

Padilla Bay (PDB) NERR Water Quality Metadata
January – December 2004
Latest Update: June 30, 2025

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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Contact Persons:

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2) Entry verification:

The data are downloaded from the YSI 6600 sondes to a Windows based PC. Graphs of all data are printed using EcoWatch software and are examined for suspect, anomalous, or outlying data and notes are made of any unusual data during the deployment. Files are exported from EcoWatch in a comma-delimited format (.CSV) and opened in Microsoft Excel for pre-processing with the EQWin format macro that was developed by the CDMO to reformat the header columns, insert station codes, insert a corrected time column and allow the technician to remove any pre- and post-deployment data from the file. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is accepted as being the most accurate. The pre-processed file is then ready to be copied into the EQWin water.eqi file where the data are QA/QC checked and archived in a database. EQWin queries, reports and graphs are used to discover data set outliers (values which fall outside the range that the instrument is designed to measure) and large changes in the data. EQWin is also used to generate statistics, view graphs, create customized queries and reports of the data, cross query the water, weather and nutrient data and finally export the data to the CDMO. Edited and raw files are archived on a PC hard drive and on a Macintosh hard drive at Padilla Bay NERR. Robin Cottrell completed this process of entry verification for the 2004 data. Robin Cottrell and Douglas Bulthuis completed final verification and this metadata documentation.

3) Research objectives:

The Bay View Channel site has been set out to detect and monitor short-term variability and long-term changes in the southern part of Padilla Bay. The Ploeg Channel site has been set out to detect and monitor short-term variability and long-term change in the northern part of Padilla Bay for comparison and contrast with water quality in the

southern part of the bay. The Joe Leary Slough site has been set at the mouth of the slough to measure the effects of tidal "closure" of the tide gates on water in the slough and to detect long-term changes in water quality in the slough associated with an implementation of a non point source pollution watershed action plan. The Gong site has been set in the deep water strait west of the northern part of Padilla Bay to monitor short-term variability and long-term change in the waters that are a source for the tidal waters flowing into Padilla Bay. Both surface (1.5 m below the surface) and bottom waters (2.0 m above the bottom, about 20 m deep) are being monitored to detect any vertical differences. The four sites are set up to provide an indication of the salinity gradient from Joe Leary Slough (freshwater) through Bayview Channel (downstream of freshwater sources from Indian and No Name Sloughs) to Ploeg Channel (remote from freshwater sources but in a tidal channel) to Gong on the marine end of the gradient. Measurements are taken every 30 minutes at all sites unless otherwise noted in data anomalies.

4) Research methods:

YSI 6600 sondes were deployed in Joe Leary Slough in a vertical position, 1.7 m from the bottom of the slough in a 4 in. diameter PVC pipe with a metal bar secured at the bottom as a stop. That portion of pipe around the sensors is cut out so that only two one-inch wide strips of deployment pipe remain around the sensor guard to allow water circulation around the probes. The PVC pipe is attached to a steel pipe that was driven into the sediment. (This slough was dredged in the fall of 2000 so the area of deployment is much deeper than it had been the previous 5 years. To keep the data comparable the YSI is deployed at the same height relative to Mean Sea Level.)

YSI 6600 sondes were deployed in Padilla Bay in a tributary of Bayview Channel. They were deployed using the same design as that in Joe Leary Slough, except that the PVC pipe was attached to two steel pipes. To keep marine fauna from interfering with operation of the sensors "Gutter Guard" (a sheet of plastic $\frac{1}{4}$ " mesh) is formed into a cylinder to fit inside the sensor guard. The depth of the YSI was -1.1 m (depth below MLLW) and about 0.75 m above the bottom along the sloping edge of a small channel draining the surrounding intertidal flats.

YSI 6600 sondes were deployed in Ploeg Channel using the same design as that in Bayview Channel including the use of mesh to protect the sensors. The depth of the datalogger was -1.54 m (depth below MLLW) and 0.5 m above the bottom along the sloping edge of a channel draining the surrounding intertidal flats.

Two YSI 6600 sondes were deployed at Gong site at two depths suspended from a single buoy: 1.5 m below the surface and 2.0 m above the bottom in 18-20 m water depth (only the surface site data is reported to CDMO). The dataloggers were secured to the line with YSI mooring clamps. The deep datalogger was deployed at about -18 m (depth below MLLW) on a gradual slope that is intertidal on the Padilla Bay side and goes down to about 75 m near the Guemes Island side of the strait. A subsurface buoy was attached to it to keep the sensors above the sediment surface during tidal fluctuations.

In all cases, measurements of temperature, specific conductivity, salinity, percent saturation of dissolved oxygen, depth, pH and turbidity are recorded every half hour. At the end of each deployment, the YSI 6600 is brought back into the laboratory for downloading, cleaning, and recalibration. Before final cleaning and recalibration a post-deployment check is done that consists of recording sensor readings in the standard solutions. The results of these checks are used to help evaluate the validity of the logged data.

All calibrations are conducted according to the protocols in the YSI Environmental Operations Manual for the 6-Series Environmental Monitoring Systems. For the conductivity calibration a conductivity standard of 50 mS/cm was used. The pH calibration is a 2-point calibration using standard buffer solutions with a pH of 7 and 10. The KCl solution and Teflon membrane on the dissolved oxygen probe are changed prior to each YSI 6600 deployment and the new oxygen membrane is allowed to stabilize overnight in water saturated air before calibration. A 2-point calibration is used for the turbidity probe and the wiper pad is changed prior to each deployment. The standards used are distilled/deionized water for zero and 4000 NTU Formazin solution diluted to 100 NTU.

5) Site location and character:

General: Padilla Bay (48° 30' N; 122° 30' W) is a shallow embayment in northern Puget Sound. The tide flats are dominated by the eelgrass *Zostera marina*, which covers approximately 3,000 ha. *Zostera japonica*, a recent invader to the region, now covers about 350 ha of the bay. Tides are mixed semi-diurnal with a mean range of 1.55 m. Salinity varies from about 15 to 30 PSU.

Padilla Bay is an "orphaned" estuary in that the Skagit River no longer empties directly into it. Most of the land in the 9300 ha Padilla Bay watershed is agricultural, and is drained by four sloughs which empty into the bay. The salinity in Padilla Bay reflects both the sloughs that flow into the bay and the greater Puget Sound-Georgia Basin estuary in which Padilla Bay is located. Major freshwater flows into this area of the Puget Sound-Georgia Basin estuary come from the Fraser and Nooksack Rivers to the north and from the Skagit River to the south.

Joe Leary Slough Site: (48° 31' 05.3" N; 122° 28' 22.8" W) Joe Leary Slough drains land that is predominantly annual crop agriculture and pasture land with some low-density housing. The slough is characterized by high fecal and nutrient inputs, high turbidity, and low dissolved oxygen concentrations. During the summer, there is low flow and the depth ranges from 0.5-1.5 m. During winter flooding, the slough can reach a depth of 4 m. There is a dam at the mouth of the slough with twelve 4 ft. diameter outfall pipes that have one-way hinged tide gates. Upstream water flows out of Joe Leary Slough when water height in Padilla Bay is lower than water height in Joe Leary Slough (i.e. ebbing tide and low water). Some saline water from Padilla Bay seeps through the tide gates during high water. The bottom of the slough is composed of very soft sediment, which is periodically dredged, most recently October 2000. The deployment site is on the

freshwater side of the tide gates. The latitude/longitude were measured with a Trimble GeoExplorer II and differentially corrected with post processing providing a manufacturer's stated accuracy of ± 5 m.

Bayview Channel Site: (48° 29' 46.6" N; 122° 30' 01.8" W) Bayview Channel, a major Padilla Bay tributary/distributary, floods and drains intertidal flats including eelgrass beds, mats of macroalgae, and flats without macro-vegetation. The datalogger is located in a tributary channel to Bayview Channel in water at a depth of -1.8 m below MLLW. The tributary drains predominately eelgrass (*Zostera marina* and *Z.Japonica*) covered intertidal flats. Bottom sediments beneath the deployment site are fine silt and clay overlying sand. Pollutants entering the bay include general non-point source, agricultural non-point source, and fecal coliform bacteria from agriculture, failing septic tanks and wildlife. The latitude/longitude were measured with a Trimble GeoExplorer II and differentially corrected with post processing providing a manufacturer's stated accuracy of ± 5 m.

Ploeg Channel Site: (48° 33' 23.5" N; 122° 31' 46.7" W) Ploeg Channel floods and drains intertidal flats at the north end of Padilla Bay that are comprised of mud flats and eelgrass beds (*Zostera marina* and *Z.Japonica*) in approximately equal amounts. Bottom sediments beneath the deployment site are fine silt. Depth at this site is -2.0 m (depth below MLLW). Pollutants entering the bay include general non-point source, agricultural non-point source, and fecal coliform bacteria from agriculture, failing septic tanks and wildlife. The latitude/longitude were measured with a Trimble GeoExplorer II and differentially corrected with post processing providing a manufacturer's stated accuracy of ± 5 m.

Gong Site: (48° 33' 30" N; 122° 34' 21" W) The Gong site is located at -18 m on a gradually sloping bottom (from -1 m to -75 m over 2 Km) in the strait between Samish and Guemes Islands. Water in the strait flows north and south with tidal currents, the net water movement is apparently south toward the inlet to Guemes Channel. Water from the strait flows onto the intertidal flats in the northern part of Padilla Bay with each tidal cycle. Bottom sediments are mud. Depth at this site is 18-20 m. The only apparent pollution sources are the general sources of pollution to the Strait of Georgia and Northwest Straits. The latitude/longitude were measured with a Trimble GeoExplorer II and differentially corrected with post processing providing a manufacturer's stated accuracy of ± 5 m. The GS sonde is a surface sonde that is attached to a floating buoy. The sonde sits in a tube built into the buoy and there is a bolt at the bottom of the tube which sits 1 m below the surface, therefore the sonde's position does not change relative to the buoy. The depth data collected by the sonde reflects the depth the sonde is under the surface of the water. The buoy, and therefore sonde, experiences wave action, unlike the stable platform of the other sites. Any changes in depth are from barometric pressure changes (prior to correction) and wave action. The overall depth at the buoy location changes based on the fluctuation of the tide and ranges from 16 to 21m. The buoy is anchored to the bottom (~ 18 m) with a 13 ft helical anchor.

6) Data collection period:

Data collection was continuous from January 1 to December 31 2004 at Joe Leary Slough, Bayview Channel, Ploeg Channel and Gong Surface sites (except as noted in section 13, Missing data).

Deployment and retrieval times are listed below. The times indicate the first and last measurements made with each deployment.

BEGAN

ENDED

Bayview Channel Site

12/30/03	15:00:00	01/15/04	09:00:00
01/15/04	09:30:00	02/10/04	11:30:00
02/10/04	12:00:00	03/04/04	15:00:00
03/04/04	15:30:00	03/19/04	14:00:00
03/19/04	14:30:00	04/08/04	10:00:00
04/08/04	10:30:00	04/28/04	10:00:00
04/28/04	10:30:00	05/12/04	10:00:00
05/12/04	10:30:00	05/25/04	09:00:00
05/25/04	09:30:00	06/09/04	09:30:00
06/09/04	10:00:00	06/22/04	11:30:00
06/22/04	12:00:00	07/12/04	09:00:00

Site deployment pole knocked down, no data 07/6 21:30 – 07/20 15:30

07/20/04	16:00:00	08/04/04	09:00:00
08/04/04	09:30:00	08/19/04	09:00:00
08/19/04	09:30:00	09/02/04	09:30:00
09/02/04	10:00:00	09/17/04	08:30:00
09/17/04	09:00:00	10/05/04	14:00:00
10/05/04	14:30:00	10/20/04	14:00:00
10/20/04	14:30:00	11/03/04	11:00:00
11/03/04	12:00:00*	11/17/04	11:30:00
11/17/04	12:00:00	12/01/04	14:00:00
12/01/04	15:00:00*	12/15/04	10:30:00
12/15/04	11:00:00	01/05/05	14:30:00

*Missed first sample while switching out instruments.

Ploeg Channel Site

12/30/03	15:00:00	01/20/04	15:00:00
01/20/04	15:30:00	02/10/04	11:00:00
02/10/04	11:30:00	03/04/04	14:30:00
03/04/04	15:00:00	03/19/04	14:30:00
03/19/04	15:00:00	04/08/04	09:00:00
04/08/04	09:30:00	04/28/04	10:00:00
04/28/04	10:30:00	05/02/04	19:00:00

Battery compartment flooded, no data 05/02 19:30 - 05/12 09:30

05/12/04	10:00:00	05/25/04	09:00:00
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05/25/04	09:30:00	06/09/04	09:30:00
06/09/04	10:00:00	06/22/04	10:00:00
06/22/04	10:30:00	07/08/04	09:00:00
07/08/04	09:30:00	07/23/04	09:30:00
07/23/04	10:00:00	08/04/04	09:30:00
08/04/04	10:00:00	08/19/04	10:00:00
08/19/04	10:30:00	09/02/04	09:00:00
09/02/04	09:30:00	09/17/04	09:00:00
09/17/04	09:30:00	10/05/04	13:30:00
10/05/04	14:00:00	10/20/04	13:30:00
10/20/04	14:00:00	11/03/04	10:30:00
11/03/04	11:00:00	11/17/04	12:00:00
11/17/04	12:30:00	12/01/04	14:30:00
12/01/04	15:00:00	12/15/04	10:30:00
12/15/04	11:00:00	01/05/05	15:00:00

Joe Leary Site

12/23/03	14:00:00	01/08/04	09:30:00
01/08/04	10:00:00	01/23/04	11:00:00
01/23/04	11:30:00	02/13/04	11:00:00
02/13/04	11:30:00	02/27/04	11:30:00
02/27/04	12:00:00	03/10/04	13:30:00
03/10/04	14:00:00	03/24/04	15:00:00
03/24/04	15:30:00	04/16/04	12:30:00
04/16/04	13:00:00	04/30/04	10:00:00
04/30/04	10:30:00	05/14/04	10:00:00
05/14/04	10:30:00	05/26/04	13:30:00
05/26/04	14:00:00	06/11/04	10:00:00
06/11/04	10:30:00	06/21/04	13:00:00
06/21/04	13:30:00	07/09/04	10:30:00
07/09/04	11:00:00	07/23/04	08:00:00
07/23/04	08:30:00	08/06/04	12:00:00
08/06/04	12:30:00	08/19/04	08:00:00
08/19/04	08:30:00	09/09/04	12:30:00
09/09/04	13:00:00	09/29/04	12:30:00
09/29/04	13:00:00	10/14/04	12:30:00
10/14/04	13:00:00	10/26/04	15:00:00
10/26/04	15:30:00	11/09/04	13:30:00
11/09/04	14:00:00	11/24/04	11:00:00
11/24/04	11:30:00	12/09/04	09:30:00
12/09/04	10:00:00	12/22/04	12:00:00
12/22/04	12:30:00	01/11/05	10:30:00

Gong, surface Site

12/31/03	09:30:00	01/20/04	14:30:00
01/20/04	15:00:00	02/11/04	09:30:00

02/11/04	10:00:00	03/04/04	14:00:00
03/04/04	14:30:00	03/22/04	11:00:00
03/22/04	11:30:00	04/08/04	09:30:00
04/08/04	10:00:00	04/28/04	09:30:00
04/28/04	10:00:00	05/12/04	09:30:00
05/12/04	10:00:00	05/25/04	09:30:00
05/25/04	10:00:00	06/02/04	06:30:00
Site deployment system down, no data 06/02 07:00 – 06/15 10:30			
06/15/04	11:00:00	07/08/04	09:30:00
07/08/04	10:30:00*	07/23/04	10:00:00
07/23/04	10:30:00	08/04/04	09:30:00
08/04/04	10:00:00	08/19/04	10:30:00
08/19/04	11:00:00	09/02/04	08:30:00
Site deployment system down, no data 09/02 09:00 – 10/07 09:30			
10/07/04	10:00:00	10/20/04	13:00:00
10/20/04	13:30:00	11/03/04	10:00:00
11/03/04	10:30:00	11/17/04	12:30:00
11/17/04	13:00:00	12/01/04	15:00:00
12/01/04	16:00:00*	12/15/04	10:00:00
12/15/04	11:00:00*	01/05/05	15:30:00

*Missed first sample while switching out instruments.

7) Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program, NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from the NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see section 1. Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under general information link on CDMO homepage) and online at

the CDMO homepage <http://cdmo.baruch.sc.edu/>. Data are available in text tab-delimited format.

8) Associated researchers and projects:

None

II. Physical Structure Descriptors

9) Sensor Specifications:

YSI 6600/6600 EDS datalogger

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Thermistor

Model #: 6560

Range: -5 to 45 °C

Accuracy: +/-0.15 °C

Resolution: 0.01 °C

Parameter: Conductivity

Units: milli-Siemens per cm (mS/cm)

Sensor Type: 4-electrode cell with autoranging

Model #: 6560

Range: 0 to 100 mS/cm

Accuracy: +/-0.5% of reading + 0.001 mS/cm

Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependent)

Parameter: Salinity

Units: parts per thousand (ppt)

Sensor Type: Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: +/- 1.0% of reading or 0.1 ppt, whichever is greater

Resolution: 0.01 ppt

Parameter: Dissolved Oxygen % saturation

Units: percent air saturation (%)

Sensor Type: Rapid Pulse - Clark type, polarographic

Model #: 6562

Range: 0 to 500 % air saturation

Accuracy: 0-200 % air saturation, +/- 2 % of the reading or 2 % air saturation, whichever is greater; 200-500 % air saturation, +/- 6 % of the reading

Resolution: 0.1 % air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature and salinity)

Units: milligrams per Liter (mg/L)

Sensor Type: Rapid Pulse - Clark type, polarographic

Model #: 6562

Range: 0 to 50 mg/L

Accuracy: 0 to 20 mg/L, +/- 2 % of the reading or 0.2 mg/L, whichever is greater; 20 to 50 mg/L, +/- 6 % of the reading

Resolution: 0.01 mg/L

Parameter: Non-Vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 30 ft (9.1 m)

Accuracy: +/- 0.06 ft (0.018 m)

Resolution: 0.001 ft (0.001 m)

Parameter: Non-Vented Level - Medium (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 200 ft (61 m)

Accuracy: +/- 0.4 ft (0.12 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH (specify whether EDS probe or not)

Units: units

Sensor Type: Glass combination electrode

Model #: 6561

Range: 0 to 14 units

Accuracy: +/- 0.2 units

Resolution: 0.01 units

Parameter: Turbidity

Units: nephelometric turbidity units (NTU)

Sensor Type: Optical, 90 ° scatter, with mechanical cleaning

Model #: 6136

Range: 0 to 1000 NTU

Accuracy: +/- 5 % reading or 2 NTU (whichever is greater)

Resolution: 0.1 NTU

Dissolved Oxygen qualifier: The reliability of the dissolved oxygen (DO) data after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Many reserves have upgraded to the YSI 6600 EDS data sondes, which increases DO accuracy and longevity by reducing the environmental effects of fouling. (After June 2004 all of the sondes used at PBNERR were YSI 6600 EDS instruments.) The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period. However, this

potential drift is not always problematic for some uses of the data, i.e. periodicity analysis. It should also be noted that the amount of fouling is very site specific and that not all data are affected. The Research Coordinator at the specific NERR site should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor.

Depth qualifier: The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either depth or water level sensors. Both sensors measure water depth, but by convention, level sensors refer to atmospherically vented measurements and depth refers to non-vented measurements. Standard calibration protocols for the non-vented sensor use the atmospheric pressure at the time of calibration. Therefore, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.03cm for every 1millibar change in atmospheric pressure. This error is eliminated for level sensors because they are vented to the atmosphere throughout the deployment time interval. If proper atmospheric pressure data are available, non-vented sensor depth measurements can be corrected for deployments between calibrations. Readings for both vented and non-vented are automatically compensated for water density changes due to variations in temperature and salinity. The Research Coordinator at the specific NERR site should be contacted in order to obtain information regarding atmospheric pressure data availability. (All instruments at PBNERR are non-vented.)

10) Coded variable indicator and variable code definitions:

Sampling station:	Sampling site code:	Station code:
Bayview Channel	BY	pdbbywq
Ploeg Channel	BP	pdbbpwq
Joe Leary	JL	pdbjlwq
Gong Surface	GS	pdbgswq

11) Anomalous/Suspect Data:

January 1-31, 2004

Bayview channel

The cause of low salinity values on 01/21/2004 at 22:30:00 is unknown.

Ploeg Channel

Joe Leary

Gong Surface

None

February 1 – 28, 2004

Bayview Channel

None

Ploeg Channel

None

Joe Leary

Gong Surface

For the period of 02/11/04, 10:00:00 to 02/29/04, 23:30:00 the dissolved oxygen post-calibration value was low, 82.5%, cause is unknown so DO values during this time should be interpreted with caution.

March 1 – 31, 2004

Bayview Channel

None

Ploeg Channel

None

Joe Leary

None

Gong Surface

For the period of 03/01/04, 00:00:00 to 03/04/04, 14:00:00 the dissolved oxygen post-calibration value was low, 82.5%, cause is unknown so DO values during this time should be interpreted with caution.

April 1 – 30, 2004

Bayview Channel

None

Ploeg Channel

None

Joe Leary

None

Gong Surface

None

May 1 – 31, 2004

Bayview Channel

None

Ploeg Channel

None

Joe Leary
None

Gong Surface
None

June 1 – 30, 2004
Bayview Channel
None

Ploeg Channel
None

Joe Leary
None

Gong Surface
None

July 1 – 31, 2004
Bayview Channel
None

Ploeg Channel
Negative DO outliers were reported sporadically from 07/21 00:00 - 07/22 08:00. The range of measurements for this deployment went up to 222 %, so a -3 % is still within the +/- 2% accuracy of the probe, therefore these readings should be interpreted as zero.

Joe Leary
None

Gong Surface
None

August 1 – 31, 2004
Bayview Channel
None

Ploeg Channel
The cause is unknown for low salinity readings from 21:30:00 on 8/18/04 through 08/19/04 at 01:30:00.

Joe Leary
None

Gong Surface
None

September 1 – 30, 2004
Bayview Channel
None

Ploeg Channel
None

Joe Leary
None

Gong Surface
None

October 1 – 31, 2004
Bayview Channel
None

Ploeg Channel
None

Joe Leary
None

Gong Surface
None

November 1 – 30, 2004

Bayview Channel
None

Ploeg Channel
The cause is unknown for a dip in salinity from 11/12/04, 18:30:00 to 11/13/04, 02:30:00.

Joe Leary
None

Gong Surface
None

December 1 – 31, 2004
Bayview Channel

None

Ploeg Channel

None

Joe Leary

None

Gong Surface

None

12) Deleted Data:

January 1-31, 2004

Bayview Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

01/06/04 05:30:00

01/07/04 09:30:00

01/10/04 10:00:00

01/20/04 06:00:00

01/24/04 17:30:00

All dissolved oxygen data were deleted from 01/01/2004, 00:00:00 to 01/15/2004, 09:00:00 because the DO membrane was damaged, time of damage could not be determined.

Ploeg Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

01/14/04 09:30:00

01/21/04 01:30:00

01/28/04 16:00:00

Joe Leary

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

01/01/04 18:00:00, 18:30:00

01/16/04 19:00:00, 19:30:00

All turbidity data were deleted from 01/19/04, 14:30:00 to 01/23/04, 11:00:00 because they were consistently over 1800 NTU, probably caused by debris blocking the sensor.

Gong Surface

None

February 1 – 28, 2004

Bayview Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

02/18/04	02:00:00
02/20/04	01:00:00
02/23/04	12:00:00

Ploeg Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

02/04/04	02:00:00
02/05/04	00:00:00, 03:30:00, 08:30:00
02/06/04	03:00:00
02/07/04	12:00:00
02/14/04	01:00:00, 02:00:00, 02:30:00
02/20/04	15:30:00

Joe Leary

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

02/05/04	18:30:00
02/07/04	19:00:00
02/16/04	17:30:00

Gong Surface

None

March 1 – 31, 2004

Bayview Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

03/03/04	00:00:00
03/14/04	16:00:00

Ploeg Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

03/06/04	07:30:00
03/07/04	16:30:00
03/10/04	09:30:00
03/13/04	09:00:00
03/16/04	06:30:00
03/17/04	06:30:00

Joe Leary

During the following periods turbidity data were deleted because they were high and erratic, cause unknown although it is not uncommon for debris to cause interference at this site.

03/08/04	10:00:00
03/16/04	16:30:00
03/17/04	17:30:00 to 03/18/04 08:30:00
03/18/04	18:30:00 to 03/19/04 01:30:00
03/19/04	04:30:00, 09:00:00
03/20/04	07:30:00
03/23/04	10:00:00, 12:30:00
03/24/04	09:30:00 to 15:00:00
03/28/04	09:30:00

Gong Surface

During the following period turbidity data was deleted because it was high and erratic, cause unknown:

03/28/04	14:00:00
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April 1 – 30, 2004

Bayview Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

04/10/2004	14:30:00
04/11/2004	23:30:00
04/18/2004	10:00:00
04/19/2004	04:30:00
04/20/2004	09:00:00
04/26/2004	01:00:00
04/27/2004	23:30:00

Ploeg Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

04/07/04	01:30:00
04/08/04	05:30:00, 07:30:00, 16:00:00, 18:00:00, 20:00:00
04/10/04	03:30:00, 19:30:00
04/12/04	11:30:00
04/13/04	22:00:00
04/27/04	13:00:00

Joe Leary

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

04/01/04	19:30:00
04/03/04	18:30:00, 23:30:00
04/04/04	23:30:00

04/08/04 11:00:00
04/10/04 21:00:00, 21:30:00

Gong Surface

During the following periods turbidity data were deleted because they were high and erratic, this may be due to kelp observed in the water and on the line when the instrument was retrieved on 04/28/04.

04/03/04 14:30:00
04/12/04 23:30:00
04/13/04 00:00:00, 00:30:00
04/23/04 21:00:00
04/24/04 22:30:00, 23:00:00
04/25/04 05:00:00, 07:00:00, 08:30:00, 12:00:00, 17:30:00, 19:30:00, 23:30:00
04/26/04 12:00:00, 19:30:00

May 1 – 31, 2004

Bayview Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

05/12/2004 15:00:00
05/23/2004 08:30:00
05/26/04 23:30:00

Ploeg Channel

During the following periods turbidity data were deleted because they were high and erratic, cause unknown:

05/02/04 17:30:00
05/12/04 13:00:00
05/18/04 13:00:00
05/19/04 07:30:00
05/24/04 17:00:00, 19:00:00

All turbidity data were deleted from 05/25/04, 09:30:00 to 05/31/04, 00:00:00 because the turbidity probe was defective.

Joe Leary

During the following periods turbidity data were above the sensors top range of measurement limit so they were deleted, cause unknown:

05/23/04 13:30:00
05/24/04 06:30:00, 07:00:00
05/25/04 11:30:00
05/26/04 14:00:00

Gong Surface

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

05/18/04 13:00:00

05/21/04 20:00:00
05/23/04 11:00:00
05/24/04 08:30:00, 23:00:00
05/29/04 08:30:00
05/31/04 08:00:00, 13:00:00, 13:30:00, 15:30:00, 17:30:00, 21:30:00

June 1 – 30, 2004

Bayview Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

06/01/04 07:00:00

06/23/04 05:30:00

All data were deleted for the following periods because it appears that the datalogger was out of the water (salinity values < 1ppt) during these low tides that included the lowest tide of the year, -3.9 on 06/04/04:

06/03/2004 10:30:00, 11:00:00

06/04/2004 11:00:00, 11:30:00, 12:00:00

06/05/2004 12:00:00

All turbidity data were deleted from 06/09/04 at 10:00:00 to 06/22/04 at 11:30:00 due to a malfunctioning turbidity probe.

Ploeg Channel

All turbidity data were deleted from 06/01/04, 00:30:00 to 06/09/04, 09:30:00 due to a malfunctioning turbidity probe.

Joe Leary

During the following period turbidity data was deleted because it was high and erratic, cause unknown:

06/26/04 09:00:00

Gong Surface

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

06/01/04 00:30:00, 04:30:00, 06:00:00, 06:30:00, 07:00:00, 08:00:00

On 06/01/04 between 10:30:00 and 11:00:00, the mooring line with the datalogger attached broke loose and drifted west to Cypress Island where it was retrieved on 06/02/04. All data from 06/01/04, 11:00:00 to 06/02/04, 06:30:00 has been deleted.

All turbidity data was deleted from 06/27/04, 08:00:00 to 06/30/04, 23:30:00 because the turbidity data were high and erratic. The anchor had drifted and the deployment line had become entangled with the mooring line at this site interfering with the turbidity readings, there is no indication in the data that any of the other sensors were affected.

July 1 – 31, 2004

Bayview Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

07/28/04 14:30:00

All data were deleted for the following periods because it appears that the datalogger was out of the water during these extreme low tides with salinity values near zero:

07/02/04 10:00:00, 10:30:00

07/03/04 11:00:00, 11:30:00

07/04/04 12:00:00

Ploeg Channel

During the following period turbidity data was high and erratic so it was deleted, cause unknown:

07/09/04 14:00:00

Joe Leary

None

Gong Surface

All turbidity data was deleted from 07/01/04, 00:00:00 to 07/08/04, 09:30:00 because the turbidity data were high and erratic. The anchor had drifted and the deployment line had become entangled with the mooring line at this site causing optical interference with the turbidity readings, there is no indication in the data that any of the other sensors were affected.

During the following period turbidity data were deleted because it was high and erratic, cause unknown:

07/14/04 14:00:00

August 1 – 31, 2004

Bayview Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

08/01/04 00:30:00

08/10/04 14:30:00

08/17/04 02:00:00

08/31/04 04:00:00

Ploeg Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

08/01/04 16:30:00

08/04/04 13:30:00, 14:00:00

08/08/04 07:30:00

08/10/04 05:00:00, 08:30:00

08/13/04 12:30:00

08/14/04 11:00:00

08/20/04 00:00:00, 03:30:00, 04:30:00

08/23/04 17:30:00

08/29/04 07:30:00

08/31/04 04:30:00, 10:30:00, 15:30:00

Joe Leary

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

08/22/04 06:30:00

08/24/04 16:00:00

Gong Surface

None

September 1 – 30, 2004

Bayview Channel

During the following period turbidity data was high and erratic so it was deleted, cause unknown:

09/21/04 06:00:00

Ploeg Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

09/01/04 13:00:00

09/06/04 09:30:00

09/14/04 22:30:00

Joe Leary

None

Gong Surface

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

09/01/04 16:00:00

09/02/04 05:00:00

October 1 – 31, 2004

Bayview Channel

During the following periods the turbidity data were high and erratic so they were deleted, cause unknown:

10/02/04 18:30:00

10/20/04 18:30:00

Ploeg Channel

During the following period the turbidity data were high and erratic so it was deleted, cause unknown:

10/14/04 22:00:00

10/18/04 20:30:00, 22:00:00

Joe Leary
None

Gong Surface
None

November 1 – 30, 2004

Bayview Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

11/05/04 16:00:00

11/12/04 13:00:00

Dissolved oxygen was deleted from 11/15/04, 09:00:00 to 11/17/04, 11:30:00 because the DO membrane was damaged during deployment.

Ploeg Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

11/03/04 20:30:00

11/16/04 13:00:00

11/20/04 01:30:00

Joe Leary

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

11/01/04 11:00:00, 15:00:00, 16:30:00

11/11/04 17:00:00

11/15/04 04:30:00

11/18/04 17:30:00

Gong Surface
None

December 1 – 31, 2004

Bayview Channel

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

12/10/04 06:30:00

12/11/04 00:00:00, 00:30:00

12/27/04 09:00:00

Ploeg Channel

All turbidity data were deleted from 12/01/04, 15:00:00 to 12/15/04, 10:30:00 because the wiper on the turbidity probe was missing when the instrument was retrieved.

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

12/19/04 22:30:00
12/28/04 15:00:00
12/30/04 23:00:00

Joe Leary

During the following periods turbidity data were high and erratic so they were deleted, cause unknown:

12/03/04 08:00:00
12/11/04 08:00:00
12/21/04 13:30:00

All turbidity data were deleted from 12/22/04 at 12:30:00 to 12/31/04 at 23:30:00 because the wiper was missing from the turbidity probe.

Gong Surface

None

13) Missing data:

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. For more details on deleted data, see the Deleted Data Section (12.). If additional information on missing data are needed, contact the Research Coordinator at the reserve submitting the data.

Ploeg Channel

Data is missing from 05/02/04, 19:00:00 to 05/12/04, 10:00:00 because the battery compartment of the datalogger flooded shutting the instrument down during deployment.

Gong Surface

On 06/01/04 between 10:30:00 and 11:00:00, the mooring line with the datalogger attached broke loose and drifted west to Cypress Island where it was retrieved on 06/02/04. Because the mooring system had to be replaced before another datalogger could be deployed there is no data from 06/01/04, 11:00:00 until 06/15/04, 11:00:00.

Bayview Channel

The pole that the data logger was deployed on was knocked down on 07/06/04 between 21:00:00 and 21:30:00 when the depth abruptly increased by 0.8 m. There is no data from 07/06/04, 21:30:00 through 07/20/04, 15:30:00 when the pole was replaced.

Gong Surface

The main marker buoy was missing when the datalogger was retrieved on 09/02/04 so no instruments were deployed. There is no data from 09/02/04, 08:30:00 to 10/07/04, 09:30:00 when divers replaced the buoy.

14) Post deployment information

End of deployment post-calibration readings in standard solutions.

Site BY

Date pH(7) Sp. Cond (50 mS/cm) Turbidity(100NTU) DO%(Air)

01/15/04	7.08	49.80	99.6	damaged
02/10/04	7.01	49.81	98.0	103.5
03/04/04	7.24	49.62	98.0	102.6
03/19/04	7.06	49.87	98.7	100.1
04/08/04	7.02	49.58	99.5	104.1
04/28/04	7.11	50.30	100.0	110.5
05/12/04	7.04	50.08	98.8	100.4
05/25/04	7.05	49.59	99.1	101.1
06/09/04	6.99	49.98	98.8	102.0
06/22/04	7.09	50.15	bad probe*	101.7
07/12/04	6.98	50.14	97.7	97.5
08/04/04	7.08	49.94	98.2	101.0
08/19/04	7.03	49.56	99.2	101.9
09/02/04	7.04	49.45	98.3	107.0
09/17/04	7.00	48.90	98.5	101.0
10/05/04	6.99	50.26	100.9	100.0
10/20/04	7.02	49.35	99.0	102.2
11/03/04	7.00	50.75	95.8	104.1
11/17/04	7.02	50.02	98.3	damaged
12/01/04	7.07	48.96	98.3	102.0
12/15/04	7.07	49.89	97.1	106.8
01/05/05	7.03	49.65	98.5	103.3

*YSI replaced defective probe

Site BP

Date pH(7) Sp. Cond (50 mS/cm) Turbidity(100NTU) DO%(Air)

01/20/04	6.99	50.17	102.6	102.8
02/10/04	7.09	50.31	98.7	105.6
03/04/04	6.99	50.35	98.7	106.4
03/19/04	7.00	50.56	98.6	102.0
04/08/04	7.10	50.07	98.1	105.9
04/28/04	6.98	49.80	100.3	101.3
05/02/04	7.05	49.69	99.0	99.4
05/25/04	7.03	49.34	98.9	101.0
06/09/04	6.98	49.75	bad probe*	100.6
06/22/04	7.01	49.51	99.4	100.8
07/08/04	6.99	50.41	99.3	99.4
07/23/04	7.04	51.21	100.5	100.9
08/04/04	7.02	50.29	99.9	97.3

08/19/04	6.96	49.54	100.8	99.2
09/02/04	6.96	49.04	98.0	101.4
09/17/04	7.02	49.82	98.2	102.6
10/05/04	6.95	49.73	100.8	104.7
10/20/04	7.00	50.28	100.5	104.8
11/03/04	7.05	50.02	96.9	104.0
11/17/04	7.04	49.95	100.3	109.5
12/01/04	7.05	49.43	97.8	107.4
12/15/04	7.03	49.93	97.8	104.4
01/05/04	6.99	50.02	98.9	105.5

*YSI replaced defective probe

Site JL

Date	pH(7)	Sp. Cond (50 mS/cm)	Turbidity(100NTU)	DO%(Air)
01/08/04	7.07	49.49	94.4	98.9
01/23/04	7.04	49.83	101.5	99.7
02/13/04	7.01	50.50	99.1	104.1
02/27/04	7.01	49.36	100.8	93.6
03/10/04	7.05	49.64	98.2	106.1
03/24/04	7.01	49.87	97.6	102.9
04/16/04	7.03	50.70	99.0	105.3
04/30/04	7.06	49.84	98.4	108.4
05/14/04	7.02	49.06	101.0	99.6
05/26/04	7.01	49.89	95.9	104.3
06/11/04	7.05	50.42	100.7	103.4
06/21/04	7.01	49.38	98.8	99.4
07/09/04	7.00	50.22	97.9	98.5
07/23/04	7.08	49.55	98.4	101.3
08/26/04	7.11	50.00	100.8	102.1
08/19/04	7.04	50.38	99.8	104.0
09/09/04	7.02	50.24	100.6	103.2
09/29/04	7.02	50.09	100.6	100.9
10/14/04	7.10	49.20	98.4	100.5
10/26/04	6.97	50.41	97.1	99.5
11/09/04	7.08	49.60	98.5	102.6
11/24/04	7.07	50.25	98.3	94.5
12/09/04	7.06	49.32	96.7	105.4
12/22/04	7.22	49.78	100.6	102.7
01/11/05	7.06	50.42	wiper missing	102.1

Site GS

Date	pH(7)	Sp. Cond (50 mS/cm)	Turbidity(100NTU)	DO%(Air)
01/20/04	7.05	49.62	100.1	103.5
02/11/04	7.12	50.16	98.0	105.9

03/04/04	7.04	49.91	98.9	82.5
03/22/04	7.12	49.38	98.2	93.9
04/08/04	7.03	49.44	100.4	103.7
04/28/04	7.02	49.48	101.8	103.3
05/12/04	7.00	49.67	97.5	101.6
05/25/04	7.08	49.89	99.6	103.7
06/02/04	7.02	50.13	98.2	104.3
07/08/04	7.06	49.58	98.3	99.3
07/23/04	7.08	49.46	100.7	103.5
08/04/04	7.08	50.04	100.1	102.4
08/19/04	7.07	49.74	100.4	102.1
09/02/04	7.09	49.99	99.3	100.1
09/17/03	7.05	50.22	98.7	104.1
10/20/04	7.00	49.69	100.6	101.8
11/03/04	7.10	49.99	98.4	106.6
11/17/04	7.00	49.96	99.9	103.3
12/01/04	7.11	49.30	98.9	104.8
12/15/04	7.09	49.95	96.3	108.9
01/05/05	7.06	50.00	100.5	102.2

15) Other Remarks/notes

On 06/30/2025 this dataset was updated to include updated QAQC flags and codes for the Gong Surface surface site at PDB reserve. The GS sonde is a surface sonde that is attached to a floating buoy. The sonde sits in a tube built into the buoy and there is a bolt at the bottom of the tube which sits 1 m below the surface, therefore the sonde's position does not change relative to the buoy. The depth data collected by the sonde reflects the depth the sonde is under the surface of the water. The buoy, and therefore sonde, experiences wave action, unlike the stable platform of the other sites. Any changes in depth are from barometric pressure changes (prior to correction) and wave action. The overall depth at the buoy location changes based on the fluctuation of the tide and ranges from 16 to 21m. The buoy is anchored to the bottom (~ 18 m) with an anchor.

On 08/13/2020 this dataset was updated to include embedded QAQC flags for anomalous/suspect data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2006, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

Generally high turbidities in Joe Leary Slough correspond to heavy rain events as on August 24-25 when 73.9 mm of precipitation was recorded at the PBNERR weather

station during an unusually wet summer storm. At the two bay sites, Bayview Channel and Ploeg Channel, wind is often the driving force affecting turbidity as occurred during the period of March 5-6 and October 29-30 2004 when both sites had elevated turbidities with a maximum gust of 20.3 m/s on March 5 and 12.8 m/s on October 29.

Periodic low salinity values in the 20 to 25 ppt range at Gong Surface during the summer months are probably the result of high river flows (the Fraser and Nooksack Rivers to the north and the Skagit River to the south) due to melt water from snow fields and glaciers in the Cascade Range.

From 11/25/04, 19:00:00 to 11/26/04, 07:00:00 32.7mm of rainfall was recorded at the PBNERR weather station preceded by wind averaging over 10 mph starting at 09:00:00. This weather event is reflected in higher turbidity and lower salinity values at Bayview and Ploeg sites during this time period. These effects were not seen at Gong until 11/27/04 illustrating that this deep site samples runoff from weather events while the shallow bay sites are immediately affected by the weather.

Gong Surface:

The highest 24 hour average air temperatures for the month were on July 24 and 25 (20.5 degrees C) this resulted in some of the lowest salinity readings of the year for this site, <24.0 ppt, because major rivers to the north and south of Padilla Bay are fed by melting glaciers and snow pack during the summer months.

Lower salinity from 01/31 – 02/02 is a result of runoff from heavy rainfall in the region during the previous week totaling 36.3 mm from 01/26/04 to 01/30/04 at PBNERR weather station.

Low salinity, <23 ppt, and corresponding increase in turbidity on 11/27/04 are a result of runoff from heavy rainfall of 44.7 mm on 11/24/04.

Joe Leary:

Increased salinity values on 01/24/04 indicate one or more of the tide gates was leaking marine water to the fresh water side. This can occur if debris gets caught in the gate when it is open.

Increased salinity values on 04/30/04 indicate one or more of the tide gates was leaking marine water to the fresh water side. This can occur if debris gets caught in the gate when it is open.

Increased salinity values occurring on 05/01/04 indicate one or more of the tide gates was leaking marine water to the fresh water side. This can occur if debris gets caught in the gate when it is open.

Increased salinity values occurring from 09/11/04 through 09/13/04 indicate one or more of the tide gates was leaking marine water to the fresh water side. This can occur if debris gets caught in the gate when it is open.

Increased salinity values occurring from 12/08/04 through 12/14/04 and 12/26/04 through 12/31/04 indicate one or more of the tide gates was leaking marine water to the fresh water side. This can occur if debris gets caught in the gate when it is open.

Bayview Channel

Low salinity on 01/30/04 is the result of rainfall totaling 36.3 mm from 01/26/04 to 01/30/04 at PBNERR weather station.

Ploeg Channel

Low salinity on 01/31/04 is the result of rain totaling 36.3 mm from 01/26/04 to 01/30/04 at PBNERR weather station.