

US EPA ARCHIVE DOCUMENT



[EPA Region 10 Dive Unit](#)

Wyckoff Eagle Harbor Superfund Site Scientific Diving Support 1980-2013

What: The Region 10 Dive Unit was asked to support Wyckoff Superfund Site cleanup through a variety of activities since the early 1980's. Early work included taking sediment samples at the site and support during cleanup activities. Between 1993 and 1997, the Unit monitored eelgrass beds to document potential impacts from capping work. In the 1990's and through 2007, the Unit was also asked to 1) install and check sediment traps equipment to monitor the success of placing a layer of clean riverine sediments over contaminated sediments (largely creosote), 2) conduct surveys during and after capping contaminated sediments, and 3) placing and monitoring "no anchor buoys" to ensure ongoing protection of the cap. In 2002, the dive unit was asked to perform an outfall and impact survey for the Wyckoff treatment plant to support the Region 10 Superfund program and USACE, which was repeated again in 2013 to confirm the need to repair and/or replace the pipeline. In 2007, the EPA Region 10 Dive Unit conducted a survey technique for underwater digital photography integrated with GPS location data as part of a pre-capping debris survey for the EPA Superfund cleanup program, Bainbridge Island, WA. In 2011 and 2013, the dive unit was asked to locate and sample flux chambers as well as solid phase microextraction devices (SPMD/SPME) to monitor the performance of the clean cap at the site.

Why: The [EPA Region 10 Dive Unit](#) was asked to conduct a variety of samples to both help determine the cleanup needed at the site, monitor the installation of the cleanup, and later to monitor the effectiveness of the cleanup. Eelgrass monitoring was conducted to determine what impact capping might have on nearby eelgrass beds. For pre-capping work, debris locations, photos, and video footage were necessary to inform bidding contractors of the size and location of debris, should some require removal, or additional overcapping allowance for cap placement at this Superfund Site. During Wyckoff treatment plant outfall work, the survey was designed to determine the level of impact of the outfall on nearby sediment and to observe the outfall to determine if it was in need of maintenance. The outfall discharges treated effluent from the Wyckoff treatment plant which treats creosote contaminated groundwater as part of a Superfund cleanup of an old wood treating site. Cap monitoring diver survey objectives were to 1) assess the nature of the cap during and after capping including evidence of recontamination, 2) evaluate recovery by benthic macrofauna and algae after cap placement, 3) assess movement of cap sediments (due to resuspension), and 4) maintain "no anchor zone" buoys as they are an important institutional control for the sediment cap. In 2011, divers were asked to take samples via SPMDs and flux chamber samples to analyze the degree to which the Wyckoff cap was meeting performance objectives, as well as installing passive samplers in 2013 to evaluate the need for cleanup in the east and north beach areas.

Where: Eagle Harbor, Bainbridge Island, WA.

When: The [EPA Region 10 Dive Unit](#) supported Wyckoff Superfund Site work since the early 1980's. Eelgrass survey work occurred between October, 1993 to August, 1997. The outfall survey was conducted in August, 2002 and May 2013, the debris survey in March 2007. Pre-cleanup sampling took

place throughout the 1980's and 1990's. For cap placement, the caps were placed in several phases through 2001. Dive surveys were conducted several times during and after placement. Diver surveys continue in support of EPA Office of Research and Development (ORD) work to study long-term cap effectiveness in 2004, 2005, and 2006. Work on "no anchor zone" buoys has taken place in 2006 and 2007. SPMD/flux chamber work occurred in the fall of 2011 as well as the fall of 2013.

How: Earlier work at the site included photographing and videotaping biota and sediment type along transects; measuring cap thickness atop settlement plates; measuring any increases in sedimentation in a nearby marina, and surveys of nearby eelgrass beds. Divers also helped place and retrieve sediment traps. Using handtools, divers also install and monitor "no anchor zone" buoys.

Density of eelgrass (*Zostera marina L.*) was recorded as counts of stalks within 0.1 m² quadrats; 30 quadrats were placed randomly in a 100 m by 20 m rectangle in the middle of each bed.

For the treatment plant survey, divers located the outfall, took still photos and video, then placed a transect along which surface sediment samples were taken. Samples of the top 2 cm were collected into 16 oz. jars using pre-cleaned stainless steel spoons with special care to include the very fine flocculent surface layer. In total, 54 samples were collected from the acute and chronic mixing zone/zone of deposit.

For pre-capping work in 2007, a survey procedure was conducted where a two person dive unit surveys the underwater environment in search of submerged debris by documenting the seafloor with digital photos at debris locations along a contour of the shore covering approximately one thousand feet per transect. An inexpensive recreational Global Positioning System (GPS) device is towed in a raft directly above the divers which records positions throughout the dive. Commercial software is later used to relate the GPS information to the digital photos resulting in geo-located digital photos that can be viewed on a map or Geographic Information System (GIS) for later analysis of the seafloor environment.

For flux chamber location, surface supplied dive equipment was used to employ arc pattern searches. Deployment of SPMDs was generally otherwise conducted with SCUBA buddy teams on transects.

Equipment: EPA vessel Monitor was used as the dive platform for all surveys. Early work utilized hi8 video, Nikonos V for still photos, while later work utilized high definition video and compact digital still cameras. Quadrats were used for eelgrass counts. For mapping work, a GPS device attached to diver-towed GPS raft, Underwater Digital Camera (Sony HC1 video camera, using still photo capability while simultaneously recording bottom video), GIS software & Laptop were used to create a map of the boundary and observations. For 2011 cap monitoring work, surface supplied dive equipment was used for searches to locate the flux chambers, as well as high definition video and standard definition helmet cameras. Later in 2011, SCUBA buddy teams on transect lines conducted the bulk of SPMD deployment and retrieval. The 2013 outfall survey utilized a geolocated photo technique to precisely map the configuration of the pipe, as well as locate problem areas.

Results: Videos, photos, maps and samples were conveyed to various project staff.

For eelgrass surveys, shoot density differed; the Wyckoff bed (nearest the sediment cap) consistently had the least amount of eelgrass and the Murden Cove bed (to the north of Eagle Harbor) the most.

Changes within beds appeared to be related to the natural cycle of winter reduction rather than the movement and subsequent deposition of cap sediment. Variability among divers in counting stalks was highest when the density was high and within 1 or 2 stalks when density was low.

Cap surveys that took place between 2001 and 2007 found that the cap was smooth in the south part of the harbor and “hummocky” in the north. A lot of woody debris was present. Creosote "marbles" were observed in the south on two occasions (see pictures below). Some settlement plates were lost (tipped over, broken, dragged, buried). Divers could feel the difference in substrate type (sand placed over mud). Recovery by macrofauna was rapid. Anemones pulled up through the cap and crab, flatfish, and drift algae were common. Polynuclear aromatic hydrocarbons (PAHs) were detected in samples from the sediment traps (see photo below) at times. Only minor accumulations of sediment occurred around stakes in a nearby marina. Nearby eelgrass beds were probably not affected. A survey was conducted in December, 2003 of areas that formerly seeped or pooled creosote (Area 4 within figure below) which was capped in 2000-2001. Life on the cap included various types of anemones including the frilled anemone (*Metridium senile*), seastars including the sunflower star (*Pycnopodia helianthoides*) sea lettuce (*Ulva*), unidentified bivalves, unidentified tube worms, and sporadic eel grass (*Zostera marina*). Several fish including unidentified sole, ratfish (*Hydrolagus colliei*), and other unidentified small fish were seen on the bottom or above the cap in addition to various crab- including dungeness (*Cancer magister*). “No anchor zone” buoys were placed in 2006 and replaced in 2007.

More details: <http://yosemite.epa.gov/r10/cleanup.nsf/sites/wyckoff>

[Video: Surface Sediment Sampling Techniques, \(2 minutes, Total file size 27 MB Windows Media format\)](#)

[Video: Creosote marbles and pools on the bottom of Eagle Harbor \(2 minutes, Total file size: 18 MB, Quicktime format\)](#)

Video: [Pre-capping debris survey, March 8, 2007](#) (20 minutes, 158 MB, Quicktime format)

[Duncan, P.B. and D.W. Karna. 1996. Eelgrass surveys in Eagle Harbor, WA, following capping of adjacent contaminated sediments. Proc. Amer. Acad. Underwater Sci. 1996 Sci. Diving Symp. p. 107-111. \(6 pp, 300 KB pdf\)](#)

[Siwiec T., S. Sheldrake, A. Hess, D. Thompson, L. Macchio, P. B. Duncan. 2008. Survey Technique for Underwater Digital Photography with Integrated GPS Location Data. Proceeding of the American Academy of Underwater Sciences 27th Symposium, pp. 159-166. \(PDF\) \(8 pp. 2.1MB\)](#)

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Photos:



Diver monitored sediment stakes



Creosote pools that were prevalent in nearshore areas before dredging/capping that divers were asked to photo document and map.



Bottom dump barge placing cap material.



Diver placing a sediment trap offsite (note no personal protective equipment in use).



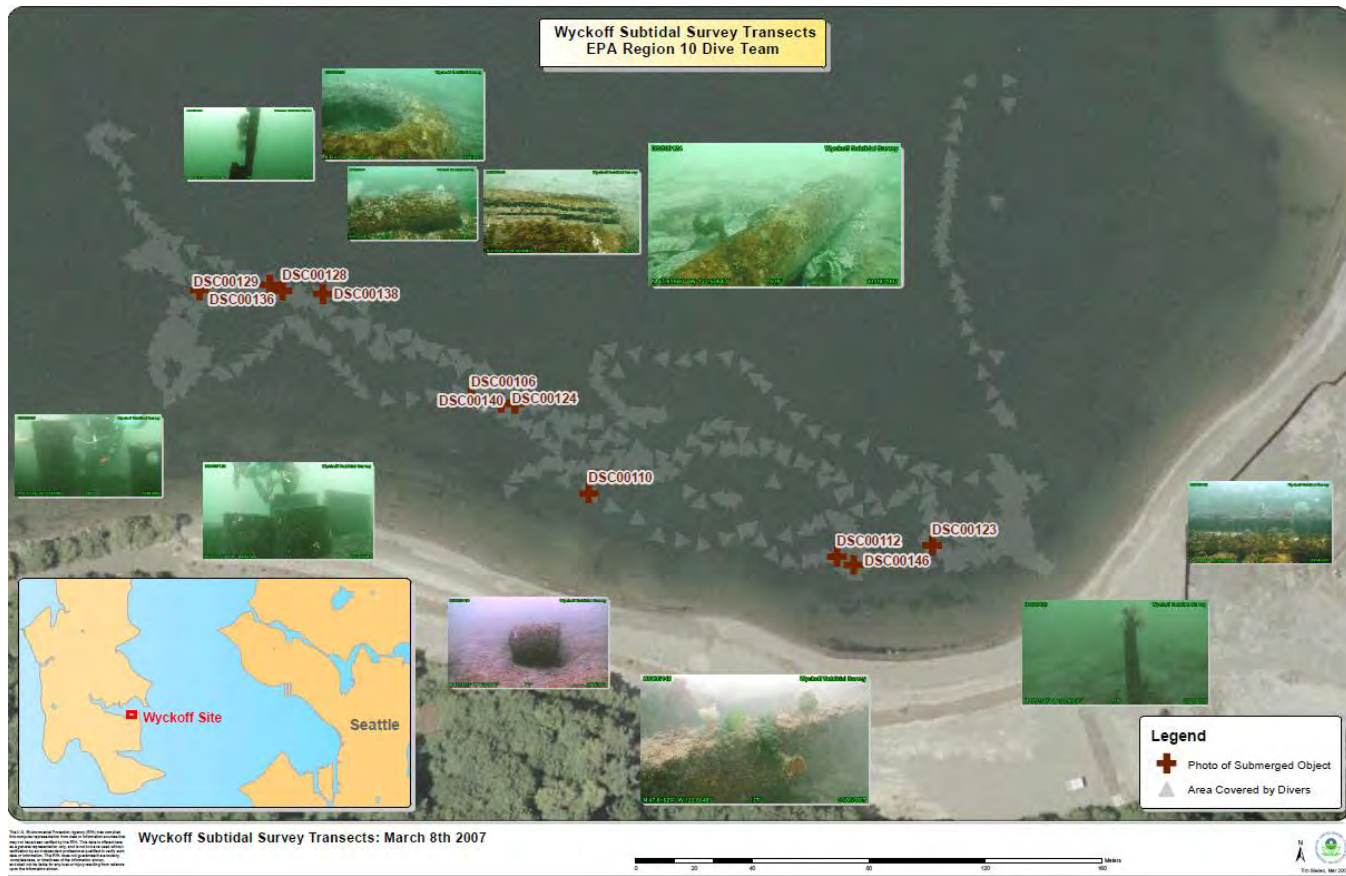
Measuring the outfall diameter for treatment plant operators.



View of algal growth along the treatment plant outfall



Diver carefully collecting a surface sediment sample.



An object located as part of the pre-capping survey in 2007.

DSC00106

Wyckoff Subtidal Survey

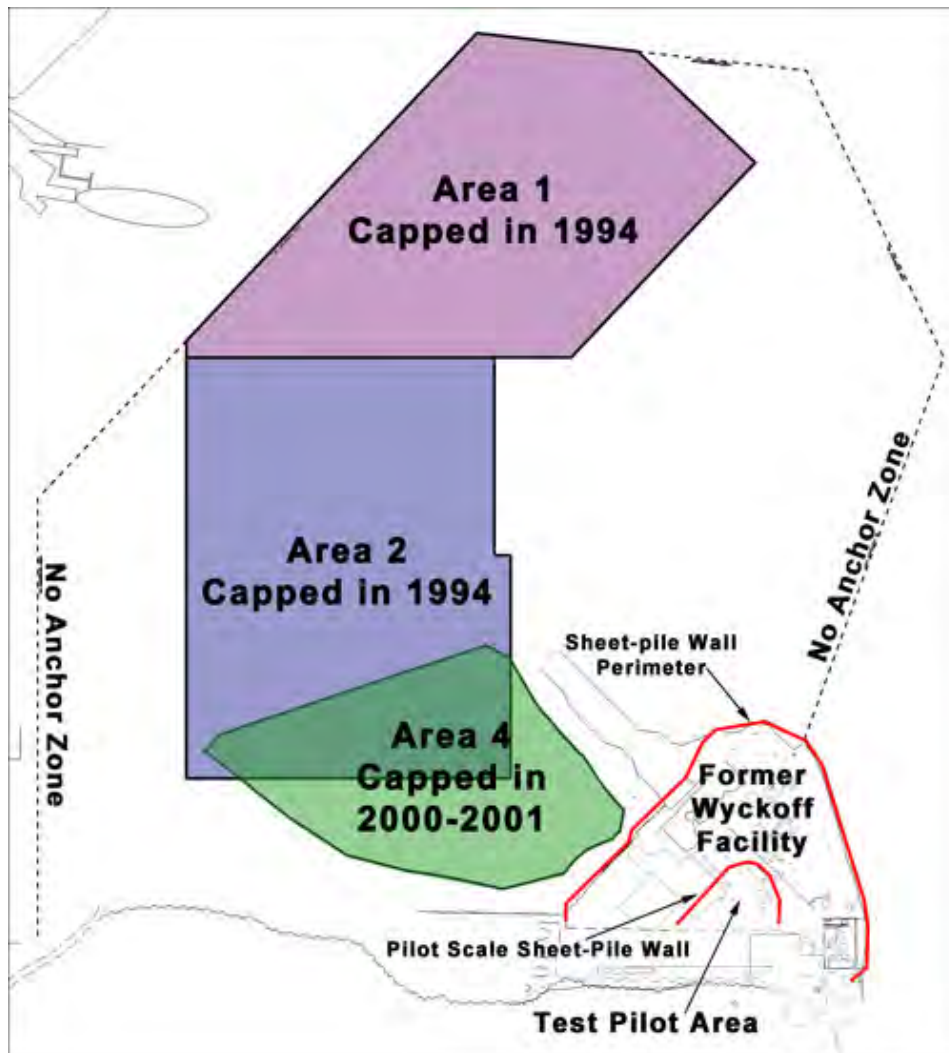


N 47.61681° W 122.50657°

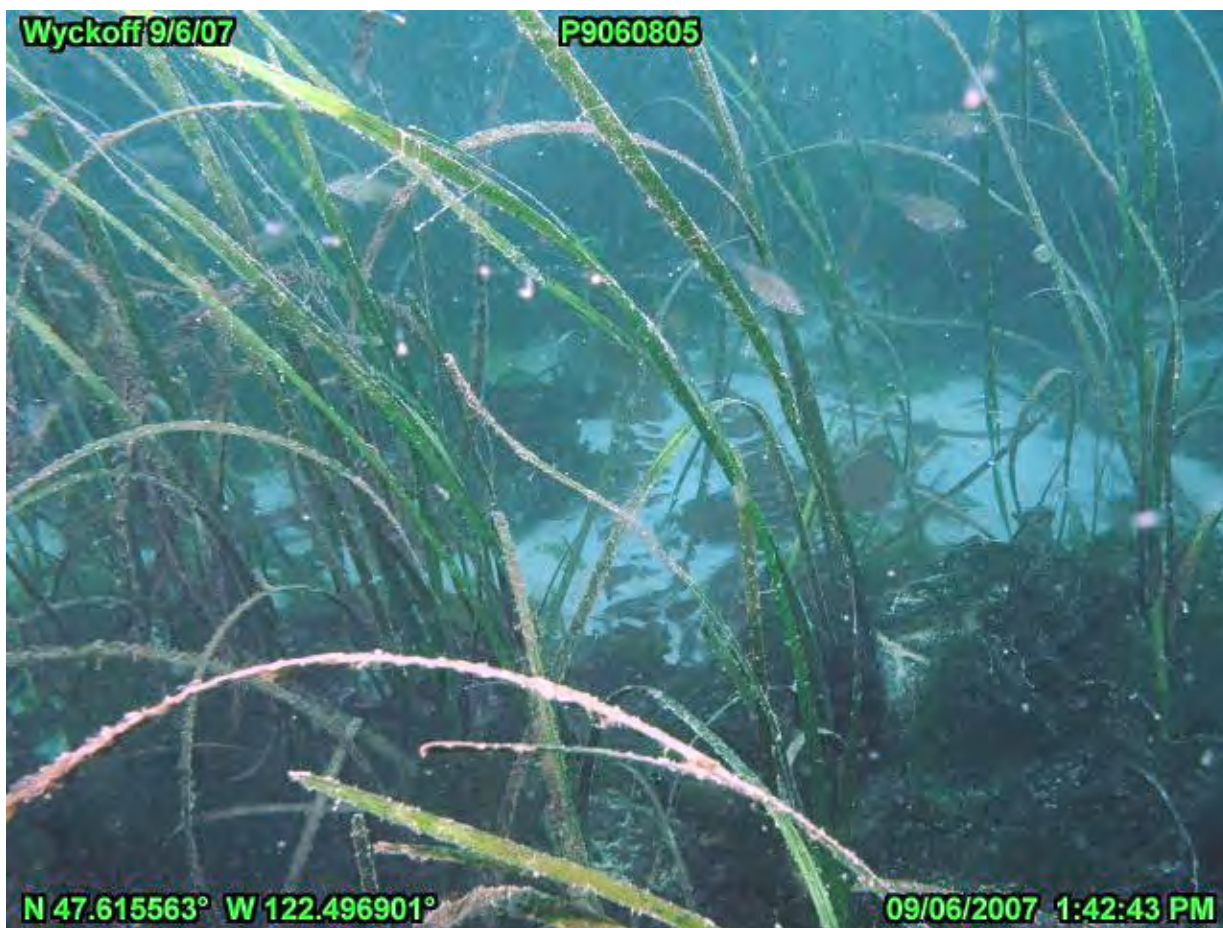
119°

03/08/2007

An object located as part of the pre-capping survey in 2007.



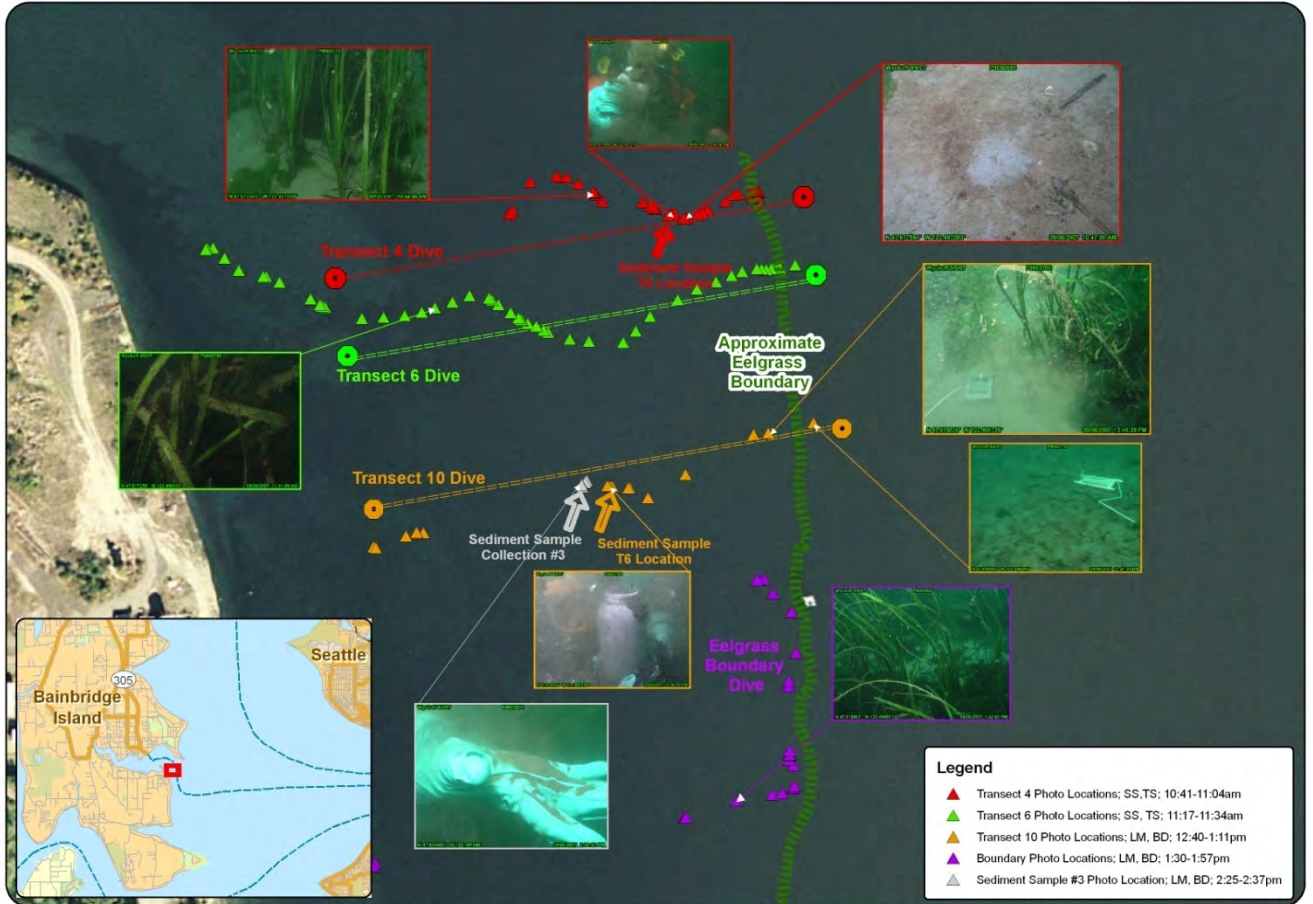
Map of areas capped at the Wyckoff Site. Note that parts of Area 4 were capped again in 2008.



Picture of an eelgrass bed being mapped in 2007.



Diver mapping the perimeter of the eelgrass bed at the Wyckoff Superfund Site.



The U.S. Environmental Protection Agency (EPA) has compiled this computer representation from data or information sources that may not have been verified by the EPA. This data is offered here as a general representation only, and is not to be re-used without verification by an independent professional qualified to verify such data or information. The EPA does not guarantee the accuracy, completeness, or timeliness of the information shown, and shall not be liable for any loss or injury resulting from reliance upon the information shown.

Wyckoff Eelgrass Survey Sept 6th 2007
US ACE / US EPA

0 100 200 400 Feet

TS, September 6th 2007

- Legend**
- ▲ Transect 4 Photo Locations; SS,TS; 10:41-11:04am
 - ▲ Transect 6 Photo Locations; SS, TS; 11:17-11:34am
 - ▲ Transect 10 Photo Locations; LM, BD; 12:40-1:11pm
 - ▲ Boundary Photo Locations; LM, BD; 1:30-1:57pm
 - ▲ Sediment Sample #3 Photo Location; LM, BD; 2:25-2:37pm



Diver conducting eelgrass counts near the Wyckoff Superfund Site.



Photo of a flux chamber sampled in 2011, at right.



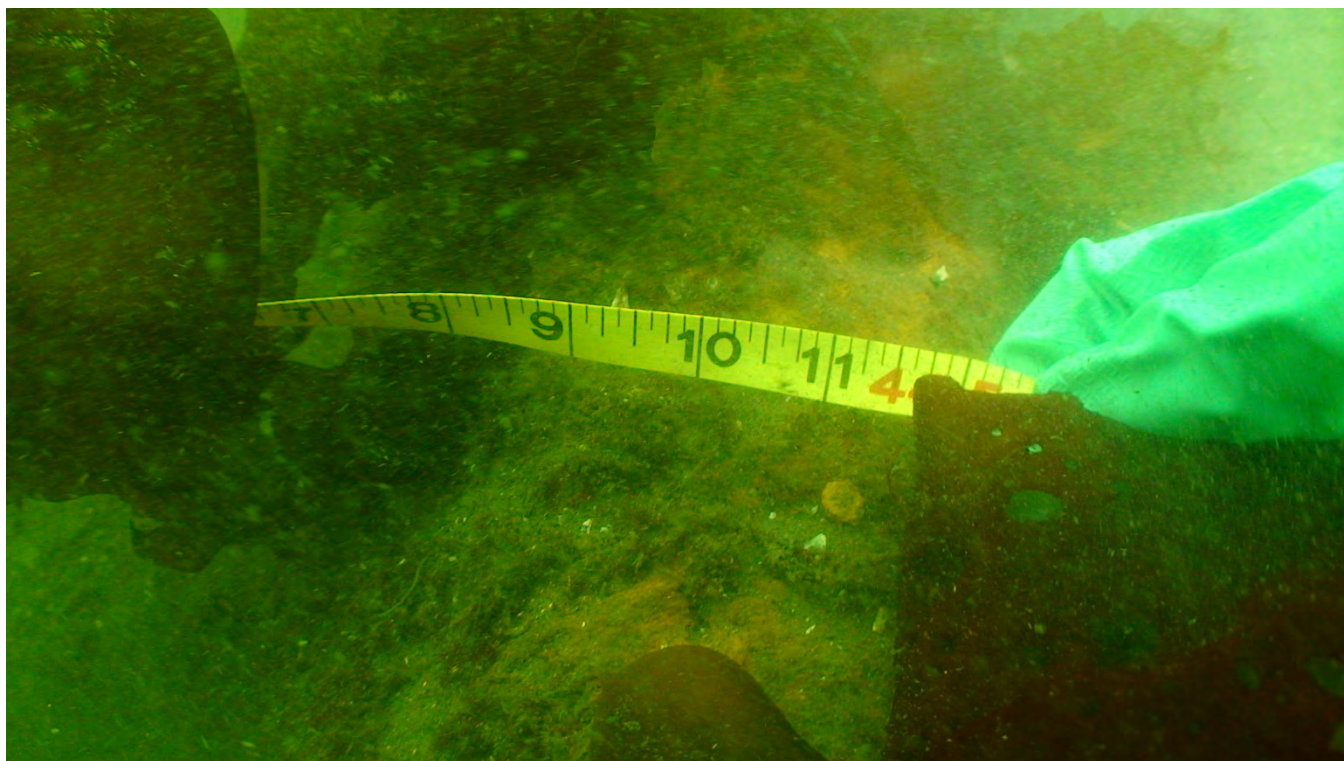
Surface supplied dive equipment was used to search for flux chambers in 2011.



Diver using a helmet camera to show objects to topside support.



Divers mapping the outfall configuration in 2013 with a towed GPS raft.



Measuring pipeline diameter.



Documenting outfall leakage. Note the freshwater diffracts ambient light differently than the saltwater.



Diver Brent Richmond installs a passive sampler in the seafloor in November, 2013 to evaluate the need for cleanup in the east and north beach areas.

Return to [EPA Region 10 Dive Unit](#) homepage.