Final Monitoring Well Decommissioning Plan

Niagara Falls Storage Site Remedial and Site Services - Balance of Plant, Lewiston, New York

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bgs	below ground surface
BOP	Balance of Plant
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWM	CWM Chemical Services, LLC
EFS	Enviro-Fix Solutions LLC
EM	Engineer Manual
ERDA	Energy Research and Development Administration
ERT	ERT, Inc.
ft	foot or feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
GPS	global positioning system
HGL	HydroGeoLogic, Inc.
ID	identification
IDW	investigative derived waste
IWCS	Interim Waste Control Structure
LOOW	Lake Ontario Ordnance Works
NFSS	Niagara Falls Storage Site
No.	number
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PPE	personal protective equipment
PVC	polyvinyl chloride
SATOC	Single Award Task Order Contract
SOW	statement of work
USACE	U.S. Army Corps of Engineers
WBZ	Water Bearing Zone

SIGNATURES

This Final Monitoring Well Decommissioning Plan has been prepared by Enviro-Fix Solutions, LLC (EFS) for the Niagara Falls Storage Site (NFSS) Remediation Single Award Task Order Contract, Lewiston, New York, Project. Work conducted under this contract will be performed in accordance with applicable federal, state, and local safety and occupational health laws and regulations including Occupational Safety and Health Administration (OSHA) standards, including 29 *Code of Federal Regulations (CFR)* 1910 and 1926, and the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (Engineer Manual [EM] 385-1-1, 15 November 2014) (USACE 2014). The contents of the SWPPP are subject to review and revision as new information becomes available.

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1.0 INTRODUCTION

This Niagara Falls Storage Site (NFSS) Remedial and Site Services Project Draft Monitoring Well Decommissioning Work Plan has been prepared by Enviro-Fix Solutions LLC (EFS) under the Single Award Task Order Contract (SATOC) Number (No.): W912P4-23-F0042, for the U.S. Army Corps of Engineers (USACE) Buffalo District. The USACE solicited environmental services to perform the project titled Niagara Falls Storage Site Remedial and Site Services – Balance of Plant (BOP) located at Lewiston, Niagara County, New York. This Work Plan presents the procedures that will be implemented to decommission 32 monitoring wells at the NFSS, hereinafter referred to as "the site." Figure 1, the Site Location, depicts the general locality and orientation of the site. Additionally, this Work Plan presents selection and implementation procedures for the decommissioning of monitoring wells that are consistent with the New York State Department of Environmental Conservation (NYSDEC) guidance document, CP-43: Groundwater Monitoring Well Decommission Policy (NYSDEC, 2009).

1.1 Purpose

The purpose of this Work Plan is to present monitoring wells identified for decommissioning, the methodology selected for decommissioning, the implementation procedures, and documentation process for the proper abandonment in accordance with NYSDEC guidance (NYSDEC, 2009). NYSDEC guidance recommends that environmental monitoring wells should be decommissioned when:

- they are no longer needed and re-use by another program is not an option; or
- when the well's integrity is suspect or compromised.

There are 32 monitoring wells at the site that have been designated for decommissioning in Table 1.4-1 of Task Order 1 Remedial Action Work Plan. These wells are either in areas requiring remediation or have been determined to be unneeded and/or unsuited for reuse at this time, and as such, satisfy the criteria for decommissioning. The 32 monitoring wells to be decommissioned are located within the NFSS. This Work Plan presents the procedures that will be implemented to decommission the monitoring wells.

The scope of activities that will be performed under this Work Plan includes the following:

- inspect monitoring well to verify construction details;
- confirm decommissioning by grout-in-place, or select alternative method appropriate for actual conditions;
- perform well decommissioning;
- completing applicable site restoration activities; and
- properly documenting the decommissioning effort.

The overall objective of this decommissioning effort is to remove any potential for adverse environmental effects due to unprotected, neglected, and/or improperly abandoned monitoring wells. The primary reason for decommissioning is to remove the potential for a preferential pathway to groundwater. Proper monitoring well decommissioning will:

- reduce the potential for contamination to be introduced to the subsurface;
- prevent any unprotected and/or neglected monitoring wells from contributing to the

unwanted mixing of groundwater and/or degradation of water quality within an aquifer; and

- removes monitoring well construction materials to prevent interference with potential future construction and/or excavation activities that may occur at the site.

1.2 Site Description

The NFSS is located in the Town of Lewiston, New York, approximately 31 kilometers (19 miles) north of Buffalo. The 77.3-hectare (191-acre) property is owned by the federal government and operated and maintained by USACE. USACE is also the lead federal agency responsible for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) actions at the NFSS, which are being addressed as part of FUSRAP. The location of the NFSS is shown on Figure 1-1. The NFSS property is bordered on the north and northeast by the CWM Chemical Services, LLC, a hazardous waste disposal facility; on the east and south by the Modern Landfill, Inc., a solid waste disposal facility; and on the west by a transmission corridor owned by National Grid.

The entire NFSS is surrounded by a chain-link fence and entry onto the site is restricted to a single main gate. To manage the CERCLA activities at the NFSS, USACE has established three separate Operable Units (OUs): the Interim Waste Control Structure (IWCS) OU, the BOP OU, and the Groundwater OU. The IWCS is an engineered landfill that encompasses approximately 4 hectares (10 acres) and is surrounded by paved access roads and chain-link security fencing. The IWCS OU encompasses the engineered landfill within the diked area of the NFSS and applies to all the material within the IWCS. The Groundwater OU incorporates groundwater contamination.

The BOP OU incorporates all the material at the NFSS that is not in the IWCS; this includes soils, buildings and building foundations, utilities, roads, and railroads (excluding groundwater). Two former Lake Ontario Ordnance Works (LOOW) buildings on site include Building 433 (historically called the radium vault), unused for decades, and Building 429, which is currently used as an office. The buildings and building foundations were constructed in the late 1930s as part of the LOOW. Another more recent Quonset-style building was constructed by USACE for equipment storage. Several building foundations are also present, including, but not limited to, foundations of former buildings identified as 401, 430, 431, and 432 (other building foundations onsite will be characterized and remediated as appropriate as part of the BOP OU). The majority of the site is covered by vegetation.

1.3 Organization

This work plan is organized in the following manner in order to present the purpose, scope, and objectives of this task.

- Section 1.0 provides project objectives, historical information regarding the site, and the Work Plan organizational structure;
- Section 2.0 details the determinations to be made prior to decommissioning of the monitoring wells, and the monitoring wells selected for decommissioning;
- Section 3.0 presents methodology for selecting and implementing decommissioning procedures;

- Section 4.0 details field activity documentation forms and items to be included in the post-decommissioning close-out report; and
- Section 5.0 provides the Work Plan references.

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2.0 PREPARATION

2.1 Compilation of Information

Prior to mobilization for decommissioning field activities, specific monitoring well information will be compiled and reviewed. Information will include the monitoring well coordinates, total depth, construction details, and any other specifics available. A review of available documentation provided initial information, such as well locations and depths. Limited information concerning well construction details was also available and is shown in Section 3. A full records search will be conducted prior to mobilization. Additionally, an inspection of each monitoring well will be performed to verify the construction details and the document the current condition of each well. Per CP-43: Groundwater Monitoring Well Decommission Policy (NYSDEC, 2009), the following information will be compiled and verified:

Well Details

- Is the well a single stem riser (all one diameter)?
- Is the well a simple overburden well (no penetration into bedrock)?
- Does the well riser consist of telescoping diameters of pipe which decrease with depth?
- Is the well seal compromised (leaking, inadequate or damaged)?
- If the well is polyvinyl chloride (PVC), is it 25 feet (ft) or shallower and not grouted into rock?
- Can the riser be pulled and is removal of the well desired?
- Is the well a bedrock well?
- If the monitoring well is a bedrock well, does it have an open boring?
- Is there a well assembly (riser and screen) installed within the bedrock hole?

Subsurface Conditions

- Is the soil contaminated?
- Does the well penetrate a confining layer?
- If the well penetrates a confining layer, might over drilling or casing pulling cause contamination to travel up or down through a break in the confining layer?
- Does a screened interval cross multiple water-bearing zones?

2.2 Monitoring Well Inspections

Monitoring well inspection will be performed prior to decommissioning in accordance with *CP-43: Groundwater Monitoring Well Decommission Policy* (NYSDEC, 2009). An example *Monitoring Well Field Inspection Log* is included in Appendix A. A separate log will be competed for each of the monitoring wells designated for decommissioning.

2.3 Monitoring Wells Designated for Decommissioning

The 32 monitoring wells designated for decommissioning are presented in Table 2-1. The locations of the wells are shown on Figure 2-1. Well Construction details are included in Table 2-2.

Table 2-1. Monitoring Wells to be Decommissioned during NFSS BOP and Groundwater OUs Remedial Action

Well ID	Northing	Easting	Bottom of Screen Depth (ft bgs)
404A	1172860.46	1041695.64	24.7
411A	1173207.6	1042465.89	17
415A	1172934.3	1042483.7	15
MW422	1172916.83	1042568.76	20
MW423	1173017.59	1042609.66	20
MW424	1173163.82	1042606.51	20
MW930	1173005.1	1042469	16.35
MW934	1173157.9	1042286.5	17.35
MW947	1172887.178	1042564.362	18.5
MW948	1173182.578	1042263.192	15
MW949	1173182.892	1042272.833	40
BH63	1172946.3	1044675.6	48.4
606	1172637.65	1044699.01	18.7
BH15	1172245.2	1041824.1	104.5
303A	1172132.85	1041876.89	14.7
MW314	1171901.58	1042361.08	20
302A	1171987.7	1042495.34	14.7
B02W19DR	1171946.993	1042525.252	43.6
OW18A	1171014.8	1040475.2	46
OW18BR	1171019.613	1040475.091	15.2
OW08A	1171816.06	1041248.85	43
OW08B	1171811.27	1041248.73	10.5
OW09A	1171616.04	1041248.32	38.9
OW09B	1171620.39	1041248	13.2
BH12	1170598.8	1041262.4	95
BH59	1170588.1	1041264.4	37.7
213A	1171613.02	1041820.83	14.7
201A	1171275.51	1041761.63	14.7
203A	1171274.95	1041899.78	14.7
MW228	1171211.31	1041860.83	18
MW229	1171203.87	1041837.16	41
816	1170504.15	1042544.77	13.67

Notes:
ft – feet
bgs – below ground surface

Table 2-2. Monitoring Well Construction Details

Well ID	Surface Casing	Borehole Diameter (inches)	Total Depth of Well (ft bgs)	Casing Type/Diameter (inches)/ Depth bgs(ft)	Grout Types	Screen Type/Diameter (inches)/Length(ft)	Filter Pack Type
404A	Steel stick-up	8	24.7’	SCH 40 PVC / 2” / 14.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
411A	Steel stick-up	8	17’	SCH 40 PVC / 2” / 7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
415A	Steel stick-up	8	15’	SCH 40 PVC / 2” / 5’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW422	Steel stick-up	8	20’	SCH 40 PVC / 2” / 10’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW423	Steel stick-up	8	20’	SCH 40 PVC / 2” / 10’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW424	Steel stick-up	8	20’	SCH 40 PVC / 2” / 10’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW930	Steel stick-up	8	16.35’	SCH 40 PVC / 2” / 6.35’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW934	Steel stick-up	8	17.35’	SCH 40 PVC / 2” / 7.35’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW947	Steel stick-up	8	18.5’	SCH 40 PVC / 2” / 8.5’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW948	Steel stick-up	8	15’	SCH 40 PVC / 2” / 5’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW949	Steel stick-up	8	40’	SCH 40 PVC / 2” / 30’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
BH63	Steel stick-up	8	48.4’	SCH 40 PVC / 2” / 38.4’’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
606	Steel stick-up	8	18.7’	SCH 40 PVC / 2” / 8.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
BH15	Steel stick-up	8	104.5’	SCH 40 PVC / 2” / 94.5’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
303A	Steel stick-up	8	14.7’	SCH 40 PVC / 2” / 4.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW314	Steel stick-up	8	20’	SCH 40 PVC / 2” / 15’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
302A	Steel stick-up	8	14.7’	SCH 40 PVC / 2” / 4.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
B02W19DR	Steel stick-up	8	43.6’	SCH 40 PVC / 2” / 33.6	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
OW18A	Steel stick-up	8	46’	SCH 40 PVC / 2” / 36	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
OW18BR	Steel stick-up	8	15.2’	SCH 40 PVC / 2” / 5.2’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
OW08A	Steel stick-up	8	43’	SCH 40 PVC / 2” / 33’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
OW08B	Steel stick-up	8	10.5’	SCH 40 PVC / 2” / 5.5’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
OW09A	Steel stick-up	8	38.9’	SCH 40 PVC / 2” / 28.9’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
OW09B	Steel stick-up	8	13.2’	SCH 40 PVC / 2” / 3.2’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
BH12	Steel stick-up	8	95’	SCH 40 PVC / 2” / 85’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
BH59	Steel stick-up	8	37.7’	SCH 40 PVC / 2” / 27.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
213A	Steel stick-up	8	14.7’	SCH 40 PVC / 2” / 4.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
201A	Steel stick-up	8	14.7’	SCH 40 PVC / 2” / 4.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
203A	Steel stick-up	8	14.7’	SCH 40 PVC / 2” / 4.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW228	Steel stick-up	8	18’	SCH 40 PVC / 2” / 8.7’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
MW229	Steel stick-up	8	41’	SCH 40 PVC / 2” / 31’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand
816	Steel stick-up	8	13.67’	SCH 40 PVC / 2” / 3.67’	Bentonite seal/ concrete grout	SCH 40 PVC 0.010 slot / 2” / 10’	#5 sand

Notes:
Well construction details will be verified in the field and documented on the Well Inspection Forms.

ft – feet
bgs – below ground surface
SCH – Schedule
PVC – polyvinylcholride

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3.0 DECOMMISSIONING METHOD

The decommissioning method selected should take into account the geologic and hydrogeologic condition at the well site; the presence or absence of contamination in the groundwater; and the original well construction details. There are four primary well decommissioning methods:

- Grouting in-place;
- Perforating the casing, followed by grouting in-place;
- Grouting in-place, followed by casing pulling; and
- Over-drilling and grouting with or without a temporary casing.

Based on a review of the criteria for selecting appropriate decommissioning methods, review of monitoring well construction details and the proximity of contamination to the monitoring wells, grouting in-place is the selected method of decommissioning. The monitoring wells designated are within areas of soil contamination that are scheduled for remediation. Should field conditions indicate another method is required for any of the identified monitoring wells, USACE will be consulted to determine the appropriate method of decommissioning. All decommissioning activities will be completed by a licensed New York State driller and oversight completed by appropriately trained / certified personnel.

Grouting in-place is the simplest and most frequently used monitoring well decommissioning method, and grouting is an essential component of all decommissioning methods. Grout seals the borehole and any portion of the monitoring well that is not removed. This method is preferred for the decommissioning of small-diameter cased monitoring wells. The monitoring wells designated for decommissioning under this Work Plan are either known or assumed to be constructed with 2-inch diameter polyvinyl chloride riser and screens.

Grouting in-place involves filling the casing with grout to a level of five ft below ground surface (bgs), cutting the monitoring well casing at the five-feet depth, and removing the top portion of the casing and associated monitoring well materials from the ground (e.g., riser, protective casing, protective bollards and protective pad). The casing will be grouted according to the procedures provided in this Work Plan, and the upper five feet of the borehole will be filled to the ground surface and restored using materials and procedures described this Work Plan.

For the purposes of these decommissioning procedures, the well seal is defined as the bentonite seal above the sand pack. Aside from obvious channeling by in-flowing surface water around the well, an indication of the well seal integrity may be obtained through review of the boring logs and/or a comparison of groundwater elevations if the well is part of a cluster. During the field inspection, the integrity of the well seal will be evaluated, as appropriate. If it suspected that the well seal is compromised, casing perforation may be the preferred method.

3.1 Selection Process and Implementation

For overburden monitoring wells, the first factor in determining the decommissioning method is whether the overburden portion of the monitoring well exhibits contamination, as determined through historical groundwater and/or soil sampling results. If the overburden is uncontaminated, the next criterion to consider is whether the monitoring well penetrates a confining layer.

Monitoring wells at the NFSS that are being decommissioned are installed in either the upper or lower water bearing zone. Of the 32 monitoring wells identified for decommissioning,

22 are installed in the upper water bearing zone, while 10 are installed in the lower water bearing zone (Table 3-1).

Table 3-1. Zone Monitored by Monitoring Wells to be Decommissioned

No.	Well ID	Bottom of Screen Depth (ft bgs)	Water Bearing Zone (WBZ)
1	404A	24.7	Upper WBZ
2	411A	17	Upper WBZ
3	415A	15	Upper WBZ
4	MW422	20	Upper WBZ
5	MW423	20	Upper WBZ
6	MW424	20	Upper WBZ
7	MW930	16.35	Upper WBZ
8	MW934	17.35	Upper WBZ
9	MW947	18.5	Upper WBZ
10	MW948	15	Upper WBZ
11	MW949	40	Lower Zone
12	BH63	48.4	Lower Zone
13	606	18.7	Upper WBZ
14	BH15	104.5	Lower Zone
15	303A	14.7	Upper WBZ
16	MW314	20	Upper WBZ
17	302A	14.7	Upper WBZ
18	B02W19DR	43.6	Lower Zone
19	OW18A	46	Lower Zone
20	OW18BR	15.2	Upper WBZ
21	OW08A	43	Lower Zone
22	OW08B	10.5	Upper WBZ
23	OW09A	38.9	Lower Zone
24	OW09B	13.2	Upper WBZ
25	BH12	95	Lower Zone
26	BH59	37.7	Upper Zone
27	213A	14.7	Upper Zone
28	201A	14.7	Upper Zone
29	203A	14.7	Upper Zone
30	MW228	18	Upper Zone
31	MW229	41	Lower Zone
32	816	13.67	Upper Zone

Notes:
ft – feet
bgs – below ground surface

Upper Water Bearing Zone

The Upper Water Bearing Zone is continuous across the site and extends from the land surface to the top of the Glacio-Lacustrine Clay Unit. The Upper Water Bearing Zone predominantly consists of the Upper Clay Till Unit, but also includes small amounts of fill wherever present at the surface. The Upper Water Bearing Zone ranges in thickness from 3 to 42 ft, with a mean thickness of 15 ft based on 610 borehole locations throughout the site (HGL, 2007).

Upper Aquitard

The Glacio-Lacustrine Clay Unit and intervening Middle Silt Till Unit act as an aquitard between the Upper Water Bearing Zone and the underlying units. It is saturated and continuous across the site. This aquitard underlies the Upper Clay Till Unit, and overlies the Alluvial Sand and Gravel Unit (Lower Water Bearing Zone). It ranges from 1 to 30 ft thick, with an average thickness of 16 ft based on 327 borehole logs.

Lower Water Bearing Zone

The Lower Water Bearing Zone is the main water-bearing unit and consists of three distinct lithologic units: the Alluvial Sand and Gravel Unit, the Basal Red Till Unit and the weathered Upper portions of the Queenston Formation. The Alluvial Sand and Gravel Unit and the Upper Queenston Formation are permeable, fully saturated, water-bearing zones. The Basal Red Till Unit has permeability characteristic of an aquitard. The inclusion of the Basal Red Till Unit in the Lower Water Bearing Zone is on the basis of its typically thin or intermittent occurrence, which enables a hydraulic connection between the adjacent, more permeable units. (HGL, 2007)

The top elevation of the Lower Water Bearing Zone corresponds to the bottom of the Glacio-Lacustrine Clay Unit. The bottom elevation of the Lower Water Bearing Zone corresponds to the transitional zone from a weathered to a more intact, less permeable rock within Queenston Formation. The overall thickness of the Lower Water Bearing Zone, ranges from 10 to 38.5 ft) having a mean thickness of 19.3 ft.

The 10 Lower Water Bearing Zone wells penetrate the upper aquitard. Currently, there is no reason to believe that the well seal is compromised; therefore, grouting the riser in place in an appropriate decommissioning method for all of the designated monitoring wells. If during the inspection, conditions indicate that the well seal is compromised, alternate methods of decommissioning will be considered with consultation with USACE.

Prior to grouting, the depth of the well will be measured to determine if any silt or debris has plugged the well. If plugging has occurred, all reasonable attempts to clear it will be made before grouting. A tremie pipe will be used to grout the borehole from the bottom of the well to the top of bedrock to ensure a continuous grout column.

3.2 Locating and Setting up on the Well

The USACE Contracting Officer will be notified 14 days prior to mobilizing to decommission a monitoring well. An on-site geologist will be present and be responsible for all borehole logging, drilling, and reporting. The drilling contractor shall be licensed in the State of New York per State requirements. All personnel mobilizing to the site will be qualified and have the appropriate medical monitoring and training.

Once mobilized to the field, the well locations and identification will be verified. Where appropriate, utility location services will be used to verify decommissioning activities will not impact utilities.

3.3 Removing the Protective Casings

The monitoring wells identified for decommissioning at the site are completed as stick-up monitoring wells and finished with an elevated, protective casing (steel guard pipe), and a concrete pad. In the case of stick-up wells, the riser pipe may be bonded to the guard pipe and rain pad. When the protective casing and concrete pad of a stick-up monitoring well are "yanked out," a PVC riser will typically break off at the bottom of the guard pipe several feet below grade. Once this happens, it may become impossible to center a drill rig upon the well. The riser may become splintered and structurally unstable for pulling. If it is determined based on field conditions that a monitoring well requires the casing to be pulled or over-drilling to occur, each location will be grouted in-place before the additional monitoring well decommissioning activities occur. This effort will ensure that the monitoring well is properly sealed, regardless of potential problems later with removing the protective casing.

The specific procedure for removing the protective casing at each monitoring well will depend on the casing construction and the selected decommissioning method. The variety of protective casings available precludes developing a universal removal procedure; however, it is preferred to simply break up the concrete seal surrounding the casing and jack or hoist the protective casing. Steel monitoring well casings will be removed approximately five ft bgs, to be below the frost line and out of the way of any subsequent shallow digging. Waste handling and disposal will be consistent with the methods and procedures outlined in this Work Plan.

3.4 Selecting, Mixing, and Placing Grout

Successful decommissioning depends on the proper grout mixture and placement in order to eliminate the potential for groundwater to travel within the volumes of the former monitoring well and its boring. Grout mixtures will use Type 1 Portland cement and 4 percent bentonite by weight, as specified by the NYSDEC well decommissioning policy (NYSDEC, 2009).

A standard grout mixture will be administered at MWs identified for decommissioning at the site. To produce a standard grout mixture with a bentonite content of 4 percent by weight, the mixture will be formulated according to the following:

- One 94-pound bag of Type I Portland cement
- 3.9 pounds of powdered bentonite
- 7.8 gallons of potable water

None of the monitoring wells identified for decommissioning were constructed with screens that transect multiple groundwater zones. However, if this construction is encountered, more water may be used to penetrate the sand pack of the monitoring well. A standard grout mixture will be used unless monitoring well construction and/or subsurface conditions warrant use of a special grout mixture.

If a special gout mixture is required (e.g., excessive grout loss), the contractor will use a quick-setting grout mixture if a large amount of grout is lost to the subsurface during decommissioning with a

standard grout mixture. To produce a special grout mixture with a bentonite content of 4 percent by weight, the mixture will be formulated according to the following:

- One 94-pound bag of Type I Portland cement
- 3.9 pounds of powdered bentonite
- 1 pound calcium chloride
- 6.0 to 7.8 gallons of potable water (depending on desired thickness)

The contractor will calculate the volume of grout required to fill the borehole. If possible, the mixing basin should be large enough to hold all of the grout necessary for the borehole. The grout will be mixed until a smooth, homogeneous mixture is achieved. Grout can be mixed manually or with a mechanized mixer.

3.5 Grout Placement

Grout will be placed in the well from the bottom to the top by means of a "tremie." A tremie is a pipe, a hose or a tube extending from the grout supply to the bottom of the well. The tremie delivers the grout all the way down through the water column without being diluted and mixed with the water that may be present in the well. The tremie pipe or tube is withdrawn as (or after) the well is filled with grout.

Withdrawal of the tremie will occur during or after filling of the monitoring well with grout. If groundwater that is suspected to be contaminated, based upon historic sampling results, is displaced during the grouting process, the groundwater will be containerized for characterization sampling and proper disposal. Based on historical information, it is not anticipated that contaminated water will be encountered. Non-contaminated groundwater will be discharged to the ground surface.

After grouting is complete, it will be monitored to determine if settling has occurred and if additional applications of grout are necessary. Should enough settling occur that the grout does not reach at least five ft bgs, more grout will be added. Grout will be added, as needed, as each section of down-hole tooling is removed in order to keep the level between zero and five ft bgs. Grout may also be placed in stages to allow for it to partially cure before adding additional grout. If the grout level drops excessively below grade, the selected grouting method will be reevaluated.

As previously described, where necessary, the outer protective stick-up portion of a well will be removed only after the well has been filled with grout, in order to ensure that the monitoring well is properly sealed. If it is determined due to site conditions that casing pulling or over-drilling are required at any monitoring well, the monitoring well will first be grouted. Pulling or over-drilling should be performed before the grout is allowed to dry. The grout level at each location will be approximately five ft bgs.

Additionally, ferrous metal marker will be embedded in the top of the grout to indicate the location of the former monitoring well. Lastly, a fabric “utility” marking will be placed one foot above the grout so an excavator can see it clearly.

3.6 Backfilling and Site Restoration

The uppermost five feet of the borehole at the land surface will be filled with material physically similar to the natural soils. The surface of the borehole will be restored to the condition of the area

surrounding the borehole. Surface materials, such as concrete and asphalt, will be patched with concrete or asphalt of the same type and thickness. Grassed areas will be seeded, and topsoil will be used in woody areas. All solid waste materials generated during the decommissioning process will be disposed of offsite.

3.7 Waste Management

All waste generated during decommissioning activities will be collected for disposal offsite. For wells that are decommissioned in areas scheduled for remediation, the waste will be left in place and removed as bulk waste during the remediation, as appropriate. Waste generated from the decommissioning of monitoring wells from areas not designated for remediation will be disposed of as described below. Assumed debris to be generated from decommissioning activities includes protective stick-up casings, polyvinyl chloride (PVC) monitoring well casings, concrete pads, and protective bollards. All types and quantities of generated waste material will be documented.

Should investigative derived waste (IDW) be generated during well decommissioning activities, it will be placed in Department of Transportation approved 55-gallon steel drums. Each drum containing IDW will be properly labeled according to the matrix, location, and date of generation as applicable. IDW will be sampled and analyzed prior to offsite disposal, as required by the receiving disposal facility. Staging of IDW will be in an area coordinated by USACE. Additional information on disposal can be found in the Waste Management, Transportation & Disposal Plan submitted under a separate cover.

3.8 Health and Safety

Public and worker health and safety are the highest priorities at the NFSS. All work will follow the safety requirements of the Occupational Safety and Health Administration (OSHA) Occupational Safety and Health Standards, 29 Code of Federal Regulations (CFR) 1910 (OSHA 2006), and Safety and Health Regulations for Construction, 29 CFR 1926 (OSHA 2009); and the USACE Engineer Manual (EM) 385-1-1, Safety and Health Requirements Manual (USACE 2008). In addition, all work will conform to the NFSS Accident Prevention Plan.

Personal protective equipment (PPE) will be required for personnel who work on site. Level D Modified PPE (i.e., safety footwear, hardhat, safety vest, eye protection, and chemical-resistant gloves) will be the standard work uniform required for soil and sediment sampling. However, the determination of appropriate PPE will be made prior to the work effort, and the PPE level will be adjusted, when necessary, to provide proper protection of workers at all times.

4.0 DOCUMENTATION

4.1 Field Documentation

The procedures and activities outlined above will be appropriately documented in accordance with *CP-43: Groundwater Monitoring Well Decommission Policy* (NYSDEC, 2009). Field observations and data collected at each location, including monitoring well condition, selected decommissioning method, quantities of materials employed, restoration activities, and GPS coordinates will be compiled in a monitoring well Decommissioning Close-out Report.

For each well a Monitoring Well Decommission Field Log (included in Appendix B) will be generated. For each day of decommissioning activities, a Daily Report will be generated by the Team Field Leader.

4.2 Close-Out Report

Well decommissioning records will be submitted to the Contracting Officer within 14 calendar days after completion of the field work. The records will be submitted in a letter format and will include a narrative summary of activities, figures and photographic log of the wells and former locations, and attachments, including, but not limited to the following information:

- list of the monitoring wells decommissioned, their GPS coordinates, and monitoring well specific decommissioning method used;
- documentation of backfilling and site restoration activities;
- completed field inspection logs;
- completed decommissioning records;
- waste material inventory and any characterization results;
- discussion of waste material handling and disposal activities;
- applicable State and Federal reporting forms; and
- incident reports (if applicable).

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5.0 REFERENCES

Hydrogeologic, Groundwater Flow and Contaminant Transport Modeling Report – Niagara Falls Storage Site. December, 2007.

New York State Department of Environmental Conservation (NYSDEC), CP-43: Groundwater Monitoring Well Decommissioning Policy. November, 2009.

Occupational Safety and Health Administration. Occupational Safety and Health Standards. 29 CFR 1910. July 1, 2006.

Occupational Safety and Health Administration. Safety and Health Regulations for Construction. 29 CFR 1926. February, 2009.

U.S. Army Corps of Engineers, Headquarters. Safety and Health Requirements Manual. Engineer Manual 385-1-1. September 15, 2008.

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APPENDIX A

MONITORING WELL FIELD INSPECTION LOG

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SITE NAME:

SITE ID.: _____
INSPECTOR: _____
DATE/TIME: _____
Well ID.: _____

MONITORING WELL FIELD INSPECTION LOG
NYSDEC WELL DECOMMISSIONING PROGRAM

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back)		

WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL: _____

	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED: _____
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable): _____
PROTECTIVE CASING MATERIAL TYPE: _____
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches): _____

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet): _____
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet): _____
MEASURE WELL DIAMETER (Inches): _____
WELL CASING MATERIAL: _____
PHYSICAL CONDITION OF VISIBLE WELL CASING: _____
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE: _____
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES: _____

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

_____
_____
_____

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.

_____
_____

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):

_____
_____
_____

REMARKS:

_____
_____

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APPENDIX B

MONITORING WELL DECOMMISSIONING RECORD

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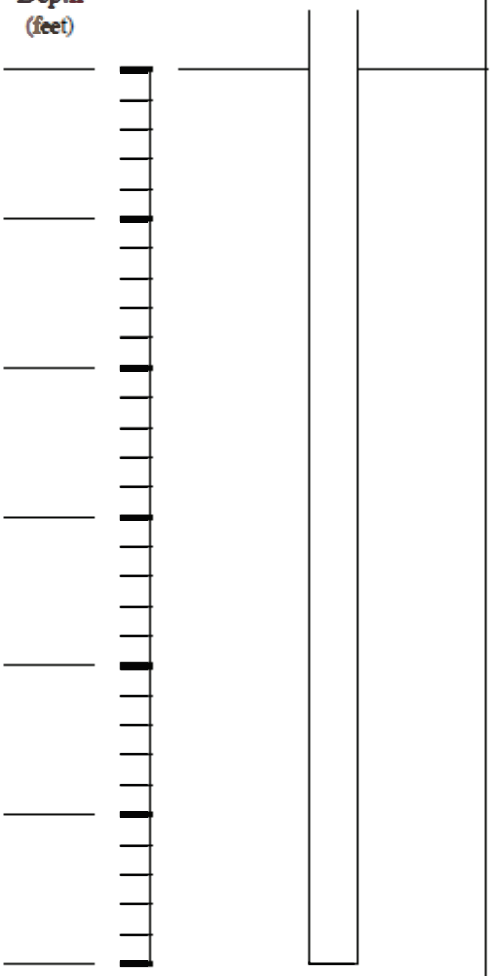
WELL DECOMMISSIONING RECORD

Site Name:	Well I.D.:
Site Location:	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



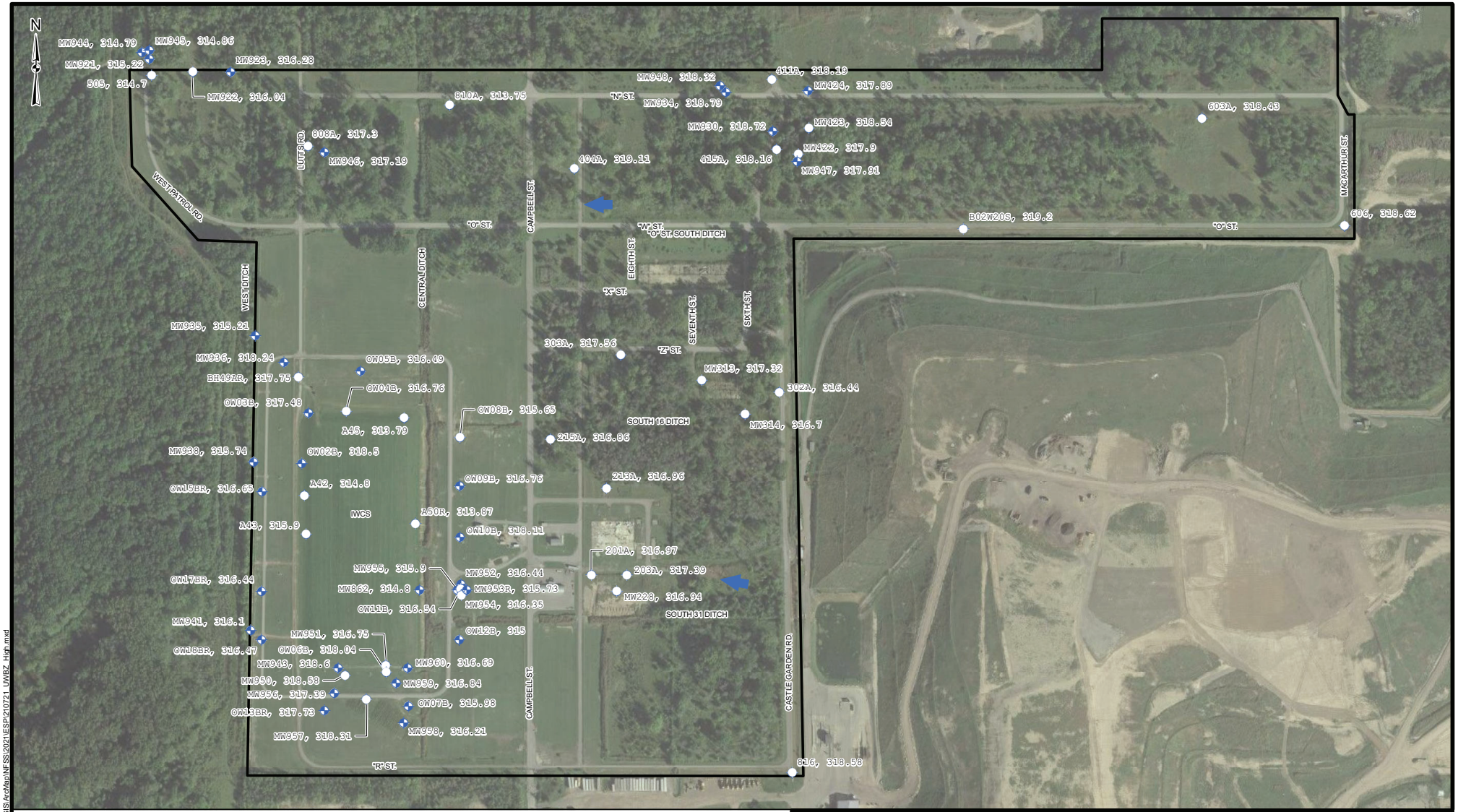
COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Figure 1-1. Location of the NFSS, Lewiston, New York



Legend

- Monitoring Well (Upper Water Bearing Zone)
- Groundwater Flow Direction
- NFSS Site Boundary

NOTES:
1) All elevations are represented in NGVD 88.

0 175 350 700 Feet

GROUNDWATER MONITORING WELLS
UPPER WATER BEARING ZONE
(MAY 4, 2020 - GROUNDWATER ELEVATIONS)

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 2-1

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Legend

- Monitoring Well (Lower Water Bearing Zone)
- Groundwater Flow Direction
- NFSS Site Boundary

NOTES:
1) All elevations are represented in NGVD 88.

0 175 350 700 Feet

GROUNDWATER MONTIROING WELLS
LOWER WATER BEARING ZONE
(FEBRUARY 26, 2020 - GROUNDWATER ELEVATIONS

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 2-2

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