PROPOSED PLAN OF REMEDIAL ACTION

Indian River DCP Site
Dagsboro, DE

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Delaware Department of Natural Resources and Environmental Control
Division of Air and Waste Management
Site Investigation & Restoration Branch
715 Grantham Lane
New Castle, Delaware 19720

DNREC Project No. DE-1028

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Proposed Plan of Remedial Action
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I. INTRODUCTION

In May, 1994 the Department of Natural Resources and Environmental Control - Site Investigation and Restoration Branch (DNREC-SIRB) was contacted by Public Water Supply Company regarding potential pesticide contamination detected in the residential drinking water supply wells that supply potable water to the Bay Colony and Mallard Creek residential communities. The pesticide, 1,2-dichloropropane was detected in water samples collected for routine Division of Public Health (DPH) sampling. The samples were collected from the water supply wells and the water distribution system. Following the review of the DPH data, the DNREC-SIRB initiated a remedial investigation of the contamination to the water supply wells for the communities.

The purposes of the investigative process were to: 1) understand the nature and extent of groundwater contamination at the site, 2) evaluate risks to the public and environment associated with identified contamination, and 3) perform a feasibility study that would identify and recommend a remedial action, if required

This document is the Department's Proposed Plan of Remedial Action for the site. It is based on the results of the previous investigations performed at the site. This Proposed Plan is issued under the provisions of the Delaware Hazardous Substance Cleanup Act ("HSCA") and the Regulations Governing Hazardous Substance Cleanup ("the Regulations"). It presents the Department's assessment of the potential unacceptable health and environmental risk posed by the site.

Section II presents a summary of the site description, site history and previous investigations of the site. Section III provides a description of the remedial investigation results. Section IV presents a discussion of the remedial action objectives. Section V presents an analysis of remedial alternatives, including identification of and rationale for selection of alternatives and description of alternatives. Section VI discusses public participation requirements.

The Department will provide public notice and opportunity to comment on the Proposed Plan in accordance with Section 12 of the Regulations. At the conclusion of the comment period, the Department, after review and consideration of the comments received, shall issue a Final Plan of Remedial Action that shall designate the remedial action. The Proposed Plan, the comments received from the public, responses to the comments and the Final Plan will constitute the "Remedial Decision Record".

II. SITE DESCRIPTION AND HISTORY

The following background information was obtained from the investigation reports, literature review and/or conversations with Public Water Supply Company, Delaware Geologic Survey, Division of Water Resources, and the DPH.

Site Setting

The site is located within the Bay Colony and Mallard Creek residential subdivisions along the southern bank of the Indian River Bay and consists of approximately 225 acres (Figure 1). The site is bordered to the north and northwest by Indian River Bay, to the southwest by an unnamed creek that drains to Indian River Bay, to the south by agricultural and residential property owned by Clifton Bennett, and to the east by County Road 348. Across County Road 348 is Cripple Creek development and golf course.

The site is relatively flat as typical with topography in marginal-marine environments. The general site elevation is 8 to 10 feet above mean sea level (MSL) with extremes from 1 foot to 16 feet MSL. The site is densely wooded in the Mallard Creek subdivision and the southern portion of Bay Colony up to the southern extent of Bay Colony Drive. The northern portion of the site contains the majority of the homes and is generally landscaped with grass and large trees.

Geologic Setting

The site is located in the Atlantic Coastal Plain Province that consists of sedimentary beds dipping southeast towards the Atlantic Ocean. In the relative vicinity under the site, this unconsolidated wedge of Quaternary Period sediments, both Pleistocene and Holocene, is approximately 150 feet thick[1]. The Miocene Chesapeake Group subcrops the Quaternary sediments in this area.

The Quaternary sediments of Pleistocene age have been subdivided into the Columbia, Omar, and Beaverdam Formations and are collectively known as the Columbia Group[2]. The group consists of fine to very coarse sand and gravel that is white, tan, yellow, and reddish-brown in color. The Pleistocene sediments in the area of the Delaware inland bays are described as near-shore deposits of yellow and gray quartz sand with some gray to white interbedded silts and clays and are chiefly neritic, offshore bar, and lagoon facies.

The Holocene sediments are all sediments deposited after Pleistocene time. This particularly includes recent deposition along the ocean shores and inland bays. The differentiation between Holocene and Pleistocene sediments may be difficult. The Holocene-Pleistocene erosional contact is usually identified by changes in mottling, oxidation, plant debris, compaction, and the presence of more organic debris in the Holocene sediments.

Hydrogeologic Setting

The unconfined aquifer framework, of direct interest and concern in this project, is known as the Columbia aquifer and occurs in the unconsolidated Holocene and Columbia Group sediments. Its thickness extents 100 to 150 feet to the Chesapeake Group. In the vicinity of the site, the Pocomoke aquifer in the Bethany Formation of the Chesapeake Group subcrops the Columbia aquifer, and is in direct hydraulic contact thereby forming an unconfined Columbia-Pocomoke aquifer up to 200 feet in total thickness.

The depth to ground water in close vicinity to the Indian River Bay is less than 20 feet and water table elevations are only several feet above mean sea level. The water table is tidally influenced. Ground water will generally discharge to the bay directly or via creeks and surface water streams that discharge to the bay. The differential sorting and grain size of the underlying formations allows for several distinct flow regimes with depth (Andres, 1992). Hydraulic conductivities have been measured from 15 to over 500 feet per day (ft/d), but generally range from 80 to 300 ft/d. Aquifer tests conducted during the FE approximated the site hydraulic conductivity to be 200 - 250 ft/d.

Site History

Prior to the construction of the residential subdivisions, in the mid- to late 1980's, the site was reportedly used as a strawberry farm by Bunting's Nursery. In 1983 one 4 inch diameter PVC domestic supply well (herein identified as PW-1) was installed by the Public Water Supply Company for the residences. A second 4 inch PVC well, PW-2, was installed in the Cripple Creek Manor subdivision, a.k.a. Mallard Creek in 1986. Both wells are approximately 80 feet deep and comprise the water supply sources for the two subdivisions. There is also a third well, PW-3, which is 6 inches in diameter that was not in use at the time of initial DNREC involvement but was put into use in 1996. Well PW-3 is located at the southern end of the Bay Colony subdivision. Well PW-1 was used as the primary supply well and PW-2 was used for intermittent additional supply as demands exceeded the supply rate of PW-1. In the late 1980s, the DPH sampling of the well PW-1 had occasionally shown low levels of the pesticide 1,2-dichloropropane (1,2-DCP) under the maximum concentration level (MCL) of 5 part per billion (ppb). Public Water Supply therefore, used PW-2 as the main supply well, with PW-1 being used for additional make-up water. An old irrigation well (herein referred to as IW-1) was rumored to be located in the Bay Colony subdivision but its location was unknown to Public Water Supply. Public wells PW-1, 2, and 3 are shown in Figure 2.

During the spring of 1994, the drinking water concentrations in several homes (up to 8 ppb) exceeded the MCL of 5 ppb. Samples from PW-1 and PW-2 detected the pesticide in both wells ranging from 2.0 to 4.0 ppb. Several other pesticides traditionally mixed with 1,2-dichloropropane in agriculture had not been detected or included in the analytical parameters of the water samples. The DPH issued a notice to the Public Water Supply, Co. requiring that the water supplied to the residences must be under the MCL. The water supply company began evaluating options such as treatment or alternate water supplies.

The DNREC Division of Air and Waste Management, DNREC Division of Water Resources, and the Department of Agriculture were contacted by Public Water Supply in an attempt to determine

options and solutions to the drinking water concern. The DNREC-SIRB decided to perform an investigation to aid the decision-making process. DNREC advised Public Water Supply the investigation would not negate the need to reduce and/or remove the pesticide concentrations in the water being supplied to the residents. During the initial DNREC investigation, an interim action was instituted by Public Water Supply by installing an air stripper treatment system on the PW-2 supply well and removing well PW-1 from service.

III. INVESTIGATION RESULTS

Based on the information available prior to conducting the facility evaluation (FE), the conceptual migration pathway was considered to be that 1,2-DCP was applied to the soil in the northern portion of the site during the period of agricultural activities. The pesticide subsequently migrated to the groundwater. Due to the density and solubility of the compound it migrated deeper into the groundwater. Tidal influences by Indian River Bay may have been strong enough, along with the increased dispersion and advection by reversing flow directions, to allow migration of the 1,2-DCP to well PW-2. Four (4) monitoring wells were installed as depicted in Figure 3.

It was evident; however, that the conceptual migration pathway posed for the site was not supported by the investigation findings. The justification was listed in the FE report as follows:

1. No pesticide residuals were found in the soils in the area of assumed application;
2. Ground water flow is northward and a site hydraulic conductivity of 250 ft/day;
3. No strong tidal influence and/or flow reversals were noted in the monitoring wells;
4. Greater concentrations, around 20 parts per billion (ppb), were found upgradient; i.e. southern portions of the site of the supply wells PW-1 and PW-2;
5. The concentration gradient decreases with distance northward; and
6. Influence of supply well(s) pumpage is very small, less than 100 ft.

It was apparent that the contamination originated from south of the supply wells and was migrating with the ground water northward to Indian River Bay. Further, it could also be assumed, based on the concentrations found in wells MW-2 and MW-3 (18 and 22 ppb), that the concentrations of the pesticides in supply wells PW-1 and PW-2 may increase with time as the plume travels to the bay. This was reported to DNREC-SIRB to have occurred during the fall of 1996 by Public Water Supply Company based on their quarterly monitoring result for the DPH. Well PW-1 had increased to approximately 13 ppb. Well PW-3, which had never shown contamination was put into service due to increased water demand.

Following the FE, a remedial investigation (RI) was planned and conducted in two phases. The main objectives of the RI were to determine if the plume was a continuing source from an upgradient location and if so, could well PW-3 become contaminated. The first phase consisted of sampling five (5) existing upgradient domestic wells from the homes immediately south of the site. These wells were directly upgradient of PW-3. All of the samples from the domestic wells

did not contain the pesticide. The second phase consisted of installing three (3) monitoring wells between the domestic wells and the previously installed monitoring wells. These wells also did not contain the pesticide. Figure 4 shows the locations of all wells used in the investigations.

Based on the analytical results shown in the previous section and the findings documented in the FE report, the plume does not appear to be a continuing source or to exhibit substantial lateral spread. The narrow characteristic of the plume is to be expected based of the groundwater flow characteristics of the aquifer and the aquifer medium. Because the domestic wells and PW-3 are upgradient of the pesticide plume it is not likely that the plume will affect them, even under rigorous pumping conditions.

Since the FE sampling event, there was a decrease in concentration in wells MW-2 and MW-3 and an increase in downgradient wells, PW-1 and PW-2. This is considered to be indicative of plume migration northward along the groundwater flow path. Because the source is not continuous, the concentrations in MW-2 and MW-3 will continue to decrease (due to construction, MW-2, it was removed after sampling).

The concentrations in the Public Supply wells PW-1 and PW-2 may temporarily continue to increase as the plume passes but is not anticipated to exceed approximately 20 ppb (the highest upgradient concentration found during the FE). Once reaching the maximum concentration the pesticide levels should also decrease. It is expected to eventually decrease to levels below the drinking water MCL.

IV. REMEDIAL ACTION OBJECTIVES

According to HSCA regulation 8.4 (1) remedial action objectives must be established. The remedial action will be established utilizing the Qualitative and Quantitative Objectives and the following considerations:

- The site is a new and currently developing residential community with water demands expected to continually increase for several years;
- The risk is to the residents from the drinking water if untreated;
- Requirement of drinking water treatment by the Delaware Division of Public Health and DNREC; and
- The ultimate fate of the contaminant is discharge to the Indian River Bay where it is expected to dissipate due to the compound's high volatility.

Based on the above considerations, the qualitative objectives for this site (having only ground water contamination) is to protect the public health by ensuring acceptable drinking water and to protect the environment prohibiting potential adverse effects at ground water discharge points (namely, the Indian River Bay).

Based on the qualitative objectives, the quantitative will be:

1. The 1,2-dichloropropane drinking water Maximum Contaminant Level (MCL) of 5 ug/L will not be exceeded for the water conveyed to the residents; and
2. The 1,2-dichloropropane Lowest Reported Toxic Concentration for ambient saltwater of 240,000 ug/L within the contaminant plume will not be exceeded. No EPA Ambient Water Quality Criteria are set for the contaminant.

V. PROPOSED REMEDIAL ACTION PLAN

Three potential remedial actions were evaluated for their ability to accomplish the Remedial Action Objectives. These were:

1. Continue operation of the water treatment system on PW-2 with PW-3 as the main supply.
2. Discontinue use of PW-2. Use PW-3 as the sole supply source.
3. Discontinue use of PW-2. Use PW-3 as a water supply source and provide an additional supply well as the water source.

All three alternatives will include: 1) quarterly monitoring as required by the Division of Public Health, 2) placement of a Ground Water Management Zone at the Bay Colony and Mallard Creek subdivisions, and 3) PW-1 will remain non-operational.

Alternative 2 has been eliminated from consideration because it is not expected that only one well will be able to supply enough water to the growing communities.

Alternative 1 has uncertainty in its short term and long term effectiveness. If the concentration of the pesticide continues to increase as expected over the short term, the treatment system removal efficiency may not keep the concentration below the MCL of 5 ppb. Over the long term, the treatment system may have unforeseen problems and costs due to maintenance and monitoring to ensure proper treatment and removal efficiency.

Therefore, the remedial action for the site is proposed to be Alternative 3, the discontinued use of PW-2, the continued use of PW-3 and providing an additional supply well as the water source. Based on the contaminant plume location and the aquifer characteristics the location of the additional supply could be on or near the utility lot that contains well PW-3. As previously stated, monitoring will continue in accordance with the requirement set forth by the Division of Public Health.

Because the highest concentration found is four orders of magnitude less than the Lowest Reported Toxic Concentration for ambient saltwater, it is not likely that this threshold will be exceeded. However, if the quarterly drinking water monitoring indicates concentrations approaching this value, the ecological risk may need to be addressed.

VI. PUBLIC PARTICIPATION

The Department actively solicits public comments or suggestions on the Proposed Plan and welcome opportunities to answers questions. Please direct written comments to:

DNREC Site Investigation and Restoration Branch
Attn: Kurt Olinger
715 Grantham Lane
New Castle, DE 19720

The comment period begins Monday May 4, 1998 and ends May 25, 1998. Comments and/or requests for a public hearing may be submitted in writing to Kurt Olinger by the close of business (4:30 p.m.) on May 25, 1998 at the above referenced address.

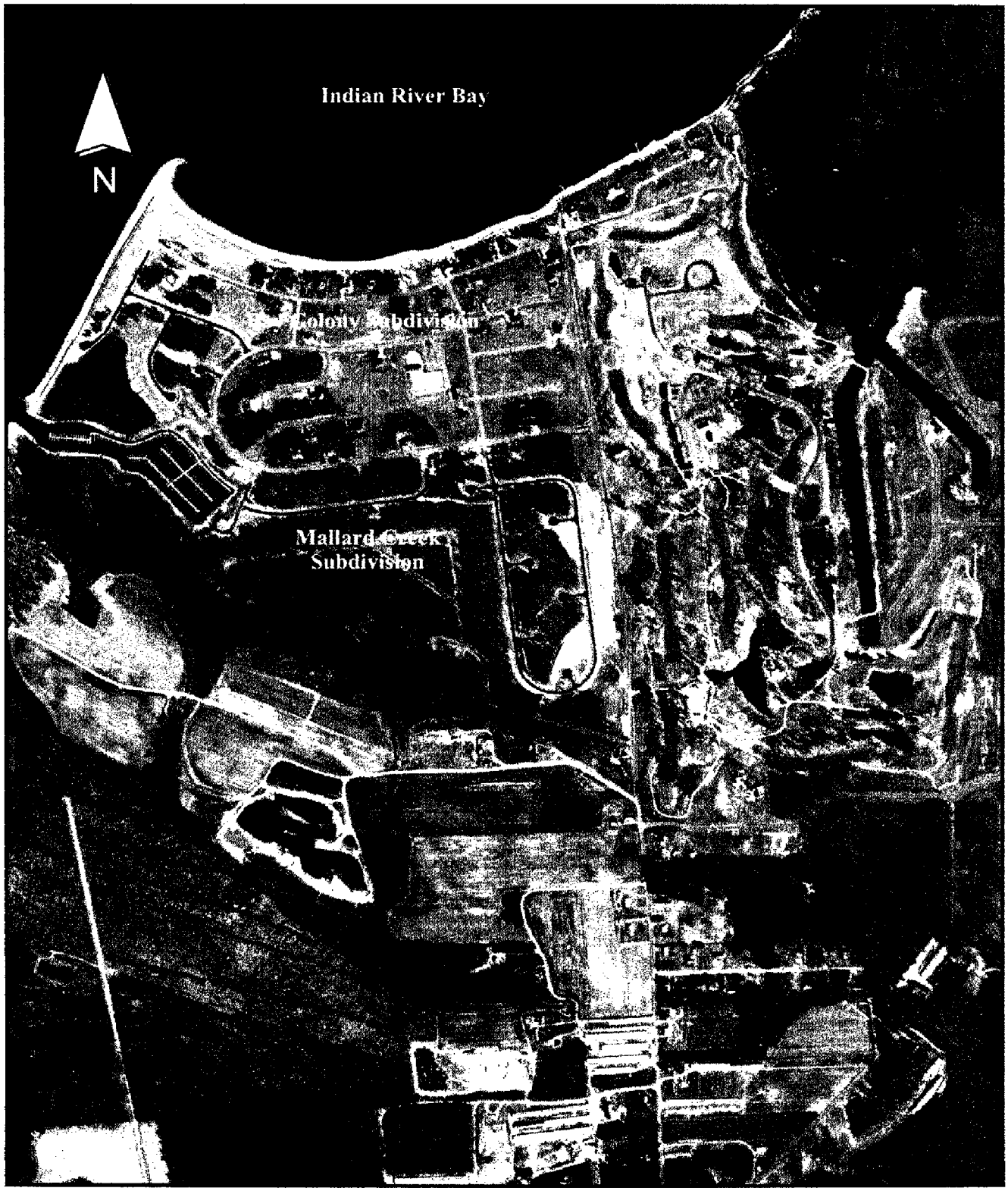

Figure 1. Site Location Map

500 0 500 1000 Feet

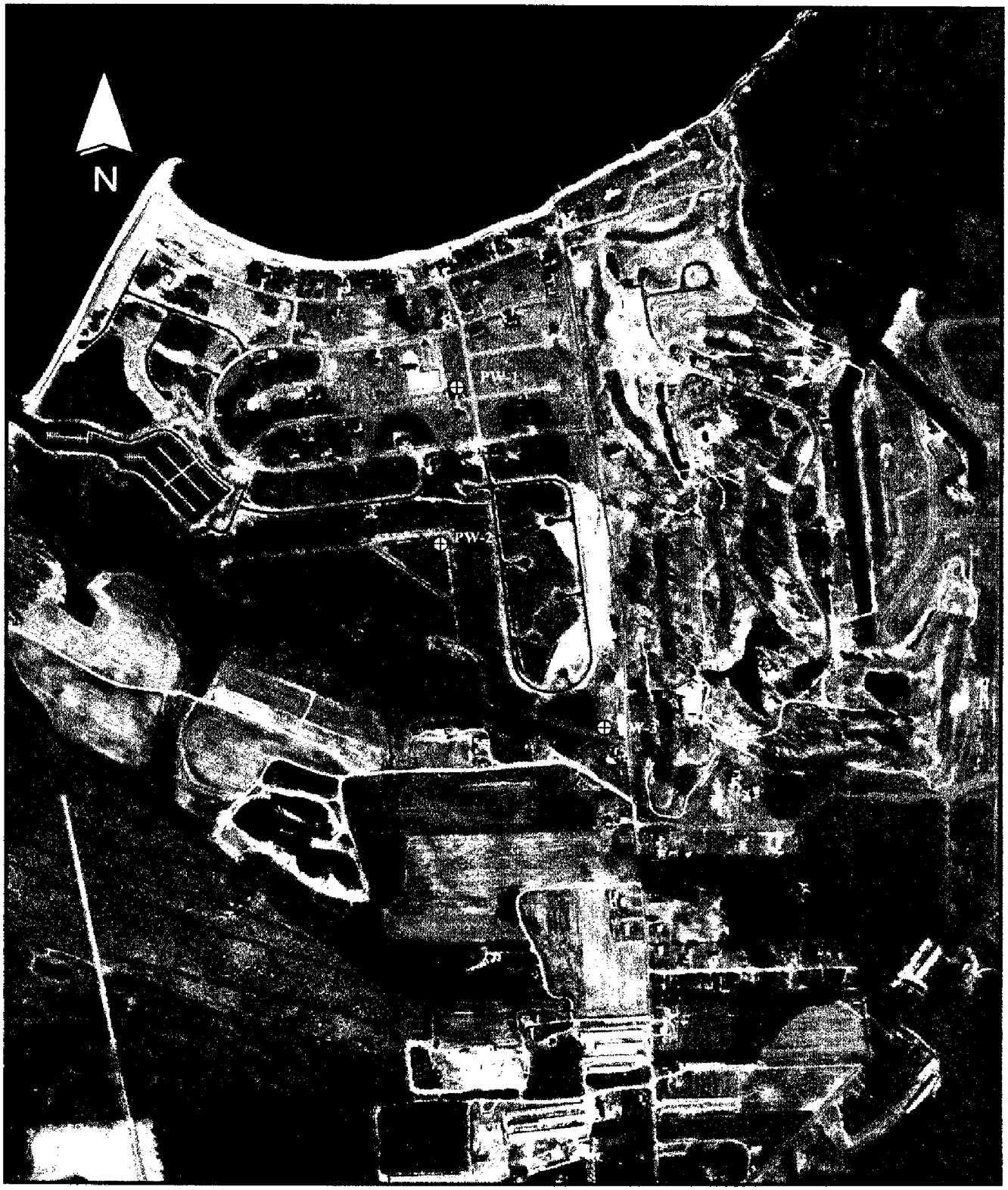

Figure 2. Public Supply Well Locations

500 0 500 1000 Feet

Figure 3. Facility Evaluation Well Locations

500 0 500 1000 Feet

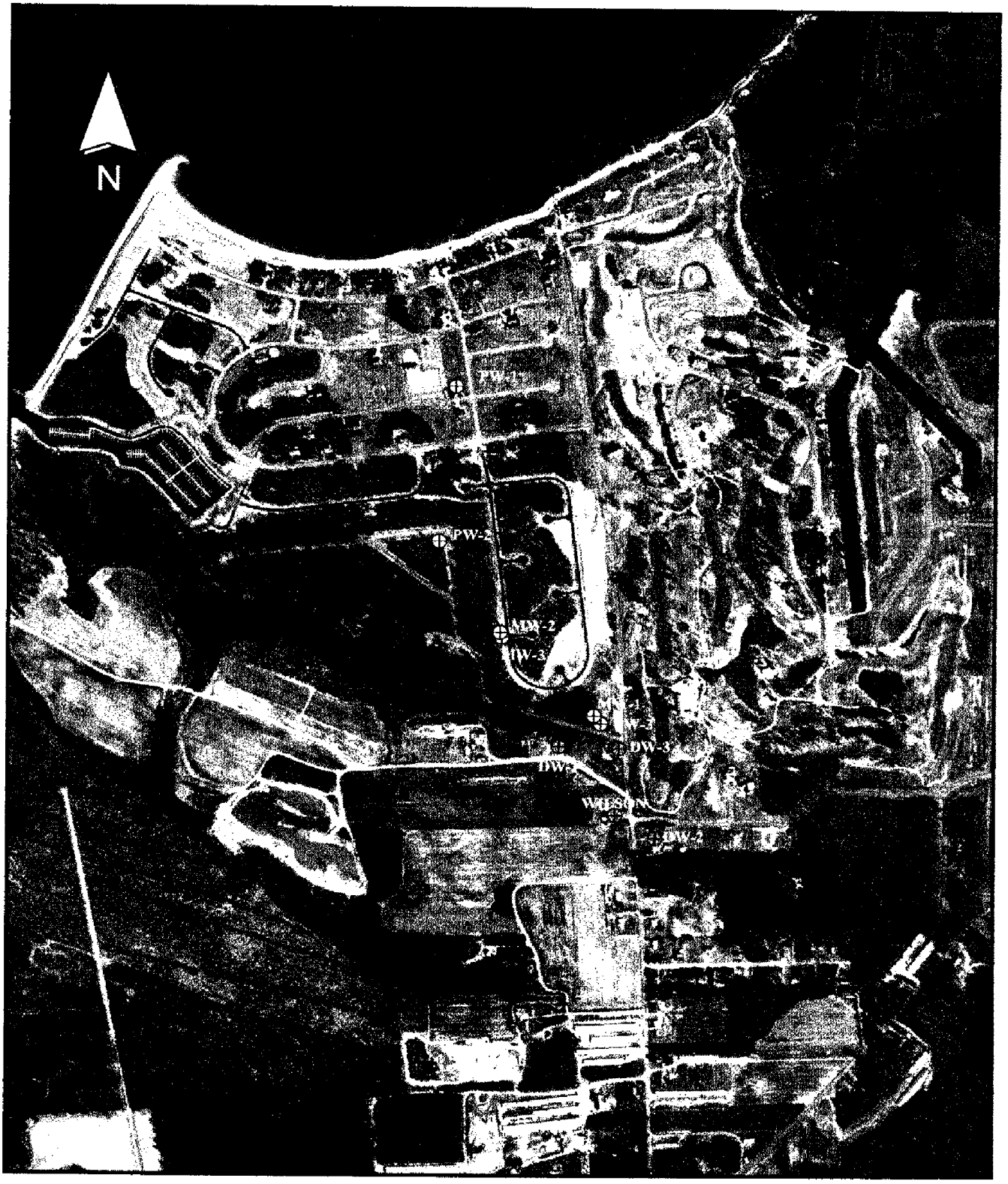

Figure 4. Domestic Well Locations

500 0 500 1000 Feet

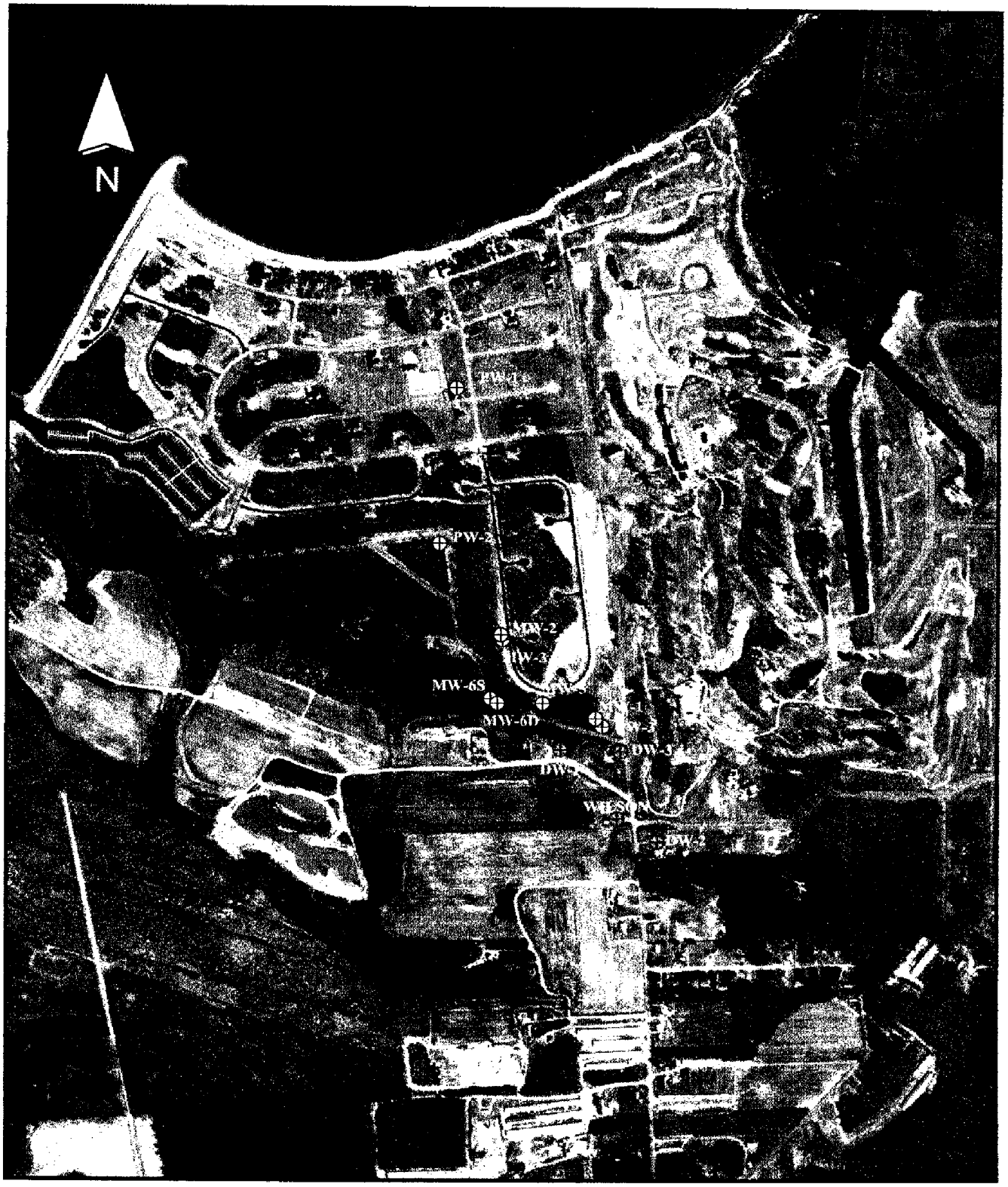

Figure 5. Well Locations

500 0 500 1000 Feet