SITE RADIOLOGICAL SURVEY PLAN

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MODEL CITY, NY

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WASTE MANAGEMENT

TABLE OF CONTENTS

List of Abbreviations, Acronyms and Symbols

%.....percent

AEC..... Atomic Energy Commission

cpm or c/m..... counts per minute

$DCGL_W$..... Derived Concentration Guideline Level–wide area average
DOD..... United States Department of Defense
DOE..... United States Department of Energy

EPA..... United States Environmental Protection Agency

ft/s..... feet per second

GPS ..... global positioning system

KAPL..... Knolls Atomic Power Laboratory

m/s..... meter per second
m^2..... square meters
MARSSIM ..... Multi-Agency Radiation Survey and Site Investigation Manual

NaI ..... sodium iodide
NRC ..... United States Nuclear Regulatory Commission

pCi/g..... picocuries per gram

Ra ..... radium

Th..... thorium

U ..... uranium
U_{tot}.....total uranium
UR..... University of Rochester
USACE..... United States Army Corps of Engineers

1.0 INTRODUCTION

Prior to being operated as a Treatment, Storage and Disposal Facility (TSDF), the property currently owned by CWM Chemical Services, LLC (CWM), was utilized by the U.S. Government from the early 1940s to the mid 1960s as part of the Lake Ontario Ordinance Works (LOOW). The Niagara Falls Storage Site (NFSS) and associated vicinity properties are historically known as the Atomic Energy Commission (AEC) portion of the LOOW. The site is located in Lewiston and Porter New York and originally included 1,511 acres. Currently, the NFSS is only 191 acres. Historically, the site was used for research, processing of uranium (U) and thorium (Th) ores, storage and burial of radioactive ores and residue. In the mid-1950's the federal government sold much of the property. Predecessor companies to CWM Chemical Services, LLC (CWM) bought a portion of the surplus property. Some of the U.S. Government activities resulted in the contamination of certain areas of the Model City Facility with chemical and radioactive wastes. On April 27, 1972, the New York State Department of Health (NYSDOH) issued an order relating to approximately 614 acres of former LOOW property, which imposed certain restrictions on the use of said property. On June 21, 1974, NYSDOH issued a supplemental order to amend the 1972 order.

As a result of extensive corrective remedial actions taken at the CWM property since the 1972 Order, on May 7, 1992, the Department of Energy (DOE) certified that the majority of the CWM property was "in compliance with applicable (radiological) decontamination criteria and standards" and provided "assurance that future use of the property will result in no radiological exposure above DOE criteria and standards established to protect members of the general public or site occupants". Decontamination was certified for all properties owned by CWM, with the exception of three properties designated as E, E' and G. These properties were excluded from the decontamination certification because an area within each property could not be properly assessed due to inaccessibility and the DOE could not confirm that contamination did not exist in these areas. The three inaccessible areas were (1) soil beneath Lagoon 6 and the berm surrounding that lagoon on Property E, (2) soil beneath a roadway and PCB storage tanks on Property E', and (3) soil beneath the liquid treatment pond on the western edge of Property G.

Based on the May 7, 1992, DOE letter, on December 23, 2003, CWM requested that the NYSDOH execute an order to rescind and vacate the 1972 and 1974 Orders for all CWM property, except properties E, E' and G. After reviewing all historical documentation and data related to the areas covered by the Orders, both in the NYSDOH files and provided by CWM, the NYSDOH determined a potential for residual radiological contamination still exists and that a survey be performed identifying any surface areas above a target investigation level.

As required by condition J.1 of Module II (corrective Action) of CWM's Sitewide 6 NYCRR Part 373 Permit, a revised Site Radiological Survey Plan is being submitted. The principles guiding the development of this radiological survey plan include:

- Continue to protect worker health and safety
- Continue to protect public health and safety
- Continue to protect the environment
- Survey plan is not linked to historical information
- Provide for positive identification and control of any Manhattan Engineer District (MED), Knolls Atomic Power Laboratory (KAPL), and University of Rochester (UR) materials encountered
- Provide a new baseline for future CWM operational plans and programs
- Apply latest technology and Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (DOD 2000) methodology

The major elements of the plan include:

- Site wide surface survey methodology
- Identify areas needing special attention
- Survey protocols for Gamma Walkover Survey
- Survey Sensitivities, Detection Limits and Field Instrumentation
- Report Preparation and Format
- Detailed Investigations
- Interior building surveys of "Legacy" structures
- Radon testing of facility buildings
- Contractor/Consultant qualifications
- Health & Safety Plan for survey activities

2.0 RADIOLOGICAL SURVEY

Guidance provided in the MARSSIM will be the basis for the radiological survey. The MARSSIM process was developed collaboratively by the U. S. Nuclear Regulatory Commission (NRC), the U. S. Environmental Protection Agency (EPA), the DOE, and the U. S. Department of Defense (DOD), for use in designing, implementing, and evaluating surveys for sites contaminated with radionuclides. The result of the implementation of this survey plan will be to identify those areas that will require additional investigation through sampling and radiochemical analysis. All survey work will be performed under a Health and Safety Plan that includes controls and requirements for activities, including personnel protective equipment, and personnel monitoring.

An initial gross-count Investigation Level of 16,000 counts per minute (cpm, c/m) (10,000 cpm plus 6,000 cpm net) has been selected based on the Investigation Level used at Western New York FUSRAP sites and preliminary results gathered to date, which indicate a site background of about 10,000 cpm. Data collection thus far appears to indicate a lower background level for asphalt/paved areas vs soil/vegetated areas. The investigation value for asphalt/paved areas may need to be adjusted accordingly. The Investigation Level(s) will be used as the criterion for screening the investigation units and determining which areas require a detailed investigation.

2.1 Gamma Walkover Survey

The objective of the gamma walkover survey is to provide a 100%-coverage gamma radiation map of approximately 450-acres of the CWM site with nominal 1-meter (m) resolution. The map, in digital form, will be used for screening each of approximately 18,200 investigation units, contained within the 912 site survey units, for more detailed investigation and soil sampling. Because of the large areas and quantities of data from this high-resolution survey, the identification of investigation units that require detailed investigation and soil sampling will be performed electronically during analysis of the gamma walkover survey data. The coordinates of the investigation units that fail the screening will be determined during the analyses of the walkover survey data. The physical marking of the field locations of the units that fail the screening will be performed as part of the detailed survey and soil sampling tasks.

2.2 Survey Protocol

Accessible areas of the CWM site (Figure 1) which are currently operational or may be developed in the near future (approximately 450 acres) will have a 100%-coverage scanning walkover survey to determine the levels of gross gamma radiation from the surface soil and materials of the site and from designated background areas. The 450-acre area will be divided into approximately 912 survey units (2,000 m^2 each), consistent with MARSSIM guidance. Each survey unit will be further divided into twenty (20) 100-m^2 areas that will be reviewed to identify whether there are any individual readings above the Investigation Level.

The walkover surveys will utilize gamma ray scintillation detectors coupled to count rate meters, a sub-meter global positioning systems (GPS), and data loggers to automatically record the radiation levels and their locations as the field operator performs the walkover. The electronic records of survey results will be downloaded and transferred to computers for processing, entry into a geographical information system (GIS), and analysis of results (see Figure 2).

To obtain 100% coverage, the walkover surveys will be guided by real-time GPS positioning relative to waypoints that define straight-line traverses across given portions of the site. This approach provides the field survey operator with continuous measures (once per second) of the distance to the right or left of a target traverse line, guiding the course corrections to follow the target line within approximately ± 0.5 m. Together, the successive traverses form a serpentine pattern (Figure 3) that provides approximately one radiation measurement in every 1 m^2 area based on a traverse spacing of s = 1 m; v = 0.5 m/s velocity; and $v \cdot t$ = (0.5 m/s)·(2 s) = 1 m field of view.

One or more background survey units (approximately 2,000 m^2 each) will be identified and surveyed by the same walkover method used at the rest of the CWM site for comparison with the site readings in each survey unit. The background survey unit(s) will be chosen to approximate similar soil/geology to the units found at the other areas of the CWM site. The background unit(s) may be located on CWM property at the site if it is known to have not been affected by operations with radioactive materials. The background unit(s) may also be located off-site. Prior to their use for comparisons with the CWM walkover surveys, the background-unit walkover surveys will be analyzed to assure that they do not contain anomalous hot-spots or gamma radiation levels that are significantly elevated above the baseline levels found at the CWM site.

All analyses and interpretations of the walkover surveys will be performed by off-site computers, which will receive the field data at least daily and will provide performance reports to the field operators. The reports will summarize the preliminary status of each investigation unit, the locations of any units that appear to be excessively higher than typical background readings, and survey management metrics. The daily metrics include the acres covered by each field survey operator, the mean and standard deviation of his scan velocities, and other statistics that will help track and improve performance.

2.3 Survey Sensitivities, Detection Limits and Field Instrumentation

The following radiological field survey instruments (or their functional and performance equivalent, as determined by a Certified Health Physicist) will be used (Table 2-1). Detection sensitivities have been determined following the guidance of NUREG-1507 (NRC 1998) using nominal literature values for background, response, and site conditions for the Ludlum detectors.

Table 2-1 Detection Sensitivities for Radiation Survey Instrument

Description	Application	Approximate Detection Sensitivity
2-inch x 2-inch NaI gamma scintillation detector with a scaler/ratemeter	Surface scans of all soil areas.	^{230}Th – 2120 pCi/g ^{226}Ra – 2.8 pCi/g ^{238}U – 39 pCi/g

Refinements to these detection sensitivity estimates will be made, as necessary, based on actual instrument response and background data gathered during site survey activities.

The walkover surveys will be performed using 2" x 2" sodium iodide (NaI) scintillation detectors (Model 44-20, Ludlum Measurements Inc., Sweetwater, TX or equivalent) coupled serially to count rate meters (Model 2221, Ludlum, or equivalent). The count rate meters are coupled in turn to sub-meter global positioning systems (GPS) (Trimble Pro XRS or equivalent) to automatically record detector positions every second. The data logger used to store the detector positions will also record the gamma radiation count rates (counts per minute) every two seconds. The logged data from the survey meters and GPS systems will be downloaded once or twice daily to field computers for transfer and analysis

The gamma scintillation detectors used in the walkover surveys will be mounted at 30.5-cm (1-ft.) elevations above ground surface in baby strollers or equivalent carriages (Figure 3). The GPS antenna will be mounted directly above the gamma radiation detector at a measured distance above ground surface, which distance will be entered into the corresponding GPS data logger. For surface gamma walkover surveys, the surveyor will walk at a speed of approximately 2 feet per second (ft/s) (0.5 meters per second [m/s]) while passing the detector/carriage over the surface in a Serpentine Survey Traverse Pattern (Figure 3).

If more than one detector system is mounted on a movable carriage unit, the systems will be mounted with a rigid bar to maintain a 1-m spacing between the detectors. If more than one GPS system is mounted on the unit, the GPS systems will also utilize rigid bar(s) to maintain 1-m antenna spacing. If multiple detectors are linked to a single GPS antenna, the horizontal spacing between each detector and the GPS antenna will be recorded and used in determining individual detector positions. If two detectors are mounted 1 m apart on a carriage, the traverse spacing will be increased to s = 2 m to continue providing approximate 1-m spacing between the individual rows of detector positions. The field manager may modify this method, as needed, due to terrain anomalies, obstructions, or other complications.

If areas are encountered where it is impractical to utilize the carriage-mounted detector/GPS system (dense brush, trees, etc.), grids of survey stakes will be established at 10-m spacing to define 100 m^2 units that will be surveyed in serpentine scanning patterns with a similar measurement density of one 2-

second measurement for every square meter of the staked area. If anomalous readings are observed, then more detailed static surveys will be performed to define the anomaly.

Other radiation survey equipment that will be used at the CWM site includes beta/gamma detectors (Model 44-9, Ludlum, or equivalent) that will also be coupled to survey meters (Ludlum Models 3, 2221, or equivalent). The beta/gamma survey instruments will be used to scan workers and equipment for surface radioactive contamination before leaving the work areas of the site.

All instrumentation will have current calibration (within the past 12 months, or more frequently if recommended by the manufacturer). Daily field performance checks (i.e., background and source check) will be conducted in accordance with individual instrument use procedures. These performance checks will be performed prior to daily field activities and at any time, the instrument response appears questionable. Only data obtained using instruments that satisfy the performance requirements will be accepted for use in the evaluation.

The scanning results will be recorded in counts per minute (cpm). For the walkover surveys, a gross gamma sensor will be combined with a Global Positioning System (GPS) to record the coordinates of the individual gross gamma measurements.

Based on the configuration of the scanning equipment, the sensitivity of 2" x 2" gamma ray scintillation detectors for detecting Ra-226, Th-230, and U_{tot} is analyzed here to estimate their capabilities for finding these radionuclides. The minimum detectable concentrations and associated sensitivity parameters are estimated by the methods described in NRC 1998 and NRC 2000 using the following values for survey parameters:

- Background count rate: 10,000 c/m
- Detector elevation: 30.48 cm
- Detector scan velocity: 0.5 m/s
- Count interval: 2 s

The minimum detectable number of counts in a 2-second count interval is

$$b, = (10{,}000\,\text{c/m})^{*}(2\text{s})^{*}(1\,\text{min}/60\text{s}) = 333\,\text{counts}. \quad (1)$$

The minimum detectable count rate (using d' = 1.38 for 95% true positives and 60% false positives) is

$$MDCR = (1.38)^{*}\left(\sqrt{333}\right)^{*}(60s/1\,\text{min})/2\text{s} = 756\,\text{c/m}. \quad (2)$$

The surveyor MDCR, assuming 50% efficiency in detecting hot spots, is

$$MDCR_{\text{surveyor}} = \frac{756\,\text{c/m}}{\sqrt{0.5}} = 1{,}069\,\text{c/m}. \quad (3)$$

The minimum detectable exposure rate for scanning (MDE_{scan}) with a 2" x 2" NaI scintillation detector is

$$MDE_{scan,i} = \frac{1{,}069\ \text{c/m}}{Efficiency_{2x2,i}} \quad , \tag{4}$$

where $Efficiency_{2x2,i}$ is the efficiency for detecting radionuclide set *i* with the 2" x 2" detector (cpm per µR/h).

The $Efficiency_{2x2,i}$ was obtained for each radionuclide set *i* as the weighted average of the energy-partitioned efficiencies for a 2" x 2" detector. The weighted averaging was performed as

$$Efficiency_{2x2,i} = \frac{\sum_j Eff_{i,j} G_{i,j}}{\sum_j G_{i,j}} \quad , \tag{5}$$

where $Eff_{i,j}$ is the efficiency (c/m per µR/h) for energy *j* as listed in Table 6.3 of NRC 1998 and G_j is the gamma ray intensity calculated by MicroShield (v. 5.01, Grove Engineering, Rockville, MD) for energy *j*.

The minimum detectable concentration for scanning (MDC_{scan}) is

$$MDC_{scan} = \frac{MDE_{scan,i}}{Gamma_i} \quad , \tag{6}$$

where $Gamma_i$ is the total modeled gamma radiation intensity from the reference hot spot as computed by MicroShield ($Gamma_i = \sum_j G_{i,j}$)

Separate MicroShield analyses were performed for the Ra-226, U-238, and Th-230 radionuclide sets to characterize their gamma radiation from cylindrical hot spots of 1 m^2 area and 15 cm depth. The analyses utilized unit activity concentrations (1 pCi/g) for the parent nuclide and its equilibrium decay products in the hot-spot volume, which was assumed to have a density of 1.6 g/cm^3. The activity concentrations of U-235 and its first two equilibrium decay products were defined as 0.046 pCi/g, corresponding to the isotopic abundance of U-235 in natural uranium. The following suites of radionuclides were included in the MicroShield analyses: Ra-226 (Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, and Po-210); U_{total} (Th-234, Pa-2341~1, and U-234 plus U-235, Th-231, and Pa-231); and Th-230 (analyzed with no decay products).

The calculated efficiency factors from Equation (5) were used in computing minimum gamma ray exposure rates using Equation (4). The resulting values were then used in Equation (6) for calculating values of MDC_{scan} for each radionuclide set. The results of these analyses are presented in Table 2-2. The MDC_{scan} for Ra-226 is less than half its 5 pCi/g criterion typically used for other site investigation plans, indicating that the proposed 0.5 m/s scan velocity with a 2" x 2" detector is very adequate to detect a 1 m^2 hot spot containing Ra-226. The MDC_{scan} value for U-238 is similarly about half of its 60 pCi/g

criterion, again suggesting adequate detection of U_{total} in 1 m^2 hot spots. Only the Th-230 MDC_{scan} value exceeds its riterion, indicating that the 0.5 m/s scan velocity would not detect a 1 m^2 hot spot if its only radioactive contaminant were Th-230. Again, the criteria values for Ra-226, U-238, and Th-230 above are assumed for purposes of confirming the detection sensitivities of the instrumentation and are not to be utilized as remedial decontamination criteria for the CWM Model City Facility.

Table 2-2 Calculated Values of Detector Efficiency, $MDE_{scan,i}$ and MDC_{scan}

Radionuclide	Ra-226 + dp	U_{total} + dp	Th-230 + dp
$Efficiency_{2x2,i}$	847 c/m per µR/h	3,879 c/m per µR/h	9,514 c/m per µR/h
$MDE_{scan,i}$	1.26 µR/h	0.276 µR/h	0.112 µR/h
MDC_{scan}	2.1 pCi/g	31.9 pCi/g	1,850 pCi/g

Although the gamma walkover survey will not detect Th-230 directly, Th-230 is frequently found in association with the other uranium-series contaminants. Therefore, the adequacy of detecting Ra-226 and U_{total} may also indicate the locations where Th-230 may be located. Since soil sampling will be performed on samples from the locations exceeding the investigation levels, and these analyses will give analytical data on Th-230, the extent of Th-230 contamination is expected to be reasonably characterized.

Confirmation procedures for the screening level count rate, after the data is accumulated and downloaded from the data loggers, includes verifying the average walking speed parameter of 0.5 m/s is maintained by the field technician while scanning; the positioning of the detector, whether in the cart or other apparatus is fixed at the beginning of the day and visually checked thereafter; and, the count interval of 2 seconds relates to the speed and "field of view" of the detector so that it covers an average area of 1 m^2 every 2 seconds. Additional procedures include performing daily field checks of the instruments to verify the instruments response. This is accomplished by using a radioactive source and obtaining a measurement on each detector/meter combination. Deviations should not exceed ±20%. Deviations greater than ± 20% will be investigated. If the unit is not performing properly, it will be replaced. Performing the daily source check validates the instrument performance. During field scanning activities, the instrument is checked several times to insure that it is at the proper height. This is needed to validate the calculation in Microshield that determines the exposure rate from a particular concentration of Ra-226. All data that is collected is reviewed routinely and data gathering parameters are assessed. Coverage maps are developed and reviewed to demonstrate 100 percent scanned area completion.

2.4 Gamma Walkover Survey Schedule

CWM initiated the Gamma Walkover Survey of this Plan in July 2005. CWM will complete the walkover survey phase of this Plan within one (1) year of NYSDEC and NYSDOH approval of the Plan.

3. REPORT OF GAMMA WALKOVER SURVEY FINDINGS

Each data file received from the gamma walkover survey will be processed, entered into a GIS, and analyzed. Reports from the data processing will be sent daily to the field operators to guide and improve their daily survey performance. Entry of each data set into the GIS will maintain the set identity and will occur as the files are accumulated. Analysis of the combined data will occur on completed portions of the site and will be compared to the site Investigation Level.

The data processing step includes four sub-steps: (a) differential corrections (as needed); (b) export of tabular positions, count rates, and descriptors; (c) data cleanup; and (d) analysis for the field report. Differential corrections utilize Pathfinder software (Trimble, v 2.9 or equivalent) to refine GPS position data (Easting and Northing) using web-based reference data. The need for differential corrections depends on the frequency and accuracy of the real-time radio-beacon corrections during the walkover survey. The corrected position data are exported, with the measured count rates, measurement times, and other identifiers into spreadsheets (Excel, Access, or equivalent). Data cleanup primarily involves parsing count rates from their unit identifier. If two detectors share a common GPS antenna, the actual locations of each detector are computed from the antenna position and the relative detector offsets. Analyses for field reports summarize each data file for total area covered, average scan velocity, coverage gaps, and count rate distribution statistics.

Merging individual data files into the overall CWM site GIS database is accomplished by simply importing the individual files. The analyses of the combined GIS data will operate on each investigation unit to compare its mean count rate with the Investigation Level; to demonstrate adequate coverage of survey points over the unit; and to determine the distribution of any individual elevated measurements to identify the location and extents of potential hot spots. Individual elevated measurements above the Investigation Level will be further investigated. The investigation may include, but is not limited to, re-evaluating the data files, re-surveying the area, verifying calibration of survey equipment, investigating historical use of area, and evaluating surface media to see if the elevated measurements are confirmed.

Posting plots of gamma-ray intensities at each measurement location will be generated over maps that show measurement locations, gamma ray intensity, and survey-unit boundaries. Separate posting plots will be generated for each of the 912 survey units. A key map will also be developed to identify the location of each survey unit at the CWM site.

Static background readings will be made with each survey instrument at least daily, in triplicate, in connection with equipment performance checks. The reference background location used for these readings will be kept constant so that any temporal trends that are noted can be reasonably interpreted. Instrument performance will also be monitored at the reference background location at the same frequency using check sources. Instruments whose net readings with the check-source fall outside a ±

20% range from the reference value or with low-battery or other service indicators will be removed from service until they are brought back into satisfactory performance condition.
Survey procedures and results will be documented in a report, following the general guidance in the MARSSIM. The Survey Report will at a minimum, contain the following information:

- Survey maps (Figure 2) that show the gross gamma walkover scan data;
- Summary statistics for surface walkover scan data;
- Field instrument daily performance data;
- Results of daily background measurements from various non-impacted areas (e.g., pavement, gravel, grass); and
- An interpretation of the survey data;

3.1 Reporting Schedule

Development of the report has been initiated by CWM and will continue throughout the survey field activity. CWM will complete and forward to the NYSDEC and NYSDOH a detailed report, as described above, of the Gamma Walkover Survey no later four (4) months upon completing the site walkover activities.

4.0 DETAILED INVESTIGATIONS AND SOIL SAMPLING

Any individual reading that exceeds the 16,000 cpm gross count rate investigation level or other agreed upon media specific investigation level(s) will be further investigated and considered for soil sampling utilizing the Sitewide Radiological Investigation Soil Sampling Plan. The first level of detailed investigation for the units failing the investigation level will be further computer analyses and data file review for the walkover survey data to determine the likelihood that anomalous data or localized hot spots are dominating the area for the investigation unit. Additionally, a review of field notes and daily equipment calibration sheets will be made to determine if any factors were present which would effect the accuracy of the survey data. A review of the historical usage of the area will be made, if known, to determine if any specific past practices could affect the survey data. The second level of detailed investigation will be to re-survey the elevated areas to confirm the previous elevated measurements. In addition, the surface media will be evaluated to identify obvious items, i.e, slag, that may be the cause for the elevated measurement. If a reading above the investigation level is confirmed, the final level of investigation will be the implementation of the Sitewide Radiological Investigation Soil Sampling Plan. This plan includes the following procedures to further characterize and define the nature and extent of the elevated levels:

Detailed delineation of elevated areas;

- Soil sampling procedures for an isolated location and for a general area of elevated activity;
- Sampling identification, chain of custody, and sample handling procedures;

Data quality objectives;

- Analytical procedures;
- Data review; and,
- Data Assessment.

Investigation survey locations/units exceeding the investigation limit will be marked by stakes and/or paint in the field. If there is a potential for employee exposure in the areas identified as needing further investigation, access to the area will be restricted.

4.1 Soil Sampling Schedule

CWM will complete the soil sampling activities and submit a report with the results no later than 18 months after the NYSDEC and NYSDOH have approved of the Site Radiological Survey and Sitewide Radiological Investigation Soil Sampling Plans.

5. BUILDING SURVEYS

As required by condition J.1.b of Module II (Corrective Action) of CWM's Sitewide 6 NYCRR Part 373 Permit, an interior survey will be performed on all "legacy" buildings currently used by CWM personnel. The term "legacy" building includes all buildings that were utilized by the federal government during the 1940's and LOOW activities. The legacy buildings found at CWM include:

Building Name	Location
PCB Warehouse	East of SLF 11
Building South of PCB Warehouse	East of SLF 11
Laboratory/Maintenance Shop	East of AWTS, North of "M" Street
Transformer Operations Building	South of Closed Lagoons
Maintenance/Utility Building	South of Closed Lagoons
Main Compressor Building Area (2 rooms)	South of Closed Lagoons

Prior to use, legacy buildings not currently being used by CWM will be surveyed using the same procedures as outlined below.

The interior building surveys will be performed using the following procedures and equipment:

A. Each of the buildings interiors will be cleaned with a vacuum equipped with a HEPA filter in order to collect dirt and dust particulates. Specifically, the floor and the walls, up to six feet high, will be vacuumed.

B. One sample of the dirt/dust collect from the vacuuming effort will be collected from each building and analyzed for the radionuclides as those listed in Section 5 of the Sitewide Radiological Investigation Soil Sampling Plan.

C. Survey methods will use either the carriage method or by manually walking the areas in a manner similar to the performance of the Gamma Walkover Survey except that no Global Positioning System (GPS) equipment will be used since satellite signal is not likely to be present in the buildings. Buildings will be cleared by CWM of obstacles that would prevent detecting radiation and sampling of surface radioactivity. Major grids will be marked in ten (10) meter increments and one-meter grid divisions except when the building dimension is smaller and only the one-meter grids will be used. The grids will be used by field survey crew to ensure survey coverage. The building floors will be surveyed, except where physical restrictions prevent, using a Ludlum Floor Monitoring System, Model 239-1F with 43-37 probe (425cm^2). The walls, up to six feet, and floors that cannot be surveyed with the floor monitor will be surveyed with the same technology using a smaller (100cm^2) probe (Model 43-68). Areas that indicate elevated radiation levels will be marked for follow up measurements. Follow-up

measurements will be made using the Ludlum-2360 with the Model 43-68 100cm^2-detector in a static one-minute count mode.

D. After the survey is completed, a field technician will obtain a minimum of two surface wipes (per building), approximately 100 cm^2 each, where either elevated levels were detected or the potential of radiological contamination could exist. The purpose of the wipes will be to distinguish between surface contamination or fixed contamination. The wipes will be tested on-site utilizing a Ludlum Model 2929 Dual Channel Scaler (or equivalent) to obtain a quantitative measurement of alpha/beta/gamma radiation levels.

E. For the PCB Warehouse where previously elevated levels of radiation have been detected, 5 concrete floor core samples located adjacent to building roof column supports, or other locations as determined from the survey, will be obtained and analyzed for the radionuclides as those listed in Section 5 of the Sitewide Radiological Investigation Soil Sampling Plan.

F. The sample collector will enter the grid reference points, date of sampling, sampler initials and other pertinent information on the appropriate forms and on the sample containerlenvelope. The container will be marked with black pen or use pre-prepared labels. The sample collector is responsible for maintaining custody of all samples. If requested, tamper proof seals will be placed on the sample container prior to shipment to the laboratory. In lieu of a sample label, the information may be placed on the sample envelope provided only one envelope is used per swipe. The envelope will be prepared with the surveyor name, date and unique identifier prior to placing the swipe in the envelope. Evidence of tampering and/or deviations must be explained in the remarks section of the chain of custody form. If a sample's integrity is questioned, a "Non-conformance Report" will be initiated and resolved, or that sample's result may not be used.

G. The data and analytical results from the building vacuuming, survey, surface wipe samples, and concrete core samples will be tabulated and reviewed by CWM's Health Physicist in order to determine potential radiation exposure to CWM and facility employees. If elevated levels are found, and there is a potential for employee exposure in the building areas identified as needing further investigation, access to the area may be restricted. Remediation or administrative controls to minimize occupational radiation exposure will be considered if any measurements exceed the criteria as determined by the Health Physicist.

In addition to the interior surveys, all facility buildings (except for wooden sheds or trailers mounted above grade) will be tested for radon gas levels. A detailed list of the buildings is included in Appendix 1. The radon test protocol, as prepared by URS Corporation, is also included in Appendix 1. The protocol includes information as to the types of buildings, proposed monitoring device, description on how they work, a brief discussion on how and where the monitors are placed in a building, how many monitors per building, testing duration, effective area of the canisters, how the canisters are tested, and review of data

collected. The testing protocol is based upon the New York State Education Department and Department of Health Guidance for Radon Measurement in Schools and Large Buildings (November 2003).

5.1 Building Survey and Sampling Schedule

CWM will initiate Building Survey and Sampling activities upon approval of this Plan. CWM will complete the Building Survey and Sampling activities, with supporting documentation and report, within one (1) year of NYSDEC and NYSDOH approval of the Plan. The testing for radon gas within the CWM buildings was initiated in October 2005. CWM anticipates that completion of this testing and submittal of test results to the NYSDEC and NYSDOH will be accomplished within two (2) months upon approval of this Plan.

6. SPECIAL INTEREST AREAS

CWM has identified several areas at the Model City Facility as "Special Interest Areas." The term "Special Interest Area" means that these areas have characteristics that differ from most of the general facility with respect to knowledge of the property or physical attributes. The following list of areas have been identified as "Special Interest Areas" by CWM and includes the type of radiological survey to be performed. Several of the areas listed below will not be surveyed due to lack of access or are outside the scope of this radiological survey plan. Refer to Figure 4 for the location of the 'Special Interest Areas."

- Vicinity Property B
    - PCB Warehouse – This building was classified as a Special Attention Area based upon its historical use and preliminary data obtain by CWM (above background readings found in concrete grout). This building is listed as one of the legacy buildings at the Facility and will be surveyed in accordance with the procedures outline in Section 5 of this plan.
- Vicinity Property E
    - Lagoon 6 Berm – This area was excluded from the DOE decontamination certification because it could not be properly assessed due to inaccessibility and the DOE could not confirm that contamination did not exist in these areas. A gamma walkover survey will be performed over the cap of this impoundment, which was closed and capped as a landfill, in accordance with the procedures outlined in Section 2 of this plan.
- Vicinity Property E'
    - Area of former PCB storage tanks (T-64, T-65) - – This property was excluded from the DOE decontamination certification because the area could not be properly assessed due to inaccessibility and the DOE could not confirm that contamination did not exist in the area beneath the tanks. CWM will not be performing a gamma walkover survey of this area since above background readings were identified by USACOE and that the area is currently covered by an high density polyethylene liner which prevents precipitation from contacting the underlying soils.
- Vicinity Property G
    - Area of Facultative Pond 1 and 2 (Southeast corner) - This area was excluded from the DOE decontamination certification because it could not be properly assessed due to inaccessibility and the DOE could not confirm that contamination did not exist under the pond and its berms in these areas. CWM will not be performing a gamma walkover survey of the pond since it is still currently used as a treatment storage pond. The pond

berms, that can be accessed safely, will be surveyed in accordance with the procedures outlined in Section 2 of this plan. As a note, the Fac Pond 1 and 2 pond water is transferred to Fac Pond 3, sampled and tested (including radiological analysis) and qualified prior to discharging to the Niagara River.

  - University of Rochester Burial Area – This area has been researched and investigated over the past several years by the USACOE. CWM will be performing additional surveys in the accessible areas of University of Rochester Burial Area, but it will be limited to due to the existing brush and dense vegetation.

- Vicinity Property H'

  - CMSA Pad - This area has been surveyed by the USACOE. CWM will not be performing any additional surveys of this area since information and data can be obtained from the USACOE and that the area is beyond the scope of this plan's investigation.

- Central Drainage Ditch – CWM will not be performing any surveys of this area since the area is beyond the scope of this plan's investigation.

- Area southwest corner of site potentially may be influenced by gamma radiation originating from the Niagara Falls Storage Site Interim Storage Cell. This will be determined during the survey (not shown in Figure 4). CWM will attempt a gamma walkover survey of this area in accordance with the procedures outlined in Section 2 of this plan.

In addition to the radiological survey, these areas may require special procedures to assess possible MED contamination in excess of survey limits. These procedures will be developed prior to disturbance of these areas.

In addition, Figure 1 delineates the areas of the Facility in which CWM can perform the gamma walkover survey while still obtaining a GPS signal and reliable radiological measurements. Also, the figure identifies areas which are inaccessible and partially accessible. Inaccessible areas have characteristics where there is dense vegetation, thick brush, trees, steep slopes, and ponds. Accurate radiological survey data and GPS coordinates cannot be obtained in these areas. Partially accessible areas are areas in which at least 10% of the area can be surveyed while still obtaining reliable data. CWM will scan partially accessible areas to the extent that, accurate location and radiological survey data can be obtained; that the safety of the workers is not compromised; and there is no potential for equipment damage. For areas that cannot be scanned at this time, CWM will perform a gamma walkover survey prior to future use. Additional permits, clearing and grubbing, and modified scanning techniques, equipment and procedures will be necessary to perform surveying in the currently inaccessible areas.

7. CONTRACTOR QUALIFICATIONS

The contractor selected to implement the Site Radiological Survey Plan is URS. URS has a radiological group based in their Buffalo office. The Project Manager for the detailed investigation phase is B. Scott Davidson, CHP,CSP. Mr. Davidson has an MS in Radiological Health from Rutgers University. He has 31 years of experience in radiological and environmental management. His most recent assignments include Radiation Safety Officer and Site Safety and Health Officer at a USACE FUSRAP site in Western Pennsylvania (the site had been used for the disposal of uranium wastes) and Nuclear Engineer/Health Physicist an the Plum Brook Reactor Facility Decommissioning Project. The Team Leader for the initial sitewide walkoverldata collection is Eric Olson. Mr. Olson has a BS in Civil Engineering and is a certified Radiation Worker. His most recent projects include Team Leader for health physics support and remediation verification for the remediation of uranium and thorium contaminated soils in Hicksville, NY and Radiological/Project Engineer for remediation of radiologically contaminated buildings and equipment at Bettis Laboratory. Additional support is provided by Dr. Kirk Nelson from URS' Salt Lake City office. Resumes for Mr. Davidson, Mr. Olson, Dr. Nelson as well as for four of the field technicians performing the site walk over and data collection (Jeff Day, Amy Jones, Mark Passiute and Tom Urban) are included in Appendix 2.

8. HEALTH AND SAFETY

Site specific contractor safety training is provided by CWM for the URS workers. The workers will be expected to comply with CWM's safety rules. For performing the site walkover, Level D safety equipment is required (hard hat, safety glasses, high visibility safety vests, long sleeved shirts and sturdy sboes with ankle support). Safety hazards associated with performing the sitewide survey include slips, trips and falls, heat exhaustion and biological hazards (insects, snakes, animals). Due to the past history of the site, there is also the potential for radiation exposure. During any soil disturbance activities associated with this plan, the URS Safety Officer may elect to increase the level of PPE or stop work if on-site monitoring indicates levels of concern. The details of this determination are included in the project Health and Safety Plan (Appendix 3).

REFERENCES

ANSI 1999 American National Standards Institute, Inc. *Surface and Volume Radioactivity Standards for Clearance.* ANSI/HPS N13.12-1999. August 1999.

DOD 2000 U. S. Department of Defense et al.. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) Revision 1.* NUREG-1575, EPA 402-R-97-016. August 2000.

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NYSDEC 2003 New York State Department *of* Environmental Conservation, Division of Solid & Hazardous Materials Bureau of Radiation. *Review Plan for Class 2 Final Status Survey Units at the Linde FUSRAP Site, Rev. 0.* January 2003.

Shaw 2004 Shaw Environmental, Inc. *Summary Report: Historical Radiological Assessment, Niagara Falls Storage Site, Vicinity Properties E, E', and G.* July 2004.

NRC 2000 U.S. Nuclear Regulatory Commission et.al., *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) Revision 1, *NUREG-1575,* August 2000.

New York State Education Department and Department of Health Guidance for Radon Measurement in Schools and Large Buildings, November 2003.

SITE RADIOLOGICAL SURVEY PLAN FIGURES

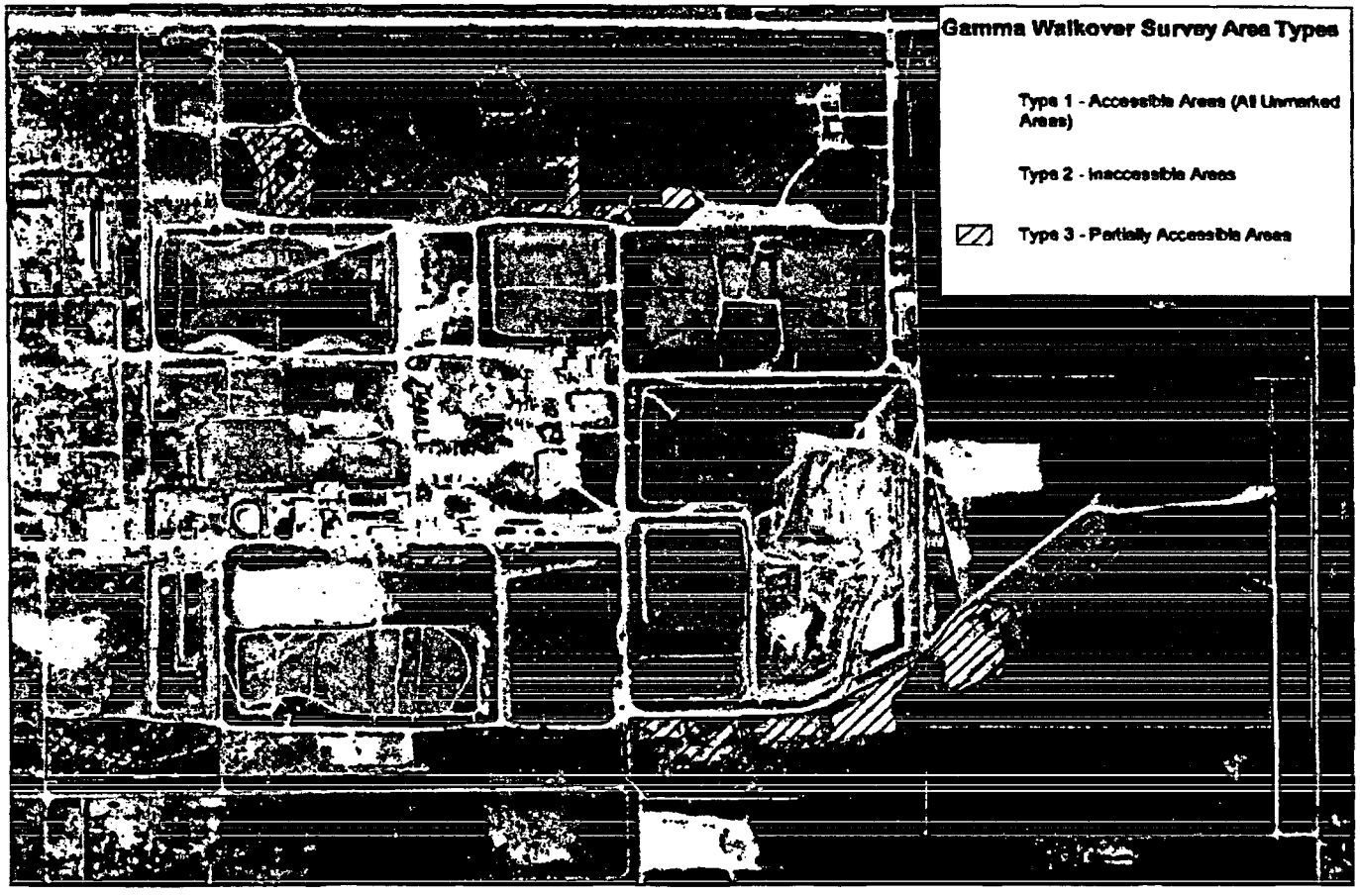


Figure 1 - Site Aerial and Survey Boundary

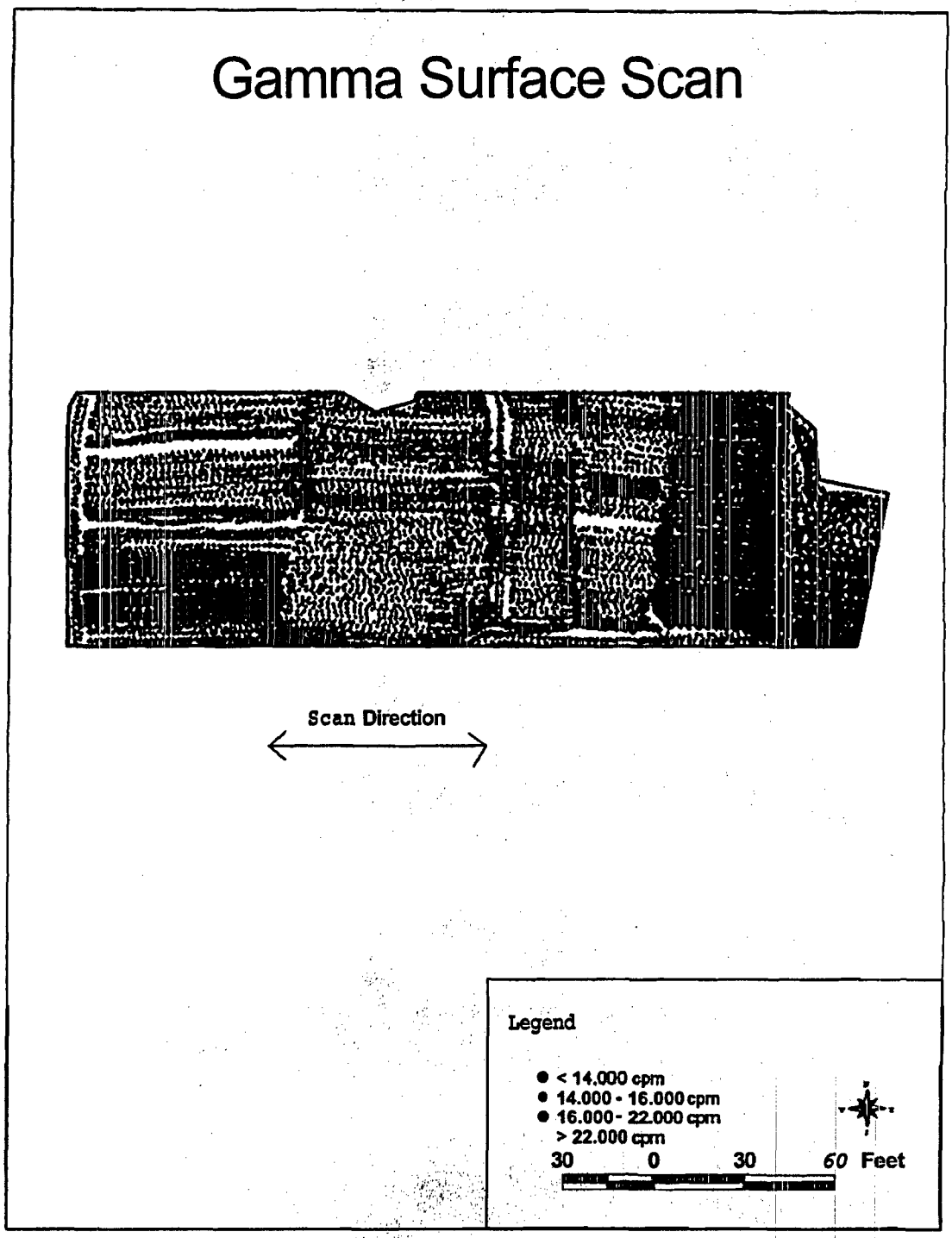


Figure 2 - Example of GPS Logged Gamma Walkover

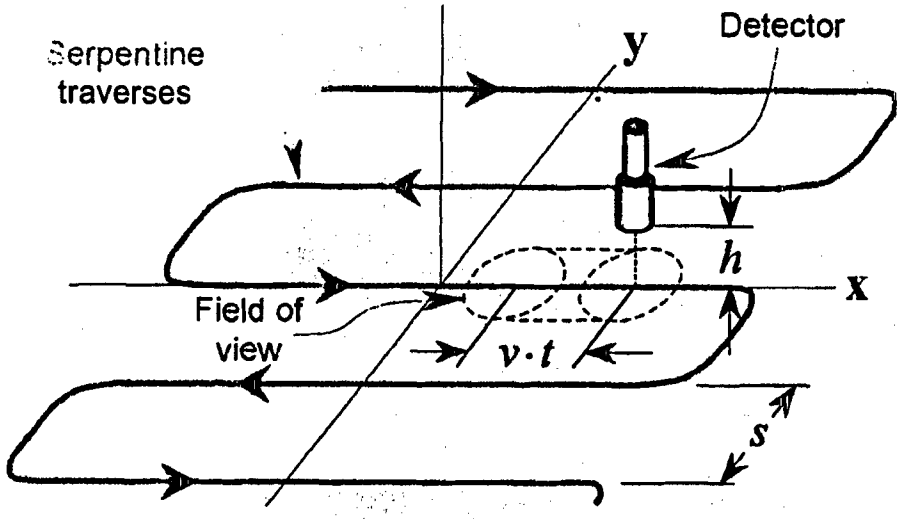
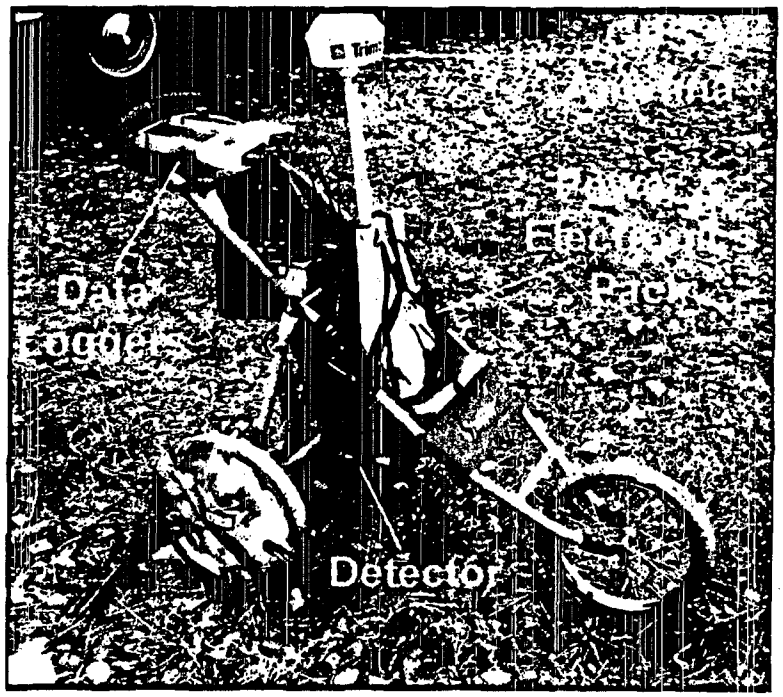


Figure 3. Serpentine Survey Traverse Pattern for Providing 100% Coverage.



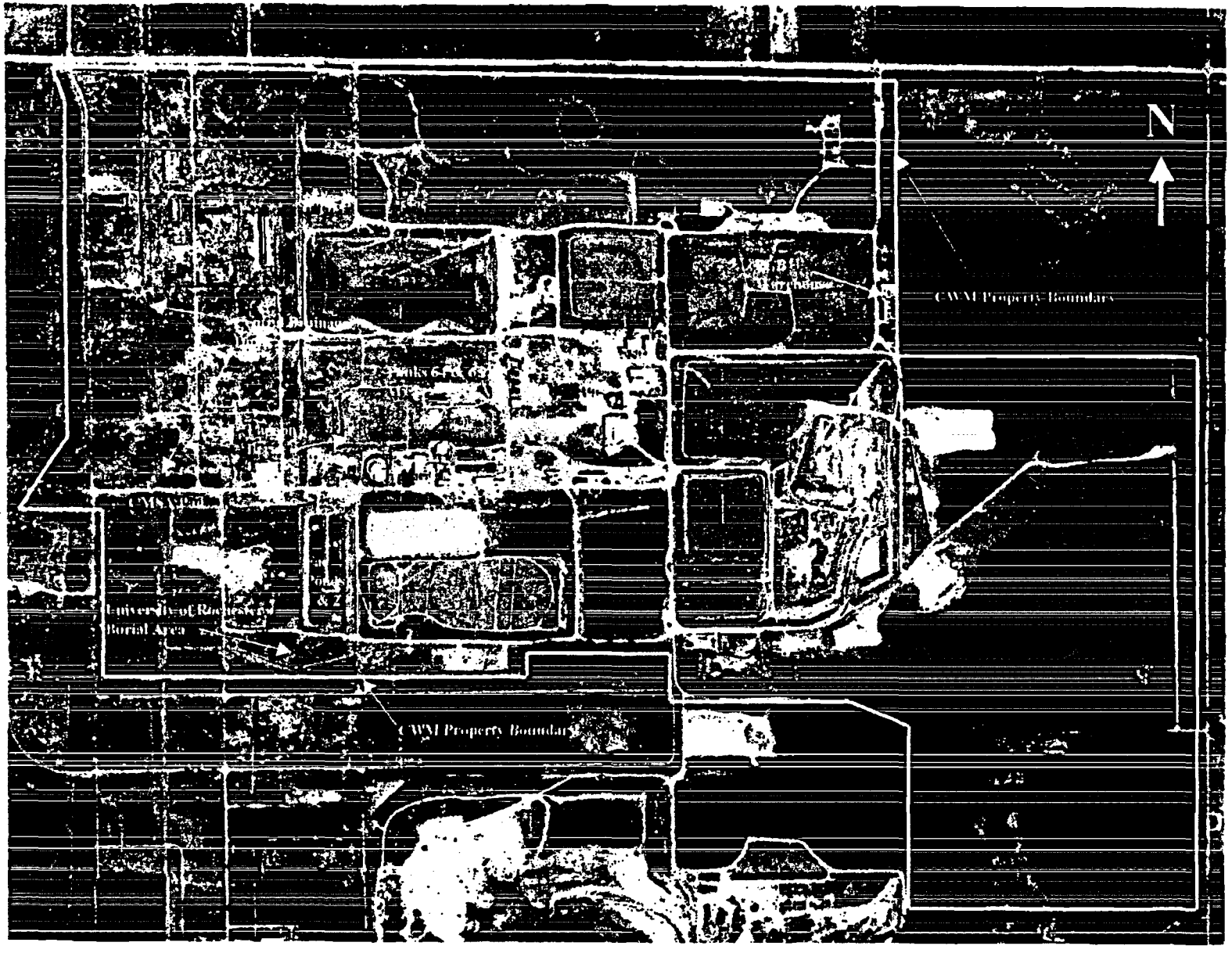


FIGURE 4 – SPECIAL INTEREST AREAS