Ohio EPA - DSIWM GUIDANCE DOCUMENT
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SUBJECT: Use of "Survey Mark" Instead of "Third Order Benchmark"

GUIDANCE #: 0536

REFERENCE:	Municipal Solid Waste	Industrial Solid Waste	Residual Solid Waste
	OAC 3745-27-08(C)(7)	OAC 3745-29-08(C)(7)	OAC 3745-30-07(C)(5)

CROSS REFERENCES: Modifications, Alterations, and Other Changes (MOD/ALT/OC) (other guidances)

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TOTAL # OF PAGES: 4

I. PURPOSE

The purpose of this document is to provide an interpretation of the term "third order benchmark."

II. APPLICABILITY

This guidance applies to owners and operators of municipal, industrial, and residual solid waste landfills installing survey marks according to OAC 3745-27-08(C)(7), OAC 3745-29-08(C)(7), and OAC 3745-30-07(C)(5).

III. BACKGROUND

When the municipal and industrial rules were promulgated on June 1, 1994, both contained an expanded description of survey practices that included survey mark referencing, stability of the physical survey marker and survey control standards for accuracy. These details incorporated into rule what was initially developed in a DSIWM IOC “Landfill Benchmark Guidance-Revised Standards” dated November 4, 1992. This IOC explained how using standard surveying practices of referencing to the National Geodetic Reference System (NGRS), performing at an accuracy to satisfy "third order" requirements, and building monuments according to Class A or B standards were more stringent than necessary. Part of this document noted that “the more correct term “survey mark” replaces the term “benchmark” in this memo and the attachments.” Benchmark typically refers to a monument which provides only vertical survey control, whereas a survey mark also provides horizontal control.

When the municipal and industrial rules were redrafted, the term “survey mark” was used throughout with the exception of the very first reference in OAC 3745-27-08(C)(7) and OAC 3745-29-08(C)(7). To correct this mistake, the phrase “At least three permanent third order benchmarks ....” should read "At least three permanent survey marks ...” The required accuracy for establishing these survey marks is given in OAC 3745-27-08(C)(7)(c)(i)-(iii) and OAC 3745-29-08(C)(7)(c)(i)-(iii).

Because the residual solid waste rules still contain the original surveying requirement of third order benchmarks, Ohio EPA DSIWM recommends that owner/operators of residual solid waste landfills follow survey mark requirements and surveying practices as now written in the municipal and industrial solid waste rules (OAC 3745-27-08(C)(7) and OAC 3745-29-08(C)(7)). To support the use of consistent survey standards for all solid waste landfills in Ohio, this document will review the reasons that were used to revise past surveying standards.

OAC 3745-30-07(C)(5) contains three criteria for establishing benchmarks at a solid waste landfill:

Reference System:	...referenced horizontally and vertically to the National Geodetic Reference System (NGRS)
Surveying Accuracy:	third order benchmarks
Monument Stability:	have a stability class A or B

The purpose of benchmarks is to provide a set of permanent reference points which can be used to verify that waste placement is occurring only within approved disposal areas for present-day enforcement, and also be used to accurately locate waste disposal areas for the long-term. The more correct term "survey mark" should be used in place of the term "benchmark" because "benchmark" typically refers to a monument which provides only vertical survey control. Changes to the rule language that contained the three criteria above has been made in the municipal and industrial solid waste rules effective June 1, 1994. The residual rules still include the benchmark standards as stated above. These standards can result in unnecessary effort and expense due to construction and surveying specifications which are more stringent than necessary for the benchmarks to fulfill their purpose.

Reference System:

The National Geodetic Reference System (NGRS) is a system of highly stable, identifiable control points whose positions have been determined through extremely accurate observations. This system of reference points is important for the planning and completion of national and local projects, utilization of natural resources, land management, national defense, and monitoring of crustal motion. Though the NGRS is a nationwide network, there are many areas within the state which are not readily accessible to control points included in the NGRS. In instances where establishment of facility survey marks requires surveying over long distances or through rough terrain, the cost of each survey mark can exceed five thousand dollars.

The requirement to reference survey marks to the NGRS is no longer necessary. As an alternative, owners/operators of RSWLFs can reference to an established control point identified on the 7.5 minute series quadrangle sheets published by the United States Geological Survey (USGS). The sheets are readily available through the USGS. The rule language in the municipal and industrial solid waste rules reads as follows:

> OAC 3745-27-08(C)(7)(a): "Survey marks shall be referenced horizontally to the 1927 North American Datum, 1983 North American Datum, or State Plane Coordinate System and vertically to the 1929 or 1988 North American Vertical Sea Level Datum as identified on the 7.5 minute series quadrangle sheets published by the United States Geological Survey."

Surveying Accuracy:

"Third order" means surveying accuracy in the range of millimeters per kilometer. For our purposes, it is not necessary to establish the position of a landfill with such global accuracy. Additionally, local surveyors are sometimes not familiar with the third order standard or the publications in which it is listed (if interested, see "Standards and Specifications for Geodetic Control Networks," Federal Geodetic Control Committee, 1984 and "Geodetic Leveling," NOAA Manual NOS NGS 3, 1981).

The third order surveying accuracy standard is no longer necessary. As an alternative, owner/operators of RSWLFs can use specific accuracy/distance standards for vertical and horizontal survey control as they appear in OAC 3745-27-08(C)(7)(c) of the municipal solid waste rules.

> OAC 3745-27-08(C)(7)(c): "Survey control standards for the survey marks shall be in accordance with the following:
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> (i) For the first facility survey mark established from the known control point, minimum horizontal distance accuracy shall be one foot horizontal to two thousand five hundred feet horizontal; and
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> (ii) For each facility survey mark established from the first facility survey mark, minimum horizontal accuracy shall be one foot horizontal distance to five thousand feet horizontal; and
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> (iii) For the first facility survey mark established from the known control point and for each facility survey mark established from the first facility survey mark, minimum vertical accuracy shall be one inch to five thousand feet horizontal.

Monument Stability:

Stability class A or B generally requires monuments to be in structures such as massive bridge abutments or retaining walls, or driven into bedrock (to refusal). If massive structures or foundations are not available for monuments adjacent to the solid waste limits, special equipment and materials are necessary to construct the marks into bedrock. Few local surveyors have the capability to install these specialized marks.

The requirement to meet a stability class of A or B is no longer necessary. Owner/operators of RSWLFs can follow the minimum stability standard of OAC 3745-27-08(C)(7)(b) of the municipal solid waste rules that provide for a specific survey mark design which requires only commonly available materials and construction methods (See attached diagram).

> OAC 3745-27-08(C)(7)(b): "Survey marks shall be at least as stable as poured concrete monument ten inches in diameter installed to a depth of forty-two inches below the ground surface. Each constructed survey mark shall include a corrosion resistant metallic disk which indicates horizontal and vertical coordinates of the survey mark and shall contain a magnet or ferromagnetic rod to allow identification through magnetic detection methods."

Construction Certification Report:

The RSWLF rules do not explicitly state how to report surveying practices. Owner/operators of RSWLFs can follow the requirements in the MSW rules. These practices are found in OAC 3745-27-08(H)(4) and OAC 3745-29-08(H)(4) in the municipal and industrial solid waste rules which include a detailed list of items what must be submitted to verify that the new survey marks are acceptable. Although the detail is new, the concept is not, as is found in the generic language in the current residual solid waste rule OAC 3745-30-07(B).

> OAC 3745-27-08(H)(4): After the initial construction and establishment of facility survey marks, the following information summarizing the activities performed to construct and establish the facility survey marks:
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> (a) an identification and description of the known control point(s) used to establish the horizontal and vertical coordinate(s) of the facility survey marks; and
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> (b) the horizontal and vertical coordinates of the known control point(s) and facility survey marks; and
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> (c) a summary of surveying activities performed in determining the coordinates of the facility survey marks; and
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> (d) a copy of the 7.5 minute series quadrangle sheet(s) used in establishing the survey marks with the

known control point(s) and the location of the facility survey marks clearly identified; and

(e) a detailed drawing(s) illustrating the design of the facility survey marks, as constructed.

IV. PROCEDURE

Ohio EPA DSIWM recommends that the phrase “At least three permanent third order benchmarks ....” in OAC 3745-27-08(C)(7) and OAC 3745-29-08(C)(7) be interpreted as “At least three permanent survey marks ...”

Owner/operators of RSWLFs can either follow the survey mark criteria in OAC 3745-30-07(C)(5) or follow the survey mark requirements and surveying practices as now written in the municipal and industrial solid waste rules (OAC 3745-27-08(C)(7) and OAC 3745-29-08(C)(7), which is Ohio EPA DSIWM's recommendation. To follow DSIWM's recommendation is considered an "Other Change" (see Modifications, Alterations, and Other Changes (MOD/ALT/OC) guidance for procedures).

It is also recommended that reporting of survey information in construction certification reports for residual solid waste facilities should follow the detailed list of reporting requirements that is in the municipal and industrial solid waste rules [OAC 3745-27-08(H)(4) and OAC 3745-29-08(H)(4)]. This reporting format can be used in place of the more generic guidelines presently in the residual solid waste rules [OAC 3745-30-07(B)].

V. POINT OF CONTACT

Engineering Rules/Policy/Training Unit, Unit Supervisor at (614) 728-5373.