Health Consultation

Burlington Northern Car Shops

City of Brainerd, Crow Wing County, Minnesota

CERCLIS No. MND000780536

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Prepared by

The Minnesota Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

FOREWORD

This document summarizes public health concerns at a hazardous waste site in Minnesota. It is based on a formal site evaluation prepared by the Minnesota Department of Health (MDH). For a formal site evaluation, a number of steps are necessary:

- *Evaluating exposure:* MDH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is found on the site, and how people might be exposed to it. Usually, MDH does not collect its own environmental sampling data. Rather, MDH relies on information provided by the Minnesota Pollution Control Agency (MPCA), the US Environmental Protection Agency (EPA), and other government agencies, private businesses, and the general public.

- *Evaluating health effects:* If there is evidence that people are being exposed—or could be exposed—to hazardous substances, MDH scientists will take steps to determine whether that exposure could be harmful to human health. MDH's report focuses on public health— that is, the health impact on the community as a whole. The report is based on existing scientific information.

- *Developing recommendations:* In the evaluation report, MDH outlines its conclusions regarding any potential health threat posed by a site and offers recommendations for reducing or eliminating human exposure to contaminants. The role of MDH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions to be taken by other agencies—including EPA and MPCA. If, however, an immediate health threat exists, MDH will issue a public health advisory to warn people of the danger and will work to resolve the problem.

- *Soliciting community input*: The evaluation process is interactive. MDH starts by soliciting and evaluating information from various government agencies, the individuals or organizations responsible for cleaning up the site, and community members living near the site. Any conclusions about the site are shared with the individuals, groups, and organizations that provided the information. Once an evaluation report has been prepared, MDH seeks feedback from the public. *If you have questions or comments about this report, we encourage you to contact us.*

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I. Summary of Background and History

The Burlington Northern Car Shops site (the site) is located on the east side of the city of Brainerd, Minnesota, southeast of the intersection of Minnesota Highway 210 and 13th Street in an area of mixed residential, commercial, and industrial use. The approximately 100-acre site was first developed by the Northern Pacific Railroad in the late 1800s and was used entirely for railroad operations until 1977. The maintenance activities included general maintenance and repair of railroad cars and locomotives, construction of new railroad cars, and degreasing and painting of equipment (MPCA 2001).

The site is divided roughly in half by an east-west running railroad line. The northern portion (57 acres) is currently owned by the Burlington Northern and Santa Fe Railway Company (BNSF). It is in active use as a railroad equipment repair and maintenance facility. The southern half of the site (approximately 47 acres) once contained many railroad buildings, including oil houses, a warehouse, an office, a storeroom, a boiler shop, a machine shop, a blacksmith shop, a power plant (coal fired), a locomotive roundhouse, an acetylene gas plant, a reclaiming plant/foundry, and a pattern shop (Barr 2000, MPCA 2001). Several of these buildings have been demolished, including the roundhouse, which was torn down in or around 1959. In 1992, the southern half of the site was purchased and is currently owned by Northern Pacific Center, Inc. (NPC). NPC leases the remaining railroad buildings to private tenants for various uses, including for offices, auto body repair, woodworking, and material storage (Barr 2000, Retec 2001). The location of the site is shown in Figure 1, and the historical site features and current ownership are shown in Figure 2.

The site was added to the Minnesota Permanent List of Priorities, the state Superfund list, in 1988 as a result of the discovery of soil and groundwater contamination from petroleum products and heavy metals. BNSF has conducted numerous investigations of the site as well as several cleanups focusing on petroleum contamination in groundwater and lead contamination in shallow soils. The northern half of the site will likely remain as a railroad maintenance facility for the foreseeable future. Some time after the purchase of the southern half of the site in 1992, NPC entered the Minnesota Pollution Control Agency's (MPCA) Voluntary Investigation and Cleanup (VIC) Program to seek liability assurances for the planned redevelopment of the southern half of the site, which is ongoing (MPCA Project Number VP7880; Barr 2000).

In late 2002, MDH received a letter from a citizen of Brainerd who expressed concern over the cleanup levels for lead in soil approved by the MPCA for the site, given the fact that the site is being redeveloped for uses that could eventually include multi-family housing. As a result, this report will focus primarily on lead contamination in soil on the southern half of the site, hereafter referred to as the "NPC Property."

Geology/Hydrogeology

The NPC Property is underlain by 4 to 10 feet of fill consisting of cinders, sand, gravel, ash, clay, and scattered debris (Barr 2002). Below this fill layer lie approximately 160

feet of unconsolidated sediments consisting of sand and gravel deposits and green clay. The uppermost bedrock unit, consisting of argillite, slate, and granite, lies below these units.

Shallow groundwater occurs at depths of 4 to 15 feet below the ground surface. The regional groundwater flow is anticipated to be towards the west, in the direction of the Mississippi River. Localized flow directions may be influenced by wetlands and other surface features on the site, however.

Initial Investigations for Lead Contamination in Soil

Various investigations conducted by BNSF at the site between 1989 and 1995 identified the presence of lead-contaminated soils on the site, primarily on the NPC Property. Soil samples for analysis for lead were collected from soil borings, test pits, surface locations, and sediments found in maintenance trenches within the former railroad buildings. Elevated concentrations of lead were found in numerous soil samples, both at the surface and at depth. The locations of the soil samples are shown in Figure 3, and the data are presented in Tables 1 and 2. The majority of the samples were collected from the western end of the NPC Property. The highest concentration of lead found in surface soil, 2,800 milligrams of lead per kilogram of soil (mg/kg), was found in a trench sediment sample from within the former machine shop. The samples were not evenly distributed across the site, but rather appear to have been focused on specific areas of historical operations. Elevated lead concentrations were also found in surface and deeper soils to the west of the NPC Property, on vacant land across 13th Street. The source and extent of this contamination is not known.

BNSF identified two main areas of lead-contaminated soil at borings B103 (next to the former roundhouse location) and B115 (near the former reclaiming plant). BNSF drilled additional soil borings around these locations to characterize the horizontal and vertical extent of the lead contamination. The results of soil samples from these borings are presented in Figures 4 and 5 and in Tables 1 and 2.

Cleanup Levels for Lead in Soil at the Site

In 1994, a consultant for BNSF prepared a focused risk assessment for the site based on several lead exposure models, including the Integrated Uptake Biokinetic Model (IUBK) developed by EPA (Retec 1994). Using the IUBK model, Retec proposed health-protective concentrations of lead in soil for the site of 650 mg/kg for a child living on the site and 2,600 mg/kg for an adult worker. Calculations using a separate model (Bowers 1994) resulted in establishment of a soil lead concentration of 4,980 mg/kg as being protective of adult workers. The report further stated that the health protective concentrations should not be compared with individual or maximum lead soil concentrations. Using the same lead in soil data presented in Tables 1 and 2, Retec calculated arithmetic and geometric mean surface soil lead concentrations for the site of 495 mg/kg and 234 mg/kg, respectively, and concluded that these concentrations were below the proposed health-protective concentrations.

The MPCA originally proposed a soil cleanup level for lead for the site of 500 mg/kg, with 100 mg/kg for areas of bare soil (MPCA 1995). This level was based on an unrestricted land use scenario, which could include residential development. BNSF opposed the proposed soil cleanup level on the basis of factors of cost, practicality, and a belief that the property would never be used for residential purposes. BNSF instead proposed that the site be designated for strictly commercial/industrial purposes. MPCA staff raised the issue at a public meeting (attended by 10 participants) held in April of 1995. In part on the basis of a lack of objection from the public, the MPCA agreed to BNSF's proposal for designating the site for commercial/industrial use with the stipulation that BNSF would be responsible for establishing deed restrictions or institutional controls "necessary to prevent residential use or other uses of the site that could allow children or susceptible adults from coming in contact with lead-contaminated soils on a daily basis" (MPCA 1995). The city of Brainerd concurred with this decision in a letter to the MPCA dated August 8, 1995. The MPCA then set the following commercial/industrial cleanup goals for lead in soil at the site:

- 1,400 mg/kg from 0 to 5 feet below ground;
- 2,500 mg/kg from 5 to 10 feet below ground; and
- No cleanup level necessary for soils below 10 feet.

In a 1998 file memorandum, MPCA staff stated that the averaging of soil lead concentrations was acceptable for the site, including the "hot spots" identified around borings B103 and B115. The areas averaged were to be approximately 100 feet by 100 feet, simulating a small residential lot. The memorandum concluded that following cleanup of the hot spots to these commercial/industrial levels, averaging of the resulting soil lead concentrations should result in a concentration below 500 mg/kg (the level originally deemed acceptable by the MPCA for residential use), and the memorandum indicated that as a result no institutional controls would be required. The MPCA communicated these findings to NPC and BNSF in a letter dated March 31, 1999 (MPCA 1999) and again in a letter dated April 7, 2000 (MPCA 2000). The April 7, 2000 letter further stated that the commercial/industrial cleanup levels would permanently apply to the entire site and that multi-family residential housing would be acceptable on the basis of the averaging of lead concentrations in soil. It also required that the property owner file a real property notification (as opposed to an environmental restrictive covenant) disclosing the nature and location of residual contamination at the site.

In 2001, the MPCA further memorialized the commercial/industrial cleanup levels for the site in a document known as a Minnesota Decision Document (MPCA 2001). This document describes the contamination at the site, the approved cleanup levels, and the approved remedy.

Cleanup Actions for Lead in Soil

In 2001, BNSF conducted a cleanup of the two lead-impacted areas around borings B103 and B115 (Retec 2001). These were the only areas of outdoor contaminated soil (besides

some samples from within the boiler and machine shops) that exceeded the site cleanup goals for lead. The work was conducted under the oversight of the MPCA, and a detailed site safety plan was developed to ensure that workers at the site were not exposed to lead-contaminated soil during the cleanup. Dust control measures would be used when needed to ensure that any lead-contaminated dust that was generated would be contained to the site, and air monitoring was conducted around the perimeter of the site. The workers' blood lead levels were also measured before and after the cleanup.

Approximately 590 tons of lead-contaminated soil were excavated from the area around B103, as shown in Figure 4. A steam tunnel was found during the excavation and cleaned out. Fifteen confirmation samples were collected from the sidewalls and the base (approximately 10 feet below ground) of the excavation. While none of the confirmation samples exceeded the site cleanup levels, lead concentrations as high as 1,240 mg/kg remained at depth at the perimeter of the excavation. The hole was then backfilled with clean soil from off-site.

The excavation of lead-contaminated soil around boring B115 was more problematic. The initial excavation area was based on the area of lead contamination identified by previous samples, as shown in Figure 5. The excavation extended to a depth of approximately 6–8 feet below ground, to just below a peat layer that seemed to act as a confining layer preventing the downward migration of the lead contamination. Waste materials, including cinders, clinkers, red and green paint, and battery cores and plates were encountered in various locations. A total of 29 sidewall and 16 base confirmation samples were collected from the initial excavation. Lead concentrations in excess of the soil cleanup level were found in the initial sidewall samples in multiple locations, in some places as high as 4,470 mg/kg. The excavation limits were then extended, and new confirmation samples were collected, one of which had a lead concentration of 39,000 mg/kg. This process of excavation and confirmation sampling continued until the site cleanup levels were met. At the final limits of the excavation, which was much more extensive than initially planned, lead concentrations in the sidewall samples averaged several hundred mg/kg of lead.

A total of 7,048 tons of soil (590 tons from the boring B103 area excavation and 6,458 tons from the B115 area excavation) were excavated and removed from the site for disposal at a local landfill. Because of high lead concentrations, some of the excavated soil was considered hazardous waste requiring treatment prior to disposal. Treatment consisted of mixing the contaminated soil with a commercial stabilization agent on a concrete pad so that the resulting mixture would pass the soil-leaching test used to determine if it was hazardous waste. It was then accepted for disposal by the landfill. The results of air/dust monitoring around the perimeter of the site during cleanup showed no detections of lead. The MPCA issued a site closure letter to BNSF in acknowledgment of the completion of the soil lead cleanup in February 2002.

In 1991, the lead-contaminated sediment found in trenches inside the former machine shop were managed by scraping up the sediment and mixing it with cement, and then capping the trenches and encapsulated sediment with a new concrete floor (Retec 2003).

Activities Associated with Redevelopment of the NPC Property

NPC is working with the city of Brainerd on the phased redevelopment of the NPC Property (Barr 2000). The redevelopment may include commercial, industrial, and residential uses. The western end of the property will likely remain as commercial/industrial space, while the mainly vacant eastern end of the property may eventually include commercial or multi-family residential uses. Redevelopment activities may include demolition of selected buildings; possible additions to existing buildings; grading and construction of roads, parking lots, and stormwater ponds; installation of subsurface utilities; and construction of new commercial and multi-tenant residential buildings (Barr 2000). A conceptual site development plan prepared by NPC is presented in Figure 6. The property is currently zoned solely for commercial/industrial use, however, and recent activities are focused mainly on utility upgrades and site grading (J. Hulsether, City of Brainerd, personal communication 2002). NPC and the city have also obtained grant funding for the redevelopment activities from the Minnesota Department of Trade and Economic Development (DTED).

The redevelopment activities may involve disturbance of soils to depths of 5 to 10 feet below grade in some areas. Prior to the initiation of redevelopment activities, NPC conducted additional investigation for lead in soils on the NPC Property (Barr 2000). The investigation was focused on areas that were likely to be disturbed during redevelopment activities, and it involved the advancement of 45 push probe borings to depths of up to 12 feet for the collection of soil samples. The majority of the samples were analyzed for lead. Other samples were analyzed variously for heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and polynuclear aromatic hydrocarbons (PAHs). During the investigation, a pile of soil with suspected asbestos-containing materials (ACM) was also observed on the NPC Property.

Analysis of shallow (0–1 foot) soil samples from 37 locations showed lead concentrations ranging from 2 mg/kg to 1,100 mg/kg. The soil boring locations and lead analysis results are shown in Figure 7. Eight soil samples collected from 1.5 to 5.5 feet showed lead concentrations of 2 to 620 mg/kg, and only low levels of lead were found in the three samples collected from 5.5 to 10 feet below ground. Elevated levels of arsenic and barium were found in several soil samples. Low levels of two SVOCs were found in one boring; concentrations of VOCs and PAHs were below laboratory detection limits. The investigation report concluded that all the lead sample results were below the site-specific cleanup goal for lead in shallow soils, but that some samples did exceed MPCA Soil Reference Values (SRV) for lead for residential and industrial land use scenarios. The SRVs for lead will be discussed in more detail below.

In July 2001, NPC proposed conducting additional cleanup in the areas excavated by BNSF in order to meet the MPCA's SRV for lead in residential soils of 400 mg/kg (Landmark 2001). The work was not conducted, however (K. Haberman, Landmark Environmental LLC, personal communication 2002).

Because the planned redevelopment activities may involve the disturbance of residual contaminated soil, a consultant for NPC and the city of Brainerd developed a formal contingency plan (Barr 2002). The initial phase of redevelopment, carried out in 2002, involved site grading as well as street and utility upgrades on the western end of the property. The contingency plan calls for the screening of soil as it is excavated for visible contamination. Much of the lead-contaminated soil at the site is associated with waste products, such as sand-blasting sand, paint chips or wastes, and other waste materials. Suspect lead-contaminated soils were to be excavated from the work area and stockpiled, and samples collected for testing for total lead. If the results of the soil lead samples are below the site-specific cleanup level of 1,400 mg/kg, then the soils will remain on the NPC Property for use in backfilling the excavation or for placement under a paved road or parking area. Soils in excess of the site-specific cleanup level would be disposed of in an off-site landfill. Soils suspected of being contaminated with ACM will also be managed appropriately. In its approval letter for the contingency plan, however, the MPCA modified the contingency plan to state that soils contaminated with between 400 and 1,400 mg/kg of lead must be replaced in the area they were excavated from, and that only soils with a total lead concentration of less than 400 mg/kg (the MPCA SRV for lead in residential soil) could be re-used anywhere on the site (MPCA 2002).

Prior to the development activities in 2002, a series of test pits were excavated along the proposed streets and utility corridors to look for the presence of contamination. Lead concentrations as high as 3,200 mg/kg were detected in soil samples collected from the test trenches, and wastes such as boiler ash, clinker debris, railroad ties, and other debris were observed in some of the test pits. Mercury was found at a concentration of 5.4 mg/kg in a composite test pit soil sample (the MPCA industrial SRV for mercury is 2 mg/kg), and asbestos-containing materials above the regulatory threshold of 1% in soil were also identified in one test pit soil sample. The investigation associated with the 2002 utility and grading work resulted in approximately 250 to 300 cubic yards of contaminated soil being excavated for disposal at a local landfill prior to construction. A final report on these activities is pending.

In a letter to the MPCA dated April 4, 2002, NPC requested that the NPC Property be de-listed from the state Superfund list. To date, no action has been taken by the MPCA in response to this request.

Site Visit

On April 18, 2003 MDH staff conducted a site visit at the Burlington Northern Car Shops / NPC Property Site located at Highway 210 and 13th Street in Brainerd, Minnesota. As described previously, the NPC Property consists of several approximately 100-year-old buildings originally constructed and used by the Northern Pacific Railroad for the maintenance of railroad equipment. Most of the remaining buildings have been at least partially refurbished, while two (the power plant and gas plant) are in disrepair. Improvements to the property were completed in 2002 by the property owner and the city of Brainerd, and those improvements included the upgrading of utilities and construction of paved streets on the western (commercial) end of the site. The trenches inside the

various buildings where lead-contaminated sediments were found by BNSF have all been sealed with concrete.

The property uses surrounding the site are as follows: 1) north–an active railroad maintenance yard operated by BNSF; 2) east–extensive swamps; 3) south–residences, separated from the site by a chain link fence and Laurel Street; and 4) west–13th Street, vacant land (swamp, trees), and a BNSF rail yard.

Several of the site buildings are occupied by a variety of small businesses, including a woodworking shop, offices, cold storage, and a small FedEx terminal. None of the businesses appeared to be using lead or other types of contaminants found at the site, although a close inspection was not conducted. It was estimated that perhaps 10–25 people spend the majority of their workday at the site.

The two main lead excavation areas remediated by BNSF in 2001 (around original borings B103 and B115) have been filled in and covered with gravel, and they are unremarkable. Multiple piles of soil and debris (ties, cinders, concrete, etc.) are present on the east end of the NPC Property, perhaps from the utility work conducted by the city in 2002. Of the two surface soil samples that showed lead levels in excess of the current MPCA industrial SRV for lead of 700 mg/kg [SB-6 (870 mg/kg) and SB-38 (1,100 mg/kg)], SB-6 is located in a gravel lane between the machine and blacksmith shop buildings in what appears to be a low-traffic area. SB-38 is located some distance away from the site buildings near the edge of the extensive swamps that lie east of the site. There would be no apparent reason for people to venture into this area.

The chain-link fence that runs along the southern boundary of the site is in somewhat poor condition; it has fallen down at the intersection of 18th Street and Laurel Street. While trespassing does not appear to be a significant concern, the presence of several dilapidated buildings and various dirt piles may make the site attractive to neighborhood children.

II. Discussion

Lead is one of the most common contaminants found at Superfund sites (ATSDR 1999). Elemental lead or lead compounds are or were used in a variety of products, including electrical batteries, ammunition, solder used in plumbing, gasoline additives, and paints. Its commercial use has been declining, and lead has been banned from use in gasoline since 1996. As a result of its past widespread use, however, lead can be found throughout the environment and in the bodies of humans. The occurrence of an elevated blood lead level (a sign of lead exposure) in people, especially children, is still somewhat common as a result of the widespread presence of lead in the environment, and the health effects of exposure to lead are well documented.

Lead is toxic to many of the body's organ systems, including primarily the nervous system (ATSDR 1999). Long-term exposure to lead has been associated with decreased

neurological function in workers exposed to lead on the job. High blood pressure is another possible effect from exposure to lead. Of greatest concern, however, is lead's toxicity to the developing nervous system. Young children are especially vulnerable to the toxic effects of lead exposure. Children between one and five years of age are also the most likely group in the general population to have high lead exposures because their behaviors (e.g. playing on the floor or ground, frequent hand-to-mouth contact) result in greater exposures than the behaviors of older children and adults to contaminated paint, dust, and soil, both in general and based on a per pound of body weight basis. Children who ingest large amounts of lead may develop anemia, kidney damage, colic, muscle weakness, and brain damage (ATSDR 1999). Ingestion of smaller amounts of lead, at once or over time, may result in lesser effects on the blood and brain function. Exposure to low levels over time may affect physical and mental growth. Prenatal exposure may result in premature birth, low birth weight, and impaired development.

The concentration of lead in blood serves as an indicator of exposure. The Centers for Disease Control and Prevention (CDC) considers children to have an elevated level of lead in their blood if the lead level is 10 micrograms per deciliter of blood (σg/dl) or higher (ATSDR 1999). This level of concern has also been recognized by MDH, EPA, and MPCA. Minnesota state statutes (Minn. Stat. § 144.9501) established 10 σg/dl as an "elevated blood lead level." However, there is no firm threshold of toxic exposure to lead, so it is important for blood lead levels in any population to be as low as possible. Low blood lead levels are important both to protect the health of children (and others) from subtle adverse effects that might occur below the level of concern and to limit the size of the population with blood lead levels above 10 σg/dl. A recent study published in the *New England Journal of Medicine* in fact suggests that blood lead levels even below 10 σg/dl may be associated with intellectual impairment in children (Canfield et al 2003).

According to the MDH Lead Surveillance System, 12 children (2.8% of children tested) in Brainerd were found to have elevated blood lead levels during 2001 and 2002. Two of those children had blood lead levels between 15 and 19.9 σg/dl, and one child had a blood lead level above 20 σg/dl. Furthermore, another 11 children (or 2.2% of the children tested) had blood lead levels of 8–9.9 σg/dl and are at high risk for developing elevated blood lead levels. An additional 78 children (15.7%) were at some risk for elevated blood lead, with measured levels between 5 and 7.9 σg/dl. There are, no doubt, many potential sources of lead in the Brainerd environment, the most likely being lead-based paint used in older housing stock. MDH is aware of at least one other site that has had high soil lead levels and is located in a residential area of Brainerd, however. The Brainerd Foundry site is located approximately ½ mile southwest of the BN Car Shops site, and it has also been the subject of a health consultation done by MDH in cooperative agreement with the US Agency for Toxic Substances and Disease Registry (MDH 2001).

Soil Cleanup Levels for Lead

In 2001, the EPA issued soil cleanup regulations under section 403 of the Toxic Substances Control Act and the Residential Lead-Based Paint Hazard Reduction Act (40 C.F.R. Part 745). The regulation specifies 400 mg/kg of lead in soil as the cleanup

standard in play areas and 1,200 mg/kg as the cleanup standard in bare soil in remaining areas of a residential yard. However, Minnesota state statutes (Minn. Stat. § 144.9501) define a play area as "any established area where children play, or on residential property, any established area where children play *or bare soil is accessible to children*." (italics added). Minnesota state statutes (Minn. Stat. § 144.9508) further established a maximum standard of 100 mg/kg of lead in bare soil in such cases.

MDH must conduct a lead risk assessment at a residence (including all common areas accessible to a child who lives in a building with 2 or more dwelling units) if the residence is: 1) of a child with a blood lead level at or greater than 20 σg/dl; 2) of a child with a blood lead level of 15–19.9 σg/dl that persists for 3 months; or 3) of a pregnant woman with a blood lead level at or above 10 σg/dl (Minn. Stat. § 144.9504). MDH must then order soil replacement if soil lead concentrations exceed 100 mg/kg, and replacement soils must not exceed 25 mg/kg (Minn. Stat. § 144.9508).

EPA states that a soil cleanup standard of 400 mg/kg of lead will result in a 1–5% chance of an individual child's having a blood lead level above 10 σg/dl (40 C.F.R. Part 745). This is approximately the rate of elevated blood lead levels found in Brainerd children in 2001 and 2002. If the 400 mg/kg standard is exceeded, EPA further states that there is a 2% probability that a child exposed to the soil will exceed 15 σg/dl of blood lead, and a less than 1% probability that a child's blood lead would exceed 20 σg/dl. EPA considers this to be an "exceedingly high risk." At 1,200 mg/kg of lead in soil, EPA stated that the *mean* blood lead level of young children would be expected to be in the range of 8–11 σg/dl based on the IUBK model, with 30–60% of children exceeding 10 σg/dl, and 2 to 10% of children exceeding 20 σg/dl blood lead. These are very high probabilities that a serious case of lead poisoning could occur in an exposed child.

The EPA Office of Solid Waste and Emergency Response (OSWER) soil lead guidance for Superfund sites specifies that soil lead above 400 mg/kg may pose a health risk to children as a result of elevated blood lead levels (EPA 1994). Therefore, EPA deems a cleanup level of 400 mg/kg appropriate at Superfund sites unless site-specific information provides a basis to identify a different soil lead level that would be protective of human health. The MPCA has established a Soil Reference Value (SRV) of 400 mg/kg of lead in soil, assuming that human exposure to contaminants is chronic and occurs in a residential setting (MPCA 2003). An SRV is the concentration of a contaminant in soil above which exposure may result in an unacceptable risk to human health. MPCA has also established an SRV of 700 mg/kg of lead in soil for commercial/industrial settings.

Soil Lead Investigation and Averaging of Results

Currently, a limited number of soil samples have been collected in areas that may potentially be developed for residential uses. Adequate characterization of soils both at the surface and at depth is critical for estimating the risks from potential exposure to lead in the event that any digging, construction, or other disturbance or removal of soil occurs. Fortunately, laboratory analysis for lead in soil is relatively inexpensive, and field

screening instruments are available that can provide fast, reliable lead data during investigation and development activities.

Children are most likely to be exposed to the top 1–3 inches of soil. It is therefore not appropriate to take deep vertical samples and average the lead concentrations in soil at various depths, as has been done in some instances at the site. For purposes of environmental investigations at Superfund sites or other hazardous sites, soils need to be characterized at various depths. For example, the investigation of the National Lead/Taracorp/Golden Auto Parts site (a federal Superfund site) as described in a health consultation done by MDH in cooperative agreement with the ATSDR (MDH 1995) included the collection of 90 soil samples from 45 residential yards, coring to a depth of only 3 inches. Subsequently, MDH and MPCA did a further study using soil samples to a depth of 2 centimeters. A geostatistical analysis was done to determine the areas where lead in soil was expected to be greater than 400 mg/kg. This type of analysis obviously precludes "averaging" of lead samples taken at different depths.

Similarly, the averaging of lead results in soil from multiple horizontal locations is also inappropriate, and contrary to the intent of EPA and MDH rules. The averaging of soil lead concentrations could result in the failure to clean up areas of lead-contaminated soil well in excess of the EPA criterion and the MPCA SRV of 400 mg/kg. If redevelopment results in those areas being used as play areas by children, significant lead poisoning could result.

Child Health Considerations

ATSDR and MDH recognize that the unique vulnerabilities of infants and children make them of special concern to communities faced with contamination of their water, soil, air, or food. Children are at greater risk than adults from certain kinds of exposures to hazardous substances at waste disposal sites. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are smaller than adults, meaning they breathe dust, soil, and heavy vapors close to the ground. Children also weigh less, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

Children are unlikely to have been exposed to lead-contaminated soils for any length of time at the NPC Property because of its current commercial/industrial uses. Access to the site by children should be restricted, however. If the planned redevelopment of the property includes residential uses and no further cleanup is conducted, significant exposures to lead-contaminated soils could occur.

III. Conclusions

Lead concentrations of up to 1,100 mg/kg remain present in shallow soil (0–2 feet) on the NPC Property, and at concentrations of up to 2,060 mg/kg in deeper soils. While these concentrations meet the cleanup goals set for the site by the MPCA, they are significantly above soil lead levels that are typically considered health protective by EPA, MPCA, and MDH. While current exposures by workers at the NPC Property as its exists today are unlikely to result in significant health risks, if portions of the property are redeveloped for residential use (as previously deemed acceptable by the MPCA, and as shown in Figure 6) without further investigation and cleanup, significant health risks may occur, especially to children. The discovery of lead-contaminated soils during development activities in 2002 demonstrates that waste materials remain on the site. For these reasons, the site currently represents no apparent public health hazard, but it may pose a public health hazard in the future unless the recommended actions are taken.

IV. Recommendations

1. If the NPC Property is to remain a commercial/industrial property as it exists today, an environmental restrictive covenant should be filed with the property deed that restricts the use of the property to commercial and/or industrial uses, records the location of any surface or shallow soils contaminated with lead in excess of 700 mg/kg, and prohibits their disturbance for any reason without following an MPCA-approved contingency plan.
2. To minimize potential health risks from exposure to lead in soil, if further commercial or industrial development or construction activities are planned on the NPC Property, a soil cleanup level of 700 mg/kg of lead in soil should be applied to those areas. Any such work should be conducted only under an MPCA-approved construction contingency plan.
3. If portions of the NPC Property are to be developed for residential use, a thorough characterization of lead concentrations in shallow soil (0–3 inches) and at depth should be conducted in the areas proposed for residential use, especially in areas where children may play. Soil sample results should not be averaged in any way. Soils found to exceed 400 mg/kg of lead at the surface or at depth in areas that may be disturbed should be excavated and removed from the site, or placed under concrete buildings or asphalt parking lots to prevent future contact. Post-development samples should also be collected to ensure that the 400 mg/kg criterion is met and that no areas designated as possible play areas for children exceed 100 mg/kg of lead in soil. An environmental restrictive covenant should be filed with the property deed to notify future property owners of the presence of any residual lead-contaminated soil in excess of 400 mg/kg in those areas and to prevent its disturbance.
4. Suspected asbestos-containing materials encountered during redevelopment should be managed appropriately, and contaminants other than lead should be cleaned up to their respective residential or commercial/industrial SRVs.

5. The fence along the southern boundary of the site should be repaired and maintained and posted to discourage trespassing.
6. The above recommendations should be considered by the MPCA before the NPC Property is de-listed from the state Superfund list.
7. The presence of lead-contaminated soils to the west of 13th Street should be recorded on the property deed for that property by its owner to notify future landowners of the presence of lead-contaminated soils.

V. Public Health Action Plan

MDH's Public Health Action Plan for the site consists of consultation with MPCA staff, the city of Brainerd, and the site owner on site investigation and development activities, answering questions from the public regarding the site, and participation in any planned public outreach activities.

VI. References

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CERTIFICATION

This Burlington Northern Car Shops Site Health Consultation was prepared by the Minnesota Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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Alan W. Yarbrough
Technical Project Officer, SPS, SSAB, DHAC
ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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Roberta Erlwein
Chief, State Program Section, SSAB, DHAC, ATSDR

Table 1
Historic Surface Soil Lead Concentrations
BN Car Shops Site

Sample Location	Depth (feet)	Lead, mg/kg
B107 - TSBD*	Surface	1,400
B108 - TS*	Surface	510
B109 - FS*	Surface	710
SS101	Surface	140
SS102	Surface	240
SS103	Surface	450
SS104	Surface	1,300
T101*	Surface	920
T102*	Surface	860
T104*	0 - 1	46
T105*	Surface	420
T106*	Surface	2,800
T107*	Surface	170
T108*	Surface	190
B103A	0 - 1	1,200
B103C	0 - 1	662
B115B	0 - 1	< 31
B104	0 - 2	130
B105	0 - 2	74
B107*	0 - 2	18
B112	0 - 2	87
B113	0 - 2	24
B114	0 - 2	61
B117	0 - 2	520
B118	0 - 2	140
B119	0 - 2	670
B120	0 - 2	440
B121	0 - 2	68
P103	0 - 3	92

* Denotes sample from within building

Source: Retec 1994

Table 2
Historic Subsurface Soil Lead Concentrations
BN Car Shops Site

Sample Location	Depth (feet)	Lead, mg/kg
B101	2 - 4	4.2
	17.5 - 20	12
B102	2 - 4	36
	6 - 8	4.4
	14.5 - 16.5	9
B103	4.5 - 6.5	1,600
	15.5 - 17.5	5.4
B103A	4 - 6	268
	16 - 18	< 24
B103B	4 - 6	< 22
B103C	4 - 6	<23
	10 - 12	<22
B103D	4 - 6	34
B103E	6 - 8	12
B103F	6 - 8	< 23
B103G	6 - 8	< 24
B104	11.5 - 13.5	5
B105	11.5 - 13.5	20
B108*	2 - 4	< 2
B109*	5 - 8	3
B111	4 - 6	< 2
	8 - 10	< 2
B112	2 - 4	< 2
B113	2 - 4	< 2
B114	2 - 4	< 2
B115	2 - 4	1,400
	4 - 6	1,900
B115A	4 - 6	2,710
	8 - 10	40
B115B	4 - 6	540
	10 - 12	36
B115C	4 - 6	837
	8 - 10	< 40
B115D	4 - 6	74
B117	2 - 4	150
B118	2 - 4	20
B119	2 - 4	180
B120	2 - 4	7
B121	2 - 4	< 2
P104	7 -8	3.3
P106	12 - 13	1,300
T103*	2 - 4	1,200
TP123	8 - 17	1,400
TP124	2 - 8	220
TP126	2 - 10	160
TP128	2 - 10	550
TP129	10	18
TP130	10	< 2
TP131	3 - 8	< 2

* Denotes sample from within building

Source: Retec 1994

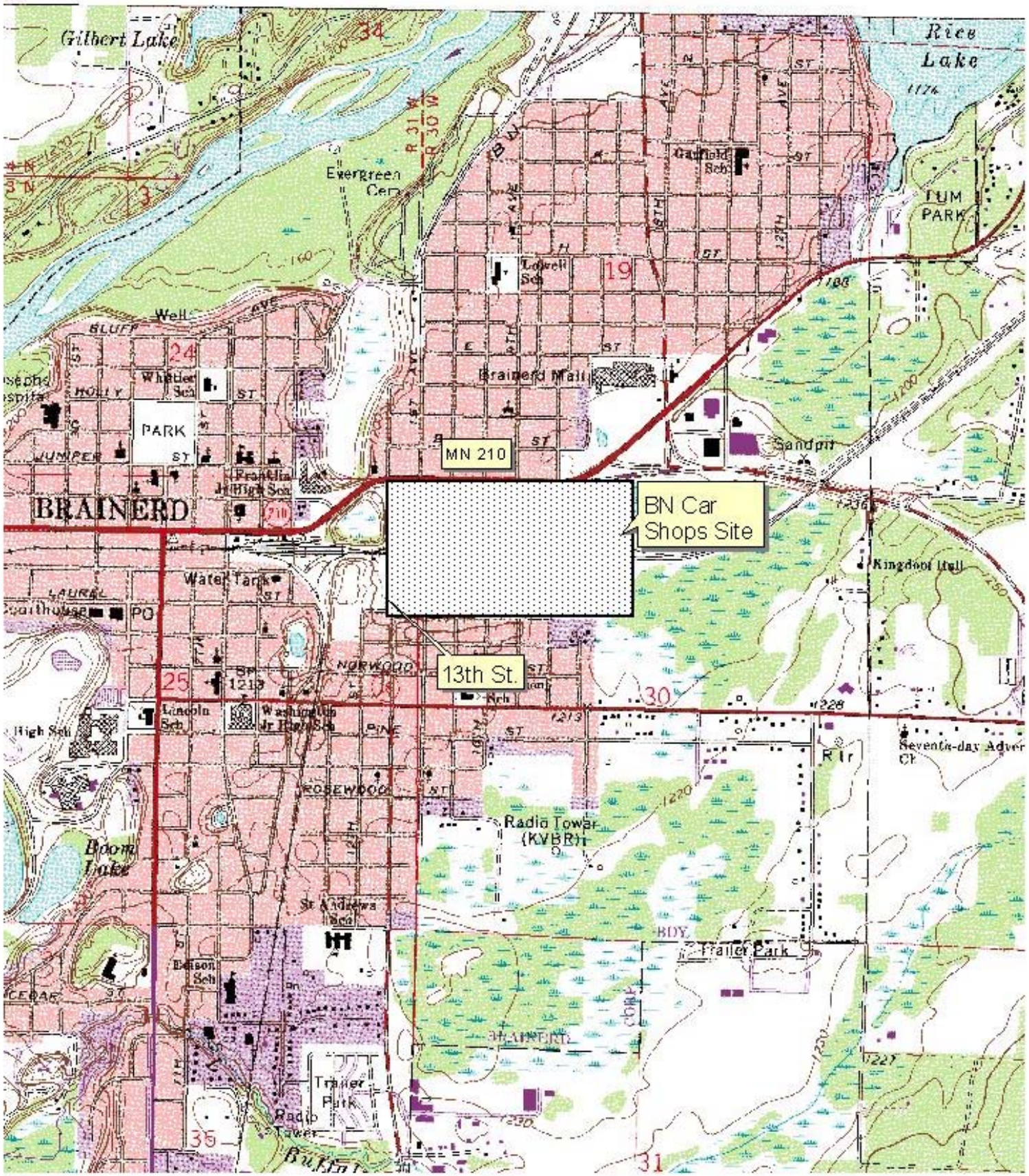


Figure 1: Site Location

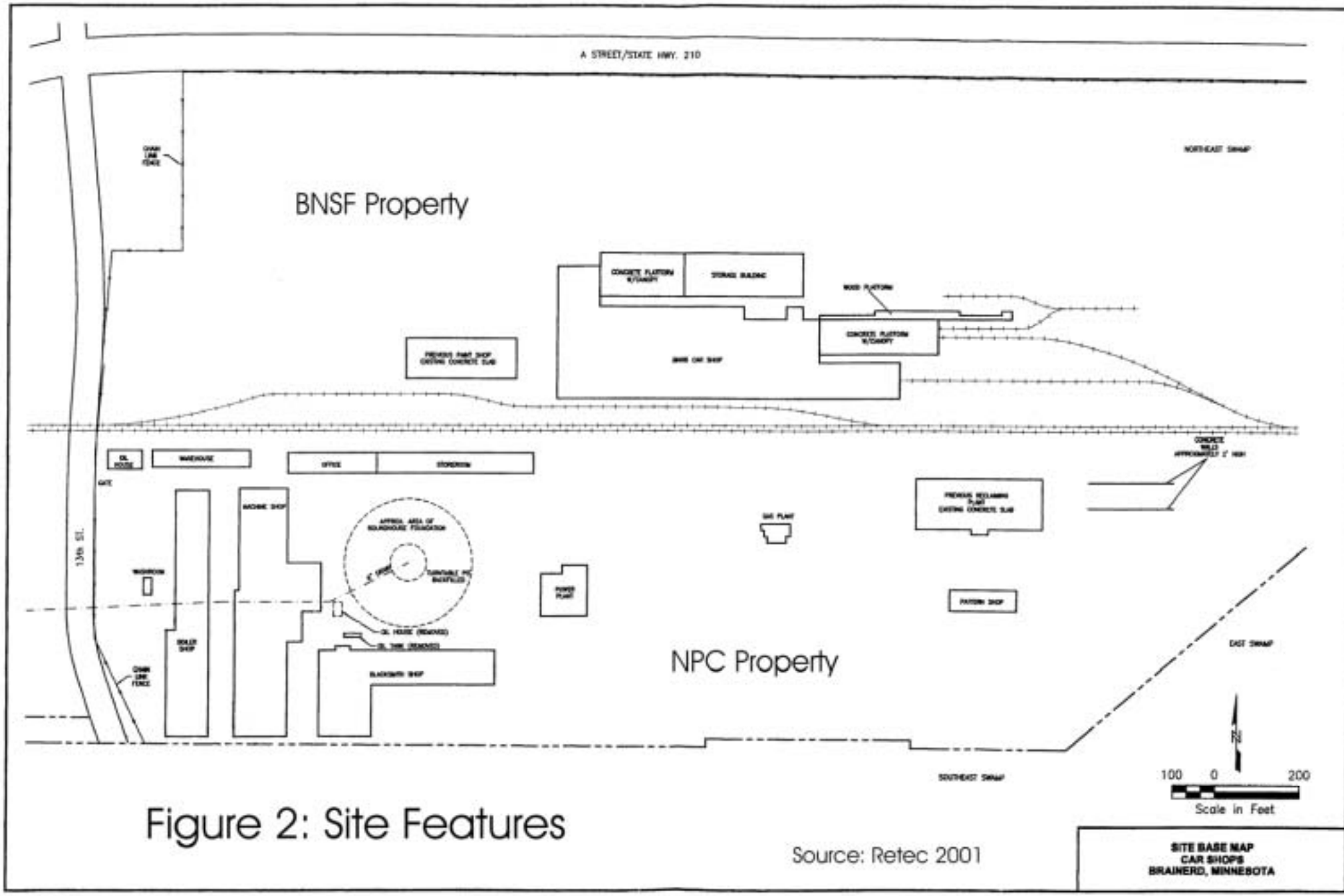


Figure 2: Site Features

Source: Retec 2001

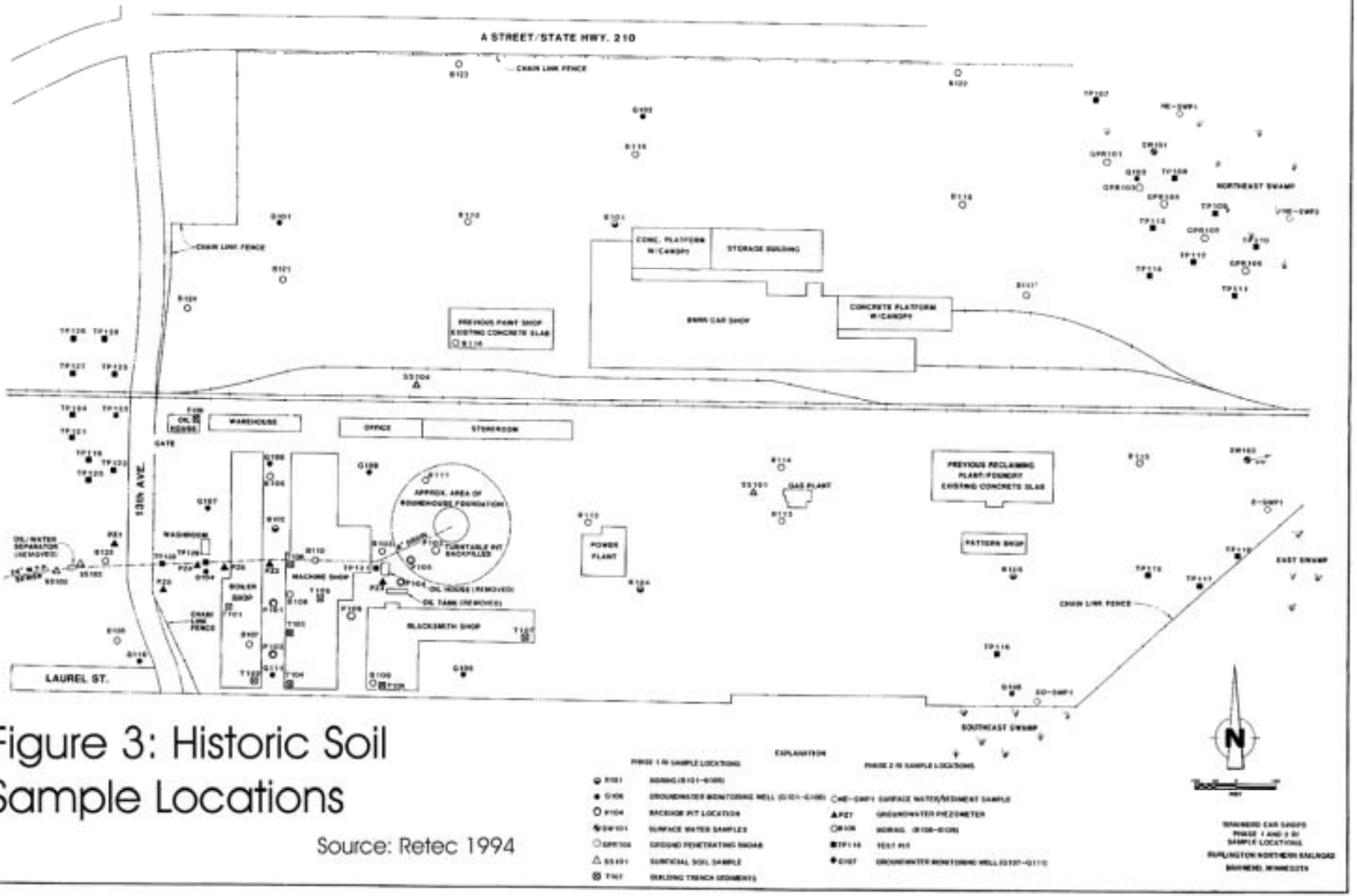
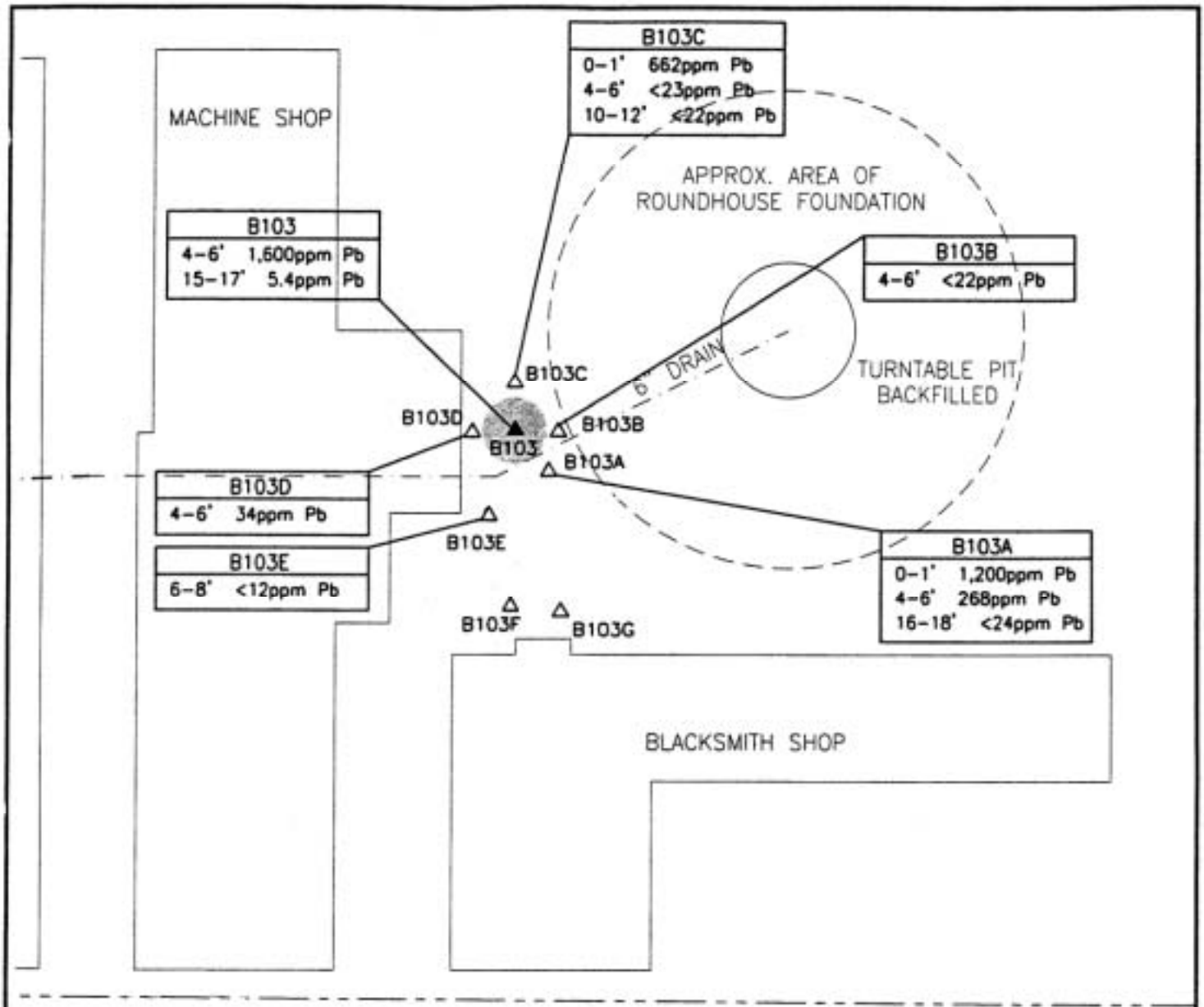


Figure 3: Historic Soil Sample Locations

Source: Retec 1994



EXPLANATION

WORK ZONE/AREA OF EXCAVATION

B103A △ FORMER SOIL BORING LOCATION

B103 ▲ FORMER PRESIT BORING LOCATION

Figure 4: B103 Area Lead Results

ZZ

50 0 100

Scale in Feet

EDGE OF CONCRETE FOUNDATION

Source: Retec 2001

ROUNDHOUSE AREA WORK ZONE AND SOIL SAMPLE RESULTS CAR SHOPS BRAINERD, MINNESOTA

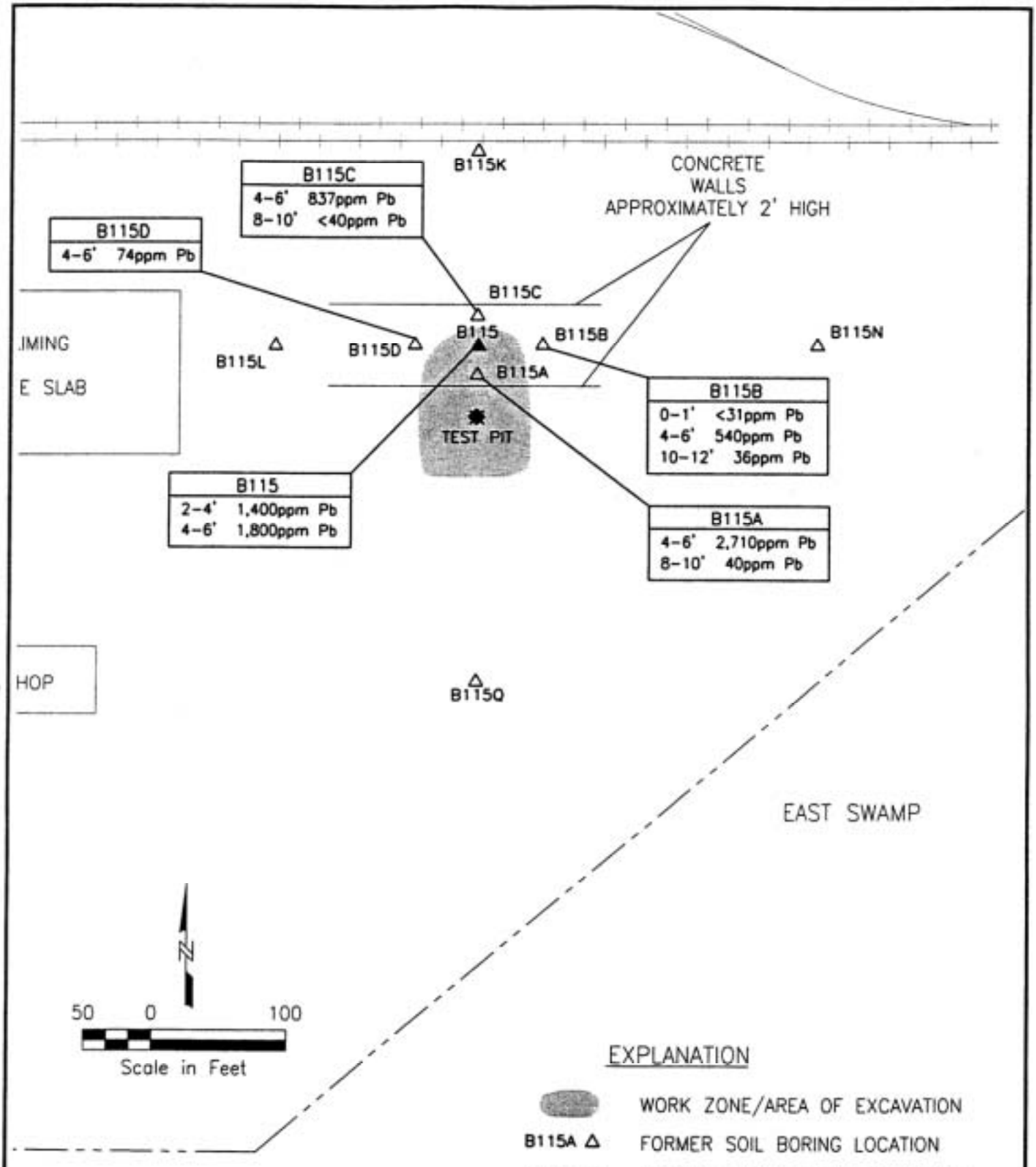
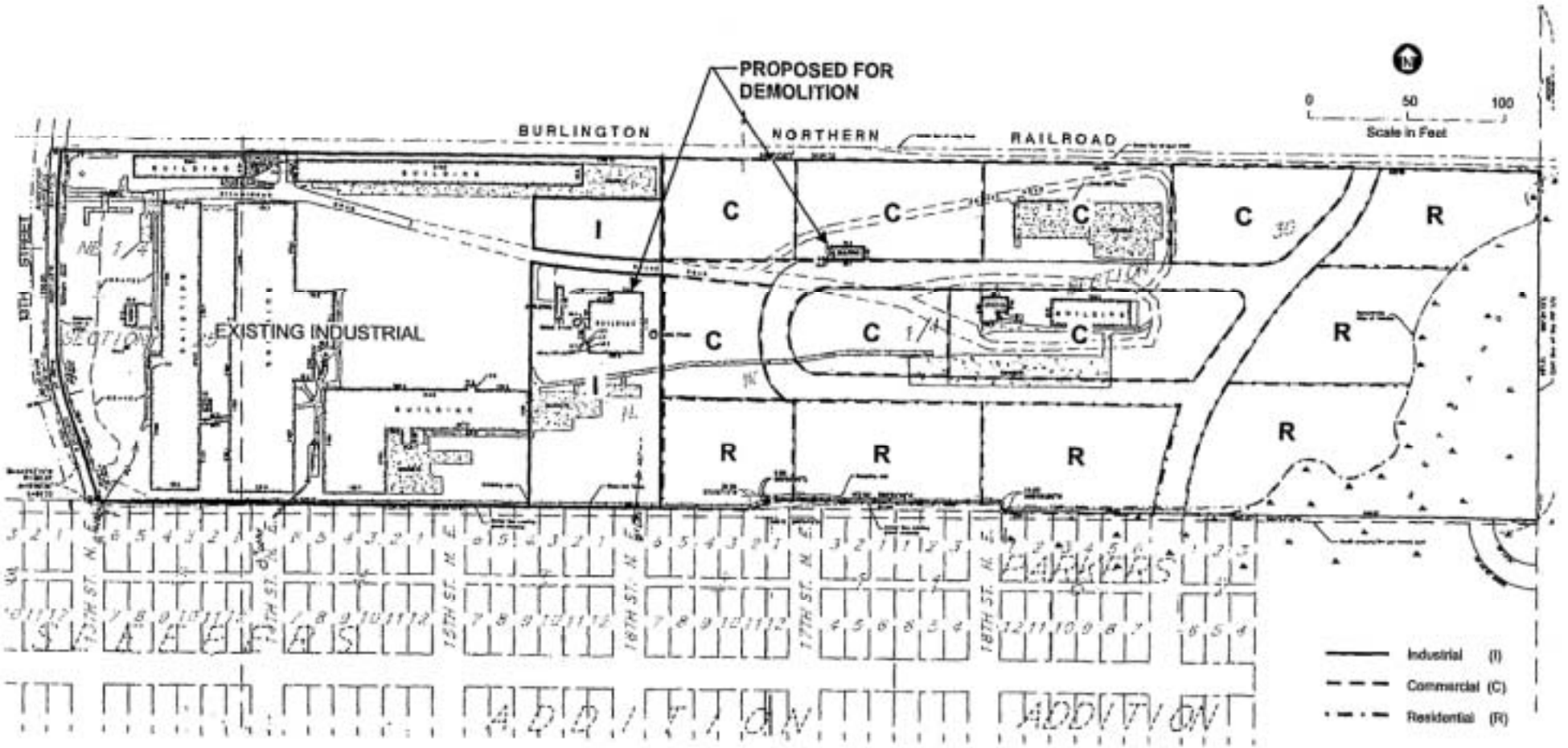


Figure 5: B115 Area Lead Results

Source: Retec 2001

RECLAIMING PLANT AREA WORK ZONE AND SOIL SAMPLE RESULTS
CAR SHOPS
BRAINERD, MINNESOTA

Figure 6: Conceptual Site Development Plan



Source: Barr 2000

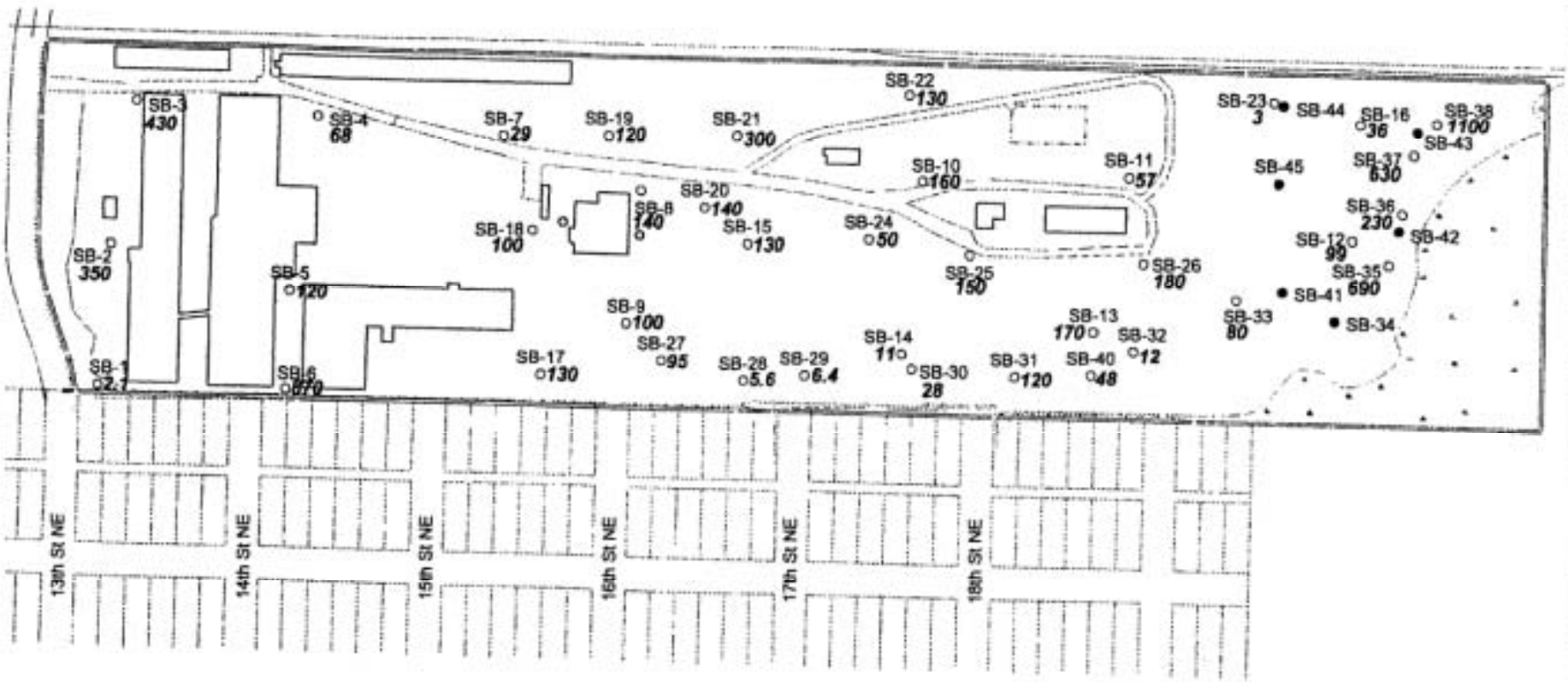


Figure 7: 2000 Soil Lead Sample Results

Source: Barr 2000