RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: OCCIDENTAL CHEMICAL CORPORATION
Facility Address: Buffalo Avenue Niagara Falls, New York
Facility EPA ID #: EPA I.D. No. NYD000824482

Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

__x__ If yes - check here and continue with #2 below.

_____ If no - re-evaluate existing data, or

_____ if data are not available, skip to #8 and enter"IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

__X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s)**FACILITY DESCRIPTION**

The Occidental Chemical Corporation Buffalo Avenue Facility is located in Niagara Falls, New York on the East bank of the Niagara River between Lake Erie and Lake Ontario. The plant is one of the largest chemical production facilities in New York State. The plant occupies approximately 160 acres, employs about 800 persons, and operates , for the most part, on a 24 hours/day, 7 days/week basis. The plant produces both organic and inorganic chemicals. Some of the major products include monochlorotoluene, parachlorobenzotriflouride, benzoyl chloride, hydrochloric acid, chlorine, hydrogen, sodium hydroxide, and sodium hypochlorite. Hazardous wastes are generated as a result of some production activities.

RCRA Facility Investigation

OCC has completed the investigation of releases of hazardous waste constituents at the Buffalo Avenue facility. Overburden and bedrock geologic conditions underlying the Plant and adjacent off-site areas have been extensively investigated and are described in the following documents:

Final SDCP Report - Buffalo Avenue Plant, April 1992
Off-Site Investigation Summary Report, August 1992
Off-Site Investigation Program Phase 2 Report, November 1993
RCRA Facility Investigation Report, January 1995

As a result of the investigation, OCC has concluded that hazardous waste constituents have been released to the fill/soil and groundwater beneath the facility.

The extent of soil and groundwater contamination at the facility is such that the Department considers the entire facility an "Area of Contamination." The most significant sources of contaminants are located in the C-Area, D-Area, F-Area, M-Area, N-Area, U-Area, T-Area and Mercury Cell Area, (Figure II-1). The releases are related to spills and leaks associated with historical and present manufacturing activities.

The hazardous waste constituents which were released to the environment are present in the soil and groundwater as aqueous (dissolved) phase contaminant plumes and as dense non-aqueous phase liquids (DNAPL). A list of the Site Specific Indicators which have been released to the soil and groundwater, their historical range of concentrations in the groundwater and the "groundwater protection standard" for those hazardous waste constituents is included in Table II-

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1. The distribution of contaminants in the soil and groundwater is depicted on the attached figures.

TABLE II-1
SITE SPECIFIC INDICATORS
BUFFALO AVENUE PLANT

Analytes	Units	Max.	Min.	Mean	Groundwater Protection Standard
Phosphorus, Total Soluble (As P)	µg-P/L	12,000	ND	721	NA
Arsenic	µg/L	11,072	ND	791	25
Mercury	µg/L	5.3	ND	0.17	2
Lead	µg/L	160	MD	19.2	25
Toluene	µg/L	8,400	ND	417	5
2 Chlorotoluene	µg/L	98,000	ND	1,853	5
4 Chlorotoluene	µg/L	8,500	ND	394	5
2,4/2,5-Dichlorotoluene	µg/L	1,800	ND	67	5
2,6-Dichlorotoluene	µg/L	230	ND	10	5
2,3/3,4-Dichlorotoluene	µg/L	830	ND	26	5
2,3,6-Trichlorotoluene	µg/L	230	ND	10	5
2,4,5 Trichlorotoluene	µg/L	160	ND	3.75	5
Benzene	µg/L	33,000	ND	2,840	1
Chlorobenzene	µg/L	150,000	ND	2,780	5
1,2-Dichlorobenzene	µg/L	12,000	ND	664	1
1,3-Dichlorobenzene	µg/L	1,300	ND	200	5
1,4-Dichlorobenzene	µg/L	19,000	ND	773	1
1,2,3-Trichlorobenzene	µg/L	5,100	ND	174	5
1,2,3,4-Tetrachlorobenzene	µg/L	1,700	ND	85	5
1,2,4,5-Tetrachlorobenzene	µg/L	515	ND	33	5
Hexachlorobenzene	µg/L	170	ND	4.1	1
Trichloroethylene	µg/L	140,000	ND	4,090	5
Tetrachloroethylene	µg/L	20,000	ND	635	5

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Analytes	Units	Max.	Min.	Mean	Groundwater Protection Standard
2-Chlorobenzotrifluoride	µg/L	3,900	ND	108	5
4-Chlorobenzotrifluoride	µg/L	4,600	ND	217	5
2,4-Dichlorobenzotrifluoride	µg/L	79	ND	2.5	5
3,4-Dichlorobenzotrifluoride	µg/L	76	ND	2.8	5
Hexachlorocyclopentadiene	µg/L	12,000	ND	226	5
Octachlorocyclopentene	µg/L	1,200	ND	23	5
Perchloropentacyclodecane (Mirex)	µg/L	25	ND	0.79	.03
2,4,5-Trichlorophenol	µg/L	160	ND	3.75	1
a-Hexachlorocyclohexane	µg/L	340	ND	19	5
b-Hexachlorocyclohexane	µg/L	180	ND	8.0	5
g-Hexachlorocyclohexane	µg/L	250	ND	3.9	5
d-Hexachlorocyclohexane	µg/L	310	ND	8.4	5
Benzoic Acid	µg/L	150,000	ND	19,129	100
2-Chlorobenzoic Acid	µg/L	5,500	ND	951	5
3-Chlorobenzoic Acid	µg/L	12,000	ND	1,256	5
4-Chlorobenzoic Acid	µg/L	15,000	ND	2,461	5
Chlorobenzaic Acid, Total	µg/L	28,000	ND	4,654	5
Chlorendic Acid	Ug/L	12,000	ND	1,780	5

Aqueous phase contamination has been observed in the soils and unconsolidated sediments (overburden) at the facility and in the bedrock. The extent of the aqueous phase plume in the overburden appears to be limited to the facility property. The extent of the aqueous phase bedrock plume is considerably greater. Contamination of the D, C and B Zones (upper 125 feet of bedrock) extends from the facility to the Fall Street Tunnel, an historic sewer tunnel incised into the upper bedrock approximately 1,800 feet to the north of the facility, and to the New York Power Authority (NYPA) conduit drains which are cut deep into the bedrock near the western boundary of the property. The extent of the Overburden and Bedrock DNAPL plumes are largely confined to the site. The stratigraphic setting of the study area and geographic distribution of the contaminant plumes are depicted on Figures II-2 through II-7.

Aqueous phase contamination has also infiltrated into the sanitary sewers and outfall sewers at the facility:

Footnotes:

[1]"Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

__X__ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

OCC has taken the following actions to address potential groundwater migration pathways.

Corrective Measures Studies

OCC has completed the following Corrective Measures Studies (CMS):

- Corrective Measures Study, Bedrock Groundwater Remediation, August 1992
- Corrective Measures Study, Overburden Groundwater Remediation, January 1994
- Corrective Measures Study, Overburden Soils, August 1996
- Final Corrective Measures Study, November 1998

Interim Corrective Measures

During the course of investigating and evaluating site conditions, OCC implemented a number of Interim Corrective Measures (ICMs) designed to mitigate the impacts associated with the observed contamination.

The implemented ICMs related to groundwater migration control include:

Bedrock Groundwater (See Figures II-8, II-9, II-10)

- Extraction wells along the downgradient west and northwest Plant property boundaries in the D, C, and B Zones
- NAPL collection from on-site bedrock wells

Overburden Groundwater (See Figure II-11)

- Flow Zone 1 - Stages 1, 3, and 4 groundwater collection systems
- Flow Zone 3 - Energy Boulevard Drain Tile System (EBDTS)
- Installation of a barrier wall along the Niagara River

Overburden Soil (See Figures II-12, II-13)

- Non-aqueous phase liquids (NAPL) recovery (when sufficient quantity is encountered) and treatment of recovered NAPL
- Capping of dioxin and elemental phosphorus areas and surface drainage control
- Demolition of a former mercury cell processing building and removal of elemental mercury from the soils and fill beneath the building
- Maintenance of capped and existing hard surfaced areas

The ICMs, combined with a detailed monitoring and response program and with appropriate Institutional Measures have served as the basis for Final Corrective Measures for the Occidental Chemical Corporation Buffalo Avenue Plant.

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On-Site Corrective Measures Implementation

The Final Corrective Measures related to controlling groundwater migration include:

Bedrock Groundwater:

- The primary goals of the bedrock groundwater remedial system are to restrict off-site migration of hazardous waste constituents in the bedrock groundwater and to reduce the concentration of hazardous waste constituents within the bedrock groundwater with time. To achieve these goals, a hydraulic barrier in the D, C, and B Zones is maintained along the north and west Plant boundaries by operating a groundwater extraction system. The hydraulic barrier extends from the vicinity of Well Cluster 401 northward to the vicinity of Well Cluster 404, and then eastward to the vicinity of Well Cluster 408 (Figure II-8). The location of each extraction well nest is shown on Figure II-9.

  Operation of the bedrock groundwater extraction and treatment system commenced on April 1, 1996. As discussed in the "One Year Performance Evaluation" dated July 1997, performance monitoring data indicated that the system could not be operated at the desired flow rate due to higher than anticipated vinyl chloride concentrations and the need for an increase in treatment capacity. Therefore, the optimization period was extended in order to make the necessary modifications to the treatment plant. Full-scale operation of the system commenced in January 1999.

  The bedrock recovery system typically removes between 900-1000 gallons per minute.

- Natural Attenuation: The bedrock groundwater remedial system components collect and treat bedrock groundwater flow at the north and west (downgradient) boundaries of the Plant except the east portion of the north Plant boundary (east

of OW408). Concentrations of site-related chemicals in the bedrock groundwater in the eastern downgradient area are low and have been decreasing over time. Therefore, the Department has determined that Monitored Natural Attenuation of the bedrock groundwater in that area is an acceptable remedial approach. It should also be noted that any contaminated bedrock groundwater which bypasses the hydraulic barrier is captured by the Fall Street Tunnel sewer and is treated by the City of Niagara Falls.

If, by April 2009, natural attenuation fails to reduce the measured concentration of SSI parameters in bedrock groundwater in that area by 50%, or, if by April 2014, natural attenuation fails to reduce the measured concentration of SSI parameters in bedrock groundwater in that area by 75% (compared to OSI sampling results), the Department may require OCC to take additional measures to remediate bedrock groundwater in that area.

- Bedrock Non-Aqueous Phase Liquid (DNAPL): A NAPL recovery program has been implemented to provide containment of DNAPL in the bedrock beneath the Plant. The collection and incineration of DNAPL from the bedrock beneath the Plant are consistent with the goal of reduction of the concentration of hazardous waste constituents within the bedrock. The program involves the collection of DNAPL from any bedrock well exhibiting collectable quantities of DNAPL.

Currently, there are only three bedrock wells that exhibit collectable quantities of DNAPL: OW402A, OW413A, and OW417A. The following amounts of DNAPL have been collected from these wells as of the end of 1998:

	Amount of NAPL (gallons)
OW402A	5,746
OW413A	330
OW417A	27

The program to address the presence of NAPL in the bedrock involves NAPL collection and monitoring in 17 A Zone wells as shown on Figure II-10. The schedule for DNAPL monitoring, collection and reporting activities for the bedrock regime is summarized below:

- All bedrock A Zone wells are checked for DNAPL presence on an annual basis. If DNAPL is detected in an A Zone well, the corresponding B Zone well also is checked for DNAPL.

- DNAPL is collected on a semi-annual basis from wells OW402A and OW413A. If the volume of DNAPL collected from either well is greater than 100 gallons

during any one event, the collection frequency increases to quarterly until the volume collected in one event is less than 50 gallons, after which semiannual pumping resumes.

- DNAPL is collected from well OW417A on an annual basis. If the volume of DNAPL collected during any one event is greater than 100 gallons, the pumping frequency increases to quarterly until the volume of DNAPL collected in one event is less than 50 gallons, after which annual pumping resumes.

- Collected DNAPL is currently shipped off-site for incineration.

- On an annual basis, OCC submits a report that describes the results of the DNAPL pumping and observation program which OCC conducted during the previous calendar year, and includes recommendations for future DNAPL collection and monitoring.

- OCC checks each of the wells in the Bedrock Monitoring Network for the presence of DNAPL on an annual basis. If DNAPL is observed in a well, OCC must notify the agencies in writing within 30 days. A proposed DNAPL collection program for the well must be included with the notification.

Overburden Groundwater

Chemical presence in the overburden groundwater beneath the Plant was extensively investigated during the RFI and earlier investigations. Four overburden groundwater organic chemical plumes were identified beneath the Plant as shown on Figure II-4. These four plumes coincide with the observed presence of DNAPL in the overburden.

- Objectives Overburden Groundwater Corrective Measures: The primary objectives of the overburden groundwater remedial system are to restrict off-site migration of hazardous waste constituents in the overburden groundwater, to reduce the concentration of hazardous waste constituents within the bedrock groundwater with time, to restrict migration of hazardous waste constituents from the overburden to the bedrock, and to restrict the discharge of hazardous waste constituents to the outfalls. An additional objective is to restrict unacceptable (as determined by the NYSDEC and the City of Niagara Falls) discharge of hazardous waste constituents to the sanitary sewers. Hydraulic containment of the contaminated plumes is the principal remedial approach which is employed to achieve these objectives (Figure II-11).

- Groundwater Extraction: The overburden groundwater extraction system is comprised of the following components:
  - Stage 1 Collection System (Converted 002 Outfall)
  - Stage 2 Collection System Monitoring
  - Stage 3 Collection System (Drain Tile System Above Stage 1)

- Stage 4 Collection System (Drain Tile System -Southwest Plant)
- Energy Boulevard Drain Tile System

The overburden groundwater collection system typically removes 30 to 50 gallons per minute.

- Sanitary Sewers: Historic sewer installations at the Plant did not use watertight construction materials and methods. Consequently, groundwater infiltration into the sanitary sewer system occurs. Throughout the late 1970s and to the present, OCC has been upgrading the sewers to improve the quality of the water leaving the Plant. The City of Niagara Falls is aware that infiltration of contaminated groundwater represents a source of chemical loadings to the sewers. The OCC sanitary systems currently operate within the discharge limits established by the City of Niagara Falls (Significant Industrial User Wastewater Discharge Permit No. 22).

  As conditions currently exist, the overburden flow which discharges to the sanitary sewer is treated by the City of Niagara Falls prior to discharge to the Niagara River. The sanitary sewer system is an effective collection system and as such serves as an essential component of the overall Plant remedial plan.

  To ensure that the City of Niagara Falls continues to be aware of the role of groundwater infiltration into the sanitary sewers, all subsequent renewals of Permit No. 22 must include a description of the groundwater infiltration to the sewers and an estimate of the chemical load associated with that infiltration.

  OCC must comply with the discharge limits specified in Significant Industrial User Wastewater Discharge Permit No. 22. In the event that the City of Niagara Falls formally notifies OCC that the rate of groundwater infiltration into the sanitary sewers is unacceptable, or modifies the Discharge Permit to preclude such infiltration, OCC must take whatever actions are necessary to reduce unacceptable groundwater infiltration into the sewers.

  Should the City of Niagara Falls so notify OCC, the company must, within 30 days of receipt of said notice, submit for Department review and approval a Plan to evaluate the impacts associated with the anticipated changes in the sewer infiltration rates, including a proposal for evaluating alternative remedial strategies for overburden groundwater. Thereafter, the Department will work with OCC and with the City to implement any necessary enhancements to the Overburden Groundwater Corrective Measures program.

- Outfall Sewers: OCC has made numerous modifications to the outfall sewer network beneath the Plant to reduce chemical loadings to the Niagara River. Modifications have included abandoning sewer sections in demolished areas of the Plant, replacing sewers with watertight piping, lining existing sewer pipes, repairing and parging manholes, cleaning and conducting video inspections of sewers, and sampling sewer flows.

Outfall sewer modifications have reduced the estimated total loading of chlorinated compounds and benzene and toluene to the Niagara River from the outfall sewers from approximately 119 lbs/day in 1984 to 8 lbs/day in 1990 for the sum of the outfalls. The current estimated loading to the river from the outfall sewers is less than 5 lbs/day. The results of the outfall sewer modifications are consistent with the remedial goal of restricting discharge of OCC hazardous waste constituents to the outfalls.

Given the nature and extent of overburden groundwater contamination and the nature of the outfall sewer network, it is reasonable to expect that future unacceptable loadings from contaminant infiltration of the sewers could take place. Discharge of contaminants from the outfall sewers is regulated by the Department under SPDES Permit No. NY0003336 (NYSDEC No. 9-2911-00112/00009-0). OCC must comply with that permit and must take whatever actions are necessary to ensure that infiltration of contaminated groundwater does not cause exceedances of the permitted discharge limits, and must respond to any exceedances associated with such infiltration as expeditiously as possible.

- Overburden Barrier Wall: Three barrier walls have been constructed south of the Plant; the NYPA intake wall, the Plant barrier wall, and the S-Area barrier wall. These walls form a continuous physical barrier to restrict Plant overburden groundwater from migrating to the upper Niagara River. The NYPA intake wall, which extends from the NYPA water conduits at the west end to the Plant barrier wall at the east end, was constructed between 1959 and 1960 as part of the intake structures and water conduits. The concrete NYPA intake wall was constructed from the ground surface and extends into the top of bedrock. The underlying bedrock was grouted to a depth of approximately 100 feet below the top of the bedrock. The Plant barrier wall, which extends from the NYPA intake wall at the west end to the S-Area barrier wall at the east end, was constructed between 1993 and 1994. The Plant barrier wall, which is a soil-bentonite slurry wall sandwiched between sheet pile walls, was constructed from near the ground surface to the clay/till confining layer or the top of bedrock. The southern segment of the S-Area barrier wall, which encircles the S-Area and the southern portion of the V-Area, was constructed in 1994. The S-Area barrier wall, which also is a soil-bentonite slurry wall sandwiched between sheet pile walls, was constructed from near the ground surface to the clay/till confining layer or the top of bedrock.

  These barrier walls provide physical containment that restricts direct overburden groundwater flow to the Niagara River. In the event that future repair of the walls is necessary to continue their function as physical barriers, the Department may require OCC to repair or enhance the walls.

- Overburden DNAPL: An ongoing DNAPL collection program has been implemented at the Plant. DNAPL is monitored and collected from the Outfall 003 DNAPL collection trench, OW313, abandoned sewer manholes, and two DNAPL collection sumps in the N-Area. DNAPL is also collected from the Energy Boulevard Drain Tile System. The

location of these collection points is shown on Figure II-12. The results of DNAPL collection, along with any proposed changes to the collection program, shall be submitted to the Department annually.

The Plant's Standard Operating Procedures (SOP) for construction activities must contain procedures to implement a DNAPL collection program. In addition, the SOP must contain provisions for notifying the Department in the event that DNAPL is encountered. Mobile DNAPL that is detected during construction activities will be extracted using either extraction wells or an extraction trench. The most suitable extraction method will be chosen depending on local conditions such as underground utility congestion, soil porosity and quantity of mobile DNAPL available for extraction. Extracted DNAPL will be treated either on-site at the Plant's LTDU or off-site at an approved facility. DNAPL encountered in sewers during maintenance or construction activities will be extracted and treated.

In June 1999, OCC conducted a comprehensive overburden DNAPL survey at the Plant. The survey included all existing Plant overburden wells. After the initial survey, the Plant overburden wells were categorized as either DNAPL-bearing wells or non-DNAPL-bearing wells. DNAPL-bearing wells were pumped to determine the quantity of DNAPL present in each well. The wells were then further categorized as either DNAPL-bearing wells with greater than one gallon of mobile DNAPL or DNAPL-bearing wells with less than one gallon of mobile DNAPL. All extracted DNAPL was treated either on-site at the Plant's LTDU or off-site at an approved facility. The results of the survey, along with recommendations for DNAPL collection, were submitted to the Department on July 21, 1999.

At a minimum, wells with greater than one gallon of mobile DNAPL will be pumped quarterly. If the quantity of mobile DNAPL in one of these wells is less than one gallon on each of two consecutive quarterly pumping events, the well will be categorized as a DNAPL-bearing well with less than one gallon of mobile DNAPL. Wells with less than one gallon of mobile DNAPL will be pumped semiannually. If a well contains no DNAPL after two consecutive semiannual pumping events, it will be categorized as a non-DNAPL-bearing well.

A second DNAPL survey will be conducted two years after the initial survey. Only non-DNAPL-bearing wells will be included in the second survey. If DNAPL is detected in a well during the second survey, the well will be categorized as a DNAPL-bearing well and pumping will be conducted according to the above schedule. If DNAPL is not detected in a well during the second survey, no further DNAPL monitoring, except as specified below, needs to be conducted at that well unless otherwise directed by the Department.

- OCC checks each of the wells in the overburden monitoring network for the presence of DNAPL on an annual basis. If DNAPL is observed in a well, OCC

must notify the agencies in writing within 30 days. A proposed DNAPL collection program for the well shall be included with the notification.

- On an annual basis (due April 1), OCC shall submit a report that describes the results of the DNAPL pumping and observation program which OCC conducted, and includes recommendations for future DNAPL collection and monitoring.

- Natural Attenuation: The overburden groundwater remedial system components collect and treat overburden groundwater flow at the southern, western and northeastern (downgradient) boundaries of the Plant (Flow Zones 1 & 3). With the exception of the northwestern corner of the Plant (Wells OW304, BH10-88, OW317), concentrations of site-related chemicals in the overburden groundwater in the eastern, western and northwestern downgradient areas that are not captured by either the overburden groundwater drain tile systems or the sanitary sewer system are low and have been decreasing over time. Therefore, the Department has determined that monitored natural attenuation of the overburden groundwater in those areas is an appropriate remedial approach.

  If, by April 2009, natural attenuation fails to reduce the measured concentration of SSI parameters in overburden groundwater by 50%, or, if by April 2014, natural attenuation fails to reduce the measured concentration of SSI parameters in overburden groundwater in that area of the facility by 75% (compared to OSI November 1993 sampling results, Figure II-16), the Department may require OCC to take additional measures to remediate overburden groundwater in that area of the facility.

Off- Site Corrective Measures Implementation

Off-Site Groundwater

The nature and extent of overburden and bedrock groundwater contamination north and west of the facility is described in the "Off-Site Investigation Summary Report," August 1992 and the "Off-Site Investigation (OSI) Program Phase 2 Report," November 1993. Additional information has also been collected as part of the Bedrock Groundwater Interim Corrective Measures monitoring program. The distribution of contamination in the Overburden groundwater is depicted on Figure II-4. The distribution of contamination in the bedrock groundwater is depicted on Figure II-5.
Based upon the information collected to date, it appears that the magnitude of both overburden and bedrock groundwater contamination decreases substantially as groundwater flows from the facility.

A. **Off-Site Overburden Groundwater**: Because overburden groundwater contamination decreases substantially as groundwater flows from the facility, and because the Corrective Measures which have been implemented to address on-site overburden contamination should restrict further off-site migration of

contaminated overburden groundwater in the future, the Department has determined that active remediation of the off-site overburden groundwater is not necessary at this time. The Department has also determined that monitored natural attenuation of the off-site overburden groundwater is an acceptable remedial approach.

If, by April 2009, natural attenuation fails to reduce the measured concentration of SSI parameters in off-site overburden groundwater by 50%, or, if by April 2014, natural attenuation fails to reduce the measured concentration of SSI parameters in off-site overburden groundwater by 75% (compared to OSI November 1993 sampling results), the Department may require OCC to take additional measures to remediate off-site overburden groundwater.

B. **Off-Site Bedrock Groundwater**: Off-site bedrock groundwater adjacent to the north Plant boundary flows toward and is collected by the bedrock groundwater extraction system. Bedrock groundwater beyond the capture zone of the groundwater extraction system north of the Plant is intercepted by the NYPA conduit drains and the Falls Street Tunnel which act as regional groundwater line sinks. Bedrock groundwater west of the Plant is in the capture zone of the NYPA conduit drains. The NYPA conduit drains act as a groundwater divide and prevent groundwater from flowing further to the west. To the north of the facility, groundwater from the NYPA conduit drains also discharges to the Falls Street Tunnel. All dry weather flow in the Falls Street Tunnel is treated in the City of Niagara Falls Wastewater Treatment Plant.

Because bedrock groundwater contamination decreases substantially as groundwater flows from the facility, and because the Corrective Measures which have been implemented to address on-site bedrock contamination should restrict further off-site migration of contaminated bedrock groundwater in the future, and because most of the off-site bedrock groundwater contamination is ultimately captured by the Falls Street Tunnel and treated by the City of Niagara Falls, the Department has determined that active remediation of off-site bedrock groundwater on the part of OCC is not necessary at this time.

Because OCC and the Department are relying in part on the Falls Street Tunnel and the City of Niagara Falls for collection and treatment of off-site bedrock groundwater, it is important that the City of Niagara Falls continues to be aware of the role of groundwater infiltration into the Falls Street Tunnel and is a willing participant in its treatment. Therefore, on an annual basis, OCC shall submit to the City of Niagara Falls and to the Department, a detailed estimate of the potential loadings of OCC-related chemicals to the Falls Street Tunnel via infiltration of off-site groundwater. OCC shall also request acknowledgment from the City of Niagara Falls that those potential loadings can be adequately treated by the City. In addition, if requested by the City, OCC shall reimburse the City

for reasonable treatment costs associated with loadings of OCC-related chemicals to the Falls Street Tunnel.

In the event that the City of Niagara Falls formally notifies OCC that the rate of OCC related chemical loading into the Falls Street Tunnel is unacceptable, OCC must take appropriate actions to reduce unacceptable chemical loading into the Falls Street Tunnel. Should the City of Niagara Falls so notify OCC, the company must, within 30 days of receipt of said notice, submit for Department review and approval a Plan to evaluate the impacts associated with the anticipated changes in the Falls Street Tunnel infiltration rates, including a proposal for evaluating alternative remedial strategies for off-site groundwater.

Thereafter, the Department will work with OCC and with the City to implement any necessary enhancements to the off-site groundwater Corrective Measures program.

C. **Off-Site DNAPL**: The perimeter wells shown on Figure II-15 will be monitored for DNAPL on an annual basis to ensure the DNAPL is not migrating to off-site areas. Monitoring reports will be prepared and submitted to the EPA/State annually. The reports will contain a description of all monitoring conducted in the previous year and the monitoring results. These wells will be monitored for two years following the initial DNAPL survey. The program will be reevaluated after the two-year period and, based on previous monitoring results, the program may be modified or discontinued at the discretion of the Department.

If the Department determines that significant quantities of DNAPL exist off-site of the facility, OCC will be required to develop a remedial program to address the presence of off-site DNAPL.

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

__X__ If yes - continue after identifying potentially affected surface water bodies.

____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):
See discussions above. Although OCC has implemented groundwater containment strategies that effectively restrict the direct discharge of contaminated groundwater to the Niagara River, some contaminated groundwater can enter the river indirectly via infiltration into outfall sewers. Any such discharge is monitored as part of the ongoing SPDES sewer monitoring program.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

___X___ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

_____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):
See discussions above. The Final Corrective Measures which have been implemented at the facility include provisions to address any on-site or off-site groundwater infiltration which is determined to be problematic.

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be **"currently acceptable"** (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):_

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

__X__ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Rationale and Reference(s):

The Department, in consultation with the New York State Department of Health, has determined that the Final Corrective Measures are sufficiently protective of human health and the environment.

Performance Monitoring Program: On August 11, 1999, OCC submitted for Department review and approval, a Performance Monitoring Plan that is used to evaluate the effectiveness of the Corrective Measures specified herein. The performance monitoring program includes hydraulic monitoring to establish the extent of plume capture, and chemical monitoring to evaluate the changes in groundwater chemistry which take place through time. OCC currently performs routine monitoring of select groundwater monitoring wells and extraction wells to evaluate the performance of the remedial systems. During each monitoring event, the hydraulic performance of the systems is evaluated to determine if the systems are operating in accordance with the intent of the system's objective. In addition, during each monitoring event chemical analysis of groundwater samples from select wells is performed. An evaluation of the groundwater chemistry is also used to determine if the systems are operating in accordance with the intent of the system's objective.

The review of the hydraulic and chemical response in the bedrock due to the operation of the groundwater recovery system indicates that the system is operating in accordance with the design objectives. There is consistent containment of bedrock groundwater (see Figure II-15, Figure II-16 and Figure II-17).

The hydraulic response due to the operation of the overburden system has generally met the design expectations of establishing a zone of groundwater capture over in the specified locations. Although a significant ground water capture zone has been established along the southern property boundary of OCC, at the request of the NYSDEC, the company has recently enhanced the groundwater capture along the southern boundary of the facility. Based upon information contained in the "Monthly Progress Report - August 2001", water levels in the collection trench are at least three feet below the water levels in all surrounding wells.

Recent performance monitoring date can be found in "Corrective Measures Implementation Annual Performance Evaluation, January Through December 2000" dated March 2001, and "Quarterly Progress Report April through June 2001" dated July 2001. The groundwater recovery systems are capturing in excess of 80 pounds of organic contaminants per day.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

__X__ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Groundwater" is "Under Control" at the **OCCIDENTAL CHEMICAL CORPORATION** facility , EPA ID #**NYD000824482** , located at_**Buffalo Avenue** **Niagara Falls, New York**.. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

_____ IN - More information is needed to make a determination.

Completed by (signature) _____ Date September 27, 2001
(print) William E. Wertz, Ph.D.
(title) Senior Engineering Geologist

Supervisor (signature) _____ Date September 27, 2001
(print) Paul J. Merges , Ph.D.
(title) Director, Bureau of Radiation & Hazardous Site Management
(EPA Region or State) NYSDEC

Locations where References may be found:

NYSDEC
Division of Solid and Hazardous Materials
625 Broadway
Albany NY 12233-7252

Contact telephone and e-mail numbers

(name)__William E. Wertz
(phone #)___(518) 402-8594
(e-mail)_wewertz@gw.dec.state.ny.us

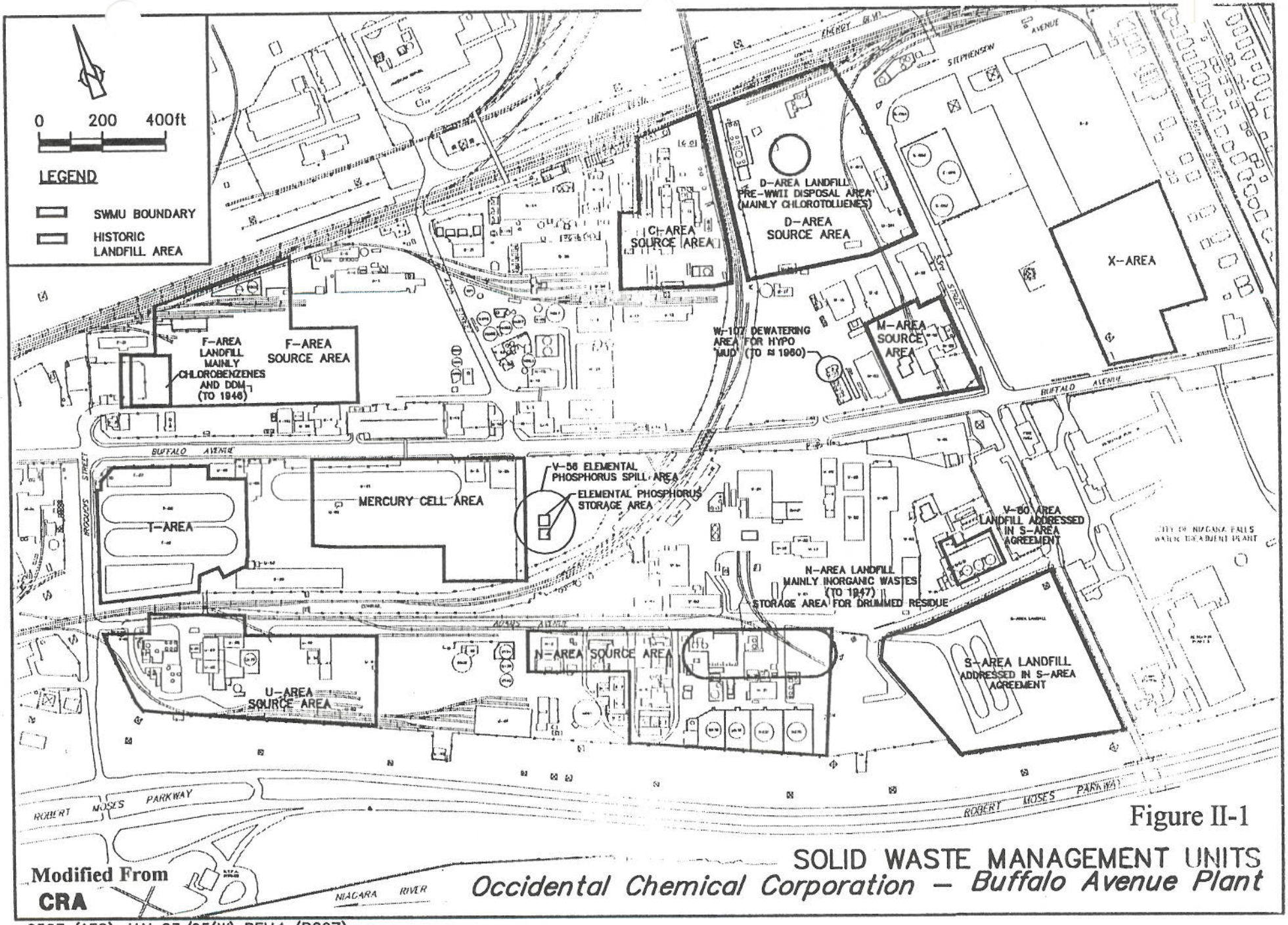


Figure II-1

SOLID WASTE MANAGEMENT UNITS

Occidental Chemical Corporation – Buffalo Avenue Plant

Modified From CRA

2583 (158) JAN 23/95(W) REV.1 (P807)

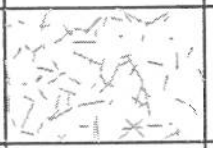
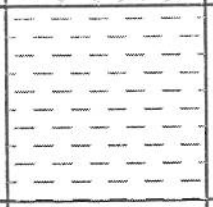
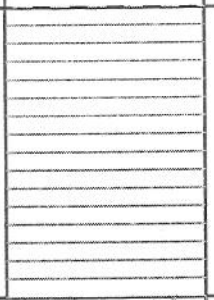
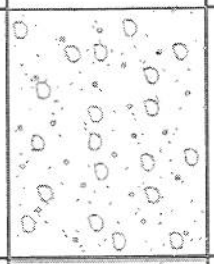
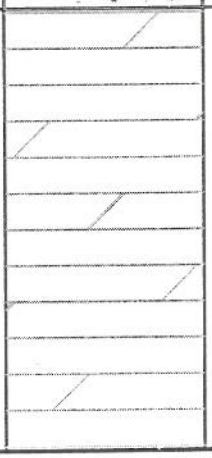
FORMATION	COLUMNAR SECTION	THICKNESS IN FEET	CHARACTER
FILL		0–15	GRAVEL, SAND, SILT AND CLAY, DEMOLITION DEBRIS, FLYASH, CINDERS, CHEMICAL WASTE
ALLUVIUM		0–15	LIGHT BROWN SILT AND VEGETATION, GRADING INTO THIN BLACK AND DARK BROWN SILTY SAND, GRADING INTO BLACK IN THE LOWER PART
GLACIOLACUSTRINE CLAY		0–15	RED BROWN SILTY CLAY AND GRAY BROWN SANDY TO CLAYEY SILT
TILL		0–15	RED BROWN SANDY SILT, TRACE TO SOME CLAY AND GRAVEL
BEDROCK			LOCKPORT DOLOMITE

Figure II-2

OVERBURDEN STRATIGRAPHY

Modified From CRA *Buffalo Avenue Plant – Occidental Chemical Corporation*

02583–00(191)GN–WA003 NOV 13/98

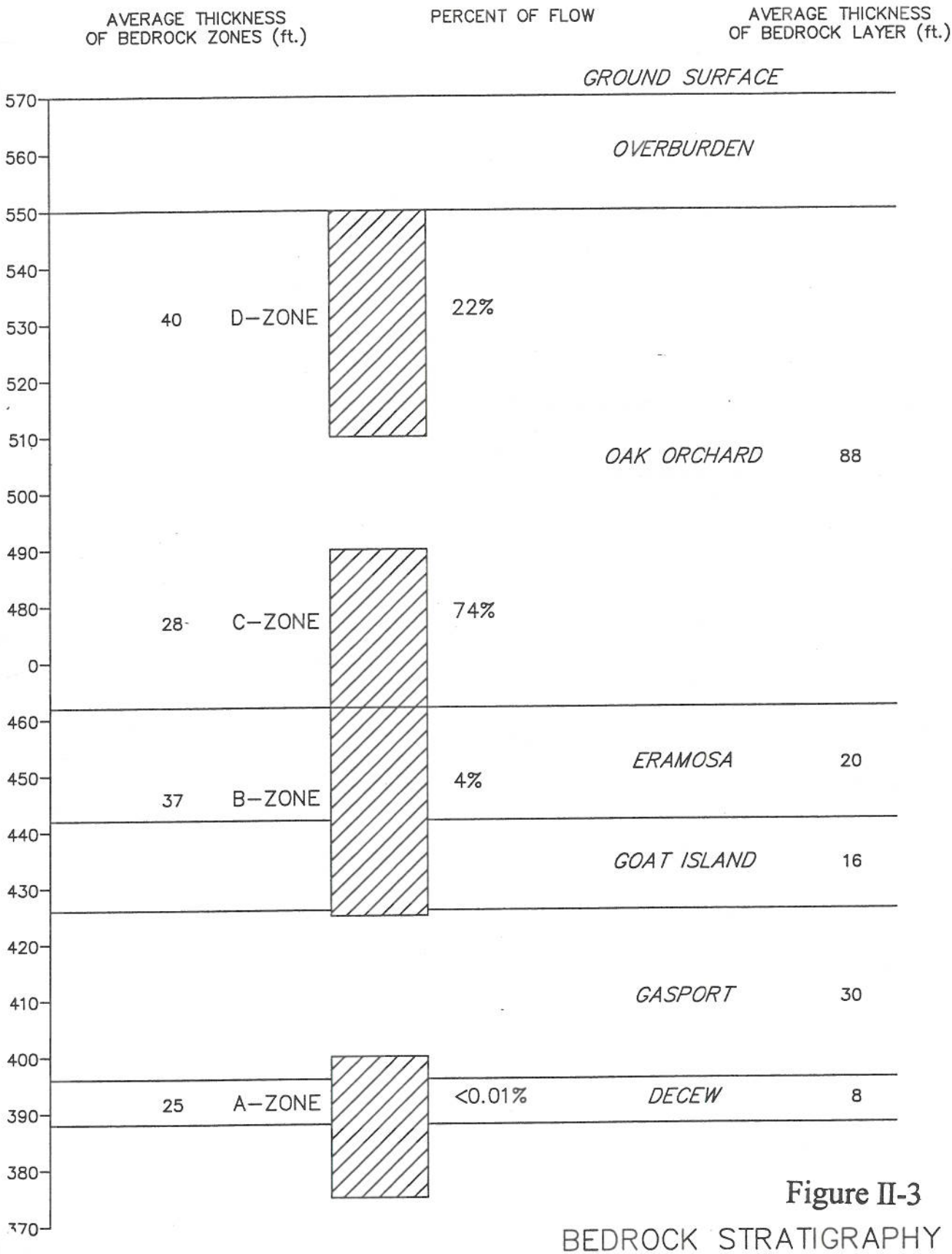


Figure II-3

BEDROCK STRATIGRAPHY

Modified From CRA

Buffalo Avenue Plant – Occidental Chemical Corporation

02583–00(191)GN–WA004 NOV 13/98

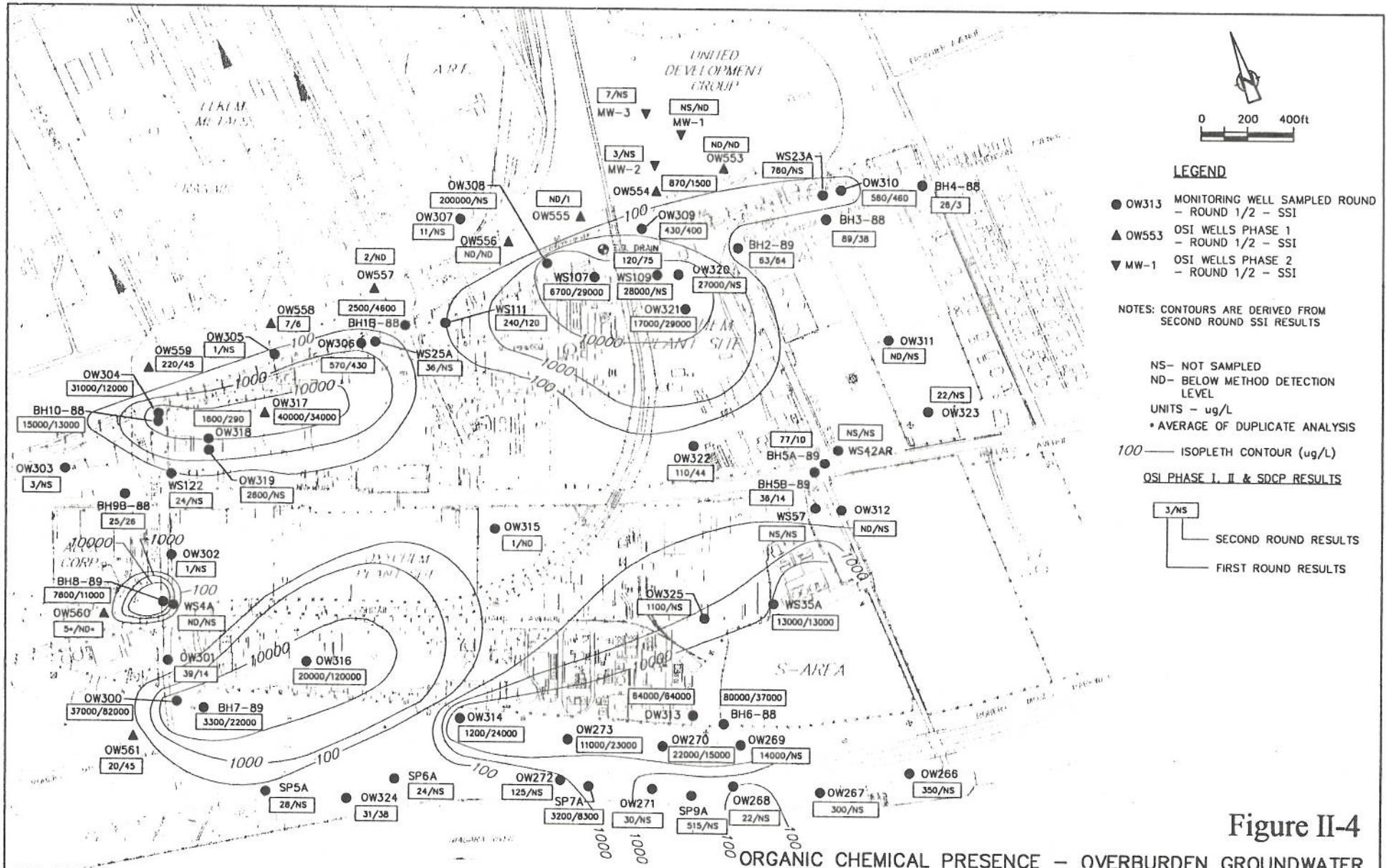


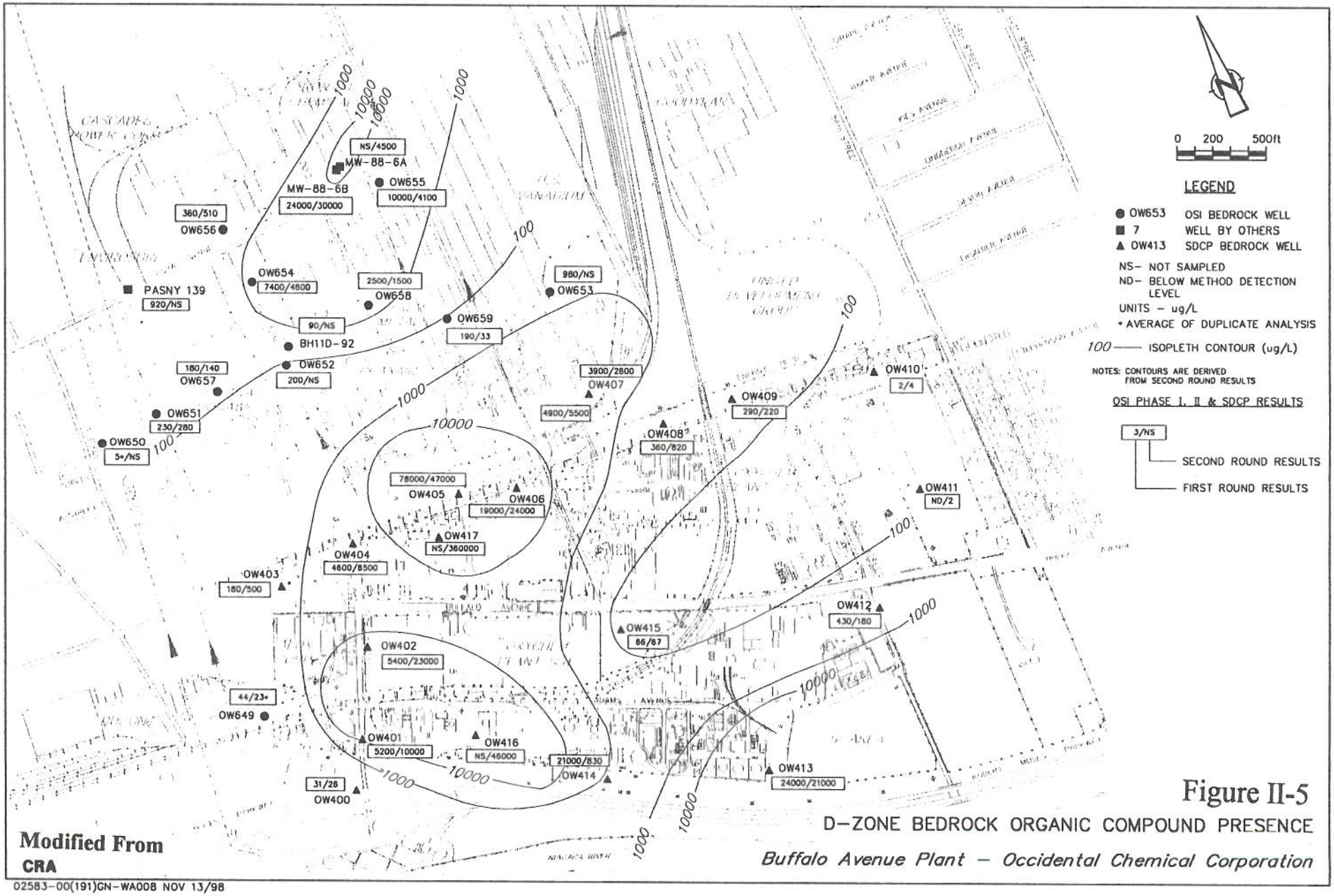
Figure II-4

ORGANIC CHEMICAL PRESENCE – OVERBURDEN GROUNDWATER

Buffalo Avenue Plant – Occidental Chemical Corporation

Modified From
CRA

02583-00(191)GN-WA014 NOV 13/98



Modified From
CRA

Figure II-5

D-ZONE BEDROCK ORGANIC COMPOUND PRESENCE

Buffalo Avenue Plant – Occidental Chemical Corporation

02583-00(191)GN-WA008 NOV 13/98

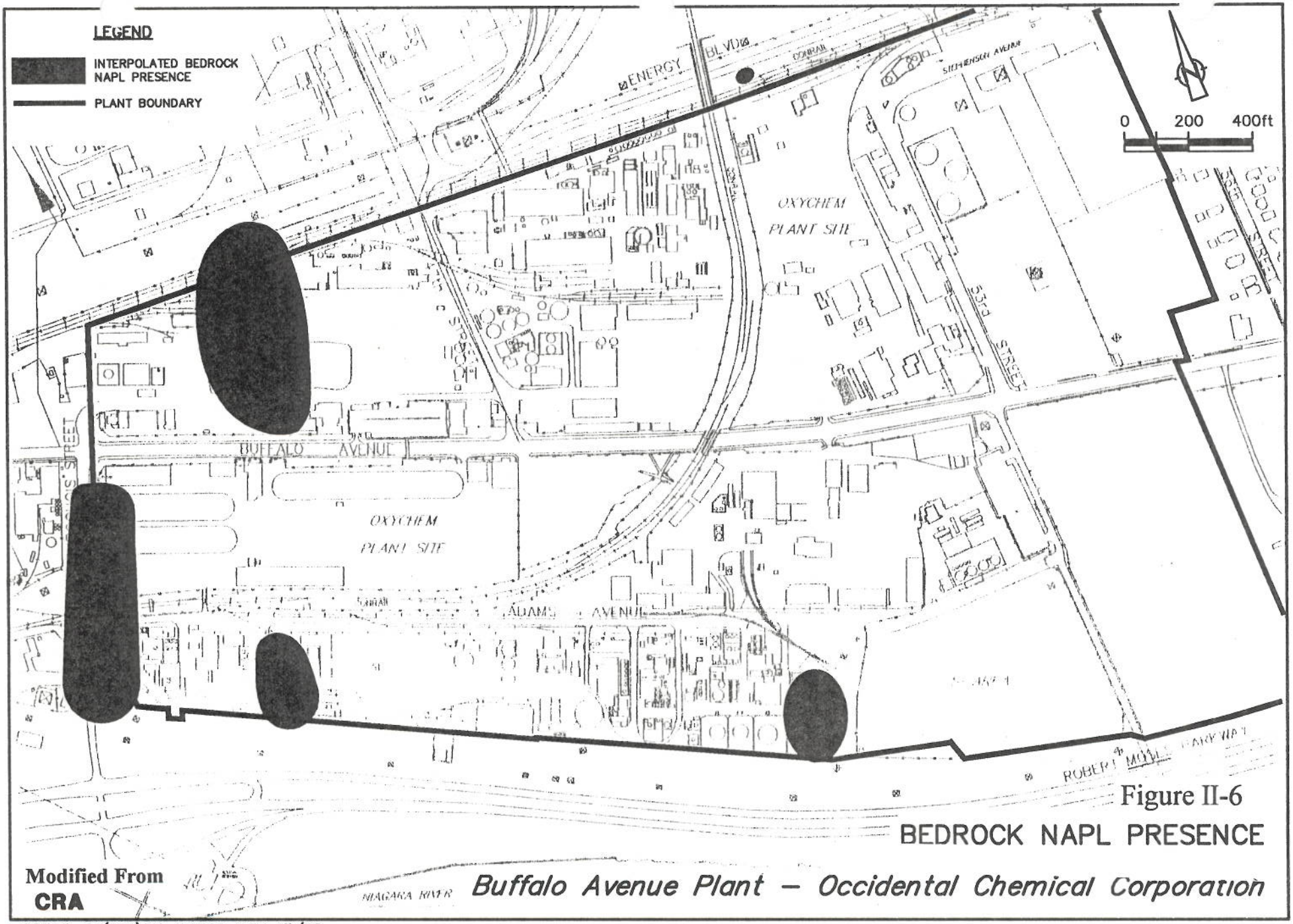


Figure II-6

BEDROCK NAPL PRESENCE

Buffalo Avenue Plant – Occidental Chemical Corporation

02583-00(191)GN-WA012 NOV 13/98

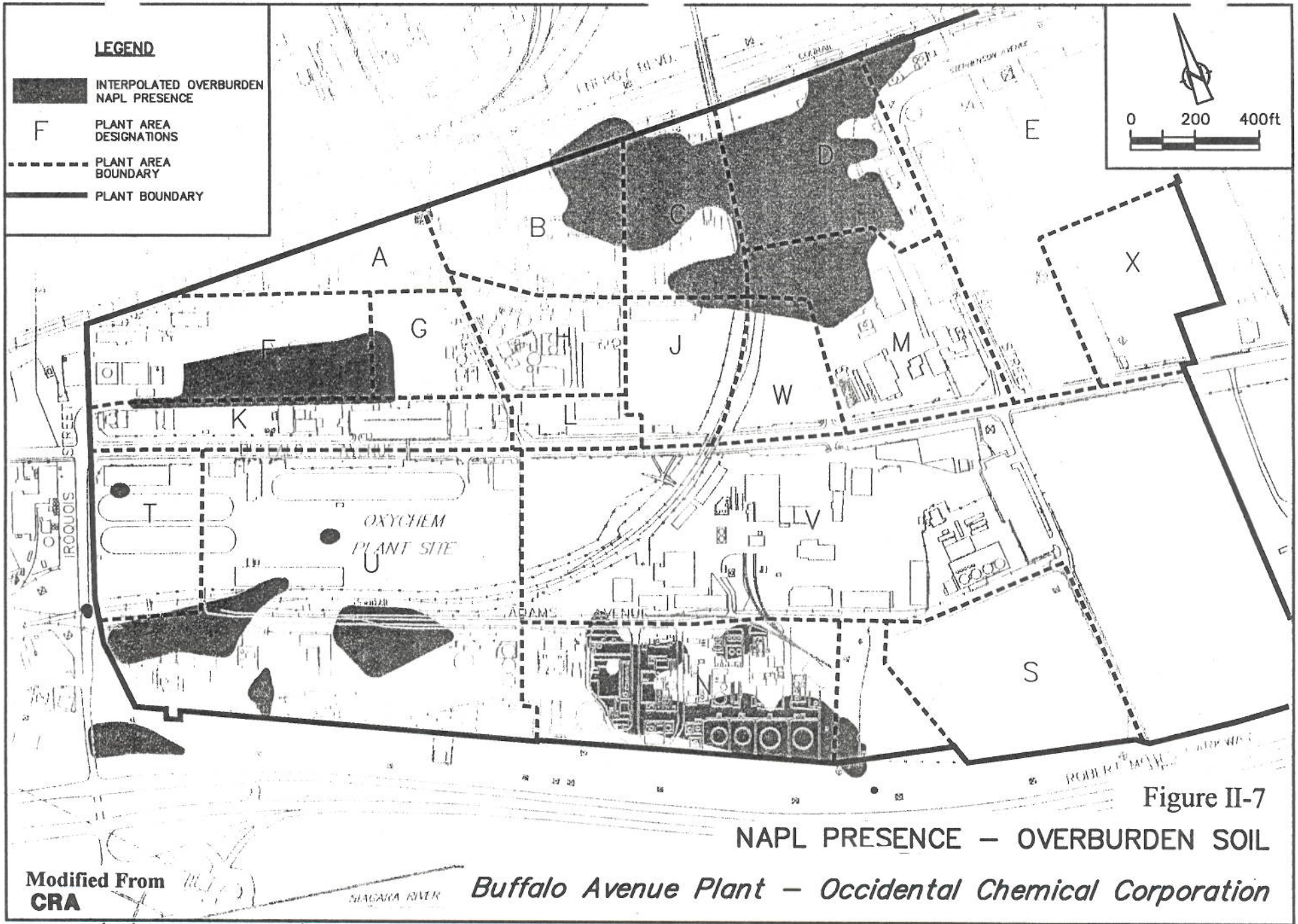


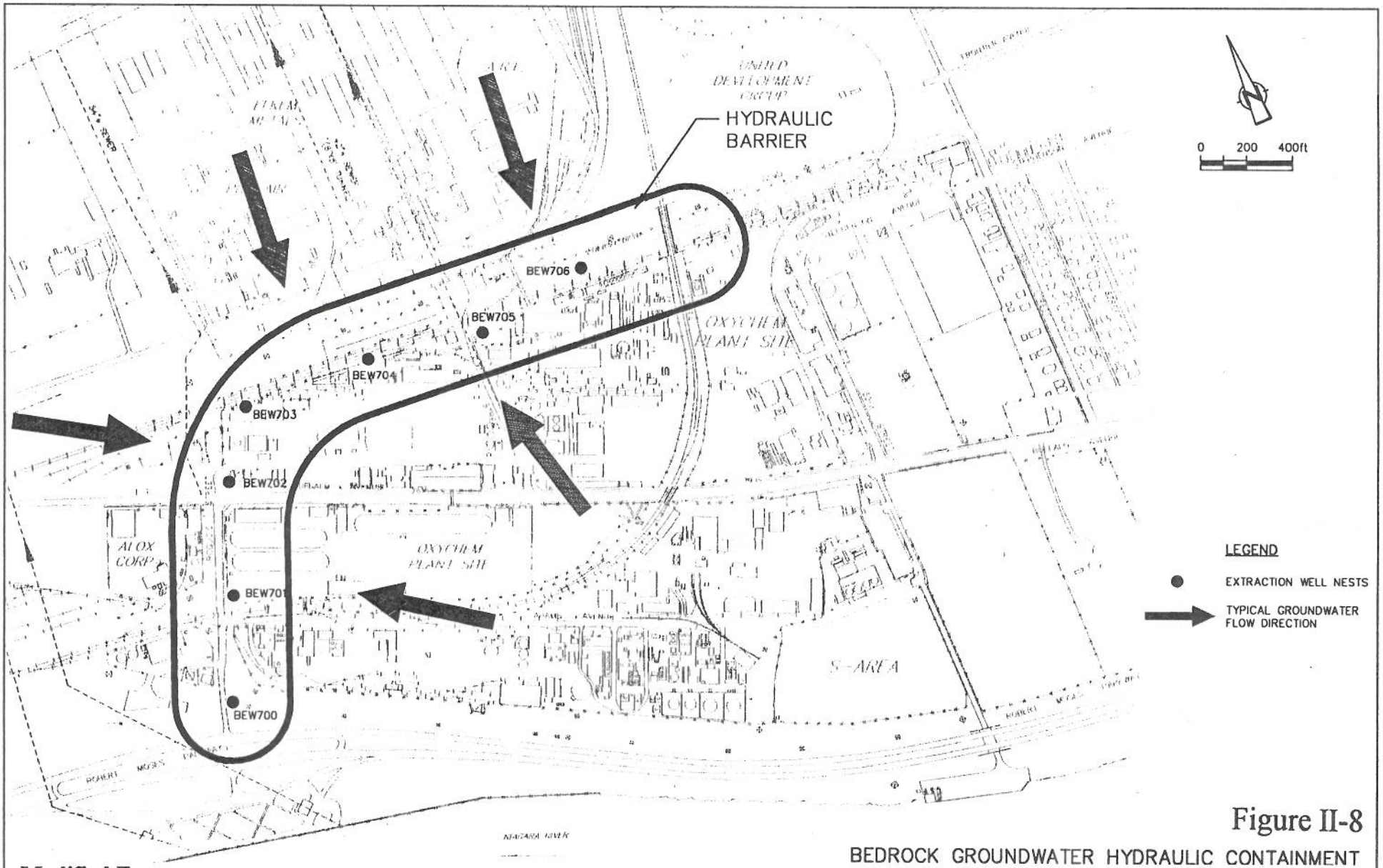
Figure II-7

NAPL PRESENCE – OVERBURDEN SOIL

Buffalo Avenue Plant – Occidental Chemical Corporation

Modified From CRA

02583-00(191)GN-WA020 NOV 13/98



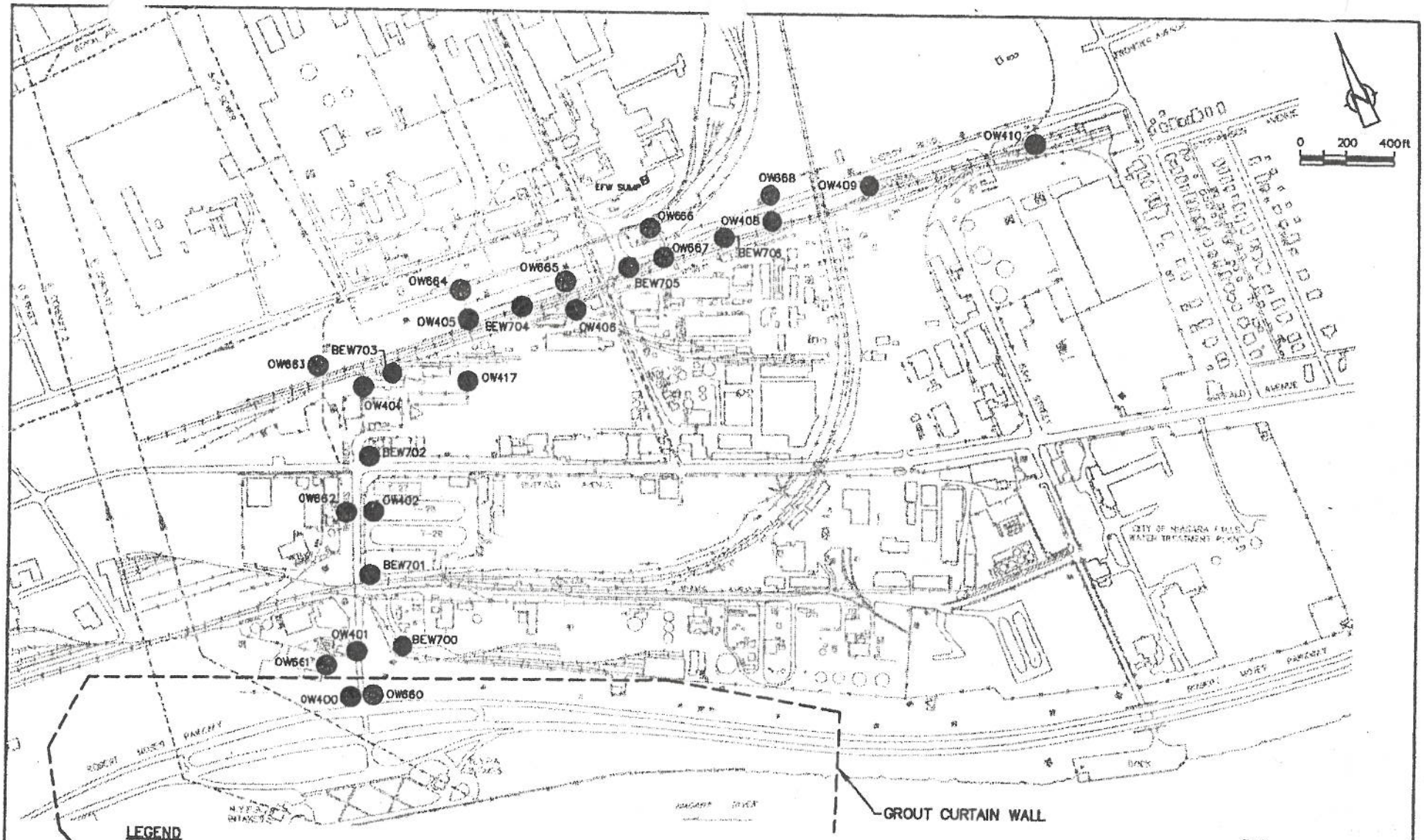
Modified From
CRA

02583-00(191)GN-WA026 NOV 13/98

Figure II-8

BEDROCK GROUNDWATER HYDRAULIC CONTAINMENT

Buffalo Avenue Plant – Occidental Chemical Corporation

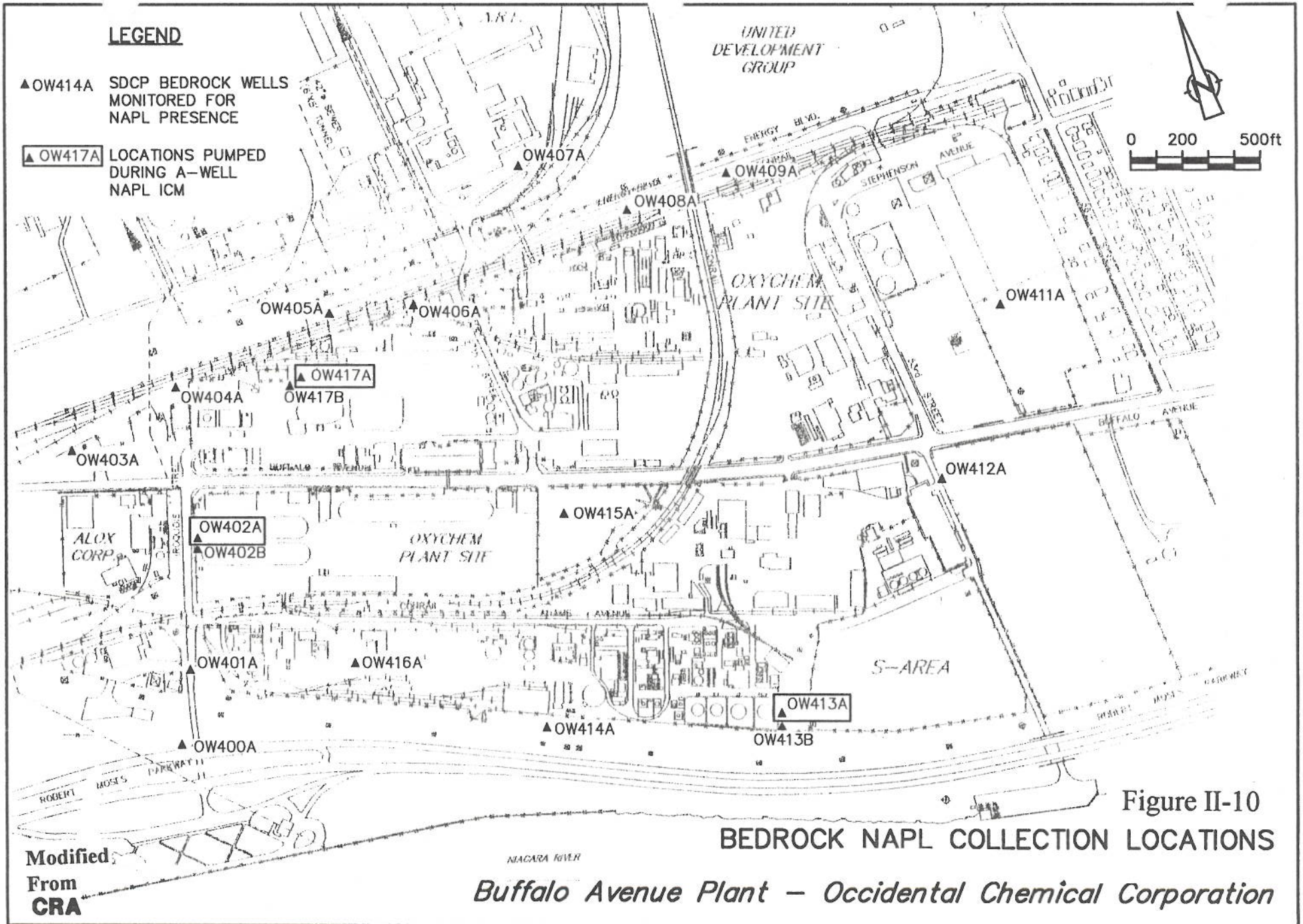


Modified From CRA

6053 (11) NOV 22/95(W) REV.1 (D-38)

Figure II-9

EXTRACTION AND HYDRAULIC MONITORING WELL LOCATIONS
BEDROCK GROUNDWATER REMEDIATION
Occidental Chemical Corporation–Buffalo Avenue Plant



Modified From CRA

Figure II-10

BEDROCK NAPL COLLECTION LOCATIONS

Buffalo Avenue Plant – Occidental Chemical Corporation

02583-00(191)GN-WA039 NOV 13/98

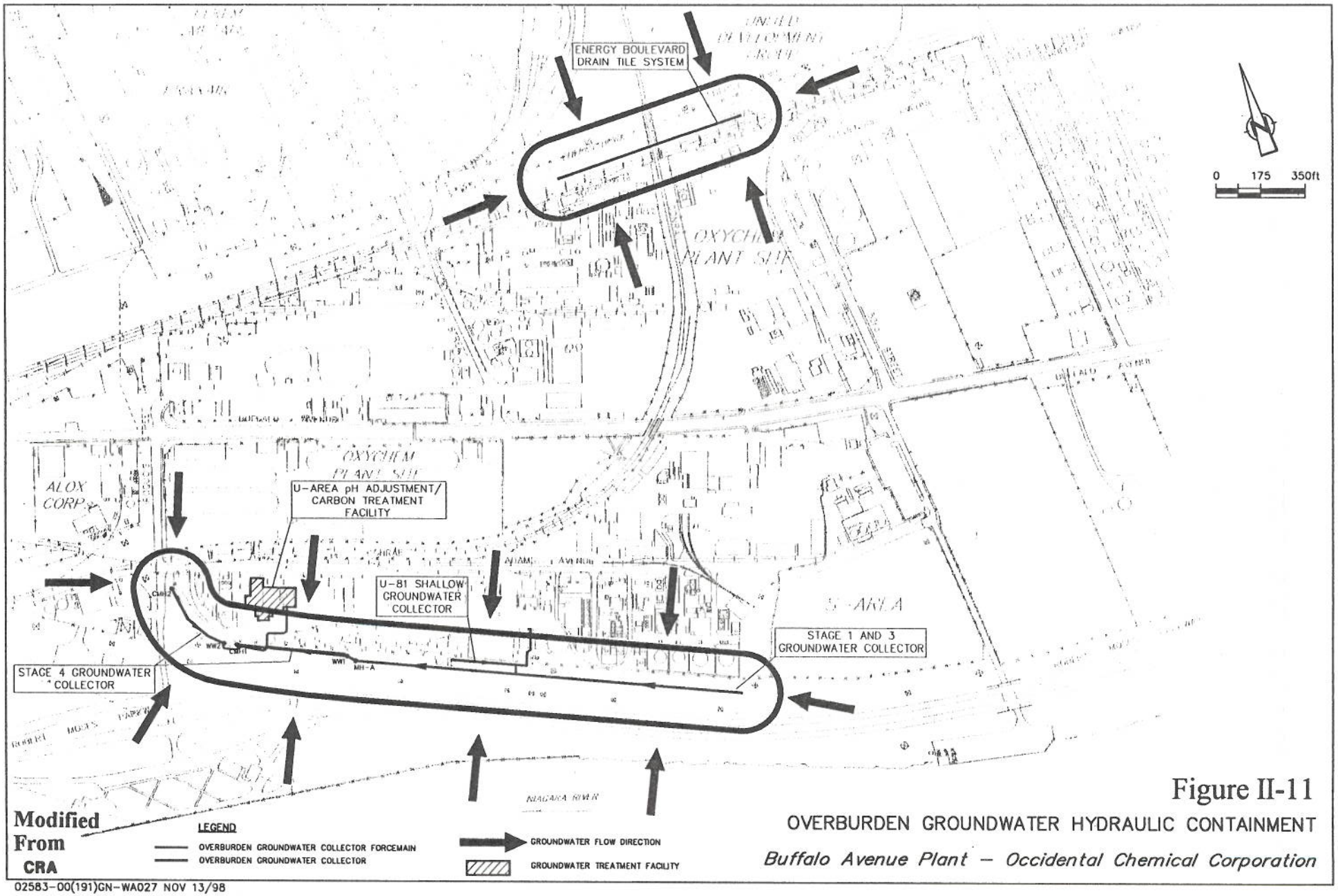


Figure II-11

OVERBURDEN GROUNDWATER HYDRAULIC CONTAINMENT

Buffalo Avenue Plant – Occidental Chemical Corporation

02583-00(191)GN-WA027 NOV 13/98

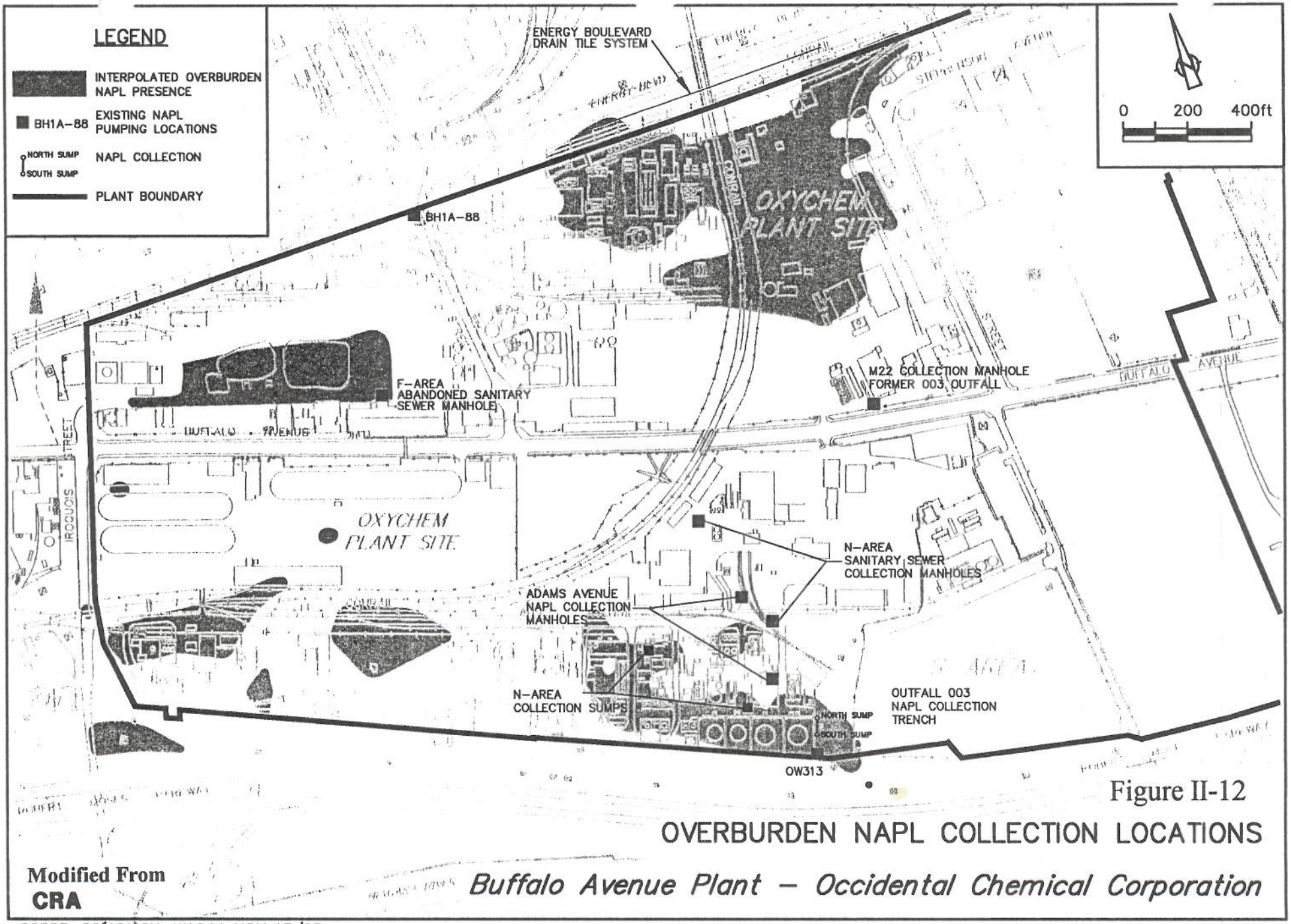


Figure II-12

OVERBURDEN NAPL COLLECTION LOCATIONS

Buffalo Avenue Plant – Occidental Chemical Corporation

Modified From CRA

02583–00(191)GN–WA044 NOV 13/98

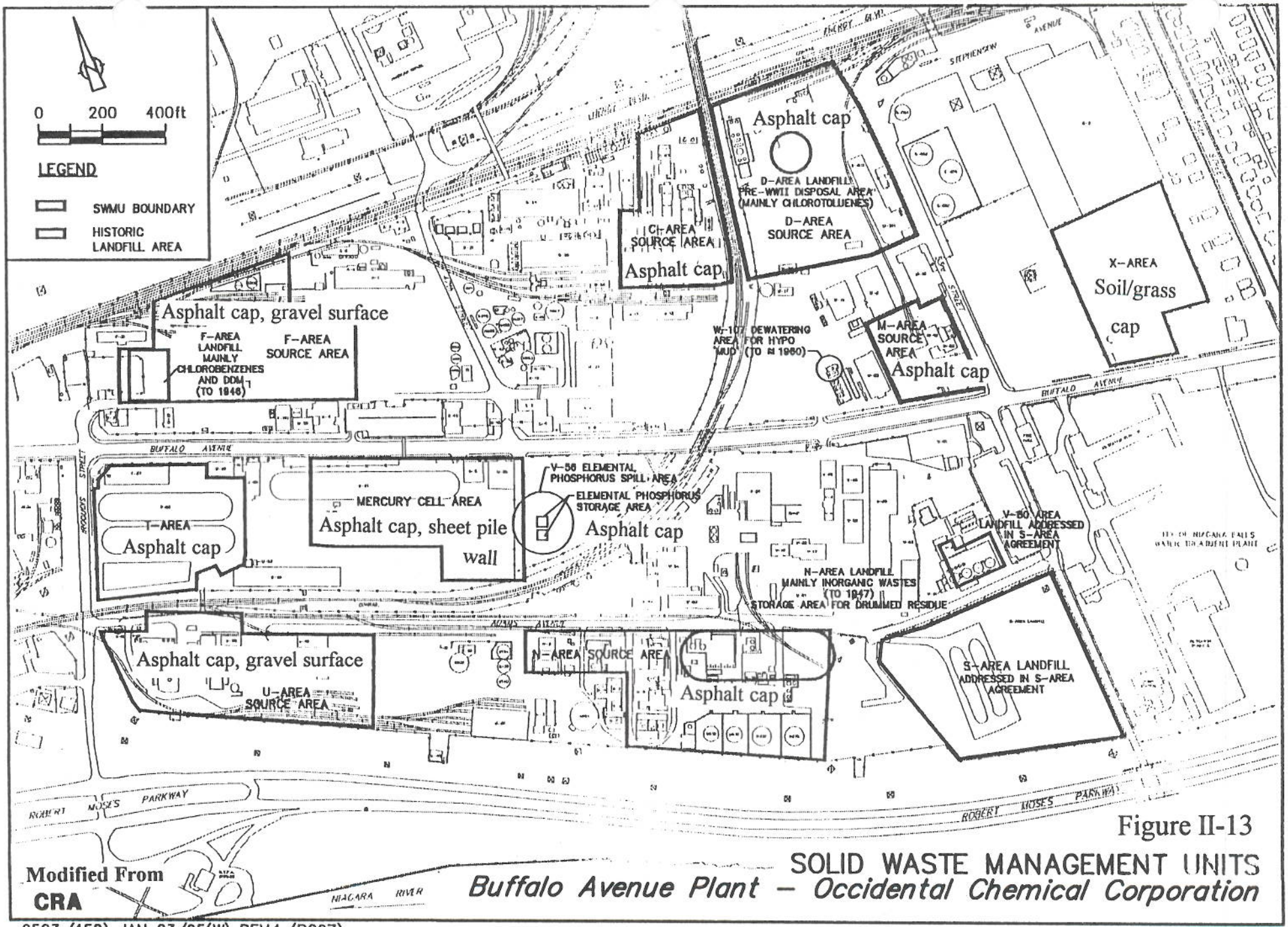


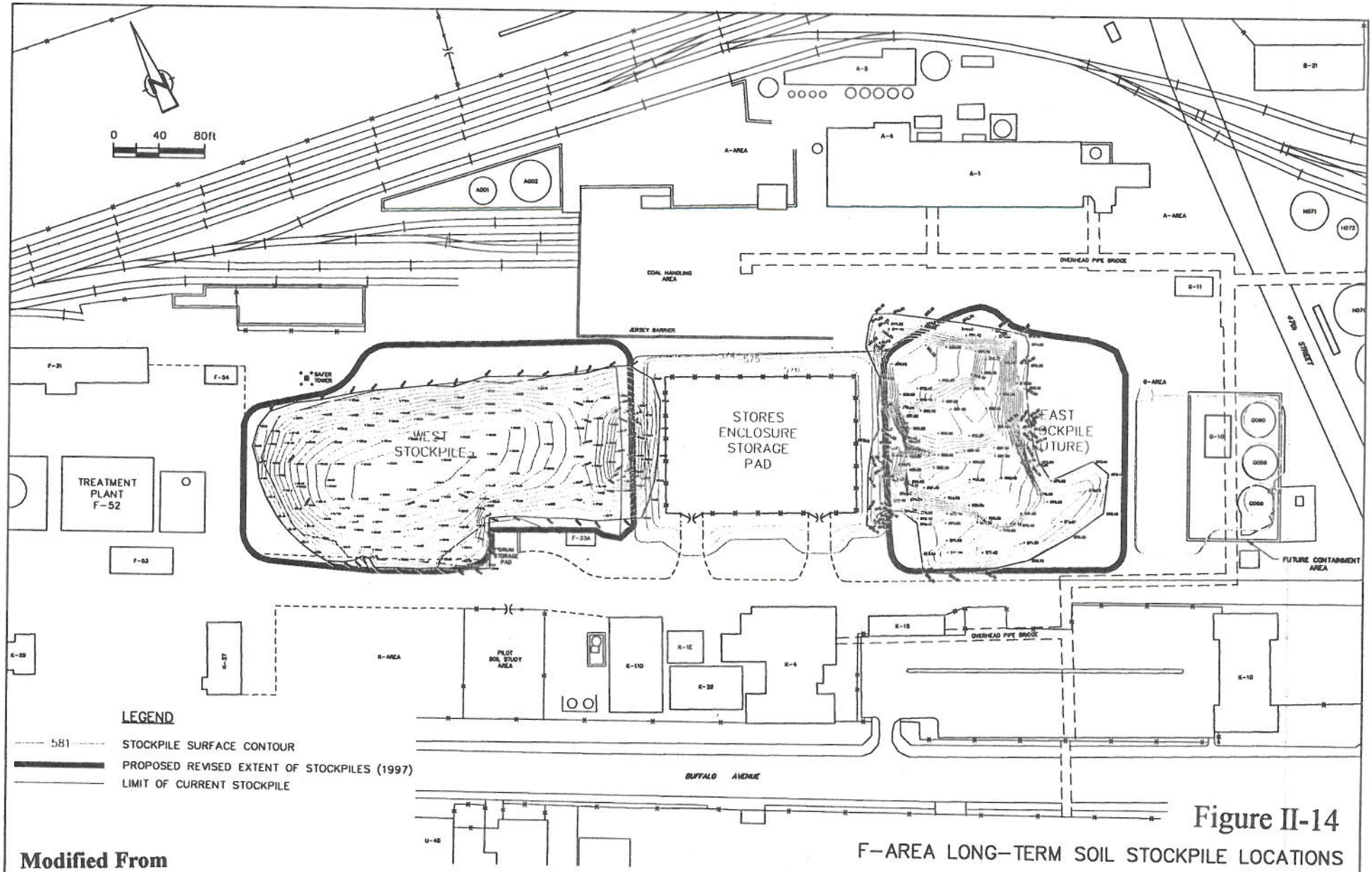
Figure II-13

SOLID WASTE MANAGEMENT UNITS

Buffalo Avenue Plant – Occidental Chemical Corporation

Modified From CRA

2583 (158) JAN 23/95(W) REV.1 (P807)



Modified From
CRA

02583-00(191)GN-WA055 NOV 13/98

Figure II-14

F-AREA LONG-TERM SOIL STOCKPILE LOCATIONS

Buffalo Avenue Plant – Occidental Chemical Corporation

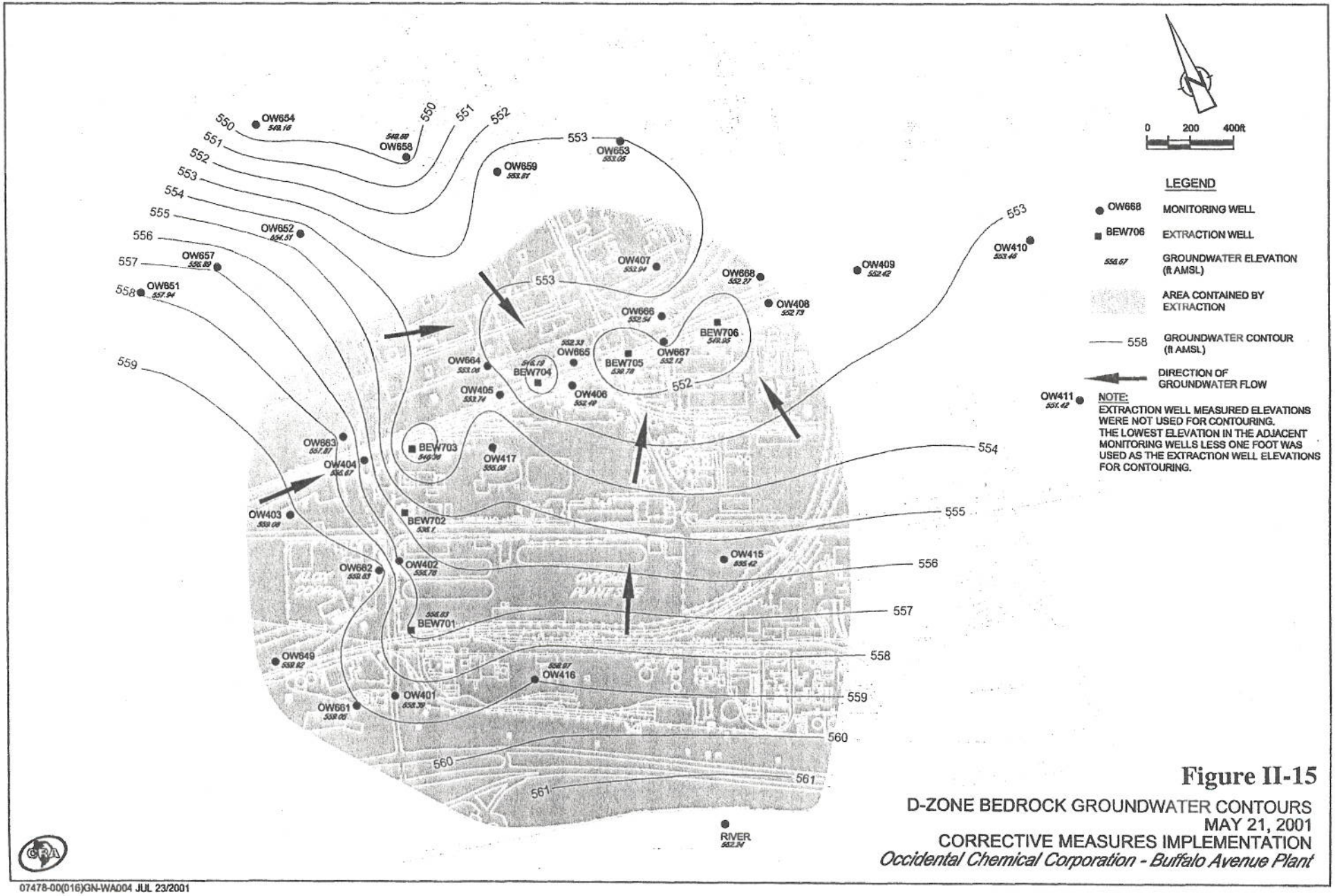


Figure II-15

D-ZONE BEDROCK GROUNDWATER CONTOURS
MAY 21, 2001
CORRECTIVE MEASURES IMPLEMENTATION
Occidental Chemical Corporation - Buffalo Avenue Plant

07478-00(016)GN-WA004 JUL 23/2001

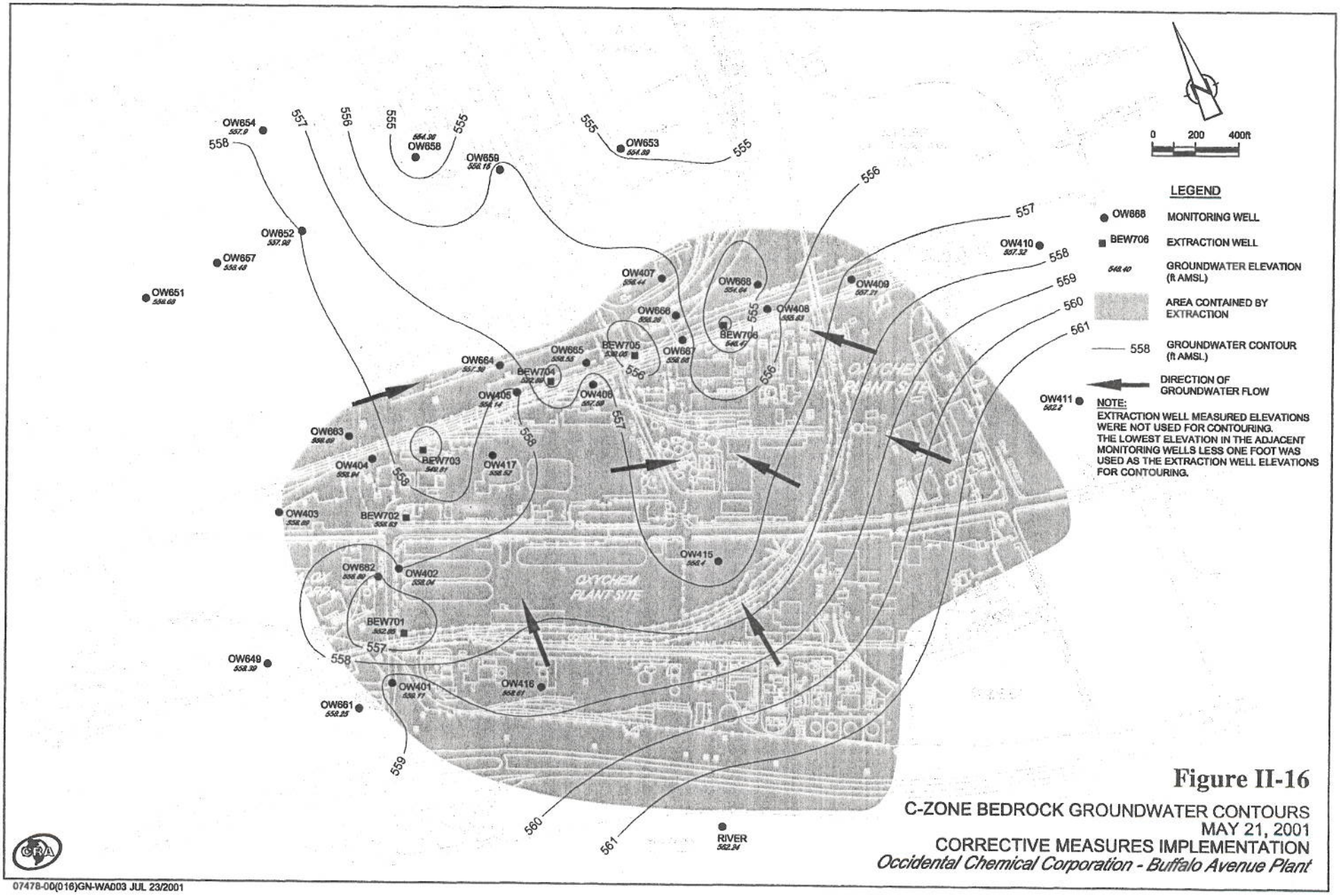


Figure II-16

C-ZONE BEDROCK GROUNDWATER CONTOURS
MAY 21, 2001
CORRECTIVE MEASURES IMPLEMENTATION
Occidental Chemical Corporation - Buffalo Avenue Plant

07478-00(016)GN-WA003 JUL 23/2001

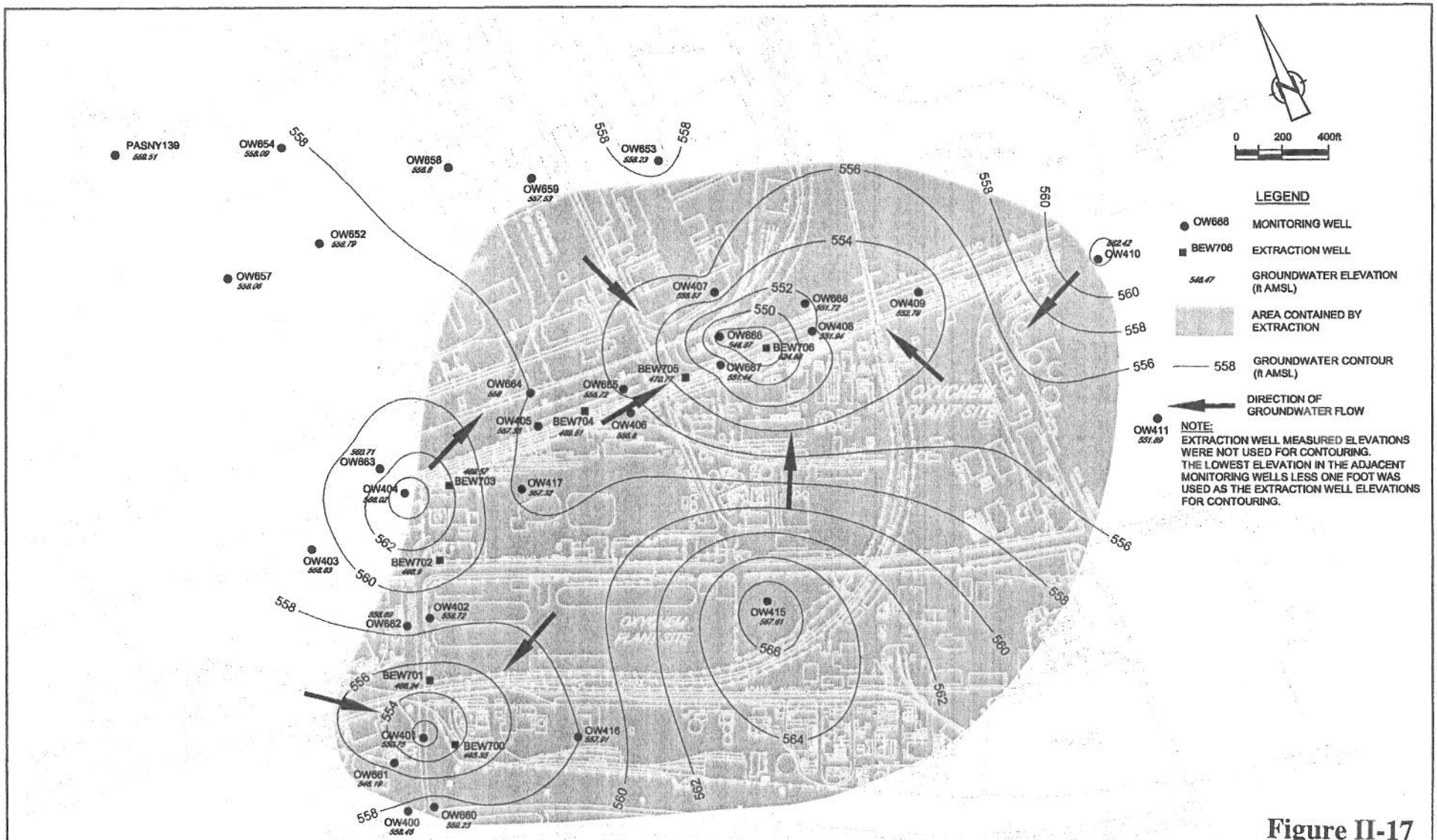


Figure II-17

B-ZONE BEDROCK GROUNDWATER CONTOURS
MAY 21, 2001
CORRECTIVE MEASURES IMPLEMENTATION
Occidental Chemical Corporation - Buffalo Avenue Plant

07478-00(016)GN-WA002 JUL 23/2001