FEASIBILITY STUDY
FORMER HULETT LAGOON
CAMDENTON, MISSOURI

October 18, 2004

Prepared for:

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Submitted by:

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SECTION 1

SECTION 1.0
INTRODUCTION

INTRODUCTION

SECOR International Incorporated (SECOR) was authorized by Hamilton Sundstrand (HS) to complete a Feasibility Study (FS) to develop practical alternatives to address groundwater impacts at, and in the area of the former Hulett Lagoon (former lagoon) that likely contributed to impacts to the Mulberry Street municipal well (Mulberry well) located in the City of Camdenton, Missouri (the City). The FS was based on data collected from a Remedial Investigation (RI) completed by HS in 2003. RI findings were summarized in a report to the Missouri Department of Natural Resources (MDNR) (reference RI Summary Report dated November 24, 2002).

The RI Summary Report highlighted the presence of two groundwater zones beneath the former lagoon and surrounding areas. These groundwater systems consist of a thin perched groundwater zone referenced as the "perched" zone and the underlying "deep" aquifer. Additionally, the RI Summary Report also suggested that groundwater impacts are the results of historical activities at the former lagoon and the Modine Manufacturing, Inc. (Modine) facility (Facility). As such, groundwater impacts (most notably to the "deep" aquifer) are more of a regional issue and cannot be differentiated (in terms of contribution) between the former lagoon and the Facility. With these thoughts in mind, the FS focuses on practical solutions to this regional groundwater issue. For purposes of the FS report, the term Site is used to refer to the impacted region in question. Additionally, the term Study Area (used to outline the impacted region in question) is used in other support documents (reference Appendix A and B) and is synonymous with Site.

PROJECT OBJECTIVES

The FS was completed in support of the continued overall objective to help protect the City's potable water supply system. The FS focuses on practical alternatives to address groundwater impacts that have the potential to affect human health from the viable pathways present in the region.

FS PURPOSE AND ORGANIZATION OF REPORT

The FS report presents a summary of the development of Remedial Action Objectives (RAOs) and the General Response Actions appropriate to the Site that are protective of human health and the environment. Technology types and process options are then presented that may be applicable to and address the RAOs. The results of screening the technologies and options, and combining them into alternatives, are presented. Alternatives are then screened and analyzed, resulting in a recommended alternative. Throughout the process, continued attention, first starting with the site investigation program, is given to Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered conditions (TBCs).

The report is divided into four sections as follows:

- Section 1 Introduction
- Section 2 Identification and Screening of Technologies
- Section 3 Development and Screening of Alternatives
- Section 4 Preliminary Analyses of Alternatives
- Section 5 Conclusions

ADDITIONAL STUDIES

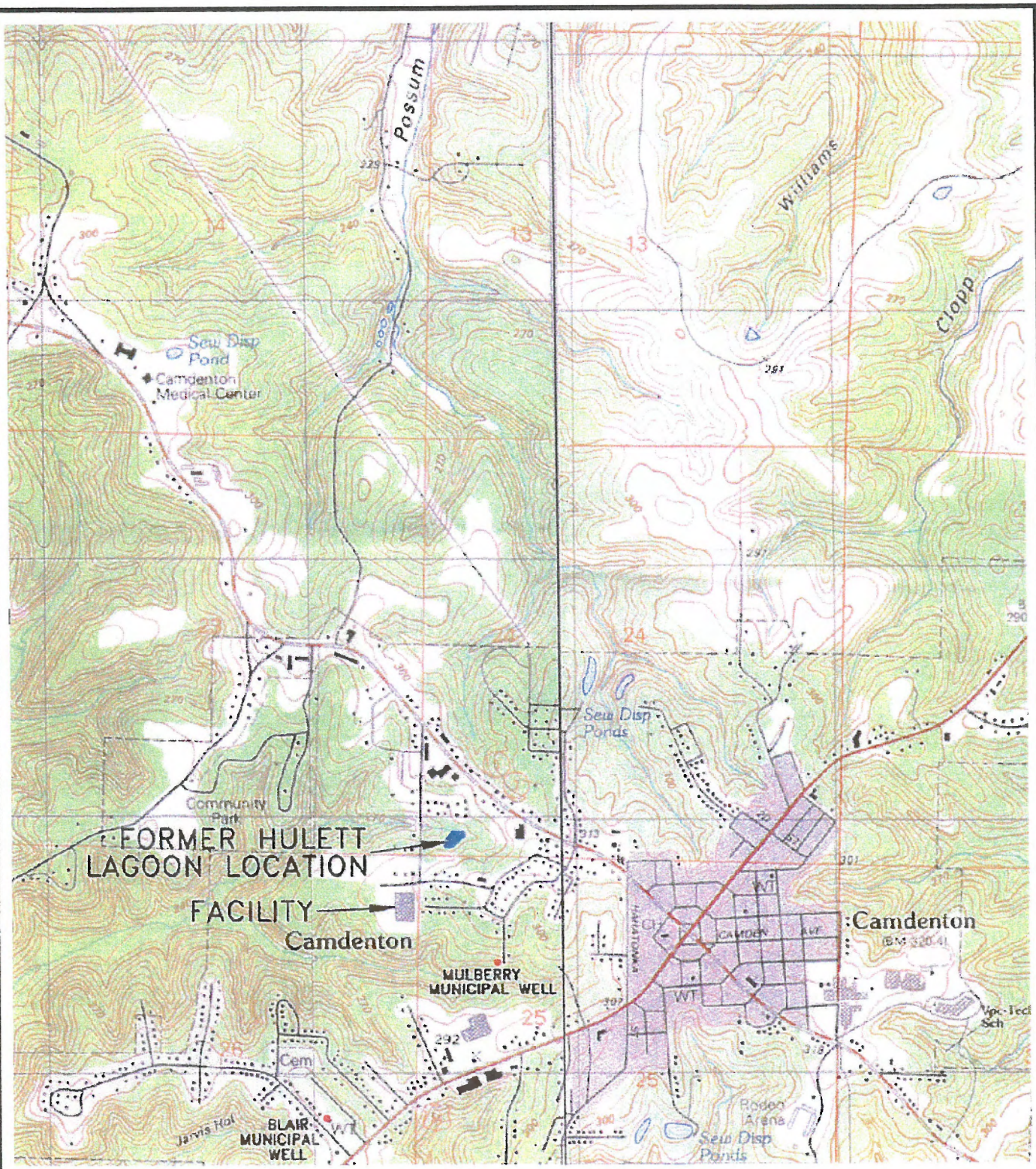
Additional studies to help support FS activities were completed including groundwater flow modeling and a targeted risk assessment focusing on human health and ecological impacts. These efforts are briefly discussed in general in the FS Report. Specific details are summarized in Appendix A (Groundwater Flow Model Report) and Appendix B (Targeted Risk Assessment).

BACKGROUND INFORMATION

Background information used in preparation of the FS is based on RI data collected by HS at the former lagoon.

Site Description

The former lagoon is located northeast of the intersection of Dawson Road and Sunset Drive in the western portion of the City of Camdenton, Camden County, Missouri (reference Figure 1.1).



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DRAWN BY:	WLG
APPROVED BY:	JDH
DATE:	09-04-03

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SITE LOCATION MAP
FORMER HULETT LAGOON
HAMILTON SUNDSTRAND
CAMDENTON, MISSOURI

JOB NO. 61UN.03001.00 FIGURE 1.1

S:\PROJECTS\061.03 PROJECTS\61UN.03001.00\cad files\FS Summary MAR 04\SITE LOCATION\FIGURE 1.1.dwg wlg 09-04-03

The former lagoon occupied an area of about one acre. Other pertinent features related to the former lagoon and overall remediation alternatives are the nearby Facility and the Mulberry well owned by the City. The locations of these features are also shown on Figure 1.1.

In addition to the industrial land use at the Facility, there is some commercial development near the former lagoon; however, most of the adjoining and nearby land use is undeveloped wooded land and residential development (reference Figure 1.2). The former lagoon site is now a generally flat, open field covered with grasses. Surface water runoff is towards the northwest entering intermittent drainages that trend downward to the west. An apartment complex is located north of the former lagoon. The former lagoon is bordered on the west by a wooded area about 500 feet wide and beyond by Dawson Road and residences. Wooded areas border the south and east of the former lagoon area with residences beyond the southern wooded border, and commercial property (along Missouri State Highway 5 and 7) beyond the eastern wooded border (reference Figures 1.2 and 1.3).

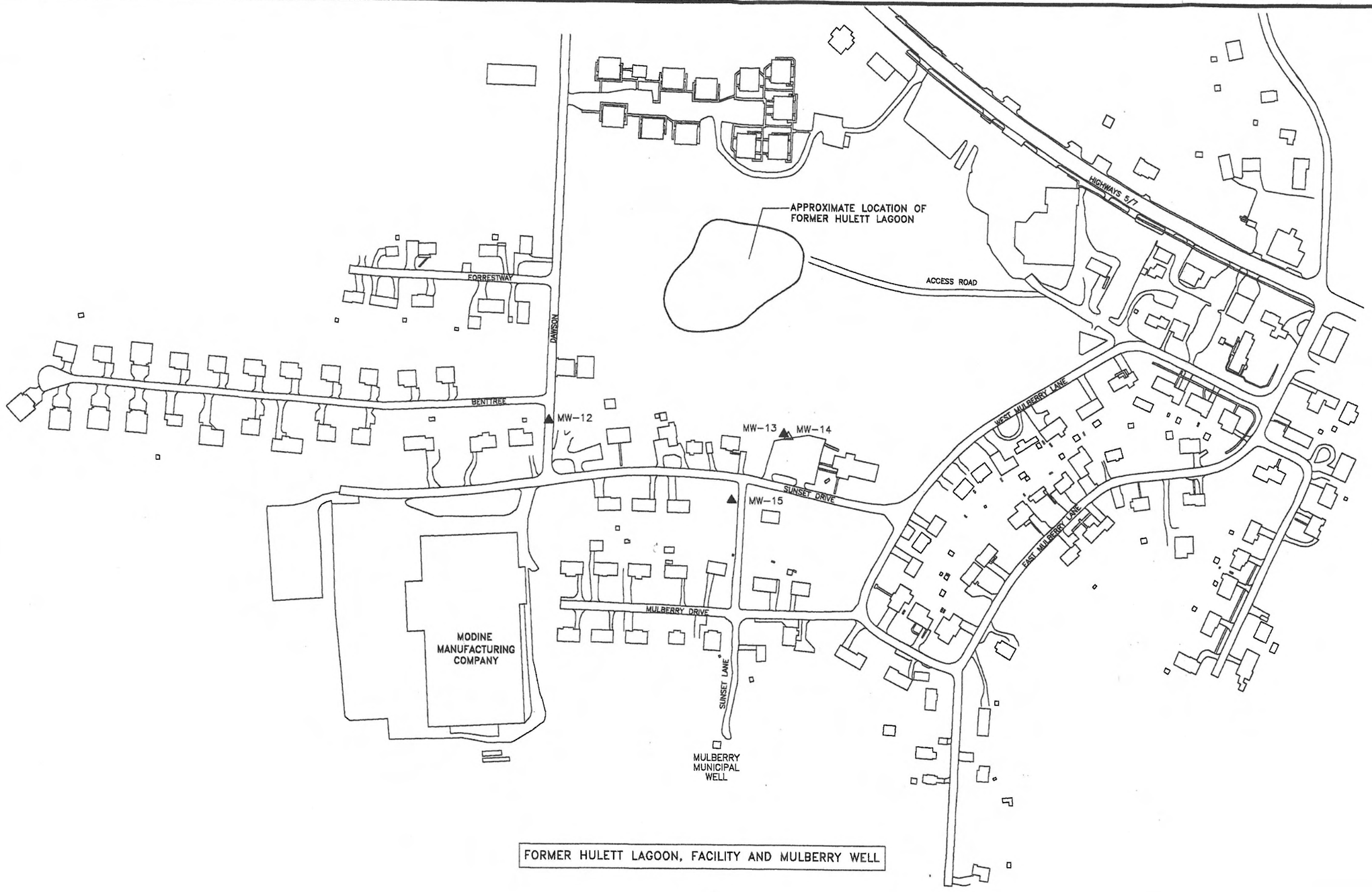
The topography of the area and region is undulating, and is characterized by a non-glaciated terrace with deeply incised ephemeral streams. The former lagoon is located at about 960 feet above mean sea level (amsl) in an area of relatively flat topography.

Surface water uses in the area are dominated by recreational activities, with much of this activity being conducted on nearby Lake of the Ozarks. The nearest surface water body to the former lagoon is the Niangua Arm of the Lake of the Ozarks, located approximately 1.5 miles west of the former lagoon. Surface drainage from the former lagoon area flows west to the Niangua Arm via deeply incised ephemeral streams. No surface water is impounded on or flows through the former lagoon. Additional details describing climate, geology, and hydrogeology around the former lagoon are provided in the RI.

Site Area History

General

The former lagoon was constructed in 1961 under the State of Missouri Grants Program. The lagoon is reported to have been an above surface grade structure with sidewalls



FORMER HULETT LAGOON, FACILITY AND MULBERRY WELL

DESIGNED BY:	JGH
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APPROVED BY:	JGH
DATE:	10-14-03

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CONFIGURATION MAP
FORMER HULETT LAGOON
HAMILTON SUNDSTRAND
CAMDENTON, MISSOURI

JOB NO. 61UN.03001.00 FIGURE 1.2

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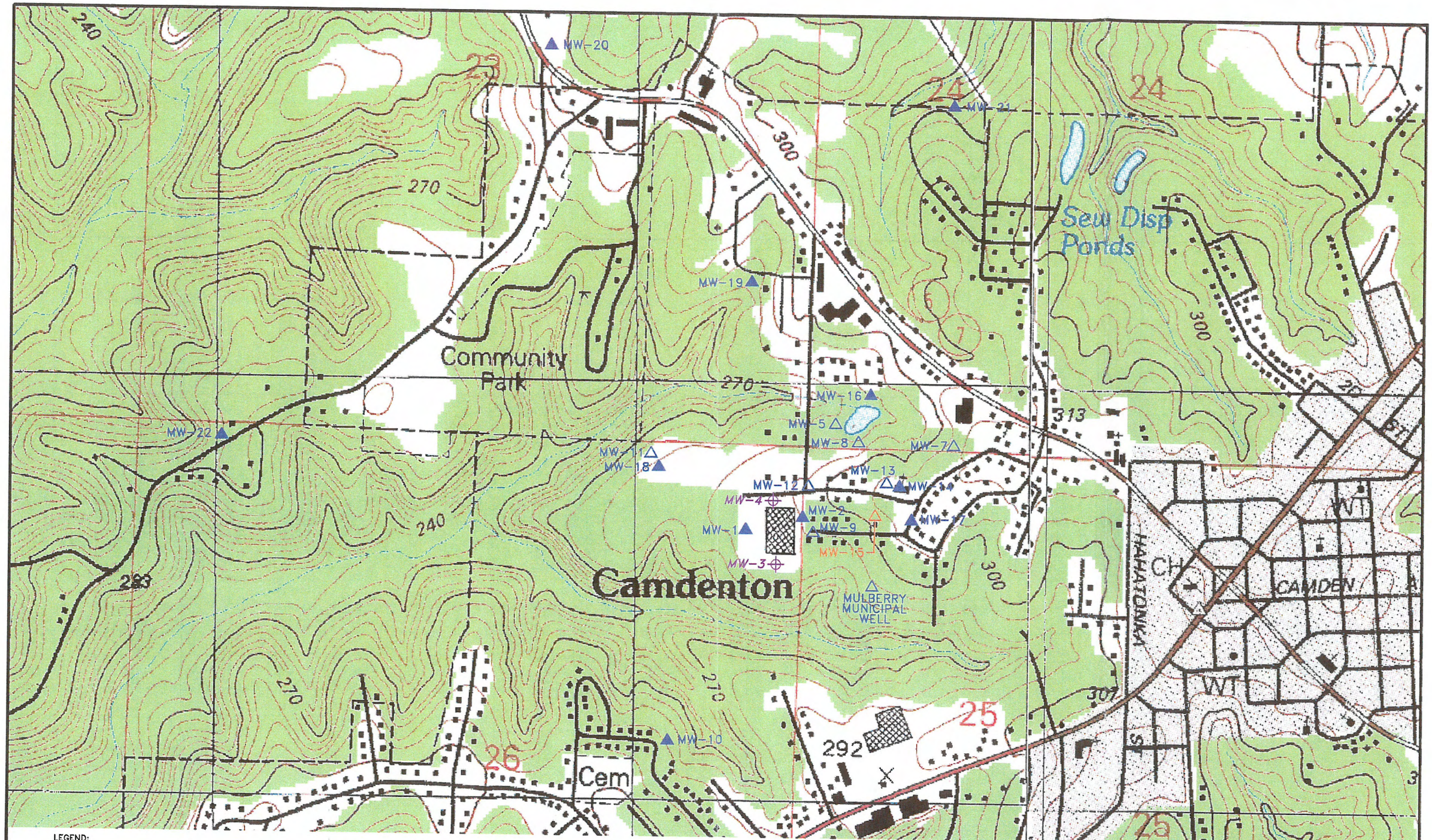

LEGEND:

MW-18 ▲ DEEP WELL
MW-12 △ SHALLOW WELL
MW-15 △ SHALLOW WELL (ABANDONED)
MW-3 ⊕ MODINE DEEP WELL (ABANDONED)

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REFERENCE: USGS 7.5 MINUTE QUADRANGLE: GREEN BAY TERRACE, MO 1983
USGS 7.5 MINUTE QUADRANGLE: CAMDENTON, MO 1983

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DRAWN BY:	GLH
APPROVED BY:	MGD
DATE:	08-29-03

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SITE AREA TOPOGRAPHIC MAP SHOWING
MONITORING WELL LOCATIONS
FORMER HULETT LAGOON
HAMILTON SUNDSTRAND
CAMDENTON, MISSOURI

JOB NO. 61UN.03001.00 FIGURE 1.3

S:\PROJECTS\061.03 Projects\61UN.03001.00\cad files\FS Summary MAR 04\061 usgs figures\FIGURE 1.3.dwg wig 07-11-03

constructed of existing site and imported clay material. Sidewall heights were believed to have been about 15 feet. Sidewall widths (at the base) were believed to have been about 25 feet. The lagoon occupied an area of about 1 acre. The former lagoon treated wastewater in accordance with a National Pollution Discharge Elimination System (NPDES) permit issued to the City by MDNR (reference permit number MO-0048577). The permit was terminated following closure of the former lagoon. The former lagoon was operated and maintained by the City from 1961 until its approved closure by MDNR in late 1989. The following discussion from the RI presents a brief summary of pertinent activities associated with the former lagoon.

In 1961, following its construction, the former lagoon began receiving storm water from storm water basins and sewers located in the surrounding area.

From 1967 through 1986, the former lagoon received storm water, domestic sewage, and untreated wastewater known to have contained several waste streams including corrosive waste, wastewater treatment sludges from electroplating operations, waste oils, and residual contaminants associated with degreasing operations, including volatile organic compounds (VOCs), most notably trichloroethene (TCE) from the Facility. These wastewaters were delivered to the lagoon via a collection sewer and discharged to an intermittent drainage way north of the former lagoon in accordance with an NPDES permit issued by MDNR.

On April 14, 1986, the Facility pretreatment plant became operational, effectively reducing contaminants associated with the Facility being discharged to the former lagoon.

The City retained Missouri Engineering Corporation (MEC) in 1988 to assist with the closure of the former lagoon. On May 26, 1988, the MDNR provided the City with several options for disposal/management of former lagoon sludges. The City selected one of these options, and the City authorized MEC to begin closure activities.

On February 22, 1989, the MDNR approved the closure of the former lagoon. Between March and May 1989, MEC prepared and submitted "Specifications and Contract Documents for the Removal and Stock Piling of Sludge from the Hulett Lagoon".

On July 21, 1989, MEC coordinated the removal of sludges from the former lagoon and application on a 22-acre area at the municipal airport located south of the City. It is believed that after sludge was removed from the lagoon, the lagoon inlet and outfall structures were removed. The lagoon area was regraded using material excavated from the lagoon sidewalls.

On April 9, 1990, the City provided the MDNR with a Hulett Lagoon Sludge Disposal Work Completion Summary.

The former lagoon location has not been utilized for any activities since it was decommissioned and closed in 1989. The former lagoon location is a generally flat, open field covered with vegetation, which is owned and maintained by the City.

Facility

Although RI activities were initially focused on the former lagoon, RI findings indicated that groundwater impacts were not solely attributable to the former lagoon. Investigative efforts by Modine, through a RCRA Corrective Action Abatement Order on Consent for the Facility, confirmed that historical activities there have also contributed to groundwater impacts.

As part of their Corrective Action activities, Modine has completed several investigations to identify the nature and extent of the contamination from chlorinated VOCs in subsurface soil at the Facility. Several thousand cubic yards of soils contaminated with chlorinated VOCs in excess of MDNR Cleanup Levels for Missouri (CALM) Soil Target Concentrations (STARC) Leaching to Groundwater (C_{LEACH}) levels have been removed from the Facility.

Remediation and regulatory closure issues directly related to the Facility are being addressed by others and are near completion. MDNR has determined that human exposures (with the exception of groundwater) are currently under control at the Facility (reference Current Human Exposures Under Control (CA 725), EI Evaluation dated July 13, 2004).

The facility continues in operation.

Mulberry Well

The Mulberry well was part of the municipal well system until TCE levels above USEPA Safe Drinking Water Act Standards were detected. The well was drilled in 1986 to a depth of about 900 feet below ground surface (bgs) and is cased at a depth of about 400 feet bgs. The City currently operates the well at scheduled intervals to hydraulically contain TCE in the Site area of the Mulberry well and to prevent TCE migration to other City wells (most notably the Blair well) (see Figure 1.1). Groundwater extracted at the well is discharged to an MDNR NPDES-permitted discharge point next to the Mulberry well pump house.

Geology

The Site is an area of relatively flat topography at about 960 feet amsl In general, the stratigraphy beneath the former lagoon consists of unconsolidated surficial sediments underlain by dolomite to the maximum investigated depth of about 742 feet amsl. Surficial soils above bedrock have been disturbed during lagoon closure from excavation/grading activities. The first encountered bedrock unit in the region consists of the dolomites, sandy dolomites, and sandstones of the Ordovician-Aged Roubidoux Formation. Logs from nearby wells suggest that the Roubidoux Formation may have been completely removed by erosional processes in the vicinity of the former lagoon. Regionally, the Cambro-Ordovician-Aged strata underlying the Roubidoux are, in descending order: the Gasconade Dolomite, the Gunter Sandstone, the Eminence Dolomite, the Potosi Dolomite, and subsequently deeper dolomites, shales and sandstones.

The uppermost unit underlying the Site primarily consists of recent disintegration residuum of the upper bedrock units. Based upon a review of the former lagoon boring logs, this unit appears to be continuous across the Site and varies in thickness from about 10 to 55 feet. The uppermost materials are near-surface fill, which are underlain by red-brown cherty clay of the bedrock disintegration residuum. The underlying unconsolidated materials are lighter colored and more granular with depth, containing varying amounts of chert and sand. The unconsolidated disintegration residuum contains small fragments of the underlying bedrock and grades downward into a weathered dolomite zone.

Underlying the surficial deposits are dolomite, sandy dolomite, and clay-rich dolomite comprised of the Roubidoux or Gasconade Dolomite Formations. Dolomite is present to the maximum investigated depth at about 742 feet amsl. The dolomite bedrock is occasionally soft and friable in the upper zone and grades into a presumably less permeable zone that hydrologically isolates the "perched zone" from the underlying "deep" aquifer.

Analysis of drill cuttings in comparison to geophysical data (geophysical logs) shows a general correlation between the lithology and log response. The lithology in the interval with the increased gamma ray response tends to be composed primarily of brown, low permeability dolomite and chert. The strata below the interval with increased gamma ray response are associated with the "deep" aquifer. The base of the interval of increased gamma response in the immediate vicinity of the former lagoon is at about 745 to 760 feet amsl. The mapped interval in the Site area appears to have a general westerly dip.

Observations of fracture orientations at numerous bedrock outcrop locations along the ravines near the Facility and former lagoon indicated a primary fracture set orientation of approximately N 50^0 E and a secondary fracture set orientation of approximately N 35° W. During previous investigations (conducted primarily by Modine), a third fracture set trending N 50^0 E was also identified. When these fracture orientations are compared with major erosional features within the topographic area around the former lagoon, there are similar orientations between some of the major ravines and the primary and secondary fracture orientations. Regional groundwater flow direction tends to correspond with the primary fracture orientation. Local groundwater flow near the former lagoon area appears to be influenced by the secondary fracture set orientation.

Nature and Extent of Contamination

Soils

Characterization of near surface soils in and within the vicinity of the former lagoon was conducted during the RI. Borings were advanced to refusal within the upper (weathered) portion of the underlying bedrock; depths ranged from 4 to 11 feet bgs. Sampling and analyses strategies focused on the presence of chlorinated VOCs, the primary class of contaminants of concern for the former lagoon. Analyses also included metals.

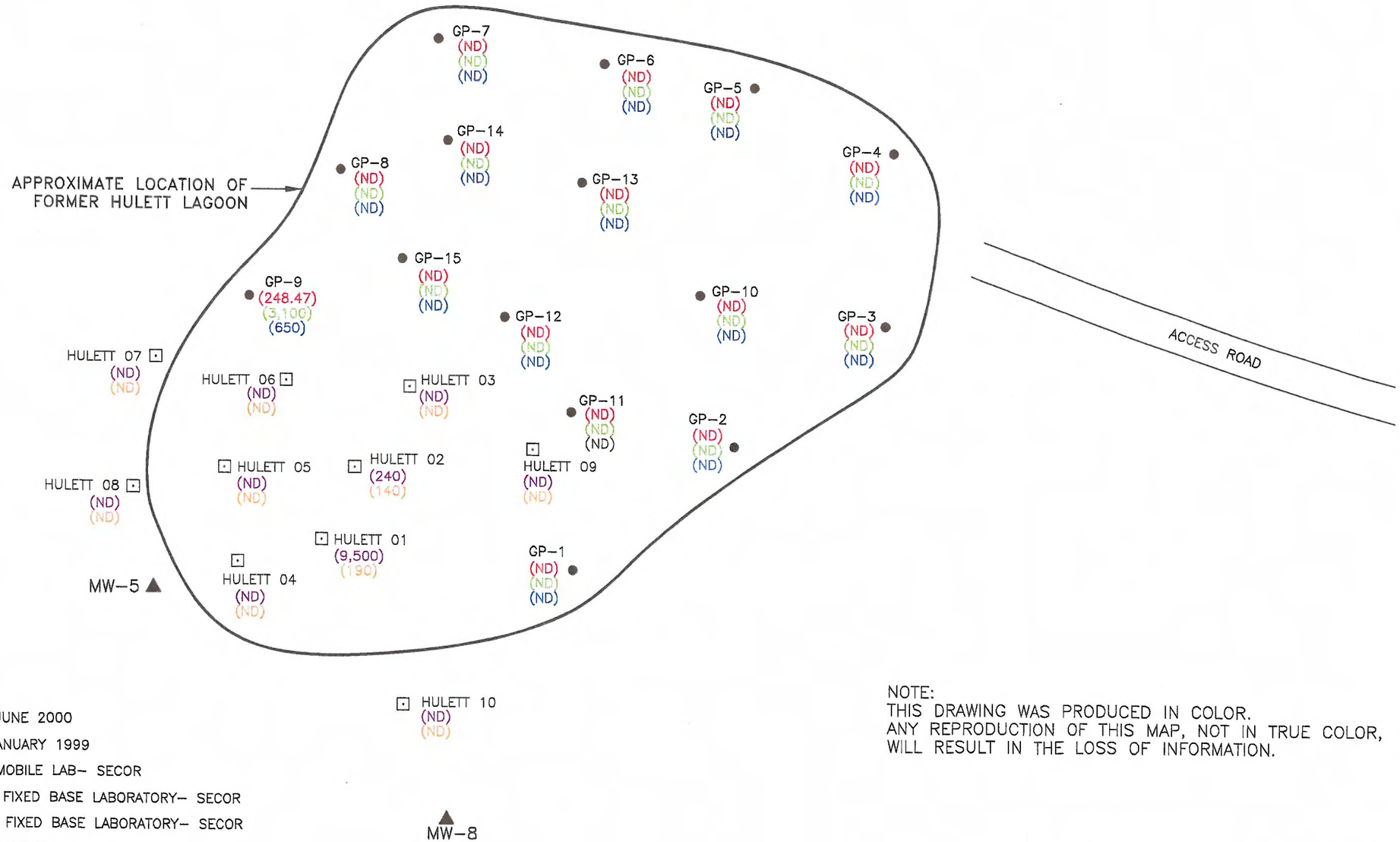
The locations of the borings and a tabulation of the analytical results from the RI are presented in Figure 1.4 and in Table 1.1. Results of the soil investigation activities performed within the footprint of the former lagoon (2000 RI activities and 1999 MDNR activities) indicate the presence of TCE and DCE in only 3 of 25 borings completed. TCE concentrations ranged from 240 parts per billion (ppb) to 9500 ppb, and DCE concentrations range from 140 ppb to 650 ppb. These concentrations were detected at depths ranging from 6 to 9 feet bgs. .

The presence of VOCs above toxicity characteristic leaching potential (TCLP) detection limits could be considered "worst-case" in terms of contribution of impacts to groundwater. TCLP analysis of select soil borings (including those that exhibited the highest concentrations detected through field screening) demonstrated that TCE and DCE concentrations were not present above TCLP detection limits (25.0 ppb). These data indicate that VOC contribution to groundwater from leaching of residual VOCs in soil should not occur.

These data indicate that the removal actions performed by the City when closing the lagoon were effective in removal of soils impacted by VOCs. Based upon the presence of VOCs in only 3 of 25 borings, the minimal potential for exposure to humans (due to their location at depth), and the apparent non-existent likelihood of VOCs leaching into groundwater at levels above regulatory limits, the need for additional soil remedial activities does not appear to be warranted.

Groundwater

Because RI findings demonstrated soil impacts attributable to the former lagoon were no longer present, most of the RI activities focused on groundwater. Early investigative activities at the Facility indicated the presence of VOCs in groundwater and the presence of TCE in a nearby City well (Mulberry well). The Camdenton area is located on an unglaciated carbonate terrace. The bedrock consists predominantly of dolomite, sandy dolomite and sandstone. The area formations are noted for being fractured and evidencing solution activity. Such features, generally the controlling factors in the flow of groundwater, are impractical to define. The RI focused on understanding the presence and nature of the groundwater flow system though extensive drilling, logging,



LEGEND:

- ▲ MONITORING WELL LOCATION
- ● SECOR SOIL BORING LOCATION, JUNE 2000
- ⊡ MDNR SOIL BORING LOCATION, JANUARY 1999
- (248.47) TCE CONCENTRATIONS IN ug/L, MOBILE LAB- SECOR
- (3,100) TCE CONCENTRATIONS IN ug/kg, FIXED BASE LABORATORY- SECOR
- (650) DCE CONCENTRATIONS IN ug/kg, FIXED BASE LABORATORY- SECOR
- (9,500) TCE CONCENTRATIONS IN ug/kg- MDNR
- (190) DCE CONCENTRATIONS IN ug/kg- MDNR
- (ND)= NOT DETECTED

NOTE:
THIS DRAWING WAS PRODUCED IN COLOR.
ANY REPRODUCTION OF THIS MAP, NOT IN TRUE COLOR, WILL RESULT IN THE LOSS OF INFORMATION.

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NORTH

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APPROVED BY:	MGD
DATE:	08-28-03

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SOIL ANALYTICAL RESULTS- FORMER LAGOON AREA
FORMER HULETT LAGOON
HAMILTON SUNDSTRAND
CAMDENTON, MISSOURI

JOB NO. 61UN.03001.00 FIGURE 1.4

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Table 1.1
Detected Analytes- Hulett Lagoon Soils
Remedial Investigation Activities
Hamilton Sundstrand
Camdenton, Missouri

ANALYTE	UNITS	SOIL SAMPLES – MOBILE LABORATORY														
		GP-1 9.5'– 10'	GP-2 8.5'– 9'	GP-3 6'– 7'	GP-4 8'– 9'	GP-5 7'– 8'	GP-6 4'– 5'	GP-7 6'– 7'	GP-8 3'– 4'	GP-9 7'– 8'	GP-10 6.5'– 7.5'	GP-11 8'– 9'	GP-12 5'- 6'	GP-13 6'– 7'	GP-14 10'– 11'	GP-15 5.5'– 6.5'
Trichloroethene	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	248.47	ND	ND	ND	ND	ND	ND

ug/Kg – micrograms/Kilogram (ppb)
Analysis by EPA Method 3810 "Static Heated Headspace"

ND – Analyte not detected within reporting limits of the test
10' – 11' – Approximate sample depths in feet below ground surface

ANALYTE	UNITS	SOIL SAMPLES – FIXED LABORATORY														
		GP-1 9.5'– 10'	GP-2 8.5'– 9'	GP-3 6'– 7'	GP-4 8'– 9'	GP-5 7'– 8'	GP-6 4'– 5'	GP-7 6'– 7'	GP-8 3'– 4'	GP-9 7'– 8'	GP-10 6.5'– 7.5'	GP-11 8'– 9'	GP-12 5'- 6'	GP-13 6'– 7'	GP-14 10'– 11'	GP-15 5.5'– 6.5'
Trichloroethene	ug/Kg	ND	ND	ND	ND(1)	ND(1)	ND(1)(2)	ND	ND(1)	3,100(1)(3)	ND(1)(2)	ND(1)	ND(1)	ND(1)(2)	ND(1)(2)	ND(1)(2)
CIS 1,2 – Dichloroethene (Total)	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	650(3)	ND	ND	ND	ND	ND	ND

(1) Methylene Chloride detected above reporting limits – suspected laboratory artifact
(2) Acetone detected above reporting limits – suspected laboratory artifact
(3) Laboratory calibration range exceeded

Analysis by USEPA Method 8260B(VOCs) and Method 7470A/7471A/6010B (Metals)
ND – Analyte not detected within reporting limits of the test
10' – 11' – Approximate sample depths in feet below ground surface

geophysics, monitoring wells, analytical chemistry, and aquifer pump testing. Through these efforts an understanding of groundwater and the aquifer system has resulted.

Aquifer testing early in the RI identified two disparate water-bearing zones. These zones were the subject of extensive aquifer testing, analytical sampling, and field mapping. The studies conclusively identified the occurrence and behavior within the separate "perched zone" and in the "deep" aquifer system in and around the former lagoon area. Groundwater within both the "perched zone" and the "deep" aquifer system occurs primarily within secondary porosity features (i.e. fractures, bedding plane separations, and dissolution cavities).

Groundwater within the "perched zone" system occurs under unconfined (water table) to semi-confined conditions. The "perched zone" monitoring wells typically exhibit groundwater surface elevations at about 817 to 828 feet amsl across the area in and around the former lagoon. Saturated thickness of the "perched zone" ranges between about 1 to 8 ft, and appears to be controlled by the surface configuration of the low permeability zone that forms the base of the "perched zone." The low permeability zone has been generally identified as a brown low dolomite and chert (identified by examination of cuttings and elevated gamma ray response).

Groundwater elevation data associated with the "perched zone" indicate that groundwater movement is generally from north to south (with local deviations to this flow direction). This general flow direction appears to be controlled by the occurrence, depth and surface slope of the above referenced low permeability zone. The inferred potentiometric surface for the "perched zone" system in and around the former lagoon for June 2003 was about 820 feet amsl. The ground surface in the immediate vicinity of the former lagoon varies from about 935 to 960 ft amsl.

The "deep" aquifer system is separated from the overlying "perched zone" by an argillaceous interval that typically ranges between 30 and 40 feet thick. Groundwater within the "deep" aquifer system typically occurs at about 781 to 792 feet amsl across the area in and around the former lagoon. Groundwater movement in the "deep" aquifer is generally from east to west, but the fracture network likely results in local flow/movement mimicking fracture orientations. Groundwater within the "deep" aquifer occurs entirely

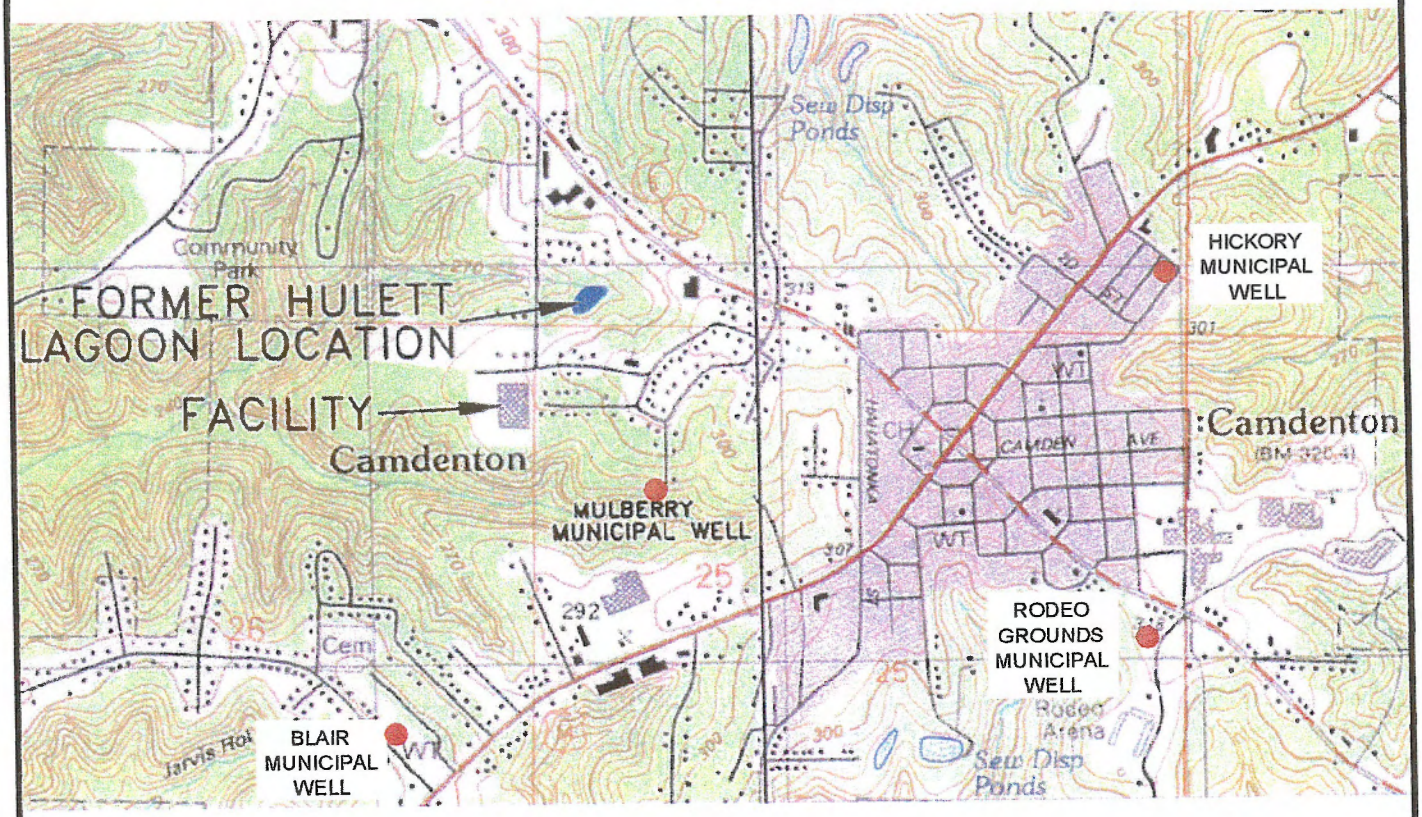
within bedrock material throughout most of the former lagoon area; however, the low permeability zone is probably breached by erosion in the ravines west of the Facility.

The City's potable water needs are provided by a series of municipal wells located in and around the Camdenton area. These wells (known locally as the Hickory, Rodeo and Blair wells) range in depth from 800 to 1100 feet bgs. These wells were constructed from 1936 to 1997. These wells are operated cyclically or based upon usage demands. The wells extract water from the "deep" aquifer system. These well locations are shown in Figure 1.5.

The Mulberry well was withdrawn from service as a potable supply after TCE levels above USEPA Safe Drinking Water Act standards were detected. The City currently operates the Mulberry well at scheduled intervals that hydraulically contain TCE in the Site and prevent TCE migration to other City wells (most notably the Blair well). Groundwater is extracted at the Mulberry well and discharged to an MDNR NPDES-permitted discharge point next to the Mulberry well pump house.

Results of extensive aquifer tests during the RI indicate that the hydraulic stresses generated by groundwater extraction from the Mulberry well are measurable within the "deep" aquifer system. Measured drawdowns associated with these aquifer tests suggest that hydraulic influences can be exerted within the "deep" aquifer well beyond the former lagoon area. This also indicates that hydraulic containment of contaminants identified within the "deep" aquifer system can be achieved through the continuous operation of the Mulberry well. Analytical and potentiometric data suggest that groundwater movement and VOC migration are strongly influenced by preferential pathways within the fractured (i.e., fractures and bedding plane separations) bedrock. The aquifer testing also indicated that pumping of the Mulberry well had little discernable influence on the upper "perched zone."

The RI activities indicate that the likely extent of the TCE plume in the "perched zone" appears to be west of MW-7 (non-detect for VOCs) and east of MW-11 (non-detect for VOCs). The apparent extent of contamination in the "perched" zone is shown on Figure 1.6. This zone includes only the southern portion of the former lagoon itself.



0 1000 2000 3000 4000 5000

SCALE FEET

NORTH

DESIGNED BY:	MGD
DRAWN BY:	MWB
APPROVED BY:	JDH
DATE:	03-11-04

SECOR

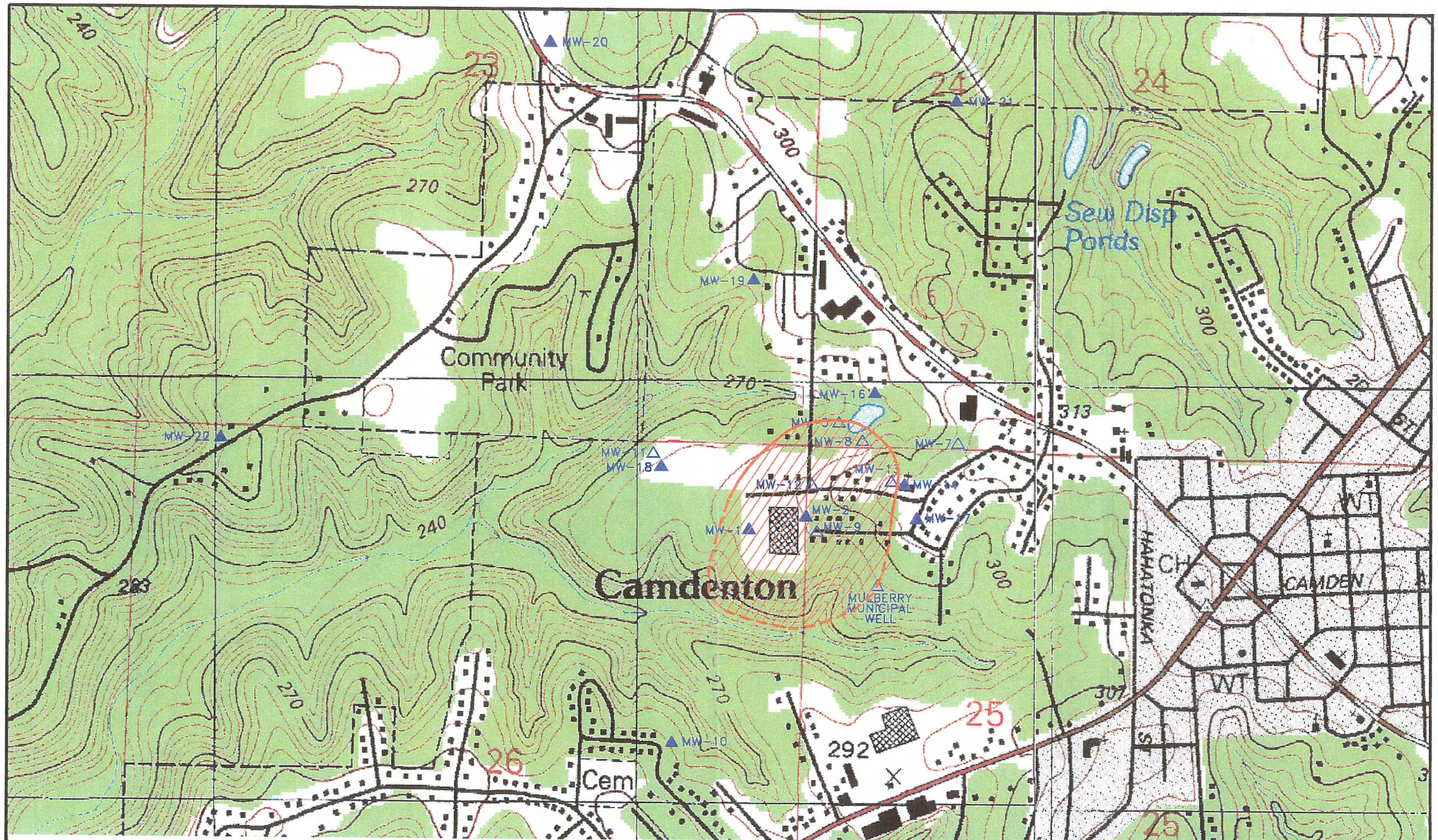
MAP SHOWING MUNICIPAL WELL LOCATIONS

FORMER HULETT LAGOON
HAMILTON SUNDSTRAND
CAMDENTON, MISSOURI

JOB NO. 61UN.03001.00

FIGURE 1.5

S:\PROJECTS\061.03 PROJECTS\61UN.03001.00\cad files\FS Summary MAR 04\SITE LOCATION\FIGURE 1.5.dwg wig 09-04-03



LEGEND:

MW-18 ▲ DEEP WELL

MW-12 △ SHALLOW WELL

EXISTING MONITORING WELL LOCATION

AREA OF DELINEATED TCE CONTAMINATION

AREA OF POTENTIAL TCE CONTAMINATION

0 700 1400

SCALE IN FEET

NORTH

REFERENCE: USGS 7.5 MINUTE QUADRANGLE: GREEN BAY TERRACE, MO 1983
USGS 7.5 MINUTE QUADRANGLE: CAMDENTON, MO 1983

DESIGNED BY:	MGD
DRAWN BY:	GLH
APPROVED BY:	MGD
DATE:	09-05-03

SECOR

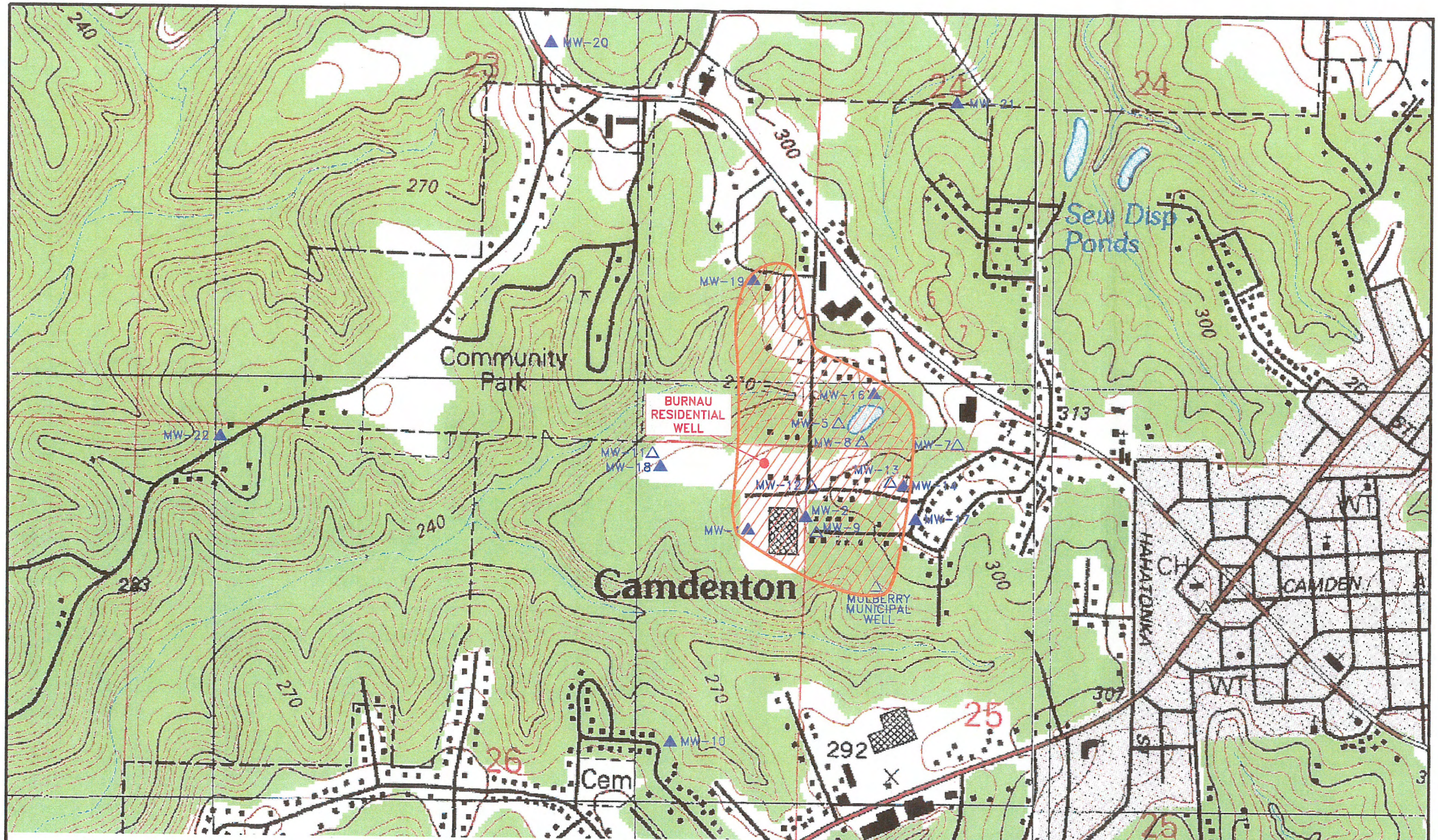
MAP SHOWING DELINEATED EXTENT OF TCE PLUME IN THE "PERCHED ZONE"
FORMER HULETT LAGOON
HAMILTON SUNDSTRAND
CAMDENTON, MISSOURI

JOB NO. 61UN.03001.00 FIGURE 1.6

S:\PROJECTS\061.03 Projects\61UN.03001.00\cad files\FS Summary MAR 04\061 usgs figures\FIGURE 1.5.dwg wlg 07-11-03

The apparent extent of the TCE plume in the "deep" aquifer appears to be south of MW-20 and MW-21 (both non-detect for VOCs), north of MW-10 (non-detect for VOCs), east of MW-18 (non-detect for VOCs), west of MW-17 (non-detect for VOCs). The apparent extent of contamination in the "deep" aquifer is shown on Figure 1.7.

City residences are required through local ordinances to receive potable water from the municipal system. There are a few private wells within the City, but none are believed (based on discussions with City representatives) to be used for consumption. One private well in particular, located immediately north of the Facility along Benttree Street (known as the Burnau well) (See Figure 1.7), has had detections of VOCs. Although the well is not abandoned, it is believed the well is not operational, and is not used for consumption.



LEGEND:

MW-18 ▲ DEEP WELL

MW-12 △ SHALLOW WELL

EXISTING MONITORING WELL LOCATION

AREA OF DELINEATED TCE CONTAMINATION

● RESIDENTIAL WELL

0 700 1400

SCALE IN FEET

NORTH

REFERENCE: USGS 7.5 MINUTE QUADRANGLE: GREEN BAY TERRACE, MO 1983
USGS 7.5 MINUTE QUADRANGLE: CAMDENTON, MO 1983

DESIGNED BY:	MGD
DRAWN BY:	GLH
APPROVED BY:	MGD
DATE:	09-05-03

SECOR

MAP SHOWING DELINEATED EXTENT OF TCE PLUME IN THE "DEEP AQUIFER"
FORMER HULETT LAGOON
HAMILTON SUNDSTRAND
CAMDENTON, MISSOURI

JOB NO. 61UN.03001.00 FIGURE 1.7

S:\PROJECTS\061.03 Projects\61UN.03001.00\cad files\FS Summary MAR 04\061 usgs figures\FIGURE 1.6.dwg wlg 07-11-03

SECTION 2

SECTION 2.0
IDENTIFICATION AND SCREENING OF TECHNOLOGIES

INTRODUCTION

The respective groundwater investigative efforts completed to date by HS and Modine indicate that groundwater impacts reflect a regional issue and cannot be differentiated (in terms of contribution) between the former lagoon and historical operations at the Facility. As such, addressing potential remedial alternatives strictly for the former lagoon would most likely not meet overall groundwater goals and objectives for the regional area in question.

SITE AREA

As clearly defined in the RI, and discussed further herein, the primary focus of the FS is on groundwater in the "deep" aquifer. The RI established an understanding that impacts to the groundwater (most notably the "deep" aquifer) are more of a regional issue and cannot be differentiated (in terms of contribution) between the former lagoon and the historical operations at the Facility. In a regional sense, the geologic setting and other subsurface conditions at the former lagoon and the Facility are nearly identical and overall are representative of the general regional conditions. Thus, the development of the FS based on the former lagoon area should be representative of considerations appropriate for application to the Site area.

ARARS

General

Selection and implementation of response actions and remedial actions are required to be in compliance with Applicable, or Relevant and Appropriate Requirements (ARARs) found in federal and/or state environmental standards, regulations, requirements, and criteria. Applicable requirements mean those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site.

Thus, such requirements are ones that would require compliance even outside of CERCLA authority. All jurisdictional requirements must be met for the requirement to be applicable.

Requirements not applicable may be relevant and appropriate to the site given the similar circumstances of the site and release. Such requirements are those cleanup standards, standards of control, or other substantive environmental provisions that do not directly and fully address site conditions, but address similar situations or problems to those encountered at a site. Whether a requirement is appropriate (in addition to being relevant) will vary depending on factors such as the duration of the response action, the form or concentration of the chemicals present, the nature of the release, the availability of other standards that more directly match the circumstances at the site, and other factors. In some cases only a portion of the requirement may be relevant and appropriate. Only those requirements that are considered both relevant and appropriate must be addressed.

ARARs vary depending on whether the subject action is related to a remedial action or a removal action. Removal actions are very specific to the immediate circumstances of the site, whereas remedial action ARARs are generally more focused on long term considerations. For the former lagoon area, the RI has demonstrated that all necessary removal actions were previously accomplished as part of the lagoon closure conducted by the City. Focus in the FS is therefore on ARARs related to remedial action at the former lagoon.

ARARs also vary depending on whether the subject is on-site or off-site compliance. For example, substantive scope of the requirements must be met anywhere, but the administrative requirements are not applicable on-site. Administrative provisions include recordkeeping, reporting, permitting, etc.

The absence of ARARs may warrant that attention be given to "To Be Considered" guidelines (TBCs). TBCs could, for example, be guidelines related to risk exposure that have not been promulgated. State regulations and practices are often important ARARs and/or TBCs. For example, the CALM regulations are important guidance for the evaluation of risk and the selection of remedies for the former lagoon. TBCs are not potential ARARs and are not required to be identified. Appropriate attention to TBCs has, however, been given in development of the RI and this FS.

ARARs fall into three general categories: chemical-specific, location-specific, and action-specific.

- Chemical-specific requirements are generally restrictions related to health or risk-based considerations such as maximum permissible concentrations for exposure or discharge.
- Location-specific requirements restrict activity from a certain area, such as preventing damage to unique ecosystems, wetlands, or cultural resources.
- Action-specific ARARs are activity or technology based and are generally identified in the FS or in remedial design (RD).

Recognition of ARARs has occurred throughout the response activities at the former lagoon. Though not formally presented as a separate discussion, ARARs and TBCs have closely guided the RI activities now completed. Informal guidance was also received from MDNR. A list of ARARs commonly considered at similar sites was obtained.

ARARs must be met, unless one of six waivers can appropriately be used. A remedial alternative that does not attain an ARAR must be justified with a clear basis for waiving the requirement. The six waiver criteria are:

- Interim Measures,
- Greater Risk to Human Health and the Environment,
- Technical Impracticability,
- Equivalent Standard of Performance,
- Inconsistent Application of State Standard, and
- Fund Balancing.

These criteria, as applicable, will be discussed individually for each potential or actual ARAR. Because of the technical challenges embodied in removal of groundwater contaminants in deep fractured bedrock media, particular attention will be given to the waiver for technical impracticability.

Potential Site ARARs and TBCs

The ARAR identification process for the Site was based on the results of the RI, comparison to other generally accepted listings from similar Missouri sites (groundwater impacted by

chlorinated hydrocarbons in fractured bedrock), and by independent evaluation. The results of this identification process have been organized by category (chemical, location or action-specific) and are presented in summary form in Tables 2.1, 2.2, and 2.3. These tables present over 30 potential ARARs and TBCs for the Site with a brief discussion of each. These listings include the results of screening and evaluation for applicability or relevance and appropriateness.

The results of the screening are shown in Table 2.4. Potential ARARs that were determined to not be applicable, or relevant and appropriate, were dropped from the listing. Six were dropped from consideration after screening. If a retained potential ARAR or TBC may fit into more than one category (chemical-, location- or action-specific), then it is shown listed in both categories. Of the total list of 28 retained entries for screened ARARs and TBCs, 9 ARARs and one TBC fall into more than one category, leaving 17 ARARs and one TBC that are unique. Applicability of several will depend on action-specific details of the technology or option being considered, and ultimately, upon details of the selected remedy.

REMEDIAL ACTION OBJECTIVES

Soil

Active Remedial Action Objectives (RAOs) for soil media at the former lagoon are not warranted. The RI and subsequent targeted risk assessment efforts indicate that the closure activities undertaken by the City (and approved by MDNR) at the former lagoon have removed contaminants of concern to concentrations within acceptable risk limits. "Source material" within the remaining soils is not present, and further removal is not necessary relative to human contact with surface soils or contribution of contaminants to groundwater. Institutional actions will however continue at the former lagoon, specifically continued ownership and control by the City and monitoring of any excavations. The need for excavation is nearly non-existent, since development of any improvements on the former lagoon will most likely not occur. This (possibly combined with a formal deed restriction) should provide sufficient institutional controls.