Printed August 28, 1998

Padilla Bay (PDB) NERR YSI 6000 Water Quality Metadata

June to December 1995

Last updated 28 August 1998

I. Data Set and Research Descriptors

1. Principal investigator and contact persons:

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2. Entry verification:

The data are downloaded from the YSI 6000s to an IBM compatible PC. Graphs of all data are printed using PC6000 software and are examined for suspect, anomalous, or outlying data. Files are converted to Macintosh Excel files and edited for transfer to the NERRS CDMO. Files are merged to contain one full month of data. Missing data (from maintenance and downloading down time) are inserted into the spreadsheet and are denoted by a period (.). Suspect data are deleted and replaced by periods(.). After formatting the data, files are more closely checked for anomolies in DeltaGraph Pro®. Edited and raw files are archived on a Macintosh hard drive at Padilla Bay NERR.

3. Research Objectives:

The Bay View Channel YSI 6000 has been set out to detect and monitor short term variability and long-term changes in Padilla Bay. The Joe Leary Slough YSI 6000 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

implementation of a watershed action plan. Measurements are taken every 30 minutes at both
sites unless otherwise noted in data anomalies.

4. Research methods:

During June and July, 1995, a YSI 6000 was deployed in Joe Leary Slough using a crab trap
which held it in a horizontal position 0.25 m above the bottom.

In August, the deployment of the YSI 6000 in Joe Leary Slough was changed, so that it is held
vertically 0.25 m above the bottom of the slough in a 4 in. diameter PVC pipe which has holes
and slits drilled in it to allow water circulation around the probes. The PVC pipe is attached to
a steel pipe which was driven into the sediment.

In September 1995, a YSI 6000 was deployed in Padilla Bay in a tributary of Bayview
Channel. It was deployed using the same design as that in Joe Leary Slough, except that the
PVC pipe was attached to two steel pipes. The depth of the YSI 6000 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 surronding intertidal flats.

In all cases, measurements of temperature, specific conductivity, salinity, percent saturation,
dissolved oxygen, depth and pH are recorded every half hour. At the end of each sampling
period, the YSI 6000 is brought back into the laboratory for downloading, cleaning, and re-
calibration.

All calibrations are conducted according to the protocols in the YSI 6000 Operation and Service
Manual. For the conductivity calibration a 10 mS/cm conductivity standard is used. The pH
calibration is a 2 point calibration using standard pH 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 6000 deployment and the new oxygen membrane is allowed to soak overnight in
water before calibration.

5. Site location and character:

General: Padilla Bay (48 deg 30' N; 122 deg 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 1.55m. Salinity varies from about 15 to 30 o/oo.

Padilla Bay is an "orphaned" estuary in that the Skagit River no longer empties directly into it. Most of the land in the Padilla Bay watershed is agricultural, and is drained by four sloughs which empty into the bay. Padilla Bay also receives fresh water from the Fraser and Nooksack Rivers to the north and from the Skagit River to the south. These rivers flow into Puget Sound and the Strait of Georgia in which Padilla Bay is located.

Joe Leary Slough Site: (48 deg 31' 05" N; 122 deg 28' 25" W) Joe Leary Slough drains land which is predominantly agricultural with some pasture land. 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 0.25-1.5 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. Saline water from Padilla Bay seeps through the tide gates during high tide. The bottom of the slough is composed of very soft sediment, which is periodically dredged. A YSI 6000 is deployed on the freshwater side of the tide gates at a depth of 0.25 m above the bottom.

Bayview Channel Site: (48 deg 29' 47" N; 122 deg 30' 07" W) Bayview Channel, a major Padilla Bay tributary, drains intertidal flats including eelgrass beds, mats of macroalgae, and flats without macrovegetation. The YSI 6000 is located in a major tributary channel to Bayview Channel. The tributary drains predominately eelgrass (Zostera marina and Z. japonica) covered intertidal flats. Bottom sediments beneath the YSI 6000 are fine silt and clay overlying sand. Pollutants entering the bay include general non-point source, agricultural non-point source, and fecal coliforms from agriculture, failing septics and wildlife.

6. Data collection period:

Intermittant data collection in Joe Leary Slough (JL) during June to August, 1995:

June 8-15, June 22-26, and June 30
July 1-5 and July 7- 21
August 22-31

Continuous data collection began August 22, 1995 in Joe Leary Slough (JL) and September 6, 1995 in the Bay View Channel in Padilla Bay (BY).

7. Associated researchers and projects:

At the Joe Leary Slough site, weekly (from April 1995 to December 1995) water samples were collected and the concentration of inorganic nutrients, suspended solids, and turbidity were measured by staff at Padilla Bay NERR and the Washington State Dept Ecology Manchester Environmental Laboratory.

II. Physical Structure Descriptors

8. Variable sequence, range of measurements, units, resolution, and accuracy:

Variable Name	Range of Measurements (Units)	Resolution	Accuracy
Date	1-12,1-31,00-99 (Mo,Day,Yr)	1mo,1 day,1yr	NA
Time	0-24, 0-60, 0-60 (Hr,Min,Sec)	1 hr, 1 min, 1 s	NA
Temp	-5 to 45 (C)	0.01 C	±0.15C
SpCOND	0-100 (mS/cm)	0.01 mS/cm	±0.5% of reading+ 0.001 mS/cm
Salinity	0-100 Parts per thousand (ppt)	0.01 ppt	±1.0% of reading or 0.1 ppt (whichever is greater)
DO	0-200 (% air saturation)	0.1%@air saturation	±2% @air sat.
DO	200-500 (% air saturation)	0.1%@air saturation	±6% @air sat.
DO	0-20 (mg/l)	0.01 mg/l	±0.2 mg/l
DO	20-50 (mg/l)	0.01 mg/l	±0.6 mg/l
Depth (shallow)	-0.5 to 9.1 (m)	0.001 m	±0.018 m
pH	2-14 units	0.01 units	±0.2 units
Turb	0-1000 NTU	0.1 NTU	±5% of reading or 2 NTU (whichever is greater)

Negative depth values are recorded because of changes in barometric pressure between the time of calibration and the time at which depth is measured.
Data columns are separated by tabs.

9. Coded variable code definitions:

JL - Joe Leary Slough Site; BY - Bayview Channel Site
File definitions: YSI deployment site/month/year (e.g. JL1195 = data from Joe Leary Slough site during November, 1995)

10. Data anomalies:

Negative depths are recorded by the depth sensors because of changes in the barometric
pressure between the time of calibration and the time that depth is measured.
Because the Joe Leary Slough site is so shallow, the apparent depth is recorded as
negative at times throughout the time that the sondes were deployed.

June 1995:
JL: From 1130 to 1700 on 22 June specific conductivity and salinity were 0 for both
parameters. This was probably caused by air getting trapped in the conductivity
probe when the YSI was deployed. The data were deleted (see Missing data).

September 1995
JL: The depth sensor was not correctly calibrated so the depth data from 0930 on 13
Sep to 2330 on 30 Sep were deleted (see Missing data section).
pH values changed abruptly at 2130 on 26 Sep and the probe was apparently cracked on retrieval of the YSI 6000. pH data from 2130 on 26 Sep to 2330
on 30 Sep were deleted (see Missing data section).

October 1995
JL: On October 5 and October 9 - 14 periods of low dissolved oxygen (< 5%
saturation) were recorded each day in Joe Leary Slough. From October 15
through 31, the dissolved oxygen values were less than 1% saturation most of
the time. The low dissolved oxygen in Joe Leary Slough was associated with
black colored water and high fecal coliforms, possibly from dairy waste upstream in the watershed.
pH probe was cracked; pH data from 0000 1 Oct through 2330 31 Oct were deleted
(see Missing data section).
The depth sensor was not correctly calibrated so the depth data from 0000 on 1 Oct
through 2330 on 31 Oct were deleted (see Missing data section).
BY: The cause for the low and fluctuating dissolved oxygen from 2000 on 16 Oct
through 0030 on 17 Oct is not known.

November 1995
JL: From 0030 on November 1 through 1300 on November 8 the dissolved oxygen
values were less than 1% saturation most of the time. The low dissolved oxygen
in Joe Leary Slough was associated with black colored water and high fecal

coliforms, possibly from dairy waste upstream in the watershed.
pH probe was cracked; pH data from 0000 1 Nov through 2330 30 Nov were deleted (see Missing data section).
The depth sensor was not correctly calibrated so the depth data from 0000 on 1 Nov
through 2330 on 30 Nov were deleted (see Missing data section).
No data for all parameters except depth from 1445 on Nov 28 to 2345 on 30 Nov
because the bottom of the probes were apparently covered in sediment (see Missing data section). Depth data were not removed because the depth sensor
is located high on the probe and there was no evidence that the depth sensor
was affected by the sediment.

December 1995
JL: The low dissolved oxygen data from 2100 on 30 Dec to 2330 on 31 Dec were not
independently confirmed.
No data for all parameters except depth from 0000 1 Dec to 0815 on 14 Dec because the bottom of the probes were apparently covered in sediment (see Missing data section). Depth data were not removed because the depth sensor
is located high on the probe and there was no evidence that the depth sensor
was affected by the sediment.
pH probe was cracked; pH data from 0000 1 Dec through 2330 31 Dec were deleted (see Missing data section).

BY: Anamolous low and fluctuating dissolved oxygen data were observed from 0500
on 22Dec95 through 1500 on 29Dec95; the cause for these low values is not known and dissolved oxygen data throughout this time period is supect.

11. Missing data:

January to May 1995: YSI 6000's were not deployed at either site

June to August 1995: A YSI 6000 was deployed intermittantly at the Joe Leary (JL) site and
none was deployed at the Bayview Channel (BY) site

June 1995
JL: no data for all parameters during the following times because a YSI 6000 was not
deployed: 0000 1June through 0830 8June; 1000 15 June through1100 22 June; 1200 26 June through 1400 30 June.
no data for all parameters 1100 through 1430 on 23 June because the datasonde
was out of the water to be checked for fouling and calibration.
data are missing for specific conductivity and salinity on June 22, 1995 from

11:30 to 17:00. The data files indicated 0 for both parameters during these
times probably because air was initially trapped in the conductivity probe when
the YSI was deployed.
no turbidity data from 0000 1 June through 2330 30 June because the datasondes
had not yet had a turbidity probe installed.

BY : a YSI 6000 was not deployed.

July 1995
JL: no data 0900 5 July through 1000 7 July and 1100 21 July through 2330 31 July
because a YSI 6000 was not deployed.
no turbidity data from 0000 1 July through 2330 31 July because the datasondes
had not yet had a turbidity probe installed.

BY: a YSI 6000 was not deployed.

August 1995
JL: no data 0000 1 August through 1300 22 August because a YSI 6000 was not
deployed.
no turbidity data from 0000 1 August through 2330 31 August because the
datasondes had not yet had a turbidity probe installed.
BY: a YSI 6000 was not deployed.

September 1995
JL: no data from 0830 on 12 Sep to 0900 on 13 Sep for maintenance & calibration;
no depth data from 0930 on 13 Sep to 2330 on 30 Sep because depth had not been
correctly calibrated;
no pH data from 2130 on 26 Sep to 2330 on 30 Sep because probe was apparently
broken.
no turbidity data from 0000 1 Sep through 2330 30 Sep because the datasondes
had not yet had a turbidity probe installed.

BY: no data from 0000 on 1 Sep to 1300 on 6 Sep because YSI 6000 had not yet been
deployed and from 1030 on 29 Sep to 2330 on 30 Sep for maintenance & calibration.
no turbidity data from 0000 1 Sep through 2330 30 Sep because the datasondes
had not yet had a turbidity probe installed.

October 1995
JL: no pH data from 0000 1 Oct through 2330 31 Oct because pH probe was broken;

no data from 1500 on 5 Oct to 1130 on 9 Oct for maintenance;
no depth data from 0000 1 Oct through 2330 31 Oct because depth sensor was not
calibrated correctly.
no turbidity data from 0000 1 Oct through 2330 31 Oct because the datasondes had
not yet had a turbidity probe installed.

BY: no data from 0000 on 1 Oct through 1530 on 6 Oct for maintenance & calibration.
no turbidity data from 0000 1 Oct through 2330 31 Oct because the datasondes had
not yet had a turbidity probe installed.

November 1995
JL: no pH data from 0000 1 Nov through 2330 30 Nov because pH probe was broken;
no depth data from 0000 on 1 Nov to 1000 on 9 Nov because depth sensor was
not calibrated correctly;
no data for all parameters except depth from 1445 on Nov 28 to 2345 on 30 Nov
because the bottom of the probes were apparently covered in sediment.
no turbidity data from 0000 1 Nov through 2330 30 Nov because the datasondes
had not yet had a turbidity probe installed.
no data from 1330 8 Nov through 1000 9 Nov for maintenance & calibration.
data in Joe Leary Slough were collected at 30 minute intervals from 0000 on 1 Nov
through 1300 on 8 Nov and at 15 minute intervals from 1030 on 9 Nov to 2345 on 30 Nov; therefore no data on the quarter hour and three quarter hour
from 0015 on 1 Nov through 1015 on 9 Nov.

BY: no data from 1630 on 15 Nov to 2330 on 30 Nov because YSI 6000 was not
deployed.
no turbidity data from 0000 1 Nov through 2330 30 Nov because the datasondes
had not yet had a turbidity probe installed.

December 1995
JL: no data for all parameters except depth from 0000 on 1 Dec to 0815 on 14 Dec
because the bottoms of the probes were apparently covered in sediment;
no data from 0830 on 14 Dec to 1430 on 15 Dec for maintenance and calibration;
no pH data from 0000 1 Dec through 3230 31 Dec because pH probe was broken.
no turbidity data from 0000 1 Dec through 2330 31 Dec because the YSI datasondes had not yet had a turbidity probe installed.
data in Joe Leary Slough were collected at 15 minute intervals from 0000 on 1 Dec
to 0815 on 14 Dec and 30 minute intervals from 1500 on 15 Dec to 2330 on

31 Dec; therefore no data on the quarter hour and three quarter hour from1515 on 15 Dec to 2345 on 31 Dec.

BY: no data from 0000 on 1 Dec to 1130 on 7 Dec because YSI datasonde was not
deployed.
no turbidity data from 0000 1 Dec through 2330 31 Dec because the YSI datasondes had not yet had a turbidity probe installed.

12. Other remarks and notes:

November 1995
JL: Data in Joe Leary Slough were collected at 30 minute intervals from 0000 on 1
Nov through 1300 on 8 Nov and at 15 minute intervals from 1030 on 9 Nov to 2345 on 30 Nov.

December 1995
JL: Data in Joe Leary Slough were collected at 15 minute intervals from 0000 on 1 Dec
to 0815 on 14 Dec and 30 minute intervals from 1500 on 15 Dec to 2330 on 31 Dec.