APPENDIX E – SEAFLOOR SURVEY PROTOCOL

Survey Purpose. The purpose of a seafloor survey is to determine compliance with water quality criteria for residues in marine waters and document the boundaries of continuous and discontinuous coverage of seafood processing waste.

Objective. The seafloor survey shall determine the depth, total area, outer boundary of continuous coverage, and the outer boundary of discontinuous coverage of seafood processing waste. The survey will use a measure of seafood waste deposits or residues which are 0.5 inches or thicker on the seafloor as the minimum detection level. The seafloor survey shall determine the total areal extent (reported in square feet and in acres to the nearest tenth acre) of the deposit of any seafood residues, waste, sludge, solid, or emulsion.

Methods. The following method is approved by DEC. A permittee can request a modification to the survey method to accommodate various survey methods including remotely operated vehicles (ROV), sonar, grab samples, or an underwater camera. The survey protocol will only be modified if DEC determines that it is appropriate. The modified protocol may include changes in survey (1) stations, (2) times, (3) parameters, or (4) methods.

Determine the number and configuration (radial or parallel) of transects which will most accurately delineate the area of seafood waste accumulation.

Establish transect lines with a surveyor's tape or other precise methodology at the actual discharge location(s). The number of transects established should extend beyond the area of continuous coverage of seafood waste accumulation, or to a water depth of -120 feet mean lower low water (MLLW), whichever is first.

Surveys using **Radial Transects**: Choose or set a central underwater permanent marker (if feasible) at a suitable location. GPS coordinates derived using WAAS (Wide Area Augmentation System) technologies must be recorded at the location of the permanent underwater marker. Establish at least five transects radially from the permanent marker. Transects should be 30º apart, extending from one side of the facility to the other. Sample plots along each transect must be not more than 15 feet apart.

Surveys using **Parallel Transects**: Choose or set up at least five underwater permanent markers (if feasible) at a suitable location. GPS coordinates derived using WAAS technologies must be recorded for each permanent underwater marker. There should a minimum six transects, each transect should be no more than 75 feet apart, and should extend in a perpendicular direction from the markers. The number of transects should be adequate to encompass the entire area of seafood waste accumulation. Samples plots along each transect must be not more than 15 feet apart.

Determine the total areal extent of continuous coverage by seafood waste within the survey area in water depths to -120 feet MLLW. Determine the total area of discontinuous coverage by seafood waste, within the survey area in water depths to -120 feet MLLW. If continuous waste deposits extend beyond -120 feet MLLW in depth, and the survey is being performed by Remotely Operated Vehicle (ROV)(or similar), the survey transects should be extended to beyond the area of continuous coverage.

If continuous coverage extends more than 15 feet beyond and perpendicular to the lateral transects that bound the discharge location area, then additional transects must be established to determine the extent of continuous coverage beyond the lateral transects.

Survey report. A permittee shall submit a seafloor survey report for each required discharge location per Permit Part 2.3.4 describing the methods and results of the survey(s). The permittee required to conduct a seafloor survey shall submit the report(s) with the Annual Report. The survey report shall include the following information:

1) Permittee and Vessel name.
2) APDES permit number.
3) Date, exact place (GPS or WAAS Latitude and Longitude) and time of seafloor survey, and name(s) and

telephone number(s) of the individual(s) who performed the survey.

4) Date(s) of discharge that occurred at the discharge location being surveyed and corresponding Latitudes(s) and Longitude(s) recorded during discharge.
5) Name and signature of the person who conducted the seafloor survey.
6) Method used to:
   a) establish transects,
   b) locate sample plots,
   c) measure seafood processing waste thickness,
   d) estimate percent coverage at each sample plot, and
   e) calculate area(s) of seafood waste coverage.
7) Date of completion of the report, and first and last name(s) of individual(s) who performed the analysis.
8) Table showing seafood processing waste thickness and percent coverage measurements along each transect line. The following information must be recorded at each sample plot. An example Seafood Waste *Monitoring Survey/Transect Data Form* is provided as Attachment D to the permit.
   a) **Seafood waste thickness.** Measure and record the estimated thickness of the seafood waste deposit using a marked stick or pipe to the nearest one-half inch. If seafood waste is visible but less than one-half inch thick, record the thickness as less than one-half inch (Trace).

   b) **Percent Coverage.** Estimate and record the percentage (0% to 100%) of area covered by seafood waste within the sample plot. A sample plot is measured as a three foot-square area (one square yard).

   c) **Digital photographs**. Digital photographs shall be captured that depict the nature and coverage of seafood waste on the seafloor at representative sample plots along transects, including all of the sample plots with continuous coverage (100%), and at least half of the sample plots with discontinuous coverage (10%-99%). Photographs shall be of sufficient clarity and detail to support the observations, and should represent what was observed. Photographs shall include a digital date and time stamp. The digital photograph log shall include the name of the seafood processor, survey date, transect line and sample plot identifier.

   d) **Water depth.** (adjusted to MLLW).

9) Tidal Stage. Ambient tidal current velocity and direction.
10) Map, with scale, delineating the survey area and locations of each transect line, area(s) of continuous (100%) seafood processing waste coverage, and outer boundary(ies) of the discontinuous coverage as it relates to the actual discharge location.
11) Total area of continuous (100%) seafood processing waste coverage and the total area of discontinuous coverage, in square feet and in acres to one tenth of an acre.
12) Information on whether a seafood processing discharge was occurring during the time(s) of the survey.
13) Types and quantities of aquatic life observed adjacent to, on, in, or feeding on any seafood processing waste deposits, along with representative photos, with time and date stamp, and an indication of change from any previous observation or seafloor survey reports.

A seafloor summary report must be submitted for each discharge location requiring a seafloor survey per Part 2.3.4. An example form, Seafloor Survey: Summary Report Form, is included as Attachment D.

If seafloor surveys submitted by the operator, or other available evidence, are not sufficient to determine whether coverage exceeds an authorized zone of deposit DEC will, in its discretion, require the operator to conduct additional surveys or other monitoring for that purpose.

EXAMPLE: Calculating the area of seafood coverage

The following diagram shows "typical" radial transects set 30 degrees apart. Points of measurement are at 15-foot intervals along the transects. There is continuous seafood coverage in the inner area, and discontinuous seafood coverage in the outer area, but the two areas easily could be reversed.

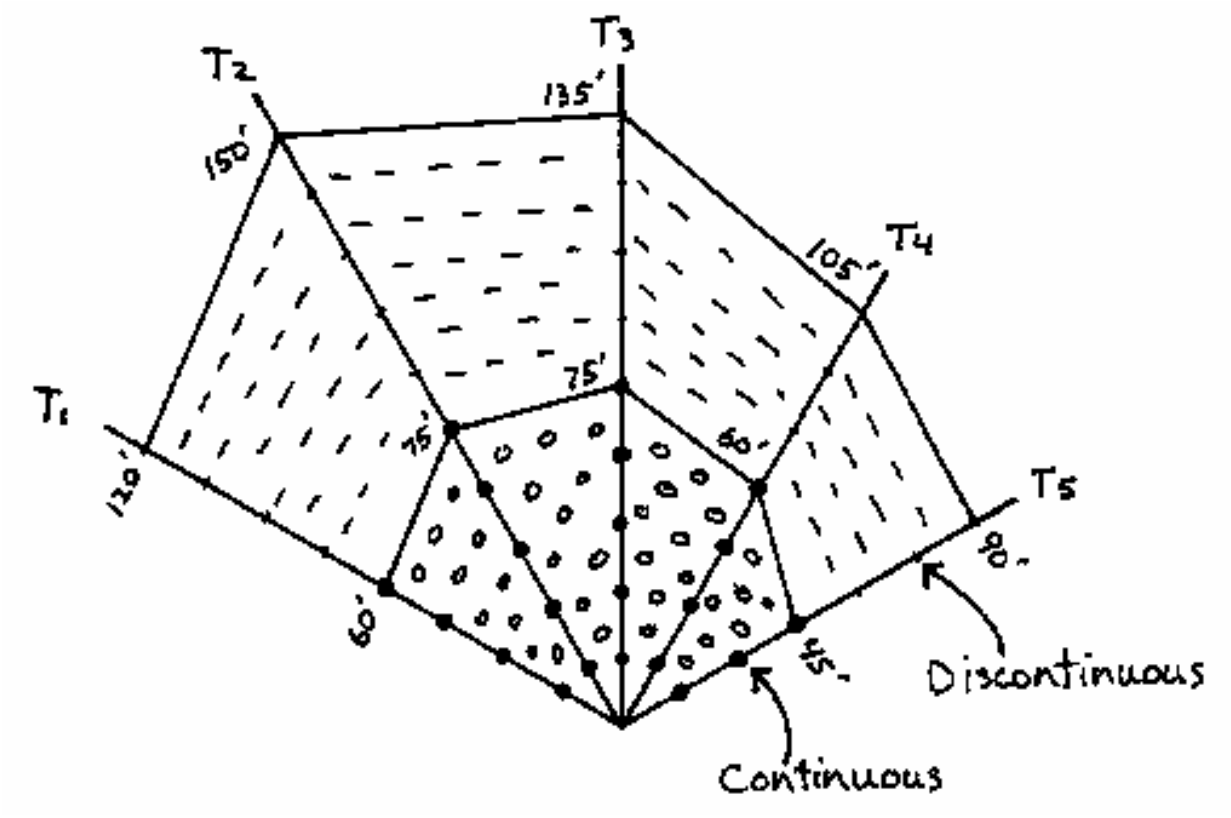

Figure 1

The continuous-coverage area is calculated as the sum of the four continuous-cover triangles between transects.

The discontinuous-coverage area is calculated as the sum of the four total-area triangles, minus the continuous-coverage areas.

Continuous coverage is defined as the total areas of seafood waste that are estimated to cover 100% of the seafloor, as measured within a three-foot square sample plot. Discontinuous coverage is defined as total area(s) of waste that are estimated to cover 10% or more, but less than 100%, in a 3-foot square sample plot. The survey must use a seafood waste deposit thickness of 0.5 inch or thicker on the seafloor as the minimum detection level.

Monitoring must provide a determination of the outer boundary of the area of the waste deposited on the seafloor. All areas of continuous and discontinuous coverage of deposited seafood processing waste must be measured and added together to calculate the total area of deposited seafood processing waste.

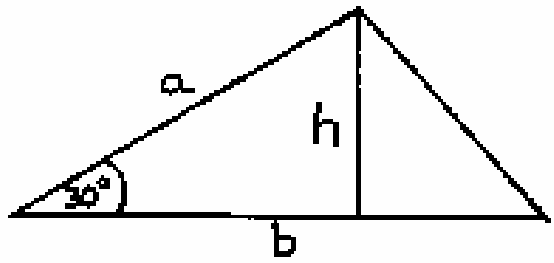

Figure 2

The formula for the area of any triangle is ***1/2 x base x height***, or ***1/2 bh***. The long side of the triangle is viewed as the base. The height is a vertical line perpendicular to the base. Fortunately, in a 30-degree triangle, the height is equal to 1/2 the length of the upper side adjacent to the 30-degree angle, or ***1/2 a***. Substituting ***1/2 a*** for ***h*** means that the area of a 30-degree triangle is equal to ***ab/4***. This makes it easy to calculate areas between transects, based on the various transect segment lengths.

h = 1/2 a Area = 1/2 bh = 1/2 b *x* 1/2 a = ab/4

Continuous and discontinuous coverage must be calculated as the total areal extent (reported in square feet and in acres to the nearest tenth acre) enclosed by a line connecting the outermost measured points of continuous and discontinuous coverage, respectively, for that area on the transect array, or by another method approved by DEC. Find the amount of continuous coverage by calculating the area(s) of each of the four triangles, then adding those four areas. The calculations follow (values are rounded to the nearest whole number).

In the following example, the five transects left to right are labeled as T1, T2, T3, T4, T5. The transect lengths are shown for the continuous coverage area (CC) and total area (TA):

	T1	**T2**	**T3**	**T4**	**T5**
CC	**60’**	**75'**	**75'**	**60’**	**45’**
TA	**120’**	**150’**	**135’**	**105’**	**90’**

Find the CC area by calculating the area of each of the four triangles, then adding those four areas. The area of the first CC triangle is 60 x 75 / 4, or 1125 square feet.

CC Area			Total Area	
60 x 75 / 4=	1125 ft^2		120 x 150 / 4 =	4500 ft^2
75 x 75 / 4 =	1406 ft^2		150 x 135 / 4 =	5063 ft^2
75 x 60 / 4 =	1125 ft^2		135 x 105 / 4 =	3544 ft^2
60 x 45 / 4 =	675 ft^2		105 x 90 / 4 =	2363 ft^2
Total =	4331 ft^2		Total=	15,470 ft^2

The continuous coverage area then is 4331 ft^2.

The discontinuous coverage area then is the total seafood waste coverage area minus the continuous coverage area.

15,470 ft^2 - 4,331 ft^2 = 11,139 ft^2

To convert any of the areas to acres, divide by 43,560 ft^2/acre.

Continuous coverage: 4,331 ft^2 / 43,560 ft^2/acre = 0.10 acre

Discontinuous coverage: 11,139 ft^2 / 43,560 ft^2/acre = 0.26 acre

To convert an area to square meters, divide ft^2 by 10.76 ft^2/m^2.

Continuous coverage: 4,331 ft^2 / 10.76 ft^2/m^2 = 402 m^2

Discontinuous coverage: 11,139 ft^2 / 10.76 ft^2/m^2 = 1,035 m^2

A similar method can be used to calculate continuous coverage if there is discontinuous coverage inside of the continuous coverage. The diagram would be similar to that above, but with continuous coverage farther from shore and discontinuous coverage near shore. In that case, calculate the inner discontinuous area, and subtract the inner discontinuous area from the total area of continuous plus inner discontinuous area. If there is additional discontinuous area beyond the continuous area (farther from shore), subtract the continuous area from the total survey area to get the sum of the inner and outer discontinuous areas.

A computer spreadsheet may be constructed to handle calculations for typical situations.

Other methods may be used to calculate area, including computer mapping, planimeter, and dot grids. The method used must be described in the seafood survey report to a degree that allows DEC to check the calculation.

Definitions applicable to the Seafloor Survey

Continuous coverage	Means seafood waste deposits that are estimated to cover 100% of the seafloor as measured within a three-foot-square sample plot. At DEC's discretion, the area will include boulders, rock outcrops, ridges, and other protrusions within an area of continuous coverage that are not covered by seafood waste.

Discontinuous coverage	Means areas of seafood waste deposits that are estimated to cover 10% or more of the seafloor, but less than 100% coverage, as measured within a three-foot square sample plot.

Trace coverage	Means areas of seafood waste that are estimated to cover less than 10% of the seafloor and having a depth under 0.5- inch, as measured within a three-foot-square sample plot.