



**Table of Submission for Technical Meeting – June 20, 2011. Shear Diamonds (Nunavut) Corp. – Submissions for Technical Meeting for the Renewal of the Jericho Type “A” Water Licence 2AM-JER0410.**

**Please refer to Item #66 - Aquatics Effects Monitoring Plan – Environment Canada - Reference 4.4 Sediment Monitoring**

**Consideration should be given to using core samples such that 1 cm or 2 cm layers can be tested. This may require overlap in sampling methods to determine whether there is any comparability between historical results and core sample results.**

Response: Core sampling can be incorporated into the current program.

*Recommendations:*

I would recommend that samples be taken both with respect to known potential point sources and in conjunction with set sampling sites. For sampling of known point sources, the sites should be set in a linear fashion radiating away from the source. The exact number of sites will depend on the number of point sources and the plume modeling. For each point source, sampling sites should cover and radiate in sufficient number to adequately document potential differences in deposition, with the final sites located beyond the expected areas of influence.

For correlation to ongoing sampling efforts, additional core sampling sites should be within establish mid-lake sites. These should include two sites within the main lake (one at each basin), a control lake site, and one site within each of the other lake groups. Sampling should be conducted at a yearly minimum. Sample storage and analysis will depend on the chosen chemical constituents of interest. Provided below is detailed methodology and equipment for core sampling.

**Jericho Core Sampling Materials and Methods (Field)**

*Introduction*

Core samplers penetrate the sediment more deeply than grab samplers. Consequently, they provide a cross-sectional slice of sediment layers and thus, information about the sediment deposition. There are many types of core samplers for specific applications. For the proposed application of obtaining a small sediment sample for chemical analysis, it is recommended that a Kajak-Brinkhurst (KB) sampler be used.

A picture of a modified KB sampler is provided below along with associated sampling equipment. A core sample is obtained by lowering the sampler into the sediments and sending a messenger weight to trip the spring-loaded suction cup, sealing the top of the core tube. This coring device uses suction to hold the sediment sample inside the core tube

during retrieval. The depth of the sample is controlled by the distance the device is allowed to fall before entering the sediments.

The corer is deployed and recovered by hand, making it a portable sampling device. The KB corer is best suited for studies that do not require large amounts of sediments. The modified KB corer is not a good sampler choice for soupy or very soft sediments because the suction force cannot hold in the sample. It also may be difficult to obtain a core sample in extremely firm substrates, such as clay.



### *Equipment Requirements*

In addition to all necessary equipment required for a safe and organized field outing, the following will be needed specifically for sediment core collection:

1. Core tubes
2. Extruder
3. Sectioning apparatus
4. Stage
5. Rubber stopper
6. Spatula
7. Screwdriver
8. Large plastic tub
9. Siphon tubing
10. Measuring device
11. Non-talc, disposable nitrile gloves

12. Cleaning brush
13. Deionized water
14. Sample cooler and ice packs
15. Field logs (on Rite-in Rain paper)
16. Plastic bags (Ziploc, garbage)
17. Preprinted sample container labels, with extra blank labels
18. Chain of Custody tags and forms
19. Pencils, indelible ink pens (fine and regular)
20. Camera
21. Depth finder
22. Maps, charts, aerial photographs
23. GPS unit
24. Cell phone
25. Sediment Sample Containers – appropriate containers for project-specific analyses

### *Decontamination/ pre-field preparation*

Pre-clean the core tubes, core slicers, and any other devices coming into contact with sediments before use in the field. The following cleaning procedure is suggested (Blakley 2008) for sediment sampling. However, individual projects may require additional or different decontamination procedures depending on the analytes of interest.

- Wash using Liquinox detergent.
- Rinse three times with tap water.
- Wash with 10% nitric acid (for metals analyses).
- Rinse with deionized water.
- In fume hood, rinse with acetone, then hexane (for organics analyses). This step is intended to remove trace organics from the sampling equipment, although

EPA (2001) also recommends it for field samples of "unknown composition". Many sources, including EPA (2001), recommend only an acetone rinse. Because the acetone molecule has both polar and non-polar components it is a good solvent for a broad range of chemicals. It is miscible in water and readily evaporates, serving as a drying agent. Hexane is also a good solvent for organic compounds and is recommended here for thoroughness, particularly for analyses of dioxins and PCBs.

Air dry in fume hood and wrap with aluminum foil (shiny side of foil facing out)

### *Sample Collection*

#### Deployment

Determine the water column depth of the sampling location using a depth finder or weighted line. Place the core tube inside the sampling housing apparatus and tighten the hose clamps around the tube. Make sure the tube is held tightly in the housing apparatus. While keeping the messenger weight on board, lower the corer through the water column. Keep track of the depth of the corer by counting the meters on the calibrated line.

When the bottom of the corer reaches approximately 0.5 m above the substrate, let the line drop quickly and allow the corer to settle into the sediments. To prevent the corer from tilting and disturbing the sample, keep a slight tension on the line when the corer is settling into the sediment. Release the messenger weight down the line.

## Retrieval

Once the messenger hits the corer, slowly lift the corer up through the water column until the core tube and rubber seal are just below the water surface. One crew member should hold the corer while another reaches under the water surface to plug the core tube with the rubber stopper. Make sure to keep the core tube and rubber seal under the water surface while plugging the bottom of the tube. It may be necessary to tilt the corer slightly to reach the bottom of the tube. In order to keep the sample intact, do not tilt the corer more than 45 degrees when placing the rubber stopper at the bottom of the corer.

Once the bottom of the liner is plugged, slowly lift the corer into the boat and place in a large tub. While the housing apparatus is still on the core tube, check to make sure that sufficient depth was achieved and that the sediment water interface is undisturbed. Loosen the hose clamps and lift the sampling housing apparatus off of the core tube.

One person should hold the core tube while another crew member takes the housing apparatus off.

Tips for sample collection:

- Adjust the line release height to attain different core depths. For firmer substrates it may be necessary to release the line at a height greater than 0.5m above the sediment in order to allow deeper penetration.
- Keep spare rubber stoppers on board. They are easily dropped when plugging the core tube.

## Collecting Sediment from the Sampler

After retrieving the core sample, check the sample for acceptability. A sample is considered acceptable if it is not over-filled with sediment, overlying water is present and not excessively turbid, the sediment surface is relatively flat, and the desired core length has been retrieved. It is important that the sediment-water interface remains intact while processing the sample. Unacceptable samples should be dumped overboard at a location away from the station.

Acceptable samples should be sub-sampled using the following techniques:

Begin by measuring the penetration depth of the coring device and length of the core. For penetration depth, measure from the bottom of the corer to the highest point on the outside of the device where sediments exist. To measure core length record the length of the sediment core inside the liner. These two measurements can be used to estimate core shortening.

Position the extruder under the rubber stopper at the bottom of the core tube and extrude the water into the large tub by gently pressing down on the core tube.

Siphon off the rest of the water without disturbing the sediment and place the stage and sectioning apparatus on top of the core tube. Hold the extruder in place and gently press down on the core tube so that the core sample is extruded up into the sectioning apparatus. For 1 cm sections, extrude the sediment core up to the 1 cm calibration on the sampling apparatus. Slide the sampling apparatus onto the adjacent surface of the stage and transfer to the appropriate sample container using a spatula.

**Note:** It is recommended that pictures be taken of each core sample prior to extrusion. The photo should show the full length of the core and the appropriately labeled sampled container it will go into.

### Field Decontamination

For most sampling applications, rinsing the equipment between grabs with site water is normally sufficient (PSEP, 1997a), using a scrub brush to remove any sediment that does not rinse off easily. Rinsing can be performed by dipping the grab in the water or using pumped water. When changing waterbodies or sampling in severely contaminated sediments decontaminate with acid washes described in pre-sampling preparation.

### Records Management

Complete the field log for each station sampled. Include a visually descriptive assessment of each acceptable sample (sediment interval), together with any unusual characteristics such as odor, debris, color. Other items to note include: waterbody name, water conditions, weather conditions, time of day, crew, core length, sampling depth, corer penetration, location, sample size (cm), type of analysis, field ID, sample number, sampling program, etc.