GROUNDWATER MONITORING WELL INSTALLATION PLAN

NEPERA CHEMICAL COMPANY SUPERFUND SITE

Site ID NYD000511451

Prepared for
The Maybrook and Harriman Environmental Trust

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INTRODUCTION

The Nepera Chemical Company Superfund Site (the Site) is located in the Town of Hamptonburgh, Orange County, New York on the northern side of Orange County and south of Highway 4 and is owned by Nepera, Inc. The site was used for wastewater disposal in six lagoons during the period from 1953 to 1967. Approximately 5 acres of the 29.3 acres of the site were affected by these historical lagoon operations. Groundwater contamination was documented during the Remedial Investigation (RI) and subsequent monitoring events. Groundwater contamination likely represents initial lagoon seepage and the continued dissolution of contaminants from lagoon sediments into infiltrating precipitation. Sampling during the RI identified volatile (VOCs) and semi-volatile organic compounds (SVOCs) above the site-specific cleanup levels. The groundwater cleanup levels for the site are the more conservative of the Federal Maximum Contaminant Levels (MCLs) or the New York Ambient Groundwater Standards and Guidance Values (TOGS 1.1.1). The VOCs detected in either the Shallow or Bedrock aquifer include benzene, toluene, ethylbenzene, xylenes, acetone and chlorobenzene, with the higher concentrations having been historically in the shallow aquifer. The primary site-related SVOC detected in the Shallow and Bedrock aquifers is 2-aminopyridine.

A Record of Decision (ROD) was issued in September 2007. The soil remedy in the 2007 ROD included biodegradation of site-related COCs in source soils through construction of a biocell. However, upon further evaluation, the Trust recommended a modification of the remedy to off-site treatment/disposal. Subsequently, the USEPA amended the ROD in July 2011. The requirements of the ROD for implementation of the remedy may be summarized as follows:

Soils:

- Excavate soils in the source areas of the site (lagoons) and transport impacted soil with concentrations of soil contaminants of concern (COCs) above the site-specific cleanup levels, off site for treatment/disposal.
- Perform post-excavation soil sampling and analysis for comparison to the site-specific cleanup criteria.
- Backfill excavated areas with soil meeting the requirements of 6NYCRR 375-6.

Groundwater:

- Use oxygenating compound within the excavations to enhance bioremediation of site-related groundwater contamination.
- Apply additional oxygenating compound, if necessary, based on groundwater monitoring results (i.e., ongoing groundwater contamination that must be addressed).

- Implement a groundwater monitoring program, in accordance with an approved Site Management Plan.
- Institute institutional controls to restrict the use of groundwater at the site as a source of potable or process water until groundwater quality standards are met.

The Maybrook and Harriman Environmental Trust (the Trust) commenced remedy construction in August 2011 with the intent that both the soil and groundwater components of the remedy would be constructed concurrently. However, as the remedial action construction progressed, the inter-relationship of the soil and groundwater components became better understood, dispersed materials were discovered that do not meet the original intent of the soil remediation, and as a consequence the soil and groundwater components of remedy construction became bifurcated. Work related to the excavation and off-site treatment and disposal of soils, and site restoration concluded as of the week of January 7, 2013. On January 9, 2013, the Trust met with the USEPA to discuss the continued implementation of the remedy, in particular the groundwater portion. At this meeting, the Trust presented information to the USEPA regarding dispersed materials north of Lagoon No. 5, west of Lagoon No. 4, and south of Lagoon Nos. 1 and 3, and the USEPA concurred that these dispersed materials would be handled as a part of the groundwater components of the remedy. In addition, the locations and types (i.e., overburden or bedrock) of groundwater monitoring wells were discussed and generally agreed upon with the USEPA. The locations of the monitoring wells are designed to assess improvement in groundwater quality consistent with the completed removal of source materials and other ROD requirements, as well as the influence, if any, of the remaining dispersed materials on site. The purpose of this document is to provide a groundwater monitoring well installation plan. In this regard, this plan presents a review of the proposed monitoring locations with respect to the site hydrogeology and monitoring objectives as an aid in determining appropriate screened intervals for the proposed wells, followed by a description of the installation means and methods for construction of the monitoring wells.

SITE HYDROGEOLOGY

As described more fully in the Remedial Investigation (RI) Report (Conestoga-Rovers and Associates, June 2006), the site geology is highly variable consisting of glacial outwash, glacial drift and glacial till overlying shale bedrock that is weathered (highly fractured) at its surface and becomes more competent with depth. The soils are typically sandy, with varying amounts of silt and clay, and may include a locally present layer typically within the southern portions of the site, of lower permeability glacial till immediately above the bedrock. Where present, the glacial till forms a localized aquitard. The former site operations included excavation of the overburden deposits and weathered shale to form the lagoons and these lagoons were subsequently backfilled and covered. The recently completed remedial actions included excavation and removal of the cover soil and underlying soil and remaining lagoon contents, and then site restoration with soils taken from an on-site borrow area.

Groundwater at the site is present within the overburden deposits and the upper three to five feet of the underlying shale bedrock that is highly fractured (shallow aquifer) and within the fractures and bedding planes of the more competent shale bedrock (bedrock aquifer). Hydraulic gradients between the shallow and bedrock aquifers are vertically downward and a groundwater divide is present in both aquifers near former Lagoon No. 4. As a consequence, groundwater flow is both vertically downward and horizontally to the north-northeast, north of former Lagoon No.4, and to the south-southwest, south of former Lagoon No. 4.

MONITORING OBJECTIVES AND WELL LOCATIONS

The objective of the groundwater monitoring program is to assess the overall effectiveness of the remedial actions by monitoring groundwater quality over time in both the immediate vicinity and down-gradient of the former lagoons, as well as to assess the effect, if any, of the remaining dispersed materials. Accordingly, the well locations are within the footprint of the former lagoons, within the dispersed materials areas, and down gradient of the former lagoon locations.

The monitoring well locations as generally agreed upon with the USEPA at the January 9, 2013 meeting are illustrated in Figure 1. As shown, a total of 11 new wells are proposed to be installed at the site. Specifically, well couplets MW-14 and MW-15 are located down gradient to the north of the former Lagoon No. 5 and also within an area where dispersed materials were documented on site and on the adjacent property. Monitoring wells MW-16 through MW-19 are located within the footprint of the former lagoons. These wells are thus designed for assessing the effect of excavating the source materials in the lagoon area as well as the placement of oxygenating compound on groundwater quality immediately beneath the former lagoons and the base of the excavation (which in all cases was the top of rock). MW-20D is a bedrock well that is located down gradient to the south of the former lagoons and slightly to the east. As described in the RI, the bedrock dips to the east and to the extent that the vertical component of groundwater flow follows the bedding planes, the proposed location would monitor groundwater originating from the former lagoons. Finally, monitoring well MW-21 is a shallow aquifer well down gradient of the lagoons and is located consistent with the monitoring objective of assessing overburden groundwater quality over time, down gradient of the former lagoons. At the January 9 meeting, the discussion of monitoring well locations included a bedrock well (MW-21D) at the same location as MW-21. However, it is recommended that MW-21D be shifted slightly to the east, approximately midway between the new well MW-21 location and existing well MW-7. Consistent with the rationale described above, shifting the bedrock well to the east will position it in a down dip direction relative to the former lagoons.

MONITORING WELL CONSTRUCTION

Monitoring wells will be constructed within both the shallow and bedrock aquifers as described below.

Shallow Aquifer/Overburden Monitoring Wells

A total of three shallow aquifer/overburden wells are planned for installation. This may need to be adjusted based on field results during drilling as described below. As noted above, the former lagoons were generally excavated to bedrock and the contaminated source soils have subsequently been removed as part of the remedial action. As such, within the former lagoon area, the overburden has been replaced with clean, compacted fill. To the north of Lagoon No. 5 dispersed materials remain, and as noted previously, wells MW-14-13 and MW-15.-13 are positioned to assess the effect, if any, of the continuing presence of these dispersed materials. Monitoring the dispersed materials in this area is best accomplished by constructing the overburden monitoring wells immediately above the bedrock, in the zone where dispersed materials were evidenced. Only one other new overburden monitoring well is included in the well installation plan, MW-21, and its installation may be affected by the presence of absence of glacial till, as is discussed further below.

At each location, a borehole will be advanced while collecting continuous split spoon samples to the depth of the weathered shale, or refusal of the augers, whichever occurs first. The collected soils will be visually logged for grain size and the depth to saturation will be recorded in the field book. Standard well construction will consist of 2" diameter PVC riser pipe and five feet of No. 10 slot PVC wire wrap screen. A clean silica sand pack will be emplaced around the screen and approximately two feet above the top of the screen, followed by an approximate two foot thick bentonite clay seal. The bentonite clay seal will be hydrated and the remainder of the annular space will be filled with a cement/bentonite grout emplaced by the tremie method. The wells will be completed with a locking steel protective casing extending approximately two to three feet above the ground surface.

The RI indicates the potential presence of a perched water table above a locally present lower permeability glacial till within the southern portion of the site, potentially within the area targeted by MW-21. Monitoring of this perched water table, if present, is not proposed as this zone is unlikely to be representative of groundwater down-gradient of the former lagoon area. If glacial till (or a similar lower permeability deposit) is present immediately above the shale bedrock at a thickness of less than two feet, the well will be constructed as described above immediately above the glacial till deposit. If glacial till is present immediately above the weathered shale at a thickness of greater than two feet, the well will be converted to a shallow top of bedrock well and constructed as described below for the bedrock monitoring wells. The well would then be identified as MW-21D to denote that it is completed in the bedrock, and MW-21D would be renamed to MW-22D.

Following completion, the monitoring wells will be developed to promote hydraulic communication with the surrounding geologic materials and remove fines that may have been introduced during drilling activities.

Bedrock Aquifer Monitoring Wells

A total of eight bedrock aquifer wells are planned for installation. This may need to be adjusted based on field results during drilling as described below. Bedrock aquifer wells will be constructed to target the upper ten feet of the shale bedrock. At each location, the borehole will be advanced to the top of rock and a temporary six-inch steel casing will be set into the borehole using bentonite. The borehole will then be advanced through the six inch casing a depth of thirteen feet.

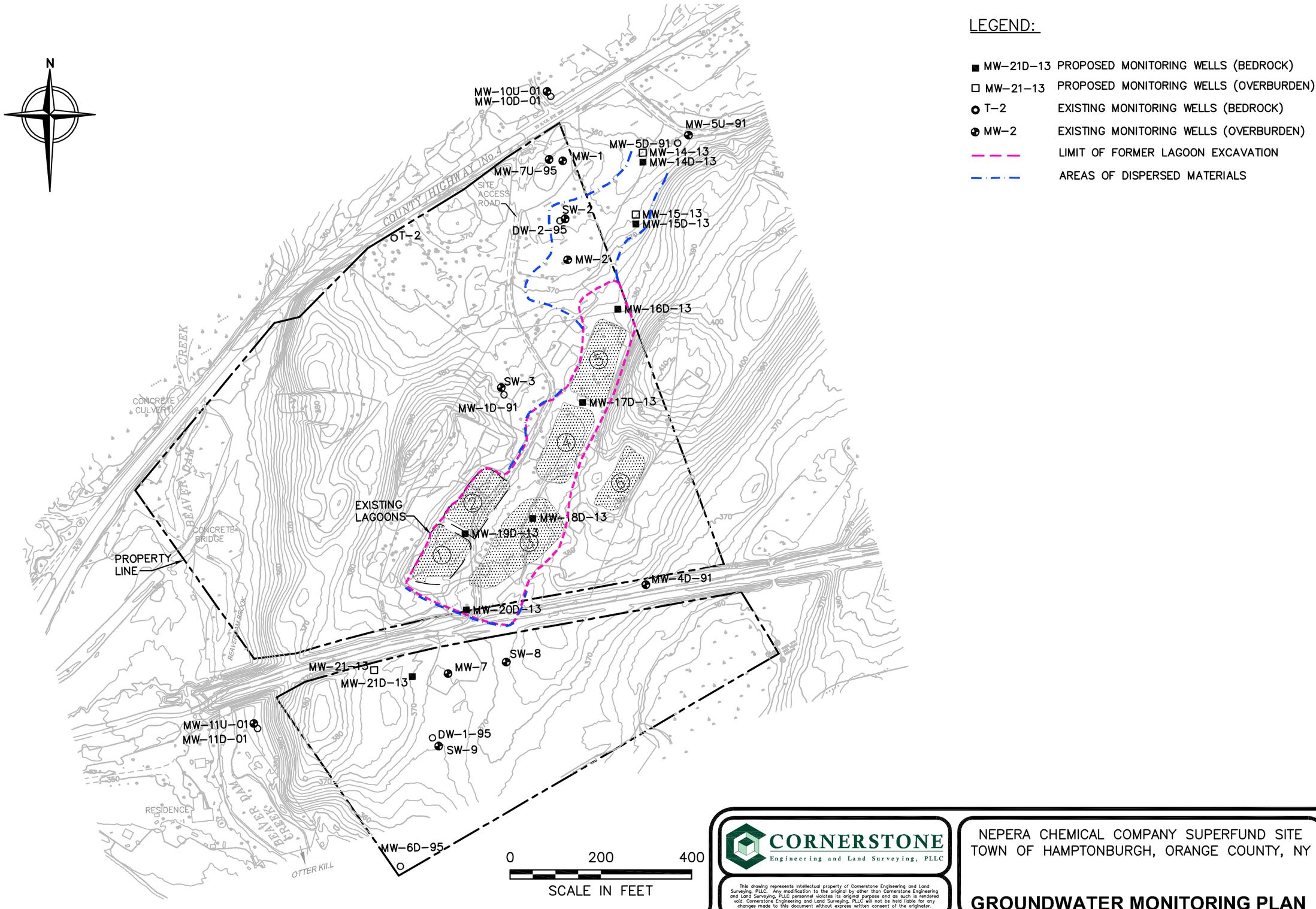
An assembly consisting of a submersible pump suspended approximately 8 feet below an inflatable packer will then be lowered into the borehole and the packer will be inflated immediately below the bottom of the steel casing. The submersible pump will then be operated to estimate the yield of the open rock interval below the packer. If the open rock interval yields approximately 0.25 gallons per minute or more, the drilling will be terminated and a two inch diameter PVC monitoring well will be constructed with a ten foot, No. 10 slot, PVC wire wrap screen and sand pack. The sand pack will extend two feet above the top of the screen and a bentonite seal will be placed extending from the top of the sand pack (i.e., one foot below the top of rock) to a minimum of one foot above the top of rock (i.e., the bentonite seal will span the interface between the top of rock and the overburden). The temporary six inch steel casing will be removed, the remainder of the annular space will be filled with cement/bentonite grout, and the well will be completed with a locking steel protective casing.

If the testing of the open rock interval yields less than 0.25 gpm, the packer assembly will be removed, and the borehole will be advanced an additional ten feet. The packer assembly will then be lowered back into the borehole, the packer will be inflated to isolate the lower ten feet of the borehole, and the yield test described above will be repeated. This process will be repeated until a ten foot interval yields greater than 0.25 gpm or to a maximum depth of 55 feet below the top of rock (i.e., 5 attempts to identify a ten foot interval yielding greater than 0.25 gpm). A monitoring well will be constructed as described above to monitor the ten foot interval yielding greater than 0.25 gpm. If an interval yielding at least 0.25 gpm is not found, the location will be abandoned and no well will be installed. Installation of monitoring wells at depths greater than 55 feet below the top of rock would not monitor groundwater flow paths associated with recent recharge migrating downward through the former lagoons.

If a shallow aquifer/overburden well is installed at MW-21, then the well construction for MW-21D would be exactly as described above. However, if the overburden location at MW-21 is converted to a top of rock monitoring well, and thereby identified as MW-21D, a second bedrock well, identified as MW-22D, will be constructed a minimum of ten feet below the bottom of the screened interval of MW-21D. Accordingly, the temporary casing would be installed as described above and the borehole would be advanced a minimum of 20 feet below the bottom depth of the screen at the top of rock well at MW-21D. The lower 10 feet of the open borehole would then be tested using the submersible pump and packer assembly described above. If this ten foot interval yields more than 0.25 gpm, the well would be constructed to screen this interval. If the yield is less than 0.25 gpm, the borehole will be advanced an

additional ten feet and the process will be repeated until a ten foot interval yields greater than 0.25 gpm or to a maximum depth of 55 feet below the top of rock.

Following completion, the monitoring wells will be developed to promote hydraulic communication with the surrounding geologic materials and remove fines that may have been introduced during drilling activities.



LEGEND:

- ■ MW-21D-13 PROPOSED MONITORING WELLS (BEDROCK)
- □ MW-21-13 PROPOSED MONITORING WELLS (OVERBURDEN)
- ○ T-2 EXISTING MONITORING WELLS (BEDROCK)
- ⊕ MW-2 EXISTING MONITORING WELLS (OVERBURDEN)
- LIMIT OF FORMER LAGOON EXCAVATION
- AREAS OF DISPERSED MATERIALS

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NEPERA CHEMICAL COMPANY SUPERFUND SITE
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GROUNDWATER MONITORING PLAN

FIGURE NO. 1

PROJECT NO. 110083