system.

Within the facility, there will be a monitoring station with access to state-of-the-art system instrumentation/controls for readout of all essential equipment and components. *In addition, a separate, enclosed storage room will allow for storage of process chemicals* and spare equipment and parts. The facility will also be supplied with various health and safety equipment (i.e., eye wash station, emergency shower, first aid station, etc.).

The main floor of the facility will house the stripper feed tank, stripper feed pumps, the air stripper, air blowers and ductwork, all process piping, and the vapor phase Granular Activated Carbon (GAC) system. A system motor control center will also be located on the main floor near the monitoring station area. An example of the proposed building schematic is shown on Figure 2-9. The proposed building will be designed and constructed by the contractor in a location as shown on Figure 2-1.

The building will be maintained above freezing utilizing an electric and/or gas heating system adequately designed for the size of the building and operating components. The facility will be serviced by all utilities such as electric, gas, sanitary sewer, potable water, and telephone. The building will also have an in-house air compression system to operate specified building and field equipment. Most utilities will be accessible from the Reynolds Can Plant facility and will be metered separately. The metering requirements for each utility will be identified by those owning the utility, and it will be the responsibility of the contractor to notify the resident utility for costs, installation, and metering. The design and construction of this building will meet or exceed the requirements set forth in the New York State Building Code and any other requirements based on the facility design. In addition, the existing 20 GPM air stripper building located on the Reynold's property, will have to be submetered for electrical use of the new groundwater collection system.

3.0 OPERATION, MAINTENANCE, AND MONITORING REQUIREMENTS

The remedial contractor will be responsible for constructing and starting-up the groundwater collection and treatment systems and the soil vapor extraction system in accordance with the specifications. Following the start-up period, which will be defined as the period required to demonstrate consistent conformance with the performance goals for each system for a minimum duration of eight weeks, and subsequent acceptance of the systems by Miller Brewing Company, the contractor will perform continued operation, maintenance, and monitoring (OM&M) of the collection, treatment, and vapor extraction systems under a 5-year renewable service agreement. The contractor will also be required to perform OM&M of the City of Fulton WTF over the same 5 year period. The OM&M requirements for the WTF are contained in the OM&M Plan for that facility, and are summarized in this section. The 5 year renewable service agreement will detail the terms and conditions of the operation, maintenance, and monitoring requirements, as well as the details of payment and reimbursement for the associated labor and expenses. This section presents a summary of the monitoring to be performed at start-up to demonstrate the effectiveness of the Reynolds Can Plant remedial systems, as well as the minimum scope of services that will be incorporated in the service agreement. Additional efforts such as air monitoring of the emissions from the Reynolds Can Plant treatment system and vapor extraction system or more frequent process water/groundwater sampling may be required based on the terms and conditions of the equivalent SPDES and air emissions permits.

3.1 GROUNDWATER COLLECTION SYSTEM

The groundwater collection system will be installed and operated at the Reynolds Can Plant site to mitigate off-site migration of overburden groundwater contamination from the Northern and Southern Operable Unit groundwater plumes that could adversely impact human health or the environment. A discussion of the pertinent operational requirements, as well as the maintenance and monitoring activities for both the start-up and post-start-up period, is presented below.

3.1.1 Collection System Operation

The basis of design for the groundwater collection system is presented in Section 2.1. As discussed, collection of contaminated groundwater in the Northern and Southern Operable Unit groundwater plumes will be effected through continuous pumping of 13 groundwater extraction wells (i.e., nine wells in the Northern Operable Unit groundwater plume and four wells in the Southern Operable Unit groundwater plume). The collection wells will be comprised of 6.5-inch diameter FRP screens and Schedule 80 PVC riser pipes fitted with submersible pumps. The well pumping rate will be maintained through a programmable logic controller (PLC) that will regulate flows from the pumping wells by automatically opening or closing discharge valves based on relative groundwater elevations, which will be measured via pressure transducers at the bottom of each recovery well. It is estimated that the high-end of the full-scale groundwater production capacity for the collection and treatment system will be approximately 220 gpm.

3.1.2 Collection System Maintenance

Due to the potential for chemical incrustation and biofouling of the groundwater collection wells and pump screens, the contractor will have to perform regular, routine maintenance of the collection system. Accordingly, the submersible pumps should be pulled and inspected regularly, and the screens should be cleaned with a scale removal solution suitable to the pump construction materials. In addition, it may also be necessary to periodically remove the pump and inject a non-sulfamic, non-hydrochloric granular or bullet acid coupled with a catalyst into the well to break down any inorganic precipitants and slime bacteria incrustations on the well screen. The acid cleaning may be supplemented with physical agitation (such as wire brushing) to break down the scale. After routine maintenance is performed at an individual pumping well, low pH water resulting from acid cleaning of the well screen may need to be neutralized prior to resuming normal groundwater treatment operations. Although the effects of dilution from the other pumping wells and the potential presence of lime scale in the treatment system may prevent pH excursions in the effluent water after the cleaned well is brought back on line, hose bibs and valves will be installed on the well influent lines to allow for temporary routing of low pH water to the floor sump in the treatment building, where it can be neutralized with sodium hydroxide or lime prior to being transferred back to the treatment system. If these periodic measures are unsuccessful in maintaining the wells, a contingency plan will have to be available to keep the wells operational.

3.1.3 Collection System Monitoring

Monitoring of the groundwater collection system will be conducted throughout its operational life to assist in the ongoing evaluation of the effectiveness of the system in remediating the contaminated groundwater in the Northern and Southern Operable Unit groundwater plumes.

Monitoring wells on site and on the City of Fulton property are currently sampled on an alternating monthly schedule. The data from the analysis of the samples collected at these wells are used to assess the water quality immediately upgradient of and within the cone of influence of municipal wells M-2/K-2 and K-1. The sampling at these wells, and at the municipal wells and WTF influent and effluent, comprise the City of Fulton WTF Early-Warning Network. A listing of the Early-Warning Network monitoring well sampling locations and the alternating monthly sampling schedule is presented in Table 3-1.

Sampling at monitoring well locations to supplement the Early-Warning Network sampling locations will be performed as one of the contractor's responsibilities. The supplemental monitoring well sampling locations are listed on Table 3-1. The data collected at these wells, in addition to the Early-Warning Network monitoring well data, will be used to assess the effectiveness of the Reynolds Can Plant groundwater collection system. Water level monitoring at the monitoring and recovery wells, and recovery well flow rate monitoring, will also generate data to aid in this assessment. The Early-Warning Network monitoring wells and supplemental monitoring wells are shown on Figure 3-1.

The sampling and water level monitoring tasks will be performed on a relatively frequent basis during the start-up period. The frequency of the data collection tasks will decrease after the start-up period has been concluded. The monitoring well locations where water level data will be collected are listed in Table 3-2. The frequency of water level monitoring, the frequency of sampling (during the start-up and post start-up periods), and the analytical methods to be used are listed on Table 3-3.

MILLER BREWING COMPANY
TABLE 3-1
REYNOLDS CAN PLANT SITE REMEDIATION

SUPPLEMENTAL MONITORING WELL SAMPLING LOCATIONS
DURING START-UP PERIOD

EVEN MONTHS	ODD MONTHS
MW-36S*	MW-32D
MW-37I*	MW-33S
MW-38Sx	MW-35D
MW-47S*	MW-62I*
MW-48S*	MW-63I*

CITY OF FULTON WTF EARLY WARNING MONITORING WELL SAMPLING LOCATIONS

EVEN MONTHS	ODD MONTHS
MW-8I	MW-10I
MW-8D	MW-13D
MW-9D	MW-14D
MW-17D	MW-15D
MW-31I	MW-21S
MW-38S	MW-25S
MW-51I	MW-25D
MW-51D	MW-46S
MW-53I	MW-46D
MW-54I	MW-49I
MW-56D	MW-49D
MW-60D	MW-50I
MW-61D	MW-60I

NOTE: Unless Otherwise designated, the samples will be analyzed for USEPA Mehtods 601/602 plus xylenes.

x – USEPA Method 8015 only
* – USEPA Method 8015 plus Methods 601/602

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MILLER BREWING COMPANY
TABLE 3-2
WATER LEVEL MONITORING POINTS AROUND EACH RECOVERY WELL

RW-1	RW-2	RW-3	RW-4	RW-5	RW-6 (582) & RW-7 (59S)
MW-7D	MW-11S	MW-1S	MW-38S	MW-6S	MW-36S
MW-8I	MW-11D	MW-1D	MW-38D	MW-6I	MW-36D
MW-8D	MW-12S	MW-2S	MW-62S	MW-6D	MW-47S
MW-16D	MW-12D	MW-2D	MW-63S		MW-48S
MW-17D	MW-16D	MW-3S			
MW-19D		MW-3D			
MW-20D		MW-4S			
MW-41S		MW-4D			
MW-61D					
RW-8	**RW-9**	**RW-10**	**RW-11**	**RW-12**	**RW-13**
MW-37S	MW-12S	MW-21S	T-2	MW-14S	MW-15D
MW-37I	MW-12D	MW-21D	T-3	MW-14D	MW-51I
MW-37D	MW-53S	MW-33S	MW-34D	MW-18S	MW-51D
MW-39S	MW-53I			MW-55D	MW-56D
MW-39I	MW-53D				
MW-40S					
MW-54S					
MW-54I					
MW-54D					

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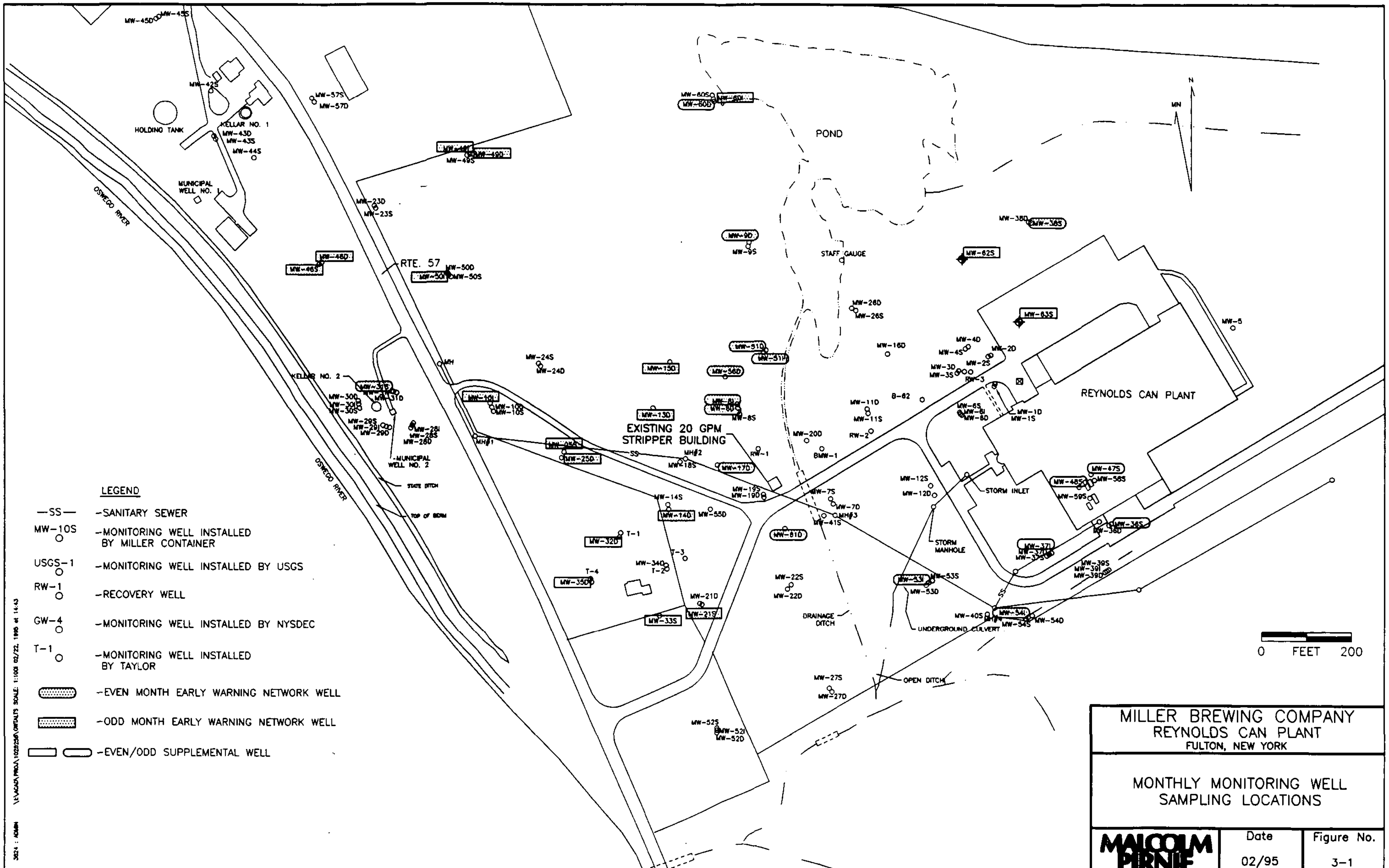
TABLE 3-3 MILLER BREWING COMPANY REYNOLDS CAN PLANT SITE REMEDIATION *GROUNDWATER COLLECTION SYSTEM MONITORING PROGRAM*		
Location	**Parameter(s)**	**Frequency**
Start-Up Period:		
Water Quality Monitoring		
Early Warning Monitoring Wells	601/602, plus xylenes	Alternating Monthly (See Table 3-1)
Municipal Wells (K-1, K-2, & M-2)	502.2	Monthly
Supplemental Monitoring Wells	601/602, plus xylenes (all wells) 8015 (select wells)	Alternating Monthly (See Table 3-1)
Recovery Wells (Except RW-6, RW-7, RW-8, & RW-9)	601/602, plus xylenes	Bi-weekly
RW-6 & RW-7	601/602, plus xylenes 8015, Oil & Grease	Bi-weekly
RW-8 & RW-9	601/602, plus xylenes 8015	Bi-weekly
WTF Influent & Effluent	502.2	Monthly
Water Level Monitoring		
Recovery Wells	Water Level Elevation	Weekly
Monitoring Wells (See Table 3-2)	Water Level Elevation	Weekly

TABLE 3-3 (Continued)		
Location	**Parameter(s)**	**Frequency**
Start-Up Period (continued):		
Production Rate Monitoring		
Recovery Wells	Flow Rate (GPM)	Daily
Post Start-Up Period:		
Water Quality Monitoring		
Supplemental Monitoring Wells	601/602, plus xylenes, 8015 (select wells), Eh, pH, Temperature, Turbidity, Specific Conductiivity	Semi-annually
Recovery Wells (Except RW-6, RW-7, RW-8 & RW-9)	601/602, plus xylenes, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
RW-6 & RW-7	601/602, plus xylenes, 8015, Eh, pH, Temperature, Turbidity, Specific Conductivity, Oil & Grease	Semi-annually
RW-8 & RW-9	601/602, plus xylenes, 8015, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
Early Warning Monitoring Wells	601/602, plus xylenes	Alternating Monthly (See Table 3-1)
Municipal Wells (K-1, K-2 & M-2)	502.2	Monthly
WTF Influent & Effluent	502.2	Monthly

TABLE 3-3 (Continued)		
Location	**Parameter(s)**	**Frequency**
Post Start-up Period (continued):		
Water Level Monitoring		
Early Warning Monitoring Wells	Water Level Elevation	Monthly
Supplemental Monitoring Wells	Water Level Elevation	Monthly
Recovery Wells	Water Level Elevation	Monthly
Production Rate Monitoring		
Recovery Wells	Flow Rate (GPM)	Daily



MILLER BREWING COMPANY
REYNOLDS CAN PLANT
FULTON, NEW YORK

MONTHLY MONITORING WELL
SAMPLING LOCATIONS

MALCOLM PIRNIE

Date	Figure No.
02/95	3-1

The samples will be analyzed for the parameters on the USEPA Methods 601/602 lists, plus xylenes. In addition, select monitoring wells (designated on Table 3-1) will be analyzed for the compounds on the Method 8015 list. Data on the occurrence of the ketone compounds will be provided by the Method 8015 analysis.

Groundwater production rates will be obtained by metering the discharge lines from each pumping well using separate flow meters for each influent line. The daily production rates will be continuously recorded on a remote read out.

During the start-up period, groundwater elevations will be recorded on a weekly basis at each of the monitoring well locations identified on Table 3-2 (at a minimum) to monitor the transient effects of pumping and to verify the effectiveness of the collection system in meeting the performance goals for drawdown and plume containment. These data will also be used to prepare equipotential maps as part of a remedial performance report, which the contractor will be required to provide to Miller Brewing Company prior to acceptance of the system. After the start-up period, the water levels will be collected on a semi-annual basis, and the data will be summarized as part of an annual monitoring report to NYSDEC (see Section 3.5). It may be necessary to collect water level data at additional monitoring well locations to prepare comprehensive equipotential maps. It will be the contractor's responsibility to collect enough water level data to adequately prepare the maps. Additional water level collection points will be specified by the contractor in its bid.

Groundwater sampling during the start-up period will involve the collection of the combined treatment process influent as described in Section 3.2.3, below. Additionally, a minimum of one round of samples will also be collected from the discrete pumping wells every two weeks during the start-up period by filling laboratory-supplied bottles from sample taps located on the pumping well influent lines. These samples will be analyzed for the USEPA Methods 601/602 volatile organics, plus xylenes, to determine the relative contribution of each pumping well to the overall VOC loading observed at the head of the plant. Samples from recovery wells RW-6, RW-7, RW-8, and RW-9 will also be analyzed for the Method 8015 parameters to provide data on ketones.

After the start-up period, the groundwater monitoring program will be modified to include semi-annual sampling of the designated supplemental monitoring wells on Table 3-1, semi-annual sampling at each recovery well, and alternating monthly sampling of Early-Warning Network monitoring wells. Municipal well sampling and City of Fulton WTF influent and effluent sampling will be performed monthly for the parameters included on the USEPA Method 502.2 list. The required City of Fulton WTF and municipal well sampling and analysis are more fully explained in Section 3.4. In addition to the analyses specified above, samples from the designated monitoring wells and each recovery wells will also be collected and analyzed for the following parameters on a semi-annual basis:

- field parameters including pH, Eh, temperature, specific conductivity, and turbidity
- oil and grease (RW-6 and RW-7 only)

Field parameters will be measured by sampling personnel using portable field instruments. The remaining parameters will be analyzed by an independent, NYSDOH Environmental Laboratory Approval Program (ELAP) certified analytical laboratory. Sampling from the recovery wells will be performed by filling laboratory-supplied bottles at the influent line sample taps. Groundwater sampling at the monitoring well locations will be performed by the contractor using dedicated bailers.

Quality control (QC) samples that will be analyzed during each semi-annual groundwater monitoring event to support the acceptability of the data will include:

- Trip blank
- Method Blank
- Blind Duplicate

One (1) trip blank and blind duplicate will be analyzed for volatile organics each day that groundwater samples for VOCs are collected in the field.

In addition, either Miller will retain a third party contractor, under a separate contract, to split samples on an annual basis and submit these samples to an alternate, approved laboratory for the same analyses listed above; or, Miller will utilize the results of NYSDEC split sampling and analyses for quality assurance/quality control measures.

3.2 GROUNDWATER TREATMENT SYSTEM

The groundwater treatment system will be installed and operated at the Reynolds Can Plant site to reduce contaminant loadings in the collected groundwater to concentrations suitable for discharge to the Oswego River. A discussion of the pertinent operational requirements as well as the maintenance and monitoring activities for the system is presented below.

3.2.1 Treatment System Operation

The groundwater treatment process is illustrated conceptually on Figure 2-9. The basis for design of the system is presented in Section 2.2. The treatment system will remain in operation until the groundwater quality in the delineated plume areas improves to below the SPDES discharge limits; or, until the trend in water quality improvement becomes asymptotic. In the latter case, it may be necessary to assess the implementation of additional treatment alternatives if the contaminant concentrations are at unacceptable levels when the recovery curve levels out. The groundwater treatment system will be designed for continuous flow operation with minimal operator attention; however, the necessary controls will be in place to allow for batch operation if production rates decline with time to the extent that batch operation becomes more efficient than continuous operation. To maintain continuous flow operation, adjustments to the process feed pump and air stripper pump discharge valve positions will need to be made to match the flow rate entering the feed tank. These adjustments will be made automatically by throttling the discharge control valve based on the level in the corresponding feed tank and air stripper sump.

Operator attention to the treatment system will be more intensive during initial system start-up, when flow from the pumping wells may fluctuate. However, even after the start-up period has ended, it is anticipated that, at a minimum, part-time staffing of the treatment system will be required to check on the system status and to perform routine monitoring and recording of the operating variables. It will be the contractor's responsibility to specify the number of manhours that will be required to operate this treatment facility as well as the City of Fulton Water Treatment Facility (WTF).

3.2.2 Treatment System Maintenance

The treatment system components will need routine maintenance to ensure effective operation. The contractor will be required to follow manufacturer and supplier maintenance manuals and instructions for all equipment. The supply of sequestering agent will be stored in containers placed within the building and will be replaced as necessary by the contractor. Filter bags will be replaced when the pressure drop through the filter vessel reaches 10 psi. Spent filter bags and oil collected from the oil/water separator will be disposed as hazardous waste in accordance with the appropriate regulatory requirements. Waste disposal will be coordinated by the contractor, who will sign manifests as an agent of Miller Brewing

Company. Periodic cleaning of the air stripper will also be required to remove scale and sediment build-up. Backwashing of the liquid-phase activated carbon beds will be required on an as-needed basis when pressure build-up begins to inhibit pumping, or when the pressure nears the acceptable limits for the carbon vessel. Liquid and vapor-phase activated carbon will be replaced based on contaminant mass loadings, as recommended by the supplier or as modified experimentally on-site to prevent breakthrough. Pumps and blowers will receive routine maintenance (e.g., stator and seal replacement) on a yearly basis or as recommended by the manufacturer.

3.2.3 Treatment System Monitoring

Monitoring of the groundwater treatment system will be conducted to demonstrate compliance with regulatory requirements associated with operation of the system (i.e., air emissions limits and equivalent SPDES surface water discharge limits), to assist in the ongoing evaluation of the effectiveness of the system in remediating the collected groundwater, and to refine the degree and frequency of routine maintenance needs. A log of the pertinent groundwater treatment system operating variables (e.g., flow rates, air stripper exhaust pressure, upstream and downstream pressures in the filter vessels and activated carbon beds, and other general observations) will be established by the contractor during the start-up period and will be maintained on file in the treatment building throughout the remediation period. System operating variables will be recorded by the contractor on a daily basis.

Treatment system performance will be demonstrated through the collection and analysis of samples at various locations within the process train. A summary of the treatment system monitoring program is presented in Table 3-4. During the first two weeks of start-up, daily samples for Method 601/602 and 8015 VOCs, plus xylenes, will be collected at the head of the system (i.e., at the feed tank) to provide information on the treatment system influent quality and to allow for a comparison with the system effluent. Samples for iron, manganese, and hardness will also be collected during this period or until such time as the sequestering agent dosage is optimized. After the initial two weeks, the influent sample collection frequency may be reduced to weekly events until the start-up demonstration period is complete. VOC samples will also be collected from the stripper

TABLE 3-4

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

TREATMENT SYSTEM MONITORING PROGRAM

Monitoring Activity	Location	Parameter	Frequency
Startup:			
Groundwater Sampling	Head of the system	Iron Manganese Hardness 601/602/8015 VOCs, plus xylenes Oil and grease	Until sequestering agent Dosage is optimized Daily* Daily*
	Stripper Effluent	601/602/8015 VOCs, plus xylenes	Daily*
	Final process effluent	601/602/8015 VOCs, plus xylenes Oil & grease Iron Copper Zinc pH Temperature Turbidity Eh Specific Conductivity	Daily*
Air Monitoring**	Process exhaust	Per equivalent emissions permit	Per equivalent emissions permit

TABLE 3-4 (Continued)

Monitoring Activity	Location	Parameter	Frequency
Post Start-Up:			
Groundwater Sampling	Head of treatment process	601/602/8015 VOCs, plus xylenes	Monthly
	Stripper effluent	601/602/8015 VOCs, plus xylenes	Monthly
	Final process effluent	601/602/8015 VOCs, plus xylenes Oil and grease Iron Zinc pH Temperature Turbidity Eh Specific Conductivity	Monthly

* Reduce to weekly after first 2 weeks.
** If air monitoring of process exhaust is required.

effluent and the final process effluent line during the start-up period at the same frequency as the process influent sampling to monitor the VOC removal efficiency of the air stripper and liquid-phase activated carbon, respectively.

Air monitoring of the process exhaust will occur during the start-up period, if required to demonstrate compliance with the emissions permit. Alternatively, NYSDEC may allow the contractor to demonstrate conformance with the emissions permit through comparison of VOC loadings to the stripper (i.e., influent minus effluent water concentrations x flow) with the mass of VOCs on the vapor-phase activated carbon (determined through analysis of a carbon sample).

Samples from the oil/water separator effluent will also be collected and analyzed for oil and grease during the start-up period, as listed on Table 3-4.

Following the start-up period, monthly sampling of the treatment system effluent will be performed to demonstrate compliance with the equivalent SPDES discharge permit. Monthly sampling for VOCs at the head of the treatment process and after the air stripper will also be conducted to provide an ongoing evaluation of the effectiveness of the system. After the start-up period, conformance with the air emissions permit will be demonstrated through the collection of air emission samples as required by the equivalent permit. A mass balance calculation, using the stripper influent concentrations minus the effluent concentrations, will be used to estimate the VOC loading to the vapor-phase GAC. An estimate of the life of the vapor-phase GAC will be made based on the loading calculations. At 80 percent of the estimated carbon life, monthly samples of the vapor-phase GAC effluent will be collected until breakthrough occurs. When the primary GAC unit is exhausted, the secondary vapor-phase carbon unit will be utilized and the primary GAC will be replaced.

After the start-up period, the monthly water samples collected from the stripper effluent and final process effluent will be used to determine when the liquid-phase GAC is nearing exhaustion (based on loading calculations). At 80 percent of the estimated exhaustion date, monthly water samples will be collected from between the primary and secondary liquid-phase GAC units to determine when exhaustion occurs. When exhaustion occurs, the switch to the back-up liquid-phase GAC train will occur. If the influent GAC concentrations (stripper effluent) are below the SPDES discharge limits for three consecutive months, the use of the liquid-phase GAC will be discontinued.

All samples collected across the treatment system will be collected as single grab samples from a sample port on the appropriate process line or tank. Sampling will be conducted in a manner such that the collected samples will be representative of normal treatment process operation. All samples will be analyzed by a New York State Department of Health ELAP-certified laboratory. Table 3-5 identifies the parameters, methods, method references, detection limits, holding times, preservatives, and container specifications for analysis of the treatment system samples. Measurements of pH, Eh, specific conductivity, temperature, and turbidity will be performed by the contractor using field instruments.

3.3 SOIL VAPOR EXTRACTION SYSTEM

The soil vapor extraction (SVE) system will be installed and operated at the Reynolds Can Plant site to remediate overburden soils beneath the southern portion of the Can Plant building (i.e., the Southern Operable Unit soils) to below the soil cleanup goals. A description of the operation, maintenance, and monitoring requirements for the SVE system is presented below.

3.3.1 SVE System Operation

The SVE system will be designed to operate on a continuous basis with the goal of remediating the Southern Operable Unit soils within one year. Pumping wells RW-6 and RW-7 will be dual purpose wells, serving as both vacuum extraction and groundwater recovery wells. Withdrawn air will be pulled through an air/water knock-out tank followed by vapor-phase activated carbon prior to venting through the treatment system stack. Piezometers located within the contaminated soils will be used to monitor the area of horizontal and vertical influence of the SVE system.

3.3.2 SVE System Maintenance

SVE system maintenance will generally consist of periodic replacement and/or regeneration of the vapor-phase carbon, and routine maintenance of the air/water separator discharge pump and the blower in accordance with the manufacturer's recommendations. Periodic cleaning of the air/water separator tank, particularly the entrainment separator, may also be necessary to remove scale build-up. At a minimum, the exit piping from the air/water separator tank should be disconnected and the entrainment separator should be

TABLE 3-5

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

ANALYTICAL METHODS AND PROTOCOLS
FOR TREATMENT AND COLLECTION SYSTEM GROUNDWATER SAMPLING

Parameter	Method	Method Reference	Holding Time	Preservation	Container
Volatile Organic Compounds Xylenes	601/602	(1)	14 days	4 drops concentrated HCL, Cool at 4°C	2-40 ml glass vials w/teflon lined septa
Iron Manganese Copper Zinc	200.7 200.7 200.7 200.7	(1) (1) (1) (1)	180 days 180 days 180 days 180 days	HNO_3 to pH <2 HNO_3 to pH <2 HNO_3 to pH <2 HNO_3 to pH <2	1-1 liter polyethylene bottle
Hardness Oil and grease	130.1 413.1	(1)	6 months 28 days	H_2SO_4 to pH <2 H_2SO_4 to pH <2 @ 4°C	1-500 ml polyethylene bottle 1-1 liter glass bottle
pH, Temp, Turbidity, Eh, specific Conductivity	Field	NA	(2)	None	1-500 ml polyethylene bottle

Notes/References:

(1) 40 CFR Part 136; Chemical Analysis of Water and Wastewater, EPA 600/4-49-020, Rev. March 93.

(2) Conduct test immediately following collection of samples.

examined on a monthly basis. Vacuum and sample ports should be routinely checked to make sure they are free of dirt and/or scale, and cleaned or replaced as necessary. Any vacuum leaks in exposed portions of the system will be repaired as soon as they are detected.

3.3.3 SVE System Monitoring

Monitoring of the SVE system will be conducted to assist in evaluating the effectiveness of the system in remediating the Southern Operable Unit soils, and to demonstrate conformance with air emissions limits. A log of the pertinent SVE system operating variables, including air flow rates from each wellhead, the applied vacuum at each wellhead and piezometer, and the vacuum and flow rate across the blower will be established by the contractor during the start-up period and will be maintained on file in the treatment building throughout the operating life of the SVE system. The operating variables will be recorded by the contractor on a daily basis and whenever samples are collected. A summary of the SVE system monitoring program is presented in Table 3-6.

During the first week of SVE system start-up, the contractor will be required to have a portable gas chromatograph on-site to allow for immediate analysis of air sample results. Individual vapor samples will be collected from the well heads at RW-6 and RW-7 and analyzed for USEPA Methods 601/602/8015 VOCs, plus xylenes, at a minimum of once per day during the first week of start-up, or after the applied vacuum is adjusted, whichever is more frequent. The degree of vacuum will be adjusted during start-up by regulating the bleed valve until the SVE system is optimized (i.e., the point at which maximum VOC removals and maximum vacuum at the well heads is achieved at the lowest vacuum applied at the blower). Samples at the head of the carbon vessel(s) and downstream of each carbon vessel will also be collected and analyzed for Method 601/602/8015 VOCs, plus xylenes, concurrent with the wellhead samples. Samples for on-site GC analysis will be collected with an air-tight syringe. After the first week of start-up, air samples will be collected from each wellhead and before and after the carbon units and analyzed for the same VOCs included above on a weekly basis for the remainder of the start-up period. These samples will be extracted from the sample ports using tedlar bags and will be collected in duplicate. One sample will be transmitted to an off-site New York State Department of Health ELAP-certified laboratory and analyzed for the aforementioned VOC analyses in accordance with USEPA Method TO-14.

TABLE 3-6

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

SVE SYSTEM MONITORING PROGRAM

Monitoring Activity	Location	Parameter	Frequency
Startup:			
Air Sampling and Analysis with On-Site GC	RW-6 and RW-7 well heads	See Note 1	Daily for first week
	Before each carbon vessel	See Note 1	Daily for first week
	After each carbon vessel	See Note 1	Daily for first week
Air Sampling with Tedlar Bags	RW-6 and RW-7 well heads	See Note 1	Weekly
	Before each carbon vessel	See Note 1	Weekly
	After each carbon vessel	See Note 1	Weekly
Post Start-Up:			
Air Sampling with Tedlar Bags	RW-6 and RW-7 well heads	See Note 1	Monthly
	Before each carbon vessel	See Note 1	Monthly
	After each carbon vessel	See Note 1	Monthly
Activated Carbon Sampling	Each carbon vessel	See Note 1	Prior to regeneration

Note 1 - Method 601/602/8015 VOCs, plus xylenes.

After the start-up period, tedlar bag samples will be collected from the wellheads and upstream and downstream of each carbon vessel on a monthly basis and analyzed for the Method 601/602/8015 VOCs, plus xylenes, in accordance with USEPA method TO-14. This will provide an indication of the degree to which the soils have been remediated, as well as a means for monitoring carbon breakthrough. SVE system operating variables will be recorded on a daily basis.

Prior to regeneration of the SVE system activated carbon, a sample of the spent carbon will be collected and analyzed for VOCs in accordance with USEPA methods 601, 602, and 8015. These results will be multiplied by the weight of the carbon in the sampled vessel and an exhaustion factor to provide an indication of the mass of VOCs removed from the Southern Operable Unit soils. Remediation of the soils will be evaluated after one year, or when VOC concentrations recovered at the wellheads become asymptotic. In this regard, the contractor will evaluate the effectiveness of the SVE system by comparing the initial VOC masses presented in Table 2-8 to the estimated VOC removals determined through carbon sample analysis, and/or the product of the soil gas concentrations and flows recorded throughout the SVE system operation. The need for collection and analysis of soil samples beneath the building floor to verify the effectiveness of the remediation will be determined by Miller Brewing Company and NYSDEC after these data have been reviewed, and will consider factors such as the area of influence reached by the vacuum (as indicated by piezometer monitoring) and the overall VOC content (if any) remaining in the soil gas at the wellheads. If a soil boring program is required, it will be performed as part of the Contractor's responsibility. Alternatively, if after the first year of operation, VOCs continue to be present in the wellheads at significant concentrations, operation of the SVE system may be continued, and/or the need for additional SVE wells will be assessed.

3.4 CITY OF FULTON WATER TREATMENT FACILITY

Miller Brewing Company will include operation, maintenance, and monitoring (OM&M) of the City of Fulton WTF in the contract for the design/build/operate of the Reynolds Can Plant site remediation system. The City of Fulton WTF OM&M requirements are included in the WTF OM&M Plan (revised June 1994). Information that is included in the OM&M Plan and that is relevant to this Basis of Design Report, is summarized in this section and in Section 4.0 of this report. The information includes a listing of Miller's operational and maintenance responsibilities which will be passed on to the contractor, the required monitoring activities, and emergency/contingency plans (Section 4.0).

3.4.1 WTF Operational and Maintenance Responsibilities

The City of Fulton is required to operate the WTF on a daily basis, to perform regular maintenance of equipment, to clean the tower, and to perform building upkeep. Generally, Miller is responsible to pay for the additional costs associated with the operation and maintenance of the facility and to perform the following operations and maintenance activities:

- order and supply air stripper cleaning chemicals,
- disposal and replacement of carbon filter media from the GAC vessels,
- repairs to the treatment system components which cannot be performed by the City's staff,
- modifications to the treatment system which are required as a result of the implementation of the Emergency/Contingency Plan.

Miller will require that the design/build contractor perform these duties on its behalf, and serve as the contact for the City of Fulton in the event of operational or maintenance-related problems at the WTF.

3.4.2 WTF Monitoring Responsibilities

The WTF is designed to treat a select list of volatile organic compounds occurring at or below a predetermined influent level to below 0.5 $\mu g/l$ concentration prior to discharging to the municipal water system. In addition to the water quality requirements, the air quality must comply with the Air Pollution Control Permit. Sampling and analyses are required on a routine basis to ensure protection of the municipal water supply and air quality. Water quality monitoring is performed monthly at the municipal wells, WTF, and the Early-Warning Network monitoring well locations.

The frequency of testing and analytical methods to be used at the WTF during finished water operations are summarized below. The frequency of testing at the Early-Warning Network wells is covered in Section 3.1.3. If finished water operations are interrupted, a demonstration period may be required to establish the water quality before finished water operations can reoccur. During the demonstration period, the water will be discharged to the Oswego River. The following analytical schedule will be utilized during the demonstration period.

Period	Testing Frequency	Samples Taken	Analysis Methods
Days 1-3: Intermittent Operation	Days 1 & 3	K-1, K-2 & M-2 Influent to Tower Effluent from Tower	USEPA Method 502.2 on all samples USEPA Method 9132 for Coliform Bacteria on Tower Effluent Only.
Days 4-7: Continuous Operations	Days 4 & 6	K-1, K-2 & M-2 Influent to Tower Effluent from Tower	USEPA Method 502.2 on all samples USEPA Method 9132 for Coliform Bacteria on Tower Effluent Only.

All samples taken during the demonstration period are to be analyzed within 24 hours.

The following analytical schedule shall be undertaken during finished water operations.

Testing Frequency	Samples Taken	Analysis Methods	Comments
Monthly	K-1, K-2, M-2, Influent to Tower, Effluent from Tower	USEPA Method 502.2 on all samples. USEPA Method 9132 for Coliform Bacteria on Tower Effluent Only.	All samples are taken from inside the Fulton Municipal Water Treatment Facility.

All samples taken during finished water operations are to be analyzed and reported within seven days.

Minor repairs which do not affect the operation of the WTF and require less than a seven day interruption will not require a demonstration period before the system can go back to finished water operations.

Analytical sampling of exhaust air is performed for two reasons: verification of exhaust air meeting the NYSDEC Air Pollution Control Permit, and to determine when carbon within the operating GAC vessel has become exhausted.

The following air sampling shall be conducted, in accordance with the Air Pollution Control Permit.

Period	Testing Frequency	Analysis Methods	Comments
During a Demonstration Period: Days 4-7	Day 5	NYSDOH Method 311-2	Sample is to be analyzed for tetrachloroethylene, 1,1-dichloroethane, 1,1-dichloroethylene, 1,1,1-trichloroethane, and trichloroethylene concentrations.
During Normal Operations:	Annually - until VOCs are detected	NYSDOH Method 311-2	Samples will be collected annually using Method 311-2 until GAC loading is estimated to be 80% of the total carbon saturation rate, based on mass balance calculations. Should compounds be detected at levels below the discharge limit, before the 80% saturation rate is reached, EPA Method 18 may be used to confirm the identity and levels of the compounds.
Months following estimate 80% total saturation rate:	Monthly - until GAC breakthrough	NYSDOH Method 311-2 or USEPA Method 18	Samples will be taken monthly until GAC breakthrough occurs and the GAC unit is taken off line.

3.5 DATA REPORTING

As discussed in Section 3.1, a performance report will be prepared by the contractor after the start-up period to document achievement of the performance goals specified in the contract documents. The performance report will present the results of the monitoring and testing identified in Sections 3.1 through 3.3, and will supplement as-built submittals required by the contract documents. Additionally, the performance report will:

- discuss any limitations of the soil vapor extraction and groundwater collection and treatment systems.
- identify any modifications that were made to the systems from the original design.
- summarize key operation, maintenance, and monitoring requirements, including the estimated carbon regeneration schedule for the SVE and groundwater treatment systems, and sequestering agent consumption.

Acceptance of the remedial measures will require review and approval of the performance report by Miller Brewing Company.

During and after the start-up period, the contractor will be required to prepare and submit letter reports of the treatment system effluent sampling results, which may include the Discharge Monitoring Report (DMR), to the NYSDEC Division of Water comparing the data to the required discharge permit limits. The frequency of reporting will be specified in the equivalent SPDES permit; however, it is anticipated that monthly reports will be required. In addition, an annual report will be prepared and submitted to the NYSDEC Division of Hazardous Waste Remediation summarizing the semi-annual groundwater sample results and all field measurements. The annual report will discuss groundwater quality at the site as it compares to both the Class "GA" Groundwater Quality Standards published in the most recent version of 6 NYCRR Parts 701-703 and to the background water quality. A discussion of the effectiveness and integrity of the remedial measures, including a summary of the efficiency of the groundwater treatment system and the SVE system, should be presented in the Annual Report.

3.6 HAZARDOUS WASTE RESIDUALS

Groundwater treatment operations will generate hazardous waste residuals as a result of the separation processes incorporated in the treatment system and regular maintenance operations. These will include:

- silts/sludges from settling tanks and filters
- pre-filtration system components
- oil/sludge from the oil/water separator
- disposable personal protective equipment such as gloves, tyvek, etc.
- drill cuttings from piezometers inside the Reynold's building

These wastes will be generated at the site and stored in 55-gallon drums inside the treatment building prior to the results of sampling/analysis and off-site disposal at a hazardous waste treatment, storage or disposal facility (TSDF). It is anticipated that the combined weight of the waste produced from these sources will be between 100 and 1000 kilograms per month, and that no more than 1000 kg of these wastes will be stored on-site at any time. Accordingly, the contractor will be required to comply with the applicable State and Federal regulations concerning permitting, accumulation, recordkeeping and reporting for small quantity generators (SQGs). In general, the New York State requirements for this category are more stringent than the Federal requirements, therefore the New York State regulations are referenced in this Section. A summary of the pertinent New York State requirements for Category 3 SQGs are presented below.

It should be noted that although the groundwater treatment process itself would technically be considered a TSDF under the RCRA regulations as it treats groundwater containing hazardous waste, the specific RCRA requirements for TSDFs such as a formal employee training program and a written contingency plan are not considered applicable since the treatment operations are part of a remediation effort that will be performed under a New York State Department of Environmental Conservation consent order thereby exempting this process (treatment) from the RCRA requirements.

3.6.1 Permitting

6 NYCRR Part 372.2(a)(3) requires procurement of an EPA identification number for the groundwater treatment facility. An EPA identification number for the site, and in particular, the site where the facility will be located, has been procured. The existing ID number will be referenced on all manifests and documentation relative to the hazardous wastes generated at the site.

3.6.2 Accumulation and Storage

The contractor will accumulate and store the hazardous wastes generated from the treatment process within the confines of the treatment building, which is designed to provide adequate secondary containment in the event of a leak or tank/drum rupture. Additionally, the contractor will be required to comply with the applicable sections of 6 NYCRR Parts 372 and 373, which identify specific labelling and storage requirements for the hazardous waste containers, as well as the minimum preparedness and prevention measures that must be in-place to address contingency situations relative to the hazardous waste. Labelling and storage requirements include:

- The date at which accumulation begins will be clearly marked and visible for inspection on the drum/container.
- The wastes may not be stored for greater than 180 days and cannot exceed 1,000 kg (total) at any one time.
- Each drum/container will be clearly marked with the words "hazardous waste" and a description of the contents.
- The drums/containers will be in good condition, free from corrosion and leaks, and must not be handled in a manner that could cause a rupture or leak. The drums/containers must be inspected weekly for corrosion or leakage.
- The drums/containers will be constructed of materials compatible with their content.
- The drums/containers will be covered except when filling.
- Continuously fed drums/containers must be equipped with the means to shut-off the waste inflow.
- The storage area must be inspected at least weekly to detect leaks and ensure conformance with the storage requirements.

- Ignitable and reactive wastes must be at least 15 meters from the property line and the generator must take precautions to prevent accidental ignition/reaction.

- Incompatible wastes must be stored in a manner that prevents intermingling to preclude: generation of extreme heat, fire or explosion; production of uncontrolled toxic mists, dusts or gases; production of flammable gases that could result in explosion; damage to the structural integrity of the container/drum; and any other threat to human health or the environment. Therefore, storage of incompatible wastes in the same container or storage of a hazardous waste in an unwashed vessel previously containing an incompatible waste is prohibited. Incompatible wastes must be separated by dikes, berms, walls or other devices.

Contingency requirements for the storage facility (i.e., the treatment building) include:

- The facility must be maintained and operated to minimize the possibility of fire, explosion or unplanned release of hazardous waste or hazardous waste constituents to the air, soil, or surface water.

- The facility must be equipped with an internal communication or alarm system capable of providing emergency instruction to facility personnel. Persons involved in hazardous waste operations must have immediate access to such devices.

- The facility must be equipped with a device, such as a telephone or 2-way radio, capable of summoning emergency assistance from local authorities.

- At all times there must be at least one employee on-site or on call with the responsibility for coordinating emergency measures.

- The name and number of the emergency coordinator, the location of fire extinguishers, and the telephone number of the fire department (unless the facility has a direct alarm) must be posted next to the telephone.

- The facility must be equipped with portable fire extinguishers and/or fire control equipment, as well as water at adequate volume and pressure to supply water hose streams or foam producing equipment or automatic sprinklers.

- Alarm systems, communications systems and fire-fighting equipment must be periodically tested and maintained (6 NYCRR Part 373-3.3(d))

- The required aisle space must be available (e.g., to allow for firefighting)

- The facility operator must make a good faith effort to notify local authorities of the information pertinent to potential emergencies, including: the function and layout of the facility; an agreement designating a primary emergency authority where duplicate services may be provided; arrangements with government emergency response teams, contractors and equipment suppliers; and notification to local hospitals of the properties of the hazardous waste and the types of injuries or illnesses that may arise from exposure. Where local authorities decline to enter into such arrangements, the owner or operator must document this refusal in the operating record.

3.6.3 Recordkeeping and Reporting

The contractor will be responsible for recordkeeping and reporting requirements relative to the treatment facility, including manifesting and labelling waste shipments and preparation of annual generators reports. The annual generators reports (6 NYCRR Part 372.2 (c)(2)) present an inventory of the types and quantities of hazardous wastes released from the facility and are required by March 1st of the following calendar year. Waste manifests must also be completed for each shipment of hazardous waste sent off-site, and the appropriate copies must be distributed. Signed copies must be retained at the facility for a minimum of three years after shipment. Prior to shipment, the contractor will need to obtain a waste profile for each waste type. This involves analysis of the waste for the suspected contaminants by the TSDF, who will then issue a profile number to the generator for future reference. Each container/drum will be labelled in accordance with U.S. Department of Transportation (USDOT) and NYSDEC requirements and so certified on the manifest form.

The contractor will be responsible for preparing/signing annual generators reports and waste manifests as an agent of Miller Brewing Company.

4.0 CONTINGENCY MEASURES

4.1 GROUNDWATER COLLECTION SYSTEM

The operational goal of the groundwater collection system is to put into place a system that will ensure continued protection of the City of Fulton municipal supply wells. Based on groundwater modeling results, it has been determined that at a minimum the continuous operation of 13 recovery wells at the Reynolds Can Plant site will contain and capture the identified groundwater plumes and result in the collection of contaminated groundwater for treatment. The collection system will be operated until, to the extent practicable, there has been an attainment of SCGs for groundwater quality in the delineated plume areas. The quality of groundwater that enters the influence of the operating municipal wells feeding the City of Fulton WTF from the direction of the site is monitored through the collection of groundwater samples at a list of monitoring wells known as the "Early-Warning Network". This list of monitoring wells that comprise the Early-Warning Network was originally set forth in the Emergency/Contingency Plan for the City of Fulton WTF (Appendix G of the City of Fulton Operation, Maintenance, and Monitoring Plan). The list of Early-Warning Network wells has been increased since the Emergency/Contingency Plan was issued as a result of the installation of additional monitoring wells at the Can Plant site. The expanded Early-Warning Network monitoring wells and the monitoring wells that will be sampled to supplement the Early-Warning Network wells are listed on Table 3-3. It will be the contractor's responsibility to sample the supplemental and Early-Warning Network monitoring wells as part of this system's OM&M plan.

Although the operation of the 13 recovery wells is anticipated to result in the creation of cones of influence that effectively capture the plume areas, it is possible that the 13 recovery wells will not adequately cover the required areas. The operation of the groundwater collection system with respect to the creation of adequate cones of influence will be determined by the contractor through the performance of pumping tests and the collection of water level data. Water quality samples will also be collected at the monitoring well locations listed on Table 3-1 to verify the adequacy of the groundwater collection system.

In the event that water level or water quality data indicate that the groundwater collection system is not performing up to specified performance criteria, a contingency plan will need to be available for implementation. The contractor will be required to develop this contingency plan. A summary of the minimum required components of the groundwater collection system contingency plan is included below.

- During the development of the groundwater collection system contingency plan, the City of Fulton WTF Emergency/Contingency Plan should be consulted to ensure that the plans are coordinated. For example, the groundwater collection system contingency plan should include a provision requiring notification of the Miller Brewing Company, the City of Fulton, NYSDOH, and NYSDEC if water quality analytical results indicate that a primary list contaminant is detected at a monitoring well located downgradient of the lead recovery wells at a level exceeding the influent design level for the City of Fulton WTF. The lead recovery wells are defined as: RW-8 and RW-9 in the Southern Operable Unit groundwater plume and RW-1, RW-10, RW-11, RW-12, and RW-13 in the Northern Operable Unit groundwater plume. The notification should also occur if a secondary list contaminant is detected at one of the monitoring wells beyond a lead recovery well, or if a previously undetected contaminant is found at the monitoring wells.
- A procedure should be included in the plan to confirm the presence of new VOCs, or VOCs detected at unusually high concentrations. The confirmation procedure should include laboratory verification first, followed by the collection of additional samples if the laboratory confirms the analytical results. Additional sampling locations may also be warranted based on the groundwater analytical results.
- A trending increase in VOC concentration at a monitoring well should be reported to Miller Brewing Company as the trend develops, and with sufficient lead time to allow implementation of a corrective response. The contractor will be provided the existing data base. It will be the contractor's responsibility to state what will define a trend in its proposal.

- The contingency plan should include a notification procedure in the event that a new contaminant is detected and confirmed in the treatment system influent. In this case, the NYSDEC Division of Water should be notified and the equivalent SPDES permit may need to be modified.
- The water quality data should be plotted on a map of the site semiannually. This process will be used to check the previous delineation of the groundwater plumes at the site. The contingency plan should include a procedure to be followed if the data indicate that the delineation of the groundwater plume(s) should be revised to include new areas of the site that are outside the cone of influence of a recovery well. Water level data collected will be plotted on a map of the site and contoured to show the distribution of the hydraulic head in the shallow and deep zones. These potentiometric surface maps will be used to assess the adequacy of the collection system relative to the delineation of the groundwater plumes.
- The contingency plan should incorporate measures for the installation of additional recovery wells at the site if the collected water level data indicate that the cone of influence at a recovery well, or recovery wells, is not adequate to contain the currently defined or modified groundwater plume areas.
- The contingency plan should specify the process that will be used to obtain Miller and NYSDEC approval if additional monitoring wells are needed at the site.
- The contingency plan will include provision for recovery well redevelopment, if normal cleaning operations specified in the operations, maintenance, and monitoring plan are not adequate to keep the recovery well screens clear.

4.2 GROUNDWATER TREATMENT SYSTEM

The Reynolds Can Plant groundwater treatment system will be designed and constructed for the purpose of reducing contamination in the groundwater collected from the Northern and Southern Operable Unit groundwater plumes to the point that it can be discharged via an underground pipe or open ditch to the Oswego River. Accordingly, the primary performance criterion for the treatment system is conformance with the equivalent SPDES permit discharge limits for the treated effluent. Since the treatment system design will incorporate an air stripper, an equally important performance criterion will be conformance with air emissions limits specified for the GEP Stack exhaust. It will be the responsibility of the contractor to develop a contingency plan that can be implemented in response to groundwater treatment system effluent levels or air discharge levels in exceedance of discharge limits. However, Section 4.2.1 below presents a summary of the minimum contingency procedures to be followed in the event that the treatment system monitoring identified in Section 3.2 indicates that these goals are not achieved.

4.2.1 Treatment System Effluent

The anticipated treatment process discharge limits are identified on Table 2-4. It will be the contractor's responsibility to select and design a system capable of meeting these limits based on the estimated groundwater production rate of 220 gpm and the contaminant concentrations presented in Table 2-2. If the treatment system effluent sample results indicate exceedance of these goals, the contractor will be required to immediately inform Miller Brewing Company, who will make the appropriate notifications to NYSDEC. The contractor should then attempt to determine the source of the exceedance. This will involve:

- checking the operating variables at each treatment unit to determine if the equipment is operating correctly and/or if adjustments are needed.
- examining analytical results for treatment system influent water from the same sample event, and from confirmational sampling events, to determine if influent contaminant loadings have increased beyond the design capacity of the system.
- examining analytical results from the effluent of the appropriate treatment equipment. For example, if the system fails to meet discharge limits for one or more of the strippable VOCs (i.e., non-ketones), the air stripper effluent data should be reviewed to determine if the exceedance is attributable to non-conformance with the minimum treatment requirements across the stripper. Alternatively, if the oil and grease limit is exceeded, the treated effluent from the oil/water separator should be examined.
- determining if the activated carbon is spent. This will be indicated by breakthrough of one or more of the ketones or other contaminants.

If the exceedance is attributable to failure of one or more unit processes, corrective actions will be taken by the contractor immediately. This may involve performing on a more frequent basis, routine maintenance, such as cleaning the equipment to remove scale or sludge build-up, or more intensive efforts such as making process modifications to accommodate changed conditions. In any event, demonstration testing involving a minimum of five consecutive daily effluent samples will be performed after the corrective actions have been completed to verify conformance with the discharge limits. All five samples must meet the required effluent limits for the corrective action to be considered successful.

4.2.2 Stripper Exhaust

The emissions limits for the air stripper will be specified in the equivalent permit to construct/certificate to operate obtained by the contractor from the NYSDEC Division of Air Resources. At a minimum, the contractor will be required to perform some form of demonstration testing at system start-up to verify conformance with the emissions limits. Depending on the permit requirements, this may involve sampling and analysis of the air stream, or a comparative analysis of the loadings to the vapor-phase carbon against the mass of VOCs adsorbed on the vapor-phase carbon. Emissions monitoring will not be required after the start-up period provided that the vapor-phase activated carbon remains in use and is regenerated on a regular basis. However, if monthly monitoring results for the air stripper influent samples indicate an increase in stripper loadings above design conditions, the contractor will undertake following steps:

- The activated carbon supplier will be contacted regarding the increased loadings to the vapor-phase carbon, and will be asked to provide an evaluation of the carbon performance under the new conditions. Specifically, the supplier will need to provide a revised estimate of the VOC breakthrough time, and the impact of the loadings on the ability to meet emissions limits.

- Stripper influent/effluent monitoring frequency will be increased to determine the consistency of the elevated loadings. Based on discussions with the activated carbon supplier, air samples from the treated exhaust will be collected and analyzed for USEPA Method 601/602/8015 VOCs, plus xylenes, near the suspected breakthrough time to verify the continued effectiveness of the carbon and to ensure the adequacy of the regeneration schedule.

- Miller Brewing Company will be immediately notified of the proposed changes.

If emissions loadings exceed the design capacity of the carbon vessel, the contractor will evaluate the increased cost associated with more frequent replacement and/or regeneration against a revised emissions control system, including a larger carbon vessel or additional vessels in series and/or other forms of emissions control. A written summary of the evaluation will be provided to Miller Brewing Company for review and action.

4.3 SOIL VAPOR EXTRACTION SYSTEM

The soil vapor extraction (SVE) system will be constructed and operated for the purpose of remediating contaminated Southern Operable Unit soils beneath the Reynolds Can Plant building to the cleanup goal concentrations calculated under NYSDEC TAGM 4046. Based on estimates prepared by the pilot test firm (Terra-Vac), full-scale remediation of these soils could be completed within 9 months to one year. Therefore, the performance goal for the SVE system is removal of VOC contamination in the unsaturated overburden beneath the Can Plant to the cleanup concentrations within one year. In addition, conformance with air emissions limits for the extracted soil gas will also be required. This section presents a summary of contingency procedures to be followed in the event that SVE system monitoring indicates non-conformance with these criteria.

4.3.1 Southern Operable Unit Soils

The anticipated contaminants and range of concentrations as well as the cleanup goals for the Southern Operable Unit soils are presented in Table 2-7. As indicated in Table 2-7, six compounds have been detected in the Southern Operable Unit soils at concentrations above their respective clean-up goals: cis-1,2-dichloroethylene; methylene chloride; tetrachloroethylene; 1,1,1-trichloroethane; trichloroethylene; and benzene. As discussed in Section 3.3.3, the contractor will demonstrate that the SVE system was effective in meeting the clean-up goals through activated carbon sample analysis and/or VOC monitoring at the wellheads. In the event that the monitoring indicates failure to reduce the in-place mass of the individual contaminants such that the clean-up goals presented in Table 2-7 are achieved, or if the piezometer monitoring shows that the area of influence does not reach the full extent of the contamination as defined in Section 3.3, the following contingency measures will be undertaken:

- the contractor will attempt to operate the SVE system in a cyclic mode (i.e., the system will be activated and deactivated at varying durations until maximum VOC removal rates are obtained) to assess whether further reduction in the in-place contaminant mass can be achieved through this method.
- The contractor will evaluate and implement, if justified, the use of additional vacuum extraction wells to effect better contaminant removal and/or increase the area of influence.
- The contractor will evaluate and implement, if justified, the use of an increased capacity vapor extraction blower to pull a greater vacuum on the wells.

If these or other measures are shown to be ineffective, the contractor will prepare a written explanation as to the deficiency of the SVE operation for Miller Brewing Company and NYSDEC review, including recommendations for an alternate remedial approach.

4.3.2 SVE System Exhaust

If monthly monitoring indicates that the SVE system exhaust concentrations are in excess of permit limits, the SVE system vapor-phase carbon will be regenerated and the monitoring results for the wellheads will be examined. If it is determined that the failure is attributable to a change in the soil vapor quality or quantity from the vacuum extraction wells, the contractor will undertake similar corrective actions as discussed in Section 4.2.2. If emissions loadings exceed the design capacity of the carbon vessel, the contractor will evaluate the increased cost associated with more frequent regeneration/replacement against a revised emissions control system, including a larger carbon vessel, additional vessels in series, and/or other forms of emissions control. Additionally, the contractor will evaluate the effects of decreasing the vacuum on the SVE wells to reduce the VOC loadings to the vapor-phase carbon. This evaluation will compare the costs associated with the increased operating life for the SVE system against the costs for modification/increased regeneration of the vapor-phase activated carbon. A written summary of the evaluation will be provided to Miller Brewing Company for review.

4.4 CITY OF FULTON WATER TREATMENT FACILITY

In the event that the City of Fulton WTF cannot reduce the level of VOCs found in the influent water to below 0.5 $\mu g/l$, the City of Fulton WTF Emergency/Contingency Plan (Appendix G of the WTF OM&M Plan) will be implemented. The Emergency/Contingency Plan (E/C Plan) includes information on responses to various potential occurrences such as:

- Treatment interruptions,
- changes in raw water quality (e.g., at the Early-Warning Network monitoring locations),
- presence of VOCs in the effluent following treatment in excess of 0.5 $\mu g/l$, and
  - changes in air discharge quality.

Reference to the E/C Plan will occur as a result of an observed deviation form standard air quality, water quality, or operational conditions. The appropriate steps to be taken as a result of the observed deviation are included in the E/C Plan. It will be the contractor's responsibility to become thoroughly familiar with the E/C Plan, and, if required, to implement the E/C Plan as Miller's representative. The required notifications in the even of E/C Plan implementation will also be the contractor's responsibility.

5.0 SAFETY AND HEALTH PLAN REQUIREMENTS

Subcontractors shall be solely responsible for the health and safety of their employees and shall comply with all applicable laws and regulations. In accordance with 1910.120, Miller will inform subcontractors of any potential fire, explosion, health, or other safety hazards associated with the hazardous waste operation that have been identified by Miller. All contractors and subcontractors are responsible for: (1) developing their own Site Specific Safety and Health Plan including a written Hazard Communication Program and any other written hazard specific programs required by federal, state, and local laws and regulations; (2) providing their own personal protective equipment; (3) providing documentation that their employees have been health and safety trained in accordance with applicable federal, state, and local laws and regulations; (4) providing evidence of medical surveillance and medical approvals for their employees; and (5) designating their own site safety officer responsible for ensuring that their employees comply with their Site Specific Safety and Health Plan and taking any other additional measures required by their site activities.

The minimum elements that must be addressed in a site safety and health plan developed for hazardous waste operations and emergency response is discussed in 29 CFR 1910.120(i)2. A brief outline of a safety and health plan is also provided below:

- 1.0 Introduction
- 2.0 Key Personnel/Identification of Health and Safety Personnel
- 3.0 Task/Operation Safety and Health Risk Analysis
- 4.0 Personnel Training Requirements
- 5.0 Personal Protective Equipment
- 6.0 Medical Surveillance Requirements
- 7.0 Frequency and Types of Air Monitoring and Personnel Monitoring
- 8.0 Site Control Measures
- 9.0 Decontamination Procedures
- 10.0 Standard Operating Procedures
- 11.0 Emergency Response and Contingency Plans
- 12.0 Hazard Communication Program
- 13.0 Spill Containment Program
- 14.0 Confined Space Entry Procedures

6.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN REQUIREMENTS

6.1 QUALITY ASSURANCE/QUALITY CONTROL PLAN

The following Construction QA/QC Plan requirement outline presents the basic scope of services that will be required of the contractor during the site remediation construction period. The main work involves the oversite, sampling and testing for the installation and/or operation of the groundwater collection/treatment systems, soil vapor extraction system and the treatment facility (building):

- INTRODUCTION
  - General
  - Project Organization And Management
    - Project Director
    - Quality Assurance Manager
    - Operation Manager
    - Sampling and Equipment Coordinator
    - Boring Program Coordinator
    - Data Validation
  - Quality Assurance Project Plan Organization
- QUALITY ASSURANCE OBJECTIVES
  - Introduction
  - Data Quality Requirements
  - Analytical Requirements
    - Ground Water Samples
    - Treatment System Samples including clarifier sludge
    - Soil Samples
    - Parameters and Detection Limits
    - Analytical Report Deliverables
  - Quality Assurance Samples

- SAMPLING PROCEDURES
  - Ground Water Collection System
    - Introduction
    - Representative Sample Collection
    - Water Level Elevations
    - Collection of Ground Water Samples - Equipment
    - Collection of Ground Water Samples - Procedures
      - Purging With a Bailer
      - Purging With a Gas Pressure Displacement System
      - Sampling Monitoring Wells With a Bailer
    - Sampling of Pumping Well Influent Lines
    - Collection of Air Samples from the Vacuum Recovery Wells
  - Treatment System
    - Collection of Influent/Effluent Water Samples - Procedures
    - Collection of Air Samples from Vapor Extraction System
  - Soil/ Process Sludge
    - Introduction
    - Soil Sampling Methods
    - Process Sludge
  - Soil Sampling With a Spade and Scoop
- FIELD MONITORING PROCEDURES
  - Location of Sampling Points
  - Daily Log and Sample Collection Activity Reports
  - Sampling Frequency
  - Parameters and Methods
- SAMPLE INTEGRITY
  - Equipment Cleaning
  - Containers, Preservatives and Holding Times
  - Quality Control Samples
    - Trip Blanks
    - Field Blanks
    - Duplicate and Split Samples
  - Chain-Of-Custody

- FIELD INSTRUMENTATION CALIBRATION AND MAINTENANCE
  - Introduction
  - Portable Field pH Meter
  - Portable Field Conductivity Meter
  - HNU Photoionization Analyzer
- ENVIRONMENTAL REVIEW AND REGULATORY REPORTING
  - Data Review of Samples and Discharge Limits
  - Monthly Data Reports to NYSDEC/Miller
  - Annual OM&M Report to NYSDEC/Miller

7.0 PROJECT SCHEDULE

7.0 FINAL DESIGN AND CONSTRUCTION SCHEDULE

The proposed project schedule is presented and is summarized below:

1.	Miller Brewing Company to Advertize for Bids	05/22/95
2.	Receive Bids for Preparation of Final Design/Build/Operate Documents	06/19/95
3.	Award Contract for Preparation of Final Design/Build/Operate Documents	07/21/95
4.	Conceptual Design/Review Meeting	08/04/95
5.	Contractor to Submit Draft Final Design/Build/Operate Specifications and Construction Documents to Miller	09/01/95
6.	Comments from Miller on Draft Final Design/Build/Operate Specifications and Construction Documents	09/11/95
7.	Submit Draft Final Design/Build/Operate Documents to NYS-DEC for Review and Comments	09/21/95
8.	Receive NYSDEC Comments on Draft Final Design/Build/Operate Documents	10/09/95
9.	Design/Builder to Prepare Final Design/Build/Operate Documents	10/23/95
10.	Construction Commencement of Site Remediation Project	10/23/95
11.	Receive NYSDEC Approval for Substantial Completion and Start-up Operations and Monitoring of All Systems	04/23/96
12.	Final Project Restoration and Close-out Documents	06/24/96
13.	Submit Required Project Certification Report (Post Remedial Operation, Maintenance & Monitoring Plan, As-Built Drawings, Final Engineering Report and Certification) to NYSDEC	07/23/96

APPENDIX A

Standards, Criteria, and Guidelines/ Applicable or Relevant and Appropriate Requirements

Soil Clean-up Levels/ Action Levels

REYNOLDS CAN PLANT SITE
SOUTHERN OPERABLE UNIT SOIL
CONTAMINANT CONCENTRATIONS AND CLEAN-UP LEVELS

COMPOUND	RANGE OF DETECTED CONCENTRATIONS ($\mu g/kg$)	SOIL CLEAN-UP LEVEL (ppb)*	"CONTAINED-IN" ACTION LEVEL ($\mu g/kg$)*
1,1-Dichloroethane	3–180	358	8000000
c-1,2-Dichloroethylene	750	585	800000
Methylene Chloride	8–700	251	93000
Tetrachloroethylene	12–5700	4350**	14000
1,1,1-Trichloroethane	17–7000	1816	7000000
Trichloroethylene	12–12000	1505	64000
Benzene	800	139	24000
Toluene	92–460	3585	20000000
Acetone	22–81	263	8000000
1,1-Dichloroethylene	5	777	12000
Methyl Isobutyl Ketone	14–67	2270	4000000
Methyl Butyl Ketone	8–220	1673	***
Methyl Amyl Ketone	45–2900	***	***
4-Methyl-2-Pentanol	11	***	***
alpha-Pinene	20	***	***
Phenanthrene	39	50,000	***
Hepta Methyl Ketone	810	***	***

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Notes:

* Soil clean-up levels were determined in accordance with the NYSDEC Technical and Administrative Guidance Memorandum on Determination of Clean-Up Levels, dated January 24, 1994, and are based on a soil percent organic carbon content of 2.39%. This value is the average organic content of the soil in the southern operable unit, as determined through soil sampling and analysis.

"Contained-in" action levels are levels which hazardous constituent concentrations in soil containing hazardous constituents from listed hazardous waste identified in 6 NYCRR Part 371 are to be brought down to in order for the soil to be classified as non-hazardous. Source: NYSDEC TAGM, "Contained-In" Criteria for Environmental Media, dated November 30, 1992.

** Limit calculated using partition coefficient (Koc) of 364ml/g, which was obtained from Exhibit A-1 of the USEPA Superfund Public Health Evaluation Manual. Although this manual is recommended in the NYSDEC Guidance Memorandum as the source from which Koc values should be obtained, the value of 364 ml/g differs from the one used by the NYSDEC (277 ml/g) in determining their recommended clean-up objective.

*** No ground water/drinking water standard exists for this compound, thus no soil clean-up level can be calculated and/or no "contained-in" action level has been established.

Ground Water & Surface Water
SCGs/ARARs

REYNOLDS CAN PLANT SITE
GROUND WATER AND SURFACE WATER SCGs/ARARs

Compound	Maximum Ground Water Concentration Detected (µg/l)		Standards, Criteria and Guidelines											
			Drinking Water		Ground Water			Surface Water						
								Class A		Class A, B, C				
	Southern Operable Unit	Northern Operable Unit	USEPA MCL	NYSDEC MCL	NYSDEC GA-S	NYSDEC GA-G	NYSDEC DIS-GA	NYSDEC AWQ-S	NYSDEC AWQ-G	NYSDEC AWQ-S	NYSDEC AWQ-G	USEPA FAC-AT	USEPA FAC-CT
Methylene chloride	2,800	4,200	—	5	5	—	—	—	5	—	—	—	—
1,1-Dichloroethylene	1,100	3,200	7	5	5	—	—	—	0.07	—	—	11,600L	—
1,1-Dichloroethane	3,000	1000	—	5	5	—	—	—	5	—	—	—	—
1,1,1-Trichloroethane	11,000	42,000	200	5	5	—	—	—	5	—	—	—	—
Trichloroethylene	2,000	810	5	5	5	—	10	—	3	—	11	45,000L	21,900L
Tetrachloroethylene	1,200	14,000	5	5	5	—	—	—	0.7	—	1	5,280L	840L
c-1,2-Dichloroethylene	52,000	690	70	5	5	—	—	—	5	—	—	11,600L	—
t-1,2-Dichloroethylene	21	110	100	5	5	—	—	—	5	—	—	11,600L	—
1,2-Dichloroethane	14	13	5	5	5	—	—	0.8	—	—	—	118,000L	20,000L
Carbon tetrachloride	410	—	5	5	5	—	5	—	0.4	—	—	35,200L	—
1,1,2-Trichloroethane	—	30	5	5	5	—	—	0.6	—	—	—	—	9,400L
1,2-Dichloropropane	—	4	5	5	5	—	—	0.5	—	—	—	23,000L	5,700L
Chloroform	—	40	100+	100+	7	—	7	7	—	—	—	28,900L	1,240L
Dibromochloromethane	—	59	100+	100+	—	50	—	—	50	—	—	—	—
Benzene	—	4	5	5	0.7	—	0.7	0.7	—	—	6	5,300L	—
Toluene	110	420	1000	5	5	—	—	—	5	—	—	17,500L	—
Ethylbenzene	150	2.1	700	5	5	—	—	—	5	—	—	32,000L	—
Xylenes, total	200	1500	10,000	5*	5*	—	—	—	5*	—	—	—	—
Acetone	5,600	—	—	50	50	—	—	—	50	—	—	—	—
Methyl isobutyl ketone	2,400	89	—	50	—	—	—	—	—	—	—	—	—
Methyl ethyl ketone	25	—	—	50	—	50	—	—	50	—	—	—	—
Vinyl chloride	5.9	59	2	2	2	—	5.0	—	0.3	—	—	—	—
Dichlorodifluoromethane	—	26	—	5	5	—	—	—	5	—	—	—	—
Bromodichloromethane	—	1	100+	100+	—	50	—	—	50	—	—	—	—

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NOTES:

All concentrations in ug/l.
— = indicates no concentration is available.
+ = Limit for total trihalomethanes
L = Insufficient data to develop criteria. Value presented is the L.O.E.L. – Lowest Observed Effect Level.
* = Value listed applies to each isomer individually.
The basis for the standard or guidance value of Class A waters is for the protection of human health.
The basis for the standard or guidance value for Class A, B, C, and D waters is for protection of aquatic life.
Water classes:
- A – Drinking water source
- A, B, C – Fishing and fish propagation
- D – Fishing and fish survival

References used:
- Drinking Water – 10 NYSCRR Part 5-1.50 through 5-1.55 (NYS Maximum Contaminant Levels in Drinking Water)
  – 40 CFR 141.11 and 40 CFR 141.61 through 141.62 (EPA Maximum Contaminant Levels in Drinking Water)
- Ground Water – 6 NYSCRR Part 703.5 (NYSDEC GA – Standard)
  – 6 NYSCRR Part 703.6 (NYSDEC Ground Water Discharge – GA Standard)
- Surface Water – 6 NYSCRR Part 703.5 (NYSDEC Class C AWQ – Standard)
  – EPA 440/5-86-001 (EPA Quality Criteria for Water 1986)

MCL = Maximum Contaminant Level
GA-S = Class GA Ground Water Standard
GA-G = Class GA Ground Water Guidance Value
DIS-GA = Class GA Ground Water Effluent Standard

AWQ-S = Ambient Water Quality Standard
AWQ-G = Ambient Water Quality Guidance Value
FAC-AT = Fresh Water Acute Criteria – Acute Toxicity
FAC-CT = Fresh Water Acute Criteria – Chronic Toxicity

APPENDIX B

Inorganic Water Quality Data

MILLER SITE GROUND WATER GEOCHEMICAL DATA

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WELL	DATE	TIME	PUMP TYPE	TEMP. (°C)	pH (S.U.)	Eh (mV)	CONDUCTIVITY (µmhos/cm)	TDS (mg/l)	TSS (mg/l)	TOC (mg/l)	TURBIDITY (NTU)	DISSOLVED O_2 (mg/l)	DISSOLVED CO_2 (mg/l)
RW-1	01/20/95	10:40	submersible	11.5	6.87	−1080	990						
		10:41		11.5	6.88	−1084	991						
		10:42		11.5	6.88	−1086	981						
		10:43		11.5	6.88	−1087	1048						
		10:44		11.5	6.89	−1089	1045						
		10:45		11.6	6.89	−1090	1046						
		10:46		11.6	6.90	−1090	1056	1300	9.0	<1	9.5	0.47	35
RW-2	01/20/95	10:58	submersible	13.3	6.89	−1056	1567						
		10:59		13.3	6.85	−1086	1579						
		11:00		13.3	6.80	−1093	1573						
		11:01		13.3	6.80	−1095	1567						
		11:02		13.4	6.80	−1096	1555						
		11:03		13.4	6.80	−1097	1550						
		11:05		13.3	6.80	−1096	1547						
		11:06		13.3	6.80	−1095	1548	1500	9.0	<1	0.75	0.24	45
RW-3	01/20/95	11:19	submersible	12.4	6.69	−1080	727					1.75	60
		11:20		12.3	6.65	−1081	680					1.69	
		11:21		12.2	6.64	−1078	673					1.72	
		11:22		12.2	6.63	−1079	890					1.72	
		11:23		12.1	6.61	−1078	914					2.04	
		11:24		12.1	6.60	−1077	532					2.26	
		11:25		12.1	6.59	−1070	710					2.70	
		11:40		12.1	6.65	−1062	1106					1.34	
		11:41		12.1	6.63	−1058	1105					1.15	
		11:42		12.1	6.62	−1059	1107					1.02	
		11:43		12.1	6.61	−1062	1106					0.93	
		11:44		12.1	6.61	−1059	1106					0.88	
		11:50			6.60	−1056	1103	1000	6.0	<1	3.3	—	
OLD RW-3	01/23/95	11:40	Redi-Flo	11.5	7.31	−65	1813				>100	0.54	
		11:50		12.1	7.25	−200	1834				>100	0.20	55
		12:02		12.0	7.23	−360	1846				>100	0.42	
		12:10		12.1	7.23	−517	1819				>100	0.15	65
		12:25		10.7	7.18	−440	1736				>100	0.11	
		12:40		12.6	7.21	−491	1753				>100	0.08	
		12:46		12.4	7.20	−538	1775	1400		2		0.08	

MILLER SITE GROUND WATER GEOCHEMICAL DATA

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WELL	DATE	TIME	PUMP TYPE	TEMP. (°C)	pH (S.U.)	Eh (mV)	CONDUCTIVITY (μmhos/cm)	TDS (mg/l)	TSS (mg/l)	TOC (mg/l)	TURBIDITY (NTU)	DISSOLVED O_2 (mg/l)	DISSOLVED CO_2 (mg/l)
MILLER INFLUENT	01/20/95	12:00	N.A.	12.5	6.78	–1056	1465					0.71	
		12:01		12.5	6.76	–1059	1482					0.60	
		12:02		12.5	6.76	–1058	1378					0.56	
		12:03		12.5	6.76	–1060	1549					0.52	
		12:04		12.6	6.75	–1058	744 *					0.64	
		12:05		12.5	6.76	–1058	755 *					0.55	
		12:06		12.4	6.76	–1058	763 *					0.42	
		12:07		12.4	6.75	–1060	1478					0.40	
		12:11		12.4	6.75	–1060	1493					0.36	
		12:14		12.4	6.75	–1056	1444					0.38	
		12:15		12.4	6.75	–1056	1439					0.35	
		12:16		12.4	6.75	–1057	1455	1300		<1	2.3	0.34	
MILLER EFFLUENT	01/20/95	13:44	N.A.	11.7	7.88	–1070	1429					9.64	
		13:45		11.7	7.89	–1071	1444					9.61	
		13:46		11.7	7.89	–1067	1454					10.26	
		13:47		11.7	7.89	–1065	1458					10.26	
		13:48		11.7	7.89	–1063	1460					10.35	
		13:49		11.7	7.90	–1062	1459					10.35	
		13:51		11.7	7.89	–1061	1458					10.35	
		13:56		11.7	7.90	–1056	1453					10.34	
		14:02		11.6	7.89	–1052	1446	1200		7			20
WTF INFLUENT	01/20/95	16:40	N.A.	10.4	7.39	–980	443					8.49	
		16:41		10.4	7.27	–986	447				0.6	8.22	
		16:42		10.4	7.24	–987	396				0.6	7.97	
		16:43		10.4	7.19	–990	435				0.6	7.87	20
		16:44		10.4	7.17	–989	431				0.6	7.84	
		16:45		10.4	7.15	–991	437				0.6	7.78	
		16:46		10.4	7.13	–990	439				0.6	7.77	
		16:47		10.4	7.13	–990	436	580		<1	0.6	7.76	
WTF EFFLUENT	01/20/95	16:32	N.A.	10.4	7.91	–799	554				4.0	9.35	
		16:33		10.4	7.88	–954	544				4.0	10.72	
		16:34		10.3	7.85	–969	550				4.0	10.80	
		16:35		10.3	7.83	–972	553				4.0	10.77	
		16:36		10.3	7.83	–975	554	580		<1	4.0	10.74	

MILLER SITE GROUND WATER GEOCHEMICAL DATA

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WELL	DATE	TIME	PUMP TYPE	TEMP. (°C)	pH (S.U.)	Eh (mV)	CONDUCTIVITY (μmhos/cm)	TDS (mg/l)	TSS (mg/l)	TOC (mg/l)	TURBIDITY (NTU)	DISSOLVED O_2 (mg/l)	DISSOLVED CO_2 (mg/l)
MW-3S	01/20/95	15:30	Redi-Flo	9.9	6.74	-1009	1174				>100	7.40	
		15:35		11.0	6.64	-997	455				>100	6.23	
		15:39		11.2	6.63	-988	395				>100	6.00	
		15:49		11.7	6.63	-983	422				>100	5.37	
		16:10		11.3	6.61	-981	1268	1200		6	>100	4.75	
MW-3D	01/20/95	14:30	Redi-Flo	10.5	6.46	-978	1360				>100	4.65	
		14:35		10.8	6.42	-981	963					4.40	
		14:40		11.0	6.42	-984	1162				>100	4.11	
		14:45		11.2	6.41	-988	1164				>100	3.36	
		14:53		11.5	6.41	-991	1072				88	2.82	140
		14:56		11.5	6.41	-1005	867					2.73	
		15:00		11.4	6.41	-1004	864				58	2.56	
		15:07		11.6	6.42	-1018	1289					2.03	125
		15:10		11.7	6.43	-1015	1268	1200		3	43	1.75	
MW-5	01/23/95	11:00	Masterflex	8.2	7.82	-163	175				5	5.31	
		11:05		8.2	7.75	-132	163				5	5.39	10
		11:10		8.2	7.87	-66		360		34	5	5.40	
MW-8S	01/23/95	14:10	Masterflex	6.8	7.73	-402	242				>100	7.92	
		14:15		7.5	7.36	-460	255				>100	7.80	10
		14:25		7.6	7.25	-429	272				>100	7.30	
		14:39		7.6	7.22	-445	303	430		3	>100	7.21	10
MW-8D	01/23/95	14:45	Redi-Flo	9.7	7.12	-500	740				28	0.41	
		14:50		9.8	7.12	-506	743				17	0.29	20
		14:55		9.8	7.12	-482	745				14	0.20	
		15:00		9.9	7.09	-1166	747	710		4	13	0.17	
MW-14D	01/23/95	15:40	Redi-Flo	8.7	7.60	-448	447				14	1.07	15
		15:45		10.0	7.36	-550	454				5.6	0.50	
		15:53		10.2	7.30	-486	454				3.3	0.46	10
		16:00		10.1	7.27	-565	450				3.0	0.42	
		16:05		10.2	7.26	-568	449	520		11	1.9	0.39	15

MILLER SITE GROUND WATER GEOCHEMICAL DATA

F:\PROJ\1028262\MLRLEVEL.WK1

WELL	DATE	TIME	PUMP TYPE	TEMP. (°C)	pH (S.U.)	Eh (mV)	CONDUCTIVITY (μmhos/cm)	TDS (mg/l)	TSS (mg/l)	TOC (mg/l)	TURBIDITY (NTU)	DISSOLVED O_2 (mg/l)	DISSOLVED CO_2 (mg/l)
MW-21S	01/23/95	16:20	Redi-Flo	8.5	7.15	–906	588				41	6.58	
		16:30		10.1	7.02	–1282	609				3.9	5.19	20
		16:37		10.1	6.99	–1211	607				3.0	4.90	
		16:40		10.2	6.98	–1161	609				1.6	4.86	25
		16:47		10.3	6.98	–1109	574	610		<1	1.0	4.81	
MW-37I	01/23/95	17:05		10.5	6.99	–612	613				>100	0.61	
		17:10		11.6	6.92	–380	655				26	0.45	20
		17:17		11.4	6.90	–367	648				13	0.31	
		17:21		11.4	6.89	–354	650				7	0.28	
		17:25		11.5	6.88	–346	650	650		<1	3	0.26	25
MW-37D	01/23/95	17:35		8.6	6.87	–326	1101				>100	4.80	30
		17:42		8.9	6.86	–315	1120					4.48	
		17:48		10.0	6.86	–311	1152				21	4.07	
		17:55		9.5	6.83	–303	1138	1100		<1	20	3.86	30
MW-48S	01/24/95	14:00	Redi-Flo	18.8	6.42	–751	1406				4.9	4.06	
		14:15		19.1	6.30	–988	1570				6.5	2.32	70
		14:21		19.5	6.28	–1007	1543				5.8	1.77	75
		14:31		19.6	6.26	–1015	1477				5.7	1.64	
		14:41		20.0	6.25	–1019	1398				5.0	1.30	
		14:51		19.9	6.24	–1024	1248	1100		9	3.3	1.23	75

* Flow had stopped during these readings due to silt clogging the lines.

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WELL	ALKALINITY (mg/l)	HARDNESS as $CaCO_3$ (mg/l)	CHLORIDE (mg/l)	SULFATE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	SODIUM (mg/l)	POTASSIUM (mg/l)	IRON (mg/l)	MANGANESE (mg/l)
RW-1	260	510	450	41	140	41	180	5.0	0.17	0.065
RW-2	320	680	600	47	170	55	260	4.8	0.22	0.12
RW-3	360	450	240	59	140	37	110	2.0	0.66	0.33
OLD RW-3	470	490	500	18	150	35	300	4.4	10	3.4

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WELL	ALKALINITY (mg/l)	HARDNESS as $CaCO_3$ (mg/l)	CHLORIDE (mg/l)	SULFATE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	SODIUM (mg/l)	POTASSIUM (mg/l)	IRON (mg/l)	MANGANESE (mg/l)
MILLER INFLUENT	300	480	460	58	150	48	200	3.7	0.18	0.15
MILLER EFFLUENT	280	450	450	43	140	42	180	3.0	0.063	0.096
WTF INFLUENT	200	160	110	19	68	19	58	1.8	0.035	0.035
WTF EFFLUENT	240	200	110	20	68	19	58	1.8	<0.02	0.035

WELL	ALKALINITY (mg/l)	HARDNESS as $CaCO_3$ (mg/l)	CHLORIDE (mg/l)	SULFATE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	SODIUM (mg/l)	POTASSIUM (mg/l)	IRON (mg/l)	MANGANESE (mg/l)
MW-3S	470	650	300	22	180	68	83	27	0.12	1.4
MW-3D	480	500	290	70	230	47	86	2.7	0.79	2.0
MW-5	160	120	<1	16	49	10	4.5	2.3	0.033	0.011
MW-8S	280	120	6.4	34	74	15	7.4	3.9	<0.02	0.023
MW-8D	280	430	150	49	100	38	47	5.2	0.2	0.19
MW-14D	210	200	64	22	62	19	34	1.4	0.043	<.01

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WELL	ALKALINITY (mg/l)	HARDNESS as $CaCO_3$ (mg/l)	CHLORIDE (mg/l)	SULFATE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	SODIUM (mg/l)	POTASSIUM (mg/l)	IRON (mg/l)	MANGANESE (mg/l)
MW-21S	290	300	80	31	82	28	52	7.9	0.027	0.011
MW-37I	350	410	51	56	100	20	72	3.3	0.21	0.54
MW-37D	410	720	280	55	160	65	86	7.0	0.46	1.6
MW-48S	410	820	250	93	220	39	70	2.7	3.7	8.5

APPENDIX C

Groundwater Recovery Pump Specification

GROUNDWATER RECOVERY PUMP SPECIFICATION

Type: Submersible

Service: Continuous Operation

Materials of Construction:

A) Impellars and Diffusers - Thermoplastic

B) Bowls - Stainless Steel

C) Pump Casing - Polished Stainless Steel

D) Discharge Head Bearing - Urethane

E) Shaft Sleeve and Coupling - Stainless Steel

F) Check Valve - Bronze

G) Gaskets - Viton or Gasketless

Power Requirements: Single Phase, 230 Volt

Maximum Effective Diameter: 3.75"

APPENDIX D

Weighted Loading Back-Up Data

Appendix D

Miller Brewing Company

Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW-1	FLOW = 12 GPM/219 GPM = 0.055 WEIGHTED				
RW-1	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-7D	1.3	BDL0.5	BDL0.5	2.0	BDL0.5
MW-8I	440	320	57	3700	10
MW-8D	91	160	19	660	12
MW-16D	150	510	BDL50	1600	BDL50
MW-17D	2.0	15	1.2	99	BDL1
MW-19D	1.2	BDL1	BDL1	BDL1	BDL1
MW-20D	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-41S	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
Average	85.7	125.6	9.7	757.6	2.8
Maximum	440	510	57	3700	12.0
Weighted Loading ug/l AVG	4.7	6.9	0.5	41.5	0.2
ug/l MAX	24.1	27.9	3.1	202.7	0.7

RW-2	FLOW = 10 GPM/219 GPM = 0.046 WEIGHTED				
RW-2	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-11S	0.6	BDL0.5	BDL0.5	21	BDL0.5
MW-11D	84	95	76	470	140
MW-12S	0.6	BDL0.5	BDL0.5	2.0	2.0
MW-12D	1.0	1.6	1.4	9.2	BDL1
MW-16D	150	510	BDL50	1600	BDL50
Average	47.2	121.3	15.5	420.4	28.4
Maximum	150	510	76	1600	140
Weighted Loading ug/l AVG	2.2	5.5	0.7	19.2	1.3
ug/l MAX	6.8	23.3	3.5	73.1	6.4

Appendix D
Miller Brewing Company
Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW-3	FLOW = 10 GPM/219 GPM = 0.046 WEIGHTED				
RW-3	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-1S	140	360	100	8100	380
MW-1D	290	130	240	1500	160
MW-2S	240	580	200	2700	16
MW-2D	70	230	150	3300	230
MW-3S	8.2	16	13	130	7.0
MW-3D	4200	3200	1000	42000	810
MW-4S	3.0	BDL0.5	BDL0.5	3.0	21
MW-4D	94	470	190	4300	350
MW-6S	180	300	9.5	1000	19
MW-6I	430	2100	BDL50	3300	80
MW-6D	76	96	86	1300	86
Average	521.0	680.2	180.8	6148.5	196.3
Maximum	4200	3200	1000	42000	810
Weighted Loading ug/l AVG	23.8	31.1	8.3	280.8	9.0
ug/l MAX	191.8	146.1	45.7	1917.8	37.0

RW-4	FLOW = 10 GPM/219 GPM = 0.046 WEIGHTED				
RW-4	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-38S	380	400	300	1600	290
MW-38D	0.9	BDL1	BDL1	BDL1	BDL1
Average	190.5	200.0	150.0	800.0	145.0
Maximum	380	400	300	1600	220
Weighted Loading ug/l AVG	8.7	9.1	6.8	36.5	6.6
ug/l MAX	17.4	18.3	13.7	73.1	10.0

Appendix D
Miller Brewing Company
Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW–5	FLOW = 10 GPM/219 GPM = 0.046 WEIGHTED				
RW–5	METHYLENE CHLORIDE	1,1–DICHLOROETHYLENE	1,1–DICHLOROETHANE	1,1,1–TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW–6S	180	300	9.5	1000	19
MW–6I	430	2100	BDL50	3300	80
MW–6D	76	96	86	1300	86
Average	228.7	832.0	31.8	1866.7	61.7
Maximum	430	2100	86	3300	86
Weighted Loading ug/l AVG	10.4	38.0	1.5	85.2	2.8
ug/l MAX	19.6	95.9	3.9	150.7	3.9

RW–6	FLOW = 20 GPM/219 GPM = 0.091 WEIGHTED				
RW–6	METHYLENE CHLORIDE	1,1–DICHLOROETHYLENE	1,1–DICHLOROETHANE	1,1,1–TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW–47S	2400	760	340	2100	320
MW–48S	800	950	1200	1200	600
MW–58S	2800	290	1600	11000	2000
Average	2000.0	666.7	1046.7	4766.7	973.3
Maximum	2800	760	1600	11000	2000.0
Weighted Loading ug/l AVG	182.6	60.9	95.6	435.3	88.9
ug/l MAX	255.7	69.4	146.1	1004.6	182.6

Appendix D
Miller Brewing Company
Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW–7	FLOW = 20 GPM/219 GPM = 0.091 WEIGHTED				
RW–7	METHYLENE CHLORIDE	1,1–DICHLOROETHYLENE	1,1–DICHLOROETHANE	1,1,1–TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW–36S	690	1000	780	1800	220
MW–36D	0.8	ND	ND	6.5	2.0
MW–48S	800	950	1200	1200	260
MW–59S	650	1100	3000	2000	120
Average	535.2	762.5	1245.0	1251.6	150.5
Maximum	800	1100	3000	2000	260.0
Weighted Loading ug/l AVG	48.9	69.6	113.7	114.3	13.7
ug/l MAX	73.1	100.5	274.0	182.6	23.7

RW–8	FLOW = 20 GPM/219 GPM = 0.091 WEIGHTED				
RW–8	METHYLENE CHLORIDE	1,1–DICHLOROETHYLENE	1,1–DICHLOROETHANE	1,1,1–TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW–37S	70	170	260	190	6.0
MW–37I	400	650	470	2300	300
MW–37D	140	320	220	1400	74
MW–39S	1.0	ND	ND	5.0	ND
MW–39I	1.1	2.3	5.4	6.0	ND
MW–39D	1.0	0.8	0.7	2.3	ND
MW–40S	BDL0.5	BDL0.5	BDL0.5	0.7	BDL0.5
MW–54S	0.7	BDL0.5	ND	ND	ND
MW–54I	0.9	1.6	13	0.52	ND
MW–54D	0.5	0.54	ND	ND	ND
Average	61.5	114.5	96.9	390.5	38.0
Maximum	400	650	470	2300	300.0
Weighted Loading ug/l AVG	5.6	10.5	8.9	35.7	3.5
ug/l MAX	36.5	59.4	42.9	210.0	27.4

Appendix D
Miller Brewing Company
Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW-9	FLOW = 20 GPM/219 GPM = 0.091 WEIGHTED				
RW-9	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-12S	1.0	BDL1	BDL1	7.3	BDL1
MW-12D	1.0	1.6	1.4	9.2	BDL1
MW-37S	70	170	260	190	6.0
MW-37I	400	650	470	2300	300
MW-37D	140	320	220	1400	74
Average	122.4	228.3	190.3	781.3	76.0
Maximum	400	650	470	2300	300.0
Weighted Loading ug/l AVG	11.2	20.9	17.4	71.4	6.9
ug/l MAX	36.5	59.4	42.9	210.0	27.4

RW-10	FLOW = 25 GPM/219 GPM = 0.114 WEIGHTED				
RW-10	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-21S	35	57	2.5	390	1.3
MW-21D	1.9	0.54	BDL0.5	7.2	BDL0.5
MW-22S	1.2	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-22D	1.0	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-33S	5.0	3.3	1.3	77	BDL0.5
Average	8.8	12.2	0.8	94.8	0.3
Maximum	35	57	2.4	390	1.0
Weighted Loading ug/l AVG	1.0	1.4	0.1	10.8	0.0
ug/l MAX	4.0	6.5	0.3	44.5	0.1

Appendix D
Miller Brewing Company
Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW-11	FLOW = 25 GPM/219 GPM = 0.114 WEIGHTED				
RW-11	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-19S	0.9	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-19D	1.2	BDL1	BDL1	BDL1	BDL1
MW-32D	39	88	6.1	410	BDL10
MW-34D	18	27	15	210	BDL5
MW-61D	0.64	BDL0.5	BDL0.5	BDL0.5	BDL0.5
T-1	5.7	35	26	120	BDL1
T-2	1.5	5.5	1.3	100	BDL0.5
Average	9.6	22.2	6.9	120.0	0.0
Maximum	39	88	26	410	0.0
Weighted Loading ug/l AVG	1.1	2.5	0.8	13.7	0.0
ug/l MAX	4.5	10.0	3.0	46.8	0.0

RW-12	FLOW = 25 GPM/219 GPM = 0.114 WEIGHTED				
RW-12	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-14S	1.2	BDL0.5	BDL0.5	6.0	BDL0.5
MW-14D	200	110	5.2	410	1.4
MW-17D	2.0	15	1.2	99	BDL1
MW-18S	0.8	2.0	BDL0.5	40	BDL0.5
MW-32D	39	88	6.1	410	BDL10
MW-55D	4.1	15	2.2	91	BDL0.5
T-1	5.7	35	26	120	BDL1
Average	36.1	37.9	5.8	168.0	0.2
Maximum	200	110	6.1	410	1.2
Weighted Loading ug/l AVG	4.1	4.3	0.7	19.2	0.0
ug/l MAX	22.8	12.6	0.7	46.8	0.1

Appendix D
Miller Brewing Company
Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW-13	FLOW = 12 GPM/219 GPM = 0.055 WEIGHTED				
RW-13	METHYLENE CHLORIDE	1,1-DICHLOROETHYLENE	1,1-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE
	MAX.	MAX.	MAX.	MAX.	MAX.
MW-8I	440	320	57	3700	10
MW-8D	91	160	19	660	12
MW-13D	3.1	9.9	2.5	61	BDL0.5
MW-15D	1.1	0.5	1.0	BDL0.5	BDL0.5
MW-51I	4.8	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-51D	2.9	BDL0.5	BDL0.5	1.4	BDL0.5
MW-56D	17	81	8.3	270	BDL2
Average	80.0	81.6	12.5	670.3	3.1
Maximum	440	320	57	3700	12.0
Weighted Loading ug/l AVG	4.4	4.5	0.7	36.7	0.2
ug/l MAX	24.1	17.5	3.1	202.7	0.7

INFLUENT	**(Sum total of weighted loading, in ug/l and lbs/day, from all RWs)**				
ug/l AVG	308.7	265.2	255.5	1200.3	133.1
ug/l MAX	716.9	646.7	582.9	4365.5	320.1
lbs/day AVG	0.8113	0.6968	0.6715	3.1544	0.3498
lbs/day MAX	1.8841	1.6996	1.5318	11.4726	0.8412

Appendix D

Miller Brewing Company

Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW-1	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-7D	3.0	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-8I	960	6.0	220	BDL50	BDL50	BDL50
MW-8D	270	30	BDL20	BDL20	BDL20	4.0
MW-16D	81	BDL50	BDL50	BDL50	BDL50	BDL50
MW-17D	4.0	BDL1	1.0	BDL1	0.7	BDL1
MW-19D	7.0	1.4	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-20D	BDL0.5	BDL0.5	1.3	BDL0.5	BDL0.5	BDL0.5
MW-41S	BDL0.5	BDL0.5	1.9	2.1	BDL0.5	BDL0.5
Average	165.6	4.7	28.0	0.3	0.1	0.5
Maximum	960	9.9	220	2.1	0.7	4.0
Weighted Loading ug/l AVG	9.1	0.3	1.5	0.0	0.0	0.0
ug/l MAX	52.6	0.5	12.1	0.1	0.0	0.2

RW-2	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-11S	8.0	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-11D	67	69	BDL5	BDL5	41	BDL5
MW-12S	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-12D	BDL1	3.7	0.6	BDL1	BDL1	BDL1
MW-16D	81	BDL50	BDL50	BDL50	BDL50	BDL50
Average	31.2	14.5	0.1	0.0	8.2	0.0
Maximum	67	69	0.6	0	41	0
Weighted Loading ug/l AVG	1.4	0.7	0.0	0.0	0.4	0.0
ug/l MAX	3.1	3.2	0.0	0.0	1.9	0.0

Appendix D
Miller Brewing Company
Maximums and Averages: Contaminant Concentrations Detected July 1986 – December 1994

RW-3	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-1S	2400	660	BDL50	BDL50	BDL50	BDL50
MW-1D	1100	9.2	6.0	BDL5	BDL5	BDL5
MW-2S	1100	270	BDL50	BDL50	BDL50	BDL50
MW-2D	860	110	BDL5	BDL5	280	BDL5
MW-3S	29	7.0	BDL	BDL	BDL	BDL
MW-3D	14000	690	420	BDL	1500	BDL
MW-4S	4.0	BDL0.5	BDL	BDL	BDL	BDL
MW-4D	430	7.3	BDL	BDL	BDL	BDL
MW-6S	580	BDL25	BDL	BDL	BDL	BDL
MW-6I	1500	BDL50	BDL	BDL	84	BDL
MW-6D	1300	120	BDL	BDL	BDL	BDL
Average	2118.5	170.3	38.7	0.0	169.5	0.0
Maximum	14000	690	420	0	1500	0
Weighted Loading ug/l AVG	96.7	7.8	1.8	0.0	7.7	0.0
ug/l MAX	639.3	31.5	19.2	0.0	68.5	0.0

RW-4	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-38S	1600	180	BDL50	BDL50	BDL50	BDL50
MW-38D	BDL1	BDL1	BDL1	BDL1	BDL1	BDL1
Average	800.0	90.0	0.0	0.0	0.0	0.0
Maximum	1600	130	0	0	0	0
Weighted Loading ug/l AVG	36.5	4.1	0.0	0.0	0.0	0.0
ug/l MAX	73.1	5.9	0.0	0.0	0.0	0.0

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RW-5	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-6S	580	BDL25	BDL	BDL	BDL	BDL
MW-6I	1500	BDL50	BDL	BDL	84	BDL
MW-6D	1300	120	BDL	BDL	BDL	BDL
Average	1126.7	40.0	0.0	0.0	28.0	0.0
Maximum	1500	120	0	0	84	0
Weighted Loading ug/l AVG	51.4	1.8	0.0	0.0	1.3	0.0
ug/l MAX	68.5	5.5	0.0	0.0	3.8	0.0

RW-6	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-47S	910	470	ND	ND	13	ND
MW-48S	1100	32000	ND	ND	ND	ND
MW-58S	810	49000	82	ND	ND	ND
Average	940.0	27156.7	27.3	0.0	4.3	0.0
Maximum	910	49000	82	0	13	0
Weighted Loading ug/l AVG	85.8	2480.1	2.5	0.0	0.4	0.0
ug/l MAX	83.1	4474.9	7.5	0.0	1.2	0.0

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RW-7	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-36S	1100	7800	110	150	88	ND
MW-36D	29	1.6	0.7	ND	ND	ND
MW-48S	1100	32000	ND	ND	ND	ND
MW-59S	53	52000	ND	ND	80	ND
Average	570.5	22950.4	27.7	37.5	42.0	0.0
Maximum	1100	52000	110	150	88	0
Weighted Loading ug/l AVG	52.1	2095.9	2.5	3.4	3.8	0.0
ug/l MAX	*100.5*	*4748.9*	*10.0*	*13.7*	*8.0*	*0.0*

RW-8	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-37S	44	1000	ND	ND	ND	ND
MW-37I	1200	4400	83	ND	200	ND
MW-37D	170	740	ND	ND	ND	14
MW-39S	ND	ND	0.6	ND	ND	ND
MW-39I	7.0	5.2	ND	ND	ND	ND
MW-39D	3.6	ND	ND	ND	ND	ND
MW-40S	BDL0.5	BDL0.5	0.5	BDL0.5	BDL0.5	BDL0.5
MW-54S	0.5	ND	1.5	ND	ND	ND
MW-54I	ND	1.9	2.9	ND	ND	ND
MW-54D	ND	ND	1	ND	ND	ND
Average	142.5	614.7	9.0	0.0	20.0	1.4
Maximum	1200	4400	83	0	200	14
Weighted Loading ug/l AVG	13.0	56.1	0.8	0.0	1.8	0.1
ug/l MAX	109.6	401.8	7.6	0.0	18.3	1.3

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RW-9	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-12S	BDL1	BDL1	0.6	BDL1	BDL1	BDL1
MW-12D	BDL1	3.7	0.6	BDL1	BDL1	BDL1
MW-37S	44	1000	ND	ND	ND	ND
MW-37I	1200	4400	83	ND	200	ND
MW-37D	170	740	ND	ND	ND	14
Average	282.8	1228.7	16.8	0.0	40.0	2.8
Maximum	1200	4400	83	0	200	14
Weighted Loading ug/l AVG	25.8	112.2	1.5	0.0	3.7	0.3
ug/l MAX	109.6	401.8	7.6	0.0	18.3	1.3

RW-10	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-21S	59	1.0	BDL5	BDL5	BDL5	BDL5
MW-21D	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-22S	BDL0.5	BDL0.5	1.0	BDL0.5	BDL0.5	BDL0.5
MW-22D	BDL0.5	BDL0.5	0.7	BDL0.5	BDL0.5	BDL0.5
MW-33S	1.3	0.5	15	BDL0.5	BDL0.5	BDL0.5
Average	12.1	0.3	3.3	0.0	0.0	0.0
Maximum	52	1	15	0	0	0
Weighted Loading ug/l AVG	1.4	0.0	0.4	0.0	0.0	0.0
ug/l MAX	5.9	0.1	1.7	0.0	0.0	0.0

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RW-11	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-19S	*BDL0.5*	*BDL0.5*	*BDL0.5*	*BDL0.5*	*BDL0.5*	*BDL0.5*
MW-19D	7.0	1.4	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-32D	16	2.6	BDL10	BDL10	BDL10	6.1
MW-34D	19	BDL5	1.0	BDL5	BDL5	BDL5
MW-61D	110	BDL0.5	0.78	BDL0.5	BDL0.5	BDL0.5
T-1	61	100	BDL1	BDL1	BDL1	BDL1
T-2	3.0	4.0	BDL0.5	BDL0.5	BDL0.5	BDL0.5
Average	30.9	15.4	0.3	0.0	0.0	0.9
Maximum	81	100	1.0	0	0	6.1
Weighted Loading ug/l AVG	3.5	1.8	0.0	0.0	0.0	0.1
ug/l MAX	9.2	11.4	0.1	0.0	0.0	0.7

RW-12	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-14S	2.0	BDL0.5	BDL0.5	BDL0.5	BDL0.5	1.0
MW-14D	81	2.1	90	BDL50	BDL50	4.0
MW-17D	4.0	BDL1	1.0	BDL1	0.7	BDL1
MW-18S	3.0	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-32D	16	2.6	BDL10	BDL10	BDL10	6.1
MW-55D	15	0.88	BDL0.5	BDL0.5	BDL0.5	BDL0.5
T-1	61	100	BDL1	BDL1	BDL1	BDL1
Average	26.0	15.1	13.0	0.0	0.1	1.6
Maximum	81	100	1.0	0	0.7	6.1
Weighted Loading ug/l AVG	3.0	1.7	1.5	0.0	0.0	0.2
ug/l MAX	9.2	11.4	0.1	0.0	0.1	0.7

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RW-13	TETRACHLOROETHYLENE	c-1,2-DICHLOROETHYLENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	1,2-DICHLOROETHANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-8I	960	6.0	220	BDL50	BDL50	BDL50
MW-8D	210	9.9	BDL20	BDL20	BDL20	4.0
MW-13D	37	3.2	BDL0.5	1.0	3.0	3.0
MW-15D	0.6	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-51I	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-51D	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5	BDL0.5
MW-56D	84	10	3.1	BDL2	BDL2	BDL2
Average	184.5	4.2	31.9	0.1	0.4	1.0
Maximum	960	9.9	220	1	3	4.0
Weighted Loading ug/l AVG	10.1	0.2	1.7	0.0	0.0	0.1
ug/l MAX	52.6	0.5	12.1	0.1	0.2	0.2

INFLUENT						
ug/l AVG	390.0	4762.7	14.3	3.4	19.1	0.7
ug/l MAX	1316.3	10097.5	77.9	13.9	120.2	4.4
lbs/day AVG	1.0248	12.5164	0.0377	0.0091	0.0503	0.0020
lbs/day MAX	3.4591	26.5362	0.2049	0.0364	0.3160	0.0115

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RW-1	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	CHLOROFORM
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-7D	11	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-8I	BDL50	BDL50	BDL50	n/a	n/a	n/a	5.6
MW-8D	110	BDL20	BDL20	n/a	n/a	n/a	7.0
MW-16D	BDL50	BDL50	BDL50	n/a	n/a	n/a	BDL50
MW-17D	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL1
MW-19D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-20D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-41S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
Average	15.1	0.0	0.0	0.0	0.0	0.0	1.6
Maximum	110	0	0	0	0	0	7
Weighted Loading ug/l AVG	0.8	0.0	0.0	0.0	0.0	0.0	0.1
ug/l MAX	6.0	0.0	0.0	0.0	0.0	0.0	0.4

RW-2	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-11S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-11D	BDL5	BDL5	BDL5	n/a	n/a	n/a	5.3
MW-12S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-12D	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL1
MW-16D	BDL50	BDL50	BDL50	n/a	n/a	n/a	BDL50
Average	0.0	0.0	0.0	0.0	0.0	0.0	1.1
Maximum	0	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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RW-3	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-1S	BDL50	BDL50	BDL50	n/a	n/a	n/a	BDL50
MW-1D	6.0	BDL5	59	n/a	n/a	n/a	BDL5
MW-2S	BDL50	BDL50	BDL50	n/a	n/a	n/a	BDL50
MW-2D	BDL5	BDL5	BDL5	n/a	n/a	n/a	BDL5
MW-3S	BDL	BDL	BDL	n/a	n/a	n/a	BDL
MW-3D	BDL	BDL	BDL	n/a	n/a	n/a	BDL
MW-4S	BDL	BDL	BDL	n/a	n/a	n/a	BDL
MW-4D	BDL	BDL	BDL	n/a	n/a	n/a	BDL
MW-6S	4.0	BDL	BDL	n/a	n/a	n/a	BDL
MW-6I	BDL	BDL	BDL	n/a	n/a	n/a	BDL
MW-6D	BDL	BDL	BDL	n/a	n/a	n/a	BDL
Average	0.9	0.0	5.4	0.0	0.0	0.0	0.0
Maximum	6.0	0	59	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.2	0.0	0.0	0.0	0.0
ug/l MAX	0.3	0.0	2.7	0.0	0.0	0.0	0.0

RW-4	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-38S	BDL50	BDL50	BDL50	n/a	n/a	n/a	40
MW-38D	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL1
Average	0.0	0.0	0.0	0.0	0.0	0.0	20.0
Maximum	0	0	0	0	0	0	40
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0	0.9
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0	1.8

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RW–5	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-6S	4.0	BDL	BDL	n/a	n/a	n/a	BDL
MW-6I	BDL	BDL	BDL	n/a	n/a	n/a	BDL
MW-6D	BDL	BDL	BDL	n/a	n/a	n/a	BDL
Average	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	4.0	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.1	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.2	0.0	0.0	0.0	0.0	0.0	0.0

RW–6	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-47S	ND	ND	ND	ND	ND	ND	ND
MW-48S	ND	ND	ND	430	ND	ND	ND
MW-58S	ND	ND	ND	ND	ND	ND	ND
Average	0.0	0.0	0.0	143.3	0.0	0.0	0.0
Maximum	0	0	0	430	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	13.1	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	39.3	0.0	0.0	0.0

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RW-7	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-36S	ND	ND	ND	630	2400	25	ND
MW-36D	ND	ND	ND	ND	ND	ND	ND
MW-48S	ND	ND	ND	430	ND	ND	ND
MW-59S	ND	410	ND	5600	ND	ND	ND
Average	0.0	102.5	0.0	1665.0	600.0	6.3	0.0
Maximum	0	410	0	5600	2400	25	0
Weighted Loading ug/l AVG	0.0	9.4	0.0	152.1	54.8	0.6	0.0
ug/l MAX	0.0	37.4	0.0	511.4	219.2	2.3	0.0

RW-8	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-37S	21	ND	ND	n/a	n/a	n/a	ND
MW-37I	ND	ND	ND	n/a	n/a	n/a	ND
MW-37D	ND	ND	ND	n/a	n/a	n/a	ND
MW-39S	ND	ND	ND	n/a	n/a	n/a	ND
MW-39I	ND	ND	ND	n/a	n/a	n/a	ND
MW-39D	ND	ND	ND	n/a	n/a	n/a	ND
MW-40S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-54S	ND	ND	ND	n/a	n/a	n/a	ND
MW-54I	0.7	ND	ND	n/a	n/a	n/a	ND
MW-54D	ND	ND	ND	n/a	n/a	n/a	ND
Average	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	21	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.2	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	1.9	0.0	0.0	0.0	0.0	0.0	0.0

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RW-9	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-12S	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL1
MW-12D	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL1
MW-37S	21	ND	ND	n/a	n/a	n/a	ND
MW-37I	ND	ND	ND	n/a	n/a	n/a	ND
MW-37D	ND	ND	ND	n/a	n/a	n/a	ND
Average	4.2	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	21	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.4	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	1.9	0.0	0.0	0.0	0.0	0.0	0.0

RW-10	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-21S	BDL5	BDL5	BDL5	n/a	n/a	n/a	2.6
MW-21D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-22S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-22D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-33S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
Average	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Maximum	0	0	0	0	0	0	2.6
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.3

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RW-11	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-19S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-19D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-32D	13	BDL10	BDL10	n/a	n/a	n/a	BDL10
MW-34D	BDL5	BDL5	BDL5	n/a	n/a	n/a	BDL5
MW-61D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	n/a
T-1	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL0.5
T-2	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
Average	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	13	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.2	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	1.5	0.0	0.0	0.0	0.0	0.0	0.0

RW-12	t-1,2-DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-14S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-14D	BDL50	BDL50	BDL50	n/a	n/a	n/a	BDL50
MW-17D	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL1
MW-18S	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW-32D	13	BDL10	BDL10	n/a	n/a	n/a	BDL10
MW-55D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
T-1	BDL1	BDL1	BDL1	n/a	n/a	n/a	BDL0.5
Average	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	13	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.2	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	1.5	0.0	0.0	0.0	0.0	0.0	0.0

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Miller Brewing Company
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RW–13	t–1,2–DICHLOROETHYLENE	CARBON TETRACHLORIDE	DIBROMOCHLOROMETHANE	ACETONE	MIBK	MEK	Chloroform
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–8I	BDL50	BDL50	BDL50	n/a	n/a	n/a	5.6
MW–8D	110	BDL20	BDL20	n/a	n/a	n/a	7.0
MW–13D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW–15D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW–51I	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW–51D	BDL0.5	BDL0.5	BDL0.5	n/a	n/a	n/a	BDL0.5
MW–56D	BDL2	BDL2	BDL2	n/a	n/a	n/a	2.7
Average	15.7	0.0	0.0	0.0	0.0	0.0	2.2
Maximum	110	0	0	0	0	0	7
Weighted Loading ug/l AVG	0.9	0.0	0.0	0.0	0.0	0.0	0.1
ug/l MAX	6.0	0.0	0.0	0.0	0.0	0.0	0.4

INFLUENT							
ug/l AVG	2.8	9.4	0.2	165.1	54.8	0.6	1.2
ug/l MAX	19.3	37.4	2.7	550.7	219.2	2.3	2.9
lbs/day AVG	0.0074	0.0246	0.0006	0.4340	0.1440	0.0015	0.0032
lbs/day MAX	0.0508	0.0984	0.0071	1.4472	0.5760	0.0060	0.0076

NOTES: All concentrations in
ND indicates that the
BDL Indicates that tl
n/a indicates that the

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RW-1	VINYL CHLORIDE	DICHLORODIFLUOROMETHANE	1,1,2-TRICHLOROETHANE	BENZENE	BROMODICHLOROMETHANE	1,2-DICHLOROPROPANE
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-7D	BDL0.5	26	BDL	BDL	BDL	BDL
MW-8I	BDL50	BDL	BDL	BDL	BDL	BDL
MW-8D	BDL20	BDL	BDL	BDL	BDL	BDL
MW-16D	BDL50	BDL	BDL	BDL	BDL	BDL
MW-17D	BDL1	BDL	BDL	BDL	BDL	BDL
MW-19D	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW-20D	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW-41S	BDL0.5	BDL	BDL	BDL	BDL	BDL
Average	0.0	3.3	0.0	0.0	0.0	0.0
Maximum	0	26	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.2	0.0	0.0	0.0	0.0
ug/l MAX	0.0	1.4	0.0	0.0	0.0	0.0

RW-2	Vinyl Chloride	Dichlorodifluoromethane	1,1,2-Trichloroethane	Benzene	Bromodichoromethane	1,2-Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-11S	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW-11D	BDL5	BDL	BDL	BDL	BDL	BDL
MW-12S	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW-12D	BDL1	BDL	BDL	BDL	BDL	BDL
MW-16D	BDL50	BDL	BDL	BDL	BDL	BDL
Average	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0

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RW–3	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–1S	BDL50	BDL	BDL	BDL	BDL	BDL
MW–1D	59	BDL	18	BDL	BDL	BDL
MW–2S	BDL50	BDL	BDL	BDL	BDL	BDL
MW–2D	BDL5	BDL	BDL	4.0	BDL	BDL
MW–3S	BDL	BDL	BDL	BDL	BDL	BDL
MW–3D	BDL	BDL	30	BDL	BDL	BDL
MW–4S	BDL	BDL	BDL	BDL	BDL	BDL
MW–4D	BDL	BDL	BDL	BDL	BDL	BDL
MW–6S	BDL	BDL	BDL	BDL	1.0	4.0
MW–6I	BDL	BDL	BDL	BDL	BDL	BDL
MW–6D	BDL	BDL	BDL	BDL	BDL	BDL
Average	5.4	0.0	4.4	0.4	0.1	0.4
Maximum	59	0	30	4.0	1.0	4.0
Weighted Loading ug/l AVG	0.2	0.0	0.2	0.0	0.0	0.0
ug/l MAX	2.7	0.0	1.4	0.2	0.0	0.2

RW–4	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–38S	BDL50	BDL	BDL	BDL	BDL	BDL
MW–38D	BDL1	BDL	BDL	BDL	BDL	BDL
Average	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0

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RW–5	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–6S	BDL	BDL	BDL	BDL	1.0	4.0
MW–6I	BDL	BDL	BDL	BDL	BDL	BDL
MW–6D	BDL	BDL	BDL	BDL	BDL	BDL
Average	0.0	0.0	0.0	0.0	0.3	1.3
Maximum	0	0	0	0	1.0	4.0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.1
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.2

RW–6	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–47S	ND	ND	ND	ND	ND	ND
MW–48S	ND	ND	ND	ND	ND	ND
MW–58S	ND	ND	ND	ND	ND	ND
Average	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0

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RW-7	Vinyl Chloride	Dichlorodifluoromethane	1,1,2-Trichloroethane	Benzene	Bromodichoromethane	1,2-Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-36S	ND	ND	ND	ND	ND	ND
MW-36D	ND	ND	ND	ND	ND	ND
MW-48S	ND	ND	ND	ND	ND	ND
MW-59S	ND	ND	ND	ND	ND	ND
Average	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0

RW-8	Vinyl Chloride	Dichlorodifluoromethane	1,1,2-Trichloroethane	Benzene	Bromodichoromethane	1,2-Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-37S	56	ND	ND	ND	ND	ND
MW-37I	30	ND	ND	ND	ND	ND
MW-37D	ND	ND	ND	ND	ND	ND
MW-39S	ND	ND	ND	ND	ND	ND
MW-39I	ND	ND	ND	ND	ND	ND
MW-39D	ND	ND	ND	ND	ND	ND
MW-40S	BDL0.5	ND	ND	ND	ND	ND
MW-54S	ND	ND	ND	ND	ND	ND
MW-54I	ND	ND	ND	ND	ND	ND
MW-54D	ND	ND	ND	ND	ND	ND
Average	8.6	0.0	0.0	0.0	0.0	0.0
Maximum	5.9	0	0	0	0	0
Weighted Loading ug/l AVG	0.8	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.5	0.0	0.0	0.0	0.0	0.0

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RW–9	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–12S	BDL1	BDL	BDL	BDL	BDL	BDL
MW–12D	BDL1	BDL	BDL	BDL	BDL	BDL
MW–37S	56	BDL	BDL	BDL	BDL	BDL
MW–37I	30	BDL	BDL	BDL	BDL	BDL
MW–37D	ND	BDL	BDL	BDL	BDL	BDL
Average	17.2	0.0	0.0	0.0	0.0	0.0
Maximum	5.9	0	0	0	0	0
Weighted Loading ug/l AVG	1.6	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.5	0.0	0.0	0.0	0.0	0.0

RW–10	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–21S	BDL5	BDL	BDL	BDL	BDL	BDL
MW–21D	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW–22S	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW–22D	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW–33S	BDL0.5	BDL	BDL	BDL	BDL	BDL
Average	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0

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Miller Brewing Company

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RW–11	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–19S	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW–19D	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW–32D	BDL10	BDL	BDL	BDL	BDL	BDL
MW–34D	BDL5	BDL	BDL	BDL	BDL	BDL
MW–61D	n/a	BDL	BDL	BDL	BDL	BDL
T–1	BDL0.5	BDL	BDL	BDL	BDL	BDL
T–2	BDL0.5	BDL	BDL	BDL	BDL	BDL
Average	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0

RW–12	Vinyl Chloride	Dichlorodifluoromethane	1,1,2–Trichloroethane	Benzene	Bromodichoromethane	1,2–Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW–14S	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW–14D	BDL50	BDL	BDL	BDL	BDL	BDL
MW–17D	BDL1	BDL	BDL	BDL	BDL	BDL
MW–18S	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW–32D	BDL10	BDL	BDL	BDL	BDL	BDL
MW–55D	BDL0.5	BDL	BDL	BDL	BDL	BDL
T–1	BDL0.5	BDL	BDL	BDL	BDL	BDL
Average	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0	0	0	0	0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.0	0.0

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RW-13	Vinyl Chloride	Dichlorodifluoromethane	1,1,2-Trichloroethane	Benzene	Bromodichoromethane	1,2-Dichloropropane
	MAX.	MAX.	MAX.	MAX.	MAX.	MAX.
MW-8I	BDL50	BDL	BDL	BDL	BDL	BDL
MW-8D	BDL20	BDL	BDL	BDL	BDL	BDL
MW-13D	BDL0.5	BDL	BDL	BDL	1.0	BDL
MW-15D	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW-51I	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW-51D	BDL0.5	BDL	BDL	BDL	BDL	BDL
MW-56D	BDL2	BDL	BDL	BDL	BDL	BDL
Average	0.0	0.0	0.0	0.0	0.1	0.0
Maximum	0	0	0	0	1.0	0
Weighted Loading ug/l AVG	0.0	0.0	0.0	0.0	0.0	0.0
ug/l MAX	0.0	0.0	0.0	0.0	0.1	0.0

INFLUENT						
ug/l AVG	2.6	0.2	0.2	0.0	0.0	0.1
ug/l MAX	3.8	1.4	1.4	0.2	0.1	0.4
lbs/day AVG	0.0068	0.0005	0.0005	0.0000	0.0001	0.0002
lbs/day MAX	0.0099	0.0037	0.0036	0.0005	0.0004	0.0010

ug/l unless otherwise noted.
: compound was below the quantitation limit.
ıe compound was below the quantitation limit; the quantitation limit may or may not be specified.
compound was not included in the analyses performed at the well.

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APPENDIX E

Oil Particle Size Analysis

APPENDIX F

Pilot Test Report

TERRA VAC

VACUUM EXTRACTION
PILOT STUDY REPORT
MILLER BREWING COMPANY
CONTAINER DIVISION SITE
FULTON, NEW YORK

Terra Vac Project No. 40-4145

Submitted to:

MILLER BREWING COMPANY
Container Division
P.O. Box 400
Fulton, NY 13069

October 6, 1992

Prepared by:

Terra Vac
P.O. Box 2199
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TERRA VAC

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I. EXECUTIVE SUMMARY

Terra Vac performed a field pilot test of its Vacuum Extraction (VE) process at the Miller Brewing Company, Container Division Site in Fulton, New York ("the site") from July 20, 1992 to July 24, 1992.

The pilot study was performed along the south side of the container plant in the area known as the "southern drum storage area." All work was performed in accordance with Terra Vac's proposal for the pilot test dated June 11, 1992. Modifications to the original proposal were discussed with and approved by Malcolm Pirnie Inc. (MPI), and are documented.

The pilot test was performed to provide information to assess the feasibility of a full-scale vacuum extraction (VE) remedial action for the site. The primary purpose of this pilot test was to acquire data that would allow for subsurface air flow modeling, and subsequent conceptual full-scale system design.

In summary, the test yielded excellent data for determining an effective zone of influence for the VE wells, and a representative soil air permeability value. The pilot test also identified an unforeseen aspect of the site. During the test, approximately 35 gallons of water was extracted from the VE wells and accumulated in the air/water separator tank. This relatively high water production rate hindered the VE system, especially at the higher applied vacuums. Lowering the water table, possibly through the use of Dual Vacuum Extraction (DVE) would be necessary for the full-scale design.

The following conclusions are presented based on the pilot test results:

1. A measurable zone of influence, ranging from 20 to 40 feet was realized for applied vacuums of 2 inches of mercury to 8 inches of mercury, respectively. This observation indicates a very high probability of success for a full-scale VE Remedy with a minimum number of installed VE wells in the southern drum storage area.

2. A representative range of values for soil air permeability for the pilot test area was determined to be 3.70E-8 cm^2 to 1.4E-7 cm^2 or 3.7 Darcys to 14.0 Darcys. These numbers are characteristic of silty sand to clean sand (Freeze and Cherry, 1979), and support the soil characterization noted during the well installation.

3. During the testing period of approximately 24 hours, 0.37 pounds of selected volatile organic compounds (VOCs) were recovered in the vapor phase. Higher VOC recovery rates are expected once water levels are lowered at the site, possibly through the use of DVE.

The results of the pilot test indicate that vacuum extraction, when combined with ground water recovery, would be capable of remediating soils on the site.

II. INTRODUCTION

A field pilot test of the VE process was performed between July 20 and July 24, 1992 at the Miller Brewing Company, Container Division Site located in Fulton, New York. The work was performed by Terra Vac under the supervision of MPI on behalf of Miller Brewing Company, Container Division. The pilot test was performed in the southern drum storage area (refer to figure 1) to acquire data for subsurface air flow modeling, and to assess the feasibility of a subsequent full-scale VE remediation system design.

Objectives:

1. Determine the effective zone of influence for an installed VE well.

2. Determine a representative value for the pilot test area soil air permeability.

3. Quantify extracted vapor concentrations and VOC extraction rates.

4. Evaluate the optimal air flow rate and anticipated well head operating vacuum for the full-scale system.

5. Use the data acquired from objectives 1-4 to model the subsurface air flow, and as a basis for the design of a conceptual full-scale VE remediation system in the southern drum storage area.

III. PROJECT DESCRIPTION AND ACTIVITIES

Well installation

Drilling operations were initiated at the site at 10:20 a.m. on July 21, 1992. Parratt-Wolff, Inc., of East Syracuse, NY was contracted by Terra Vac to perform the drilling and well installation activities. Two VE wells were installed in a single bore hole. Continuous split-spoon sampling was performed by Parratt Wolff, Inc. during the well installation. One of the split spoon samples was sent off-site by MPI for USEPA analysis 8240. A single well log of both VE wells VE01, VE02 is provided as Figure 2. The well installation process was completed at approximately 1:30 P.M. of the same day. No fugitive VOC emissions were detected during the entire well drilling and installation process, according to the on-site Hnu photo ionizing detector used during these activities.

Installation of soil gas monitoring probes/piezometers was initiated at 2:30 P.M. on July 21, 1992. Vapor probes were installed in ten locations, designated P1-P10. The location of the probes is shown on Figure 3.

The soil gas monitoring probes/piezometers were constructed by drilling a series of ½-inch holes into the bottom six inches of 7 and 12 foot lengths of ½-inch diameter black iron pipe to allow for the entry of air and water. The probes were then installed with an electric jackhammer into 1 ½-inch drilled holes in the cement paved area. One shallow (6 feet), and one deep (11 feet) probe was installed in each location except for locations P8 and P10. At these locations, only one shallow probe was installed at a refusal depth of approximately 2 to 3 feet. Refusal may have been caused by a building foundation. In addition, for these shallow probes, the annular space between the probe and the existing pavement was filled with cement grout to ensure their effectiveness.

The installation of the soil gas monitor probes/piezometers was completed at 7:30 p.m. on July 21, 1992.

Pilot Test Operations

The system manifold was constructed on July 22, 1992. Figure 4 shows the vacuum extraction system schematically.

An initial soil gas survey was performed on July 22nd. The purpose of this survey was to provide soil gas concentrations baseline data for comparison with the results of a second soil gas survey to be conducted at the end of the pilot test. The soil gas survey was completed at 5:30 p.m. on July 22, 1992.

The vacuum extraction unit (VEU) was started at 12:10 p.m. on July 23, 1992. The wells VE01 (shallow) and VE02 (deep) were placed on-line at a vacuum of two inches of mercury at 12:40 p.m.

Process Monitoring

The system was monitored by Terra Vac for the duration of the pilot test. System flow measurements and extracted vapor-phase VOC concentration samples were taken at the well heads at each applied vacuum level. Vapor-phase VOC concentration samples were also taken from before the primary carbon, after the secondary carbon, and between the two carbon vessels. All vapor samples were analyzed using an on-site gas chromatograph. A time line for the pilot test is presented as Table 1.

Soil Air Permeability/Zone of Influence Tests

Soil Air permeability tests and zone of influence tests were performed on wells VE01 and VE02. These tests were completed at 5:30 p.m. on July 23, 1992. Subsequently, it was decided to let the system run overnight at a vacuum of four inches of mercury. A site inspection at 9:00 p.m. on June 24, indicated that the system was still operating smoothly.

Soil Air permeability tests and zone of influence tests were again performed on VE wells VE01 and VE02 on July 24, 1992. Tests were performed first with both wells on-line and then with each well on-line individually. These tests were completed at 11:40 a.m. on the same day.

The VE System was then disassembled and loaded for demobilization. At the request of Miller Brewing Company, Container Division, the soil gas monitor probes/piezometers were driven below grade and cemented over. Demobilization of all Terra Vac personnel and equipment occurred at 4:30 p.m. on July 24, 1992.

IV. FINDINGS

Subsurface Conditions:

The soils in the pilot test area can be generally classified as silty sand. This is from direct observation of the drill cuttings and continuous split-spoon sampling performed during the well installation. These observations are documented as part of the well log supplied as Figure 2.

As noted on Figure 2, the soils became moist to wet at a depth of about 10 feet. Upon completion of the well installation, water level measurements showed three feet of water in VE01 (shallow) and no water in VE02 (deep). Water level measurements taken in the existing monitoring wells MW-36S and MW-36D throughout the pilot test showed a constant level approximately seventeen feet below grade.

In addition, the following hydrogeologic information from MPI's on site geologist was made available to Terra Vac and is presented below:

Unconsolidated material from zero to approximately 5 feet below land surface (BLS) consists of a dry, fill-type brownish/grayish/reddish, fine to course sand and gravel unit, with small amounts of silt. A naturally occurring, moist, dark yellowish/reddish/brownish, fine to course sand and gravel unit occurs from 5 to 10 feet BLS. At approximately 10 feet BLS, the soil samples became saturated, indicating perched water. (Nearby monitoring wells MW-36S and MW-36D maintained static water levels of approximately 17 feet BLS throughout the pilot test). A yellowish/brownish silt and very fine sand unit begins at approximately 10 feet BLS. The saturation level at 10 feet BLS decreases and soil samples were described as "moist" from 10.5 feet BLS to the bottom of the boring. At 14.5 feet BLS, the sand content decreased and traces of clay were visible as gray mottling. The boring was terminated at 17.3 feet BLS.

The perched water bearing zone may be the result of the delayed recharge from the permeable fill material into the underlying lower permeability dense silty sand unit.

The soils described above are consistent with soils described during the drilling of the four monitoring wells to the west and southwest of the pilot test area, below the Container Plant. No indication of perched water was noted on the boring logs for these wells. The lower sandy silty and silt unit also correlates with material described from a similar depth at the MW-36D location. The upper unit at MW-36D, however, is described as a dry, very fine sand and silt, with trace to little amounts of gravel and clay.

The sand and silt appears to be consistent across the pilot test area. The occurrence of the upper sand and gravel unit noted at VE-01/02 and at the inside wells, but not at MW-36D, may be a result of disturbance of native soils and various deposits of fill material during construction of the Container Plant. It is presumed that within the area of the pilot test and the proposed full-scale VE system, the gravel content varies widely in the upper 10 feet of unconsolidated material.

Vacuum Extraction Test Results

A total of 0.37 pounds of VOCs were extracted during the 24-hour pilot study. Wells VE01 and VE02 produced approximately equal amounts of VOCs. Terra Vac's analytical data is listed in Tables 2 and 3. A gas chromatography/mass spectrometry (GC/MS) analysis was also performed by Upstate Laboratories, Inc. of East Syracuse, NY., as directed by MPI, which noted the following components in the process stream:

1,1-Dichloroethylene
1,1-Dichloroethane
1,1,1-Trichloroethane
Toluene
Tetrachloroethylene
Ethylbenzene
Xylenes

The specific extracted vapor concentrations of these compounds as determined by Upstate Laboratories Inc., are listed in Table 4. The four most prominent compounds detected were tetrachloroethylene, 1,1,1-trichloroethane, toluene, and xylenes. It should also be noted that concentrations were generally higher in the deep well, VE02, due to the well's low flow rate, which allowed the vapor-phase VOC concentrations to accumulate.

A GC/MS analysis was completed on soil samples taken during the well installation. This analysis detected only two VOCs. These were tetrachloroethylene and a trace of acetone. The specific results from this analysis are provided in Table 5.

Vapor Treatment

All samples taken downstream of the primary granular activated carbon (GAC) unit were non-detect for the targeted VOCs, which were benzene, 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene.

Zone of Influence

Subsurface vacuum influence from well VE-01 was seen at probes P2, P3, P4, P6, P7, P8, P9, and P10. Subsurface vacuum influence from VE-02 was not observed at any of the probes. This data is summarized in Table 6.

Air Permeability

Air permeability data for the pilot test area is shown in Table 7 and ranges from 3.7E-8 cm^2 to 1.4E-7 cm^2 or 3.7 to 14 Darcys. Air permeability calculations were only performed for well VE01 as no detectable zone of influence was ever measured for VE02 for the duration of the pilot test.

V. EVALUATION OF FINDINGS

Subsurface Conditions

Groundwater recovery rates were surprisingly high leading to a low total mass recovery of vapor-phase VOCs. It is possible that this water is from a small, perched source. Upon completion of the well installation, water level measurements showed three feet of water in VE01 (shallow) and no water in VE02 (deep), which also supports the perched water theory.

It has been Terra Vac's experience that when working in the vicinity of concrete pavement, the underlying fill (typically gravel) frequently holds a significant amount of water due to its high porosity. Further support to the perched water theory is that the ground water measurements taken at MW-36S and MW36D throughout the pilot test showed a level approximately seventeen feet, which remained relatively constant for the duration of the pilot test.

The primary factor affecting each well's performance was the water production during the pilot test. As previously stated, approximately 35 gallons of water were collected in the air/water separator during the pilot test. No measurable water was present in VE02 at the completion of the well installation. However, nearly the entire well screen of VE02 was covered during the pilot test operations according to the water level measurements taken before, during, and after the pilot test. This explains the low flow rates (0 scfm to 2 scfm) observed at VE02. Both Terra Vac and independent GC analysis showed VOC contamination in VE02, so the water must be removed to allow remediation of this deep zone.

Although water level measurements taken in VE01 showed similar open screen intervals to those measured for VE02, its shallower depth and higher flow characteristics allowed for this water to be removed. Well VE01 showed a range of flow characteristics from 3 scfm to 13 scfm depending on the applied vacuum level. VE01 produced all of the water for the test as the low flow rate and deeper depth of VE02 did not allow any appreciable amount of water to be carried to the system.

It is evident that the subsurface water present at the site will need to be removed for the full-scale VE treatment. This would result in uncovering more of the contaminated soil (enlarge the vadose zone), and would allow this soil to be influenced by the VE system. Once this water was removed, higher subsurface air flows should also be realized, as predicted by the calculated large zone of influence and high soil air permeability. The end result of dewatering the site would be greater extracted mass flow rates for the VE system, and thus, a more aggressive clean-up timeframe.

Vacuum Extraction Test Results

The total mass of vapor-phase VOCs removed was 0.37 pounds in a 24-hour period according to Terra Vac's GC analysis results. The concentration of VOCs in the extracted vapor stream is used in conjunction with measured air flow rates at each extraction well to obtain the VOC mass extraction rate. Individual well performance data is presented in Tables 2 and 3. This extraction rate was smaller than anticipated, and, as stated above, can probably be attributed to the high water production.

Results from Terra Vac's gas chromatography analysis performed throughout the pilot test are listed in Tables 2 and 3. These results agree with those of Upstate Laboratories, Inc. except in regard to the presence of trichloroethylene. TCE was detected only in Terra Vac's sample from the process streams of VE01 and VE02. It is believed that this is due to the difference in analytical techniques used by Upstate Laboratories Inc. and Terra Vac. Specifically, Upstate Laboratories, Inc. took all of their samples via a vacuum pump while Terra Vac took direct syringe samples from the process lines. This is also believed to be the reason that Terra Vac's analytical data typically showed higher VOC concentrations than Upstate Laboratories, Inc.

Terra Vac classified one compound found in the GC analysis as "Other". Based on Terra Vac's experience, this compound is probably a mixture of dichloroethane and dichloroethylene. This possible identification is based on the observed retention time of the compound during GC analysis. It is included in the reported data because it frequently showed up in large concentrations. For quantitative purposes, a response factor for DCA, DCE was used in determining concentration and mass removal rate data for this "Other" compound. This conclusion is also supported by Upstate Laboratories, Inc. analysis which showed the presence of DCA and DCE. Terra Vac's analytical data shows higher concentrations for DCA and DCE than Upstate Laboratories, Inc. Again, this is probably due to the different sampling techniques used.

Vapor Treatment

GAC proved to be an effective method of VOC vapor treatment during the pilot test.

Zone of Influence

The zone of influence was estimated by using field data collected during the air permeability tests. This data was input to a subsurface vacuum modeling program, which interpolated and gridded a surface based on the input subsurface vacuum data. These calculated data points were converted to x and y components and a vector diagram was developed. Different colors were assigned to incremental ranges of subsurface vacuum levels, which can be correlated to related ranges of subsurface air flow. These ranges were defined as:

High Vacuum - .15-.5 inches of water vacuum
Medium Vacuum - .05-.15 inches of water vacuum
Low Vacuum - .02-.05 inches of water vacuum

The zone of influence for VE-01 was determined to be 20 feet to 40 feet. VE02 showed no effective zone of influence as measured directly in the field.

The calculated effective zone of influence for VE01 is shown in Figures 5 through 9. These diagrams show slightly irregular "zones" of vacuum influence. The observed decline in vacuum, or pressure gradient, as the distance from the VE well increases, is a direct measure of subsurface air flow. Most of this flow originates from the soils closest to the well, as this represents the path of least resistance. This zone is shown in red in the figures. As the distance from the well increases, less and less flow originates until a distance is reached where no subsurface air flow is realized. This is shown in the field by a soil vapor probe showing zero vacuum. (Terra Vac assumes a vacuum level of .01 inches of water vacuum to be our low threshold of detection.)

A few general trends were noticed in the subsurface vacuum data:

- The post-well development data showed better symmetrical coverage, most dramatically in the shallow zone data (Figures 6 and 7). These figures show that the "holes", or small areas without vacuum influence, lessened after the well development period, indicating more complete zones of influence will be developed with time. Comparison of the pre- and post-test soil vapor concentrations, listed in Table 8, shows changes in nearly all of the probes, which further supports the projected development of zones of influence. Changes in soil vapor concentrations at these points indicates that they are being influenced by the applied vacuum at the VE wells. The created subsurface air flow moves contaminants away from or through the monitored locations toward the VE wells. This explains the observed decreases and increases in soil vapor concentrations.

- The presence of some type of subsurface heterogeneity is indicated by the limited vacuum influence detected at probes P1, P2, and P3. These probes are located southwest of the wells VE01 and VE02. A possible explanation for this could be that the two monitoring wells, MW-36S and MW-36D, might have provided a short circuit path for air flow from the surface. Regardless, A VE well in this general vicinity will be needed to effectively remediate this area of the site.

Well VE02 showed no effective zone of influence as measured directly in the field.

Air Permeability

Air permeability data for the pilot test area is shown in Table 6 and ranges from 3.7E-8 cm^2 to 1.4E-7 cm^2 or 3.7 to 14 Darcys. Typical permeabilities for silty sands range from 10^{-10} cm^2 to 10^{-6} cm^2 or .01 Darcy to 100 Darcy (Freeze and Cherry, 1979). Air flow values of 0 scfm (VE02) to 12.5 scfm (VE01) were observed during the test.

The equation used to calculate the air permeability at the site is:

$$K_a = \frac{Q \mu_a \ln (Rw/Ri)}{H \pi Pw (1-(Patm/Pw))^2}$$

K_a = Average horizontal air permeability $[L^2]$

Q = Air flow rate $[L^3/T]$

μ_a = Viscosity of air .00018 g $cm^{-1}s^{-1}$

Pw = Absolute gas pressure in well $[MLT^{-2}]$

Rw = Effective radius of well [L]

Ri = Radial zone of influence of well [L]

H = Thickness of vadose zone [L]

The source of this soil air permeability equation is P. C. Johnson et. al. "Practical Approach to the Design, Operation, and Monitoring of In Situ soil-Venting Systems, Groundwater Monitoring Review, Spring, 1990."

VI. FULL-SCALE SYSTEM CONCEPTUAL DESIGN

Technical Approach and Objectives

Terra Vac has based its technical approach for the conceptual full scale design on information provided by Malcolm Pirnie and results from the pilot test. Eight additional VE wells would be installed in the pilot test area. The four existing monitoring wells located inside the Container Plant Building would be converted to VE wells and would provide adequate coverage for the estimated contaminated area below the plant building. Several soil vapor probes would also be installed to ensure that the entire designated area was influenced by the VE system, and also to monitor the progress of the clean-up effort.

It is assumed that the soils below the container plant building exhibit similar characteristics to those encountered during the pilot test. Analysis of the well and bore hole summary sheets for MW-47S, MW-48S, MW-58, and MW59 support this assumption. Specifically, it is assumed that the unsaturated soils exist to a depth of approximately 22 feet below grade with the possibility of some perched water. It is understood that the soils below the container plant building consist of primarily three lithologic units including a gravelly fill material from 1.0' to 3.5', a natural sand and gravel unit from about 3.5' to about 10.5', and a very fine natural sand unit from about 10.5' to 38.0'. There are also subsurface fuel oil recovery operations taking place in the area, indicating the presence of some fuel oil free product.

A process description of Terra Vac's Dual Vacuum Extraction Process is included in Appendix A as Terra Vac believes it to be the most efficient and cost-effective method of ensuring that the site remains de-watered, and thus allowing the VE system to be operated at its most efficient level.

System Installation

System installation would begin with the mobilization of the VE equipment to the site. This equipment includes:

1. A vacuum extraction unit (VEU) capable of 600 SCFM at 10 inches of mercury vacuum,

2. A 200-gallon air/liquid separator tank with associated level controls,

3. A granular activated carbon (GAC) vapor treatment system and,

4. Associated vacuum extraction equipment, instrumentation, manifolding, and electrical controls.

The VE equipment would be set up and the VE wells installed. Soil screening would be conducted during the well installation. It is proposed to place the VE equipment listed above inside the existing container plant building as noted on Figure 10. This would reduce the effects of the weather on the equipment, thereby minimizing the costs associated with winterizing efforts. The VE system would consist of fourteen vertical wells (including the pilot test wells (VE01 and VE02) installed above the water table. The location of these wells is shown on Figure 3. Eight additional wells would be installed in the pilot test area. These wells would be "nested" (two wells per bore hole: one shallow, one deep), similar to the design of pilot test well VE01 and VE02. The only difference would be that the deep well would be four inches in diameter instead of two inches to allow for dewatering efforts (via submersible pump or ejector) should this become necessary. The four existing monitoring wells located in the plant building (MW47S, MW48S, MW58S, and MW59S) would also be used in the full-scale remediation system. Each new vertical extraction well would contain slotted well screen (.040 slot size), sand filter pack, and a bentonite and grout seal.

The vapor treatment system would consist of two 1000 pound canisters of granulated activated carbon (GAC). The canisters would be placed on the vacuum side of the VEU to minimize the potential for fugitive emissions. All manifold piping would be installed below grade to minimize any impact on the plant's day to day operations.

As was accomplished during the pilot test, the subsurface vacuum monitoring probes/piezometers would be installed via electric impact hammer. This method of installation proved to be very successful during the pilot test. The design of these probes would be identical to those used in the pilot test.

VII. CONCLUSIONS

The following conclusions and recommendations for the effective full-scale VE remediation of the Miller Brewing Company, Container Division Site in Fulton, New York were formulated from the information obtained from the pilot study data:

1. Vacuum Extraction can effectively remediate the soils at this site.

2. A perched water supply exists in the pilot test area probably due to the high permeability of the fill used for the installed pavement. This water must be removed to allow the full-scale VE system to perform effectively.

3. Dual Vacuum Extraction would effectively remediate the soils and the ground water in this area of the site.

4. A representative zone of influence for the shallow VE well (VE01) was 20 feet to 40 feet depending on the applied vacuum.

5. From Terra Vac's past experience with the VOCs present at this site, GAC efficiency is expected to be 10 to 15%.

6. Due to the relatively low concentrations that were measured in the process stream and the moderate flow rates, the apparent choice for vapor treatment for a full-scale system is GAC. GAC performance during the pilot test was excellent. This type of vapor treatment would be the most cost efficient, while providing effective treatment for the extracted VOC-laden air.

7. Due to the presence of some subsurface heterogeneity in the vicinity of soil vapor probes P1 and P2, a VE well cluster located in the general vicinity will be required. The two proposed wells for this area and the additional wells required for the full-scale system are shown on Figure 10.

MALCOLM PIRNIE

ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

END

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