

Evaluation and Position Paper

La Crosse Marsh Gun Club

BRRTS # 02-32-576301

DNR Facility ID # 632138980

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Prepared for

City of La Crosse, Wisconsin

Prepared by

The OS Group, LLC



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Site Information

Site Name

La Crosse Marsh Gun Club (the Site)

BRRTS # 02-32-576301

DNR Facility ID # 632138980

Site Address

2020 Myrick Park Drive, La Crosse, Wisconsin 54601

The Site is located in the La Crosse River Marsh in the City of La Crosse, adjacent to and north of the City's Myrick Park.

Introduction & Purpose

The City of La Crosse (the City) engaged Coulee Environmental Solutions, a division of The OS Group, (OSG) to review and evaluate the 2016 U.S. EPA Urban Waters Grant UW00E01025 Final Report, entitled *Final Report: Monitoring and Assessment of Legacy Lead Contamination in the La Crosse River Marsh*¹, (UW-L Report), prepared by the University of Wisconsin – La Crosse River Studies Center (UW-L). It summarized and expanded on work conducted by the Wisconsin Department of Natural Resources (WDNR) and UW-L^{2,3,4}. While certain key points are summarized here, the reader is directed to the full reference documents. On November 2, 2015, the WDNR issued a responsible party letter (RP Letter)⁵ to the City notifying the City that the WDNR considers lead shot in the La Crosse River Marsh (the Marsh) a hazardous substances discharge under ch. 292, Wisconsin Statutes, and the NR 700 series of Wisconsin Administrative Rules. The RP Letter describes the City's requirements to conduct a Site Investigation and Remedial Action under the NR 700 rules. The purpose of this position paper is to determine the adequacy of the UW-L Report to serve as a site investigation per ch. NR 716, Wisconsin Administrative Code.

¹ Belby CS, Gerrish G, King-Hieden T, Rolfhus K, Sullivan J, Giblin S (2016). Final Report: Monitoring and Assessment of Legacy Lead Contamination in the La Crosse River Marsh: U.S. EPA Urban Waters Grant UW00E01025 Final Report. University of Wisconsin – La Crosse River Studies Center, Wisconsin Department of Natural Resources, La Crosse, WI

² Sullivan J, Rasmussen K (2012). Lead Contamination Investigations in the La Crosse River Marsh Project Update – November 2012. Wisconsin Department of Natural Resources, La Crosse, WI.

³ Perroy RL, Belby CS, Martin CJ (2014). Mapping and modeling three dimensional lead contamination in the wetland sediments of a former trap-shooting range. *Science for the Total Environment* 487: 72-81

⁴ Wisconsin State Laboratory of Hygiene Environmental Toxicology Section (2012). Sediment Toxicity Tests, La Crosse Marsh Lead Study, Madison, WI.

⁵ Wisconsin Department of Natural Resources (2015). November 2, 2015 letter to Mayor Tim Kabot re. Reported Contamination at Myrick Park – Former La Crosse Gun Club.

Background

Leased from the City of La Crosse, the La Crosse Gun Club conducted trap shooting over the Marsh from the adjoining Myrick Park from 1929 to 1963. This activity deposited lead shot in the Marsh over an area of 37 acres.

The La Crosse Gun Club operated four trap fields overlooking a 15 ha [37 acres] section of the LRM from 1929 to 1963.... Large quantities of Pb shot were regularly discharged in the LRM until the City declined to renew the Club's lease in 1963. Work completed in conjunction with the WI DNR in the early 1990s found Pb shot densities as high as 41,600 pellets/m² [3,865 pellets/ft²] (Fors, 1994).⁶

An estimated 20,000 kg of Pb shot remains within the marsh sediment, typically buried below 10 -30 cm [4 to 12 inches] of organic rich silt. An estimated 3.8 hectares of the LRM contains surface sediment that exceeds the EPA criteria of 400 mg/kg for contaminated soils and 8.9 hectares [22 acres] exceed the WI DNR criteria of 130 mg/kg for probable effects on biota. Terrestrial sites in the study area where most human activity is focused (e.g. gravel pedestrian trail and Myrick Park) were not found to have soil Pb levels above the EPA criteria of 400 mg/kg.⁷

Analysis of Detailed Site Investigation Requirements

Section NR 716.07 *Scoping* lists the relevant items which shall be evaluated to ensure that the scope and detail of the site investigation are appropriate to the complexity of the site, given the location of the site. Section NR 716.09 *Site Investigation Work Plan* defines the requirements of the Site Investigation Work Plan including its contents in subsection (2). Section NR 716.11 *Field Investigation, subsection (3)* defines the purposes of the Site Investigation. Table 1 below identifies and evaluates the relevant requirements of each of these sections and evaluates their applicability to the site and adequacy of the UW-L report. *Note: Shading indicates grouping of related topics.*

TABLE 1: APPLICABILITY AND ADEQUACY OF SITE INVESTIGATION REQUIREMENTS

Code Section	Item Description	Applicable	Adequate
NR 716.07 (1)	History of the site or facility, including industrial, commercial or other land uses that may have been associated with one or more hazardous substance discharges at the site or facility.	A	Yes
NR 716.07 (2)	Knowledge of type and amount of contamination . The amount of lead is adequately defined.	A	Yes
NR 716.07 (3)	History of previous hazardous substance discharges or environmental pollution	A	Yes
NR 716.07 (4)	Environmental media affected or potentially affected by the contamination.	A	No

⁶ Belby CS, et al (2016). P. 2.

⁷ Belby CS, et al (2016). P. 35.

Code Section	Item Description	Applicable	Adequate
NR 716.09 (2)(e)(6)	Potential hazardous substance migration pathways.	A	No
NR 716.11 (5)(a)	The field investigation shall include an evaluation of (a) Potential pathways for migration of the contamination, including drainage improvements, utility corridors, bedrock and permeable material or soil along which vapors, free product or contaminated water may flow.	A	No
NR 716.11 (5)(e)	The field investigation shall include an evaluation of (e) The extent of contamination in the source area, in soil and saturated materials, and in groundwater.	A	No
NR 716.11 (5)(f)	The field investigation shall include an evaluation of (f) The extent, both vertically and horizontally, of groundwater contamination. Piezometers shall be used to determine the vertical extent of contamination, as appropriate to the situation.	A	No
	Surface Water		Yes
	Sediments		Yes
	Groundwater		No
<p>During the marsh study conducted by UW-L, "sediment pore water" samples were collected and analyzed for dissolved lead (i.e. water samples were passed through a 0.45 um filter prior to analysis). These "sediment pore water" samples meet the Wisconsin regulatory definition of groundwater⁸. Analysis of 15 samples collected from 4 locations detected dissolved lead concentrations ranging from 6.6 to 409 µg/L with all samples exceeding the 1.5 µg/L NR 140 preventive action limit and 12 of the 15 samples exceeding the NR 140 enforcement standard of 15 µg/L. However, neither the horizontal and vertical extent of groundwater contamination nor vertical groundwater gradients between the surface water and underlying aquifer, which could drive dissolved lead migration deeper into the aquifer, have been evaluated.</p> <p>Recommendation:</p> <ol style="list-style-type: none"> 1) Install piezometers or mini-piezometers⁹ <ol style="list-style-type: none"> a) Measure vertical gradients under differing conditions, such as season, river stage/flooding, municipal water well pumping regimes. b) Collect samples for lead analysis at multiple depths in the underlying sands. 			

⁸ Section NR 140.05(9), Wisconsin Administrative Code: "Groundwater" means any of the waters of the state, as defined in s. 281.01 (18), Stats., occurring in a saturated subsurface geological formation of rock or soil.'

⁹ Rosenberry DO, LaBaugh JW, and Hunt RJ (2008). *Field Techniques for Estimating Water Fluxes Between Surface Water and Ground Water, Chapter 2: Use of Monitoring Wells, Portable Piezometers, and Seepage Meters to Quantify Flow Between Surface Water and Ground Water*. U.S. Department of the Interior, U.S. Geological Survey.

Code Section	Item Description	Applicable	Adequate
NR 716.07 (11)	Any other items, including climatological conditions and background water or soil quality information, that may affect the scope or conduct of the site investigation.	A	Yes
NR 716.07 (5)	Location of the site or facility, and its proximity to other sources of contamination.	A	Yes
	An assessment of background levels of lead has been adequately performed.		
NR 716.07 (6)	Need for permission from property owners to allow access to the site or facility and to adjacent or nearby properties.	A	Yes
NR 716.07 (7)	Potential or known impacts to receptors , including public and private water supplies ; buildings and other cultural features ; and utilities or other subsurface improvements. This evaluation shall include mapping the location of all water supply wells within a 1,200- foot radius of the outermost edge of contamination.	A	No
NR 716.11 (5)(b)	The field investigation shall include an evaluation of (b) The impacts of the contamination upon receptors.	A	No
NR 716.11 (5)(c)	(c) The known or potential impacts of the contamination on any of the resources listed in s. NR 716.07 (8) that were identified during the scoping process as having the potential to be affected by the contamination.		
NR 716.07 (8)	Potential for impacts to:		
NR 716.07 (8)(a)	Species, habitat or ecosystems sensitive to the contamination.	A	Yes
NR 716.07 (8)(b)	Wetlands, especially those in areas of special natural resource interest as designated in s. NR 103.04 .	A	Yes
NR 716.07 (8)(c)	Outstanding resource waters and exceptional resource waters as defined in ss. NR 102.10 and 102.11 .	NA	
NR 716.07 (8)(d)	Sites or facilities of historical or archaeological significance.	A	No
	<p>No water supply wells are present within 1200 feet of the site. Indian mounds are present in Myrick Park, and other archeological resources maybe present within the zone of contamination. While currently submerged, the damming and creation of Pool 8 of the Mississippi River raised the water level possibly inundating archeological resources. The presence of archeological resources may preclude or complicate potential remedial actions such as dredging contaminated sediments.</p> <p>Recommendation:</p> <ol style="list-style-type: none"> 1) Consult with the Mississippi Valley Archeology Center regarding the presence or potential presence of archeological resources 2) In Site Investigation Work Plan, discuss absence of potential receptors such as wells, buildings, and utilities. 		

Code Section	Item Description	Applicable	Adequate
NR 716.07 (9)	Potential interim and remedial actions applicable to the site or facility and the contamination.	A	Yes*
	*While the UW-L report does not examine interim and remedial actions and the factors for remedy selection, the information is generally available and such discussion and evaluation is better examined in the Remedial Actions Options Report.		
NR 716.07 (10)	Immediate or interim actions already taken or in progress, including any evaluations made of whether an interim action is needed at the site or facility.	NA	
NR 716.07 (12)	The need to gather data to determine the hydraulic conductivity of materials where contaminated groundwater is found.	A	No
	As discussed above, groundwater contamination has not been fully investigated. Recommendation: 1) If additional groundwater investigation is required, evaluate the need for determining hydraulic conductivity of the aquifer.		
NR 716.09 (2)(a)	Site name, address, and location by quarter–quarter section, township, range and county, and the location information specified in s. NR 716.15 (5) (d). Note: Section NR 716.15 (5) (d) requires submittal of Wisconsin Transverse Mercator (WTM) coordinates.	A	Yes
NR 716.09 (2)(b)	Name and address of the responsible party or parties, and name and address of all consultants or contractors involved in the response action.	A	No
	Recommendation: 1) Administrative detail to include in Work Plan		
NR 716.09 (2)(c)	Site location map, consisting of the applicable portion of a 1:24,000-scale topographic quadrangle published by the United States geological survey with the name of the quadrangle indicated, and a site layout map to approximate scale depicting the layout of buildings, roads, discharge location and other relevant features of the site.	A	No
	Need a map of sampling locations depicting each sample and results. There is a map showing sampling locations but there is not corresponding number (e.g. S-1) to each sample location. Furthermore, there appears to be a discrepancy between the figures and text in the UW-L Report. For example, the text indicates 456 surficial sample locations – we counted 412. A comprehensive table of sample results is also required. Recommendation: 1) Obtain full data set from Professor Colin Belby. 2) Adapt figures from UW-L Report 3) Create new figures to better represent site and contamination features in the context of remedy selection. 4) Create tables of representative results.		

Code Section	Item Description	Applicable	Adequate
NR 716.09 (2)(e)	Basic information on the physiographical and geological setting of the site necessary to choose sampling methods and locations, including:		
NR 716.09 (2)(e)(1)	The existing topography, including prominent topographic features.	A	Yes
NR 716.09 (2)(e)(2)	The surface water drainage patterns and significant hydrologic features, such as surface waters, springs, surface water drainage basins, divides, wetlands and whether the site lies within a floodplain or floodway.	A	Yes
NR 716 11 (5)(d)	The field investigation shall include an evaluation of (d) Surface and subsurface rock, soil and sediment characteristics, including physical, geochemical and biological properties that are likely to influence the type and rate of contaminant movement, or that are likely to affect the choice of a remedial action.	A	Yes**
NR 716.09 (2)(e)(3)	Texture and classification of surficial soils.	A	Yes**
	**While adequate, if additional soil or sediment samples are collected, classify soils and describe their texture.		
NR 716.09 (2)(e)(4)	General nature and distribution of geologic materials, including the thickness and type of unconsolidated materials and the type and nature of bedrock.	A	No
NR 716.09 (2)(e)(5)	General hydrogeologic information.	A	No
	Draft a discussion of local and regional geology and hydrogeology from standard references.		
NR 716.09 (2)(f)	Sampling and analysis strategy to be used during the field investigation...	TBD***	
	***If additional sampling is determined to be required.		
NR 716.09 (2)(g)	A description of other procedures to be used for site management, including erosion control and repair of structural, soil, or ground disturbance.	TBD***	
	***If additional sampling is determined to be required.		
NR 716.09 (2)(h)	A schedule for conducting the field investigation and reporting the results to the department.	TBD***	
	***If additional sampling is determined to be required.		

Code Section	Item Description	Applicable	Adequate
NR 716.11 (5)(g)	The field investigation shall include an evaluation of (g) The presence and concentration of vapors sub-slab, when investigation of soil, soil gas or groundwater indicates that vapors may migrate to the foundation of an occupied building, taking into account the biodegradability of vapors, preferential pathways of vapor movement, or other physical or chemical factors affecting vapor movement into occupied buildings.	NA	
NR 716.11 (5)(h)	The field investigation shall include an evaluation of (h) The presence and concentration of vapors in indoor air, when it is necessary to determine the impact on an occupied structure considering applicable attenuation factors, land use, building size and other site-specific factors that affect exposure to vapor.	NA	

Adequacy of UW-L Report

Although the analysis of the detailed site investigation requirements reveals several deficiencies, the more important question of whether the investigation is essentially complete, of whether sufficient information been gathered to meet the purposes of a Site Investigation as defined in the code, is examined below.

Depiction and Presentation of Contamination

Sample results tables & sample location map

The WDNR generally requires detailed depictions of all individual sample results in tables, maps, cross-sections and other graphic presentations. In the UW-L report, there is a map showing sampling locations, but there is not corresponding number (e.g. S-1) to each sample location. The necessity and level of detail required should be discussed with the WDNR to seek some relief, given the large data set (greater than 1,000 samples) collected by the UW-L researchers.

In addition, clarification of some of the data is required. For example, the report indicates that 456 surficial samples were collected. The map in the UW-L report, however, only depicts 412 surficial sampling locations. While Appendix A indicates that surficial samples were collected from terrestrial sites adjacent to the pedestrian path from “both the surface and shallow pits (5 cm increments, maximum depth of 25 cm)”, there is no indication which sampling locations were “pits” and which locations had more than one sample collected from it.

Purpose of NR 716 Site Investigation

Section NR 716.01, Wisconsin Administrative Code, requires that “site investigations provide the information necessary to define the nature, degree and extent of contamination, define the source or sources of contamination, determine whether any interim actions, remedial actions, or both are necessary at the site or facility, and allow an interim or remedial action option to be selected that complies with applicable environmental laws.” However, it is important to note that s. NR 716.01 also states: “Nothing in this chapter shall be construed to require plans or reports that are more detailed or complex than is justified by the known scope of contamination or the complexity of the site or facility.”

Section NR 716.11(3) expands on the purposes of the field investigation aspects of the overall Site investigation. These are subordinate to and supporting of the purposes defined in s. NR716.01:

- 3) The purposes of the field investigation shall be to:
 - (a) Determine the nature, degree and extent, both areal and vertical, of the hazardous substances or environmental pollution in all affected media.
 - (b) Provide sufficient information to permit evaluation of interim options pursuant to ch. NR 708, and remedial action options pursuant to ch. NR 722, and to permit a determination to be made regarding whether any of the interim or remedial action options require a treatability study or other pilot-scale study.
 - (c) Provide sufficient information to determine the hydraulic conductivity of materials where contaminated groundwater is found.
 - (d) Provide an estimate, along with all necessary supporting information, of the mass of contamination in the source area. This includes sites involving free product or where natural attenuation is considered for part of the remedy.

Discussion of Site Investigation Purposes

What follows below is a discussion of whether the UW-L report provides sufficient information to complete each of the following purposes:

Define the nature, degree and extent of contamination

Lead

The nature, degree and extent of lead contamination is adequately defined in the surface waters and sediments. The levels and distribution of lead contamination (e.g., "hot spots") in the sediments and surface water have been well investigated and defined.

This is not the case for the groundwater plume. While it is highly probable that a strong correlation exists between sediment and groundwater contamination and that the lateral extent of the lead groundwater plume lies within the zone of lead sediment contamination, the vertical extent of lead groundwater contamination has not been defined. An evaluation of vertical gradients between the surface water and the underlying aquifer will provide insight into the vertical migration potential of the lead groundwater plume. It should also be noted that no groundwater-pathway receptors, other than the Marsh itself, lie within 1,200 feet of the zone of lead contamination in the sediments.

Define the source or sources of contamination

Defining the source includes, not only identifying the cause and where the contamination came from (i.e., the trap shooting, but also defining hot spots or high levels of contamination in the soils and sediments that can continue to leach contamination to the ground and surface water. OSG is of the opinion that the UW-L report provides adequate data for defining the source, including hot spots of lead contamination.

Determine necessity of remedial actions

Contaminated Sediments

OSG is of the opinion that in general adequate information is available to determine the necessity of remedial action of the contaminated sediments. The probable greatest threats and routes of both

human and environmental exposure are for lead and via biological uptake in the wetland ecosystem, and impacts and risk pathways have been identified.

Direct-contact Human Exposure Risk

Direct-contact human exposure risk appears limited based on the description of dike and shoreline lead sample results presented in the UW-L report; however, a detailed review of individual sample results is required.

Groundwater Pathway Threats

Groundwater pathway threats are likely much longer term and much less probable, given the greater than 1,200-foot distance to active water supply wells and the slow corrosion rate of lead in its elemental state and hence dissolution and migration of resulting lead salts, carbonates and oxides.

Vapor Pathway Threats

There is no risk of vapor intrusion into occupied buildings because the contaminants are not volatile and not mobile in soil gas.

Select remedial action option

OSG is of the opinion that in general adequate information is available to at least narrow the menu of possible remedial actions. As the list of potential options is narrowed certain aspects of the site investigation may require supplementing. For example, if no active remediation is selected or closely considered for selection, then a more extensive investigation of groundwater and human direct-contact pathways may be necessary to ensure those pathways are defined sufficiently to make an informed decision regarding risk probability.

Preliminary Discussion of Range of Remedial Action Options

The options for remedy to the sediment contamination range from no remedial action (likely with some environmental and contaminant monitoring for a period of time, such as for example 1 to 3 years) to, on the other extreme, dredging out one to two feet of sediment from 25 acres. The latter would be extremely complicated and expensive. Even just a cursory evaluation suggests that dredging would likely require:

1. Damming and draining dredging area to minimize dispersion of contamination.
2. Dewatering of dredged sediments.
3. Mechanical removal of recoverable lead shot.
4. Treatment or retention of marsh draining and dewatering effluent. WPDES permit to discharge back to surface water.
5. Some or all of sediment would need to be disposed as a hazardous waste at a hazardous waste landfill (all are out of state) or treated to fix lead before disposed a regular landfill. Treatment would require a HW treatment license.
6. Significant footprint for operations.
7. Potential replacement of dredged soils and/or establishment of native wetland and aquatic vegetation

This is not a comprehensive list, but some intermediate options include:

1. Dredging hot spots only.

2. Adding a layer of isolating fill an area of over all or some of the contamination. Protection of groundwater would need more investigation for this option to be feasible. This option could also require mitigating wetland creation elsewhere in the marsh or cash payment to the state wetlands bank to offset fill volume.

More detailed analysis of existing data and likely more investigation would be required to justify less aggressive remedial actions.

Conclusion

The City desires to take practical steps to protect human health and the environment, and input from the public, taxpayers and other stakeholders should be sought and taken into careful consideration. At the same time the economic and technical challenges inherent in aggressive remedial options suggest an extremely limited remedial action should be pursued and the supplemental site investigation activities should be targeted to identifying and understanding risks that may be associated with less aggressive options, and that would support their design and planning.