STATE OF WASHINGTON
DEPARTMENT OF HEALTH
OFFICE OF SHELLFISH AND WATER PROTECTION
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DEPT OF ECOLOGY
BELLINGHAM FIELD OFFICE

October 10, 2008

Steve Hood

Sally Lawrence
Northwest Regional Office
Department of Ecology
Mail Stop NB-81

Dear Ms. Lawrence:

The Office of Shellfish and Water Protection is reclassifying a portion of the Birch Bay commercial shellfish growing area in Whatcom County from **Approved** to **Prohibited**. We anticipate that the reclassification will be finalized by November 14, 2008.

This change in classification is required because of the number of fecal coliform bacteria being discharged by Terrell Creek. A **Prohibited** classification is needed 670 yards in all shoreline directions from the mouth of Terrell Creek.

The area being reclassified is identified by boundary lines in Figure 1 of the enclosed Closure Area Evaluation report.

If you have any questions, please contact Mark Toy at (360) 236-3321.

Sincerely,

Maryanne Guichard
Office Director

Enclosure

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September 8, 2008

TO: Birch Bay Growing Area File

FROM: Mark Toy

SUBJECT: Closure Area Evaluation at the Mouth of Terrell Creek

I. INTRODUCTION

A 1994 DOH shoreline survey recommended that shellfish harvest should not occur at the mouth of Terrell Creek. A 2007 DOH shoreline survey reiterated this recommendation and substantiated it further with 3 years of sampling conducted by the Nooksack Salmon Enhancement Association (NSEA). The 2007 report also recommended that the Department evaluate the hydrographic impact from Birch Bay on Terrell Creek and the impact from Terrell Creek to the Birch Bay shellfish growing area and the creation of a Prohibited area. This report summarizes the results of the closure area assessment. Water quality and stream flow monitoring results from 2004 to 2007, dilution modeling using CORMIX software, and a drogue study were used to establish a closure zone of 670 yards around the mouth of Terrell Creek.

II. WATER QUALITY MONITORING

The Nooksack Salmon Enhancement Association conducted routine sampling of Terrell Creek starting in 2004, with results of up to 520 FC/100 ml at the mouth of the creek. The Whatcom County Marine Resource Committee (MRC) also conducts routine sampling at the mouth of Terrell Creek, and their results show contamination of up to 1190 FC/100 ml in samples taken in 2006 and 2007. Creek flow rates range from about 1 (in late summer/fall prior to rains) to 162 cfs (at height of rainy season). The highest loadings monitored by the MRC occurred in late spring and early summer, with fecal coliform levels between 560 and 1190 FC/100 ml and flows between 5.0 and 6.6 cfs. The highest daily loading monitored was 1.46×10^{11} FC/day in May 2007. MRC monitoring results are summarized in Table 1.

III. DROGUE STUDY

A study using surface drogues (oranges) was conducted the morning of June 6, 2008. Daytime air temperatures were in the low 50's with intermittent rain several days prior to the study. Measurements of stream dimensions and flow were taken with a calculated stream flow of 44.6 cfs at the time of the study. Eighteen oranges were released between 7:50 and 8:00 a.m., about two hours after high slack. High tide was +9.1 feet at 5:54 a.m. and with low tide of -3.4 at 1:56 p.m. The median water depth in the path of travel was about seven feet. Drogues were tracked for two hours and GPS readings were taken whenever drogues were sited on successive transects of the bay.

After two hours the farthest drogues had traveled about one kilometer in direction more or less perpendicular (a slight northwest bearing) to shore, with about 0.5 kilometers width of dispersal between drogues in this general direction. The path of drogue travel is shown on Figure 2, and tracking results are tabulated in Table 2. The average drogue velocity was about 15 cm/second, which is consistent with ambient velocity noted in the NPDES fact sheet for the Birch Bay WWTP.

IV. CLOSURE ZONE EVALUATION

The DOH Shellfish Program uses the CORMIX3 computer model to predict the dilution and dispersion of streams and drainages into marine waters near shellfish beds. Input values to model the dilution of Terrell Creek in the marine waters of Birch Bay include:

- 600 fecal coliforms per 100 ml (FC/100 ml), based on the 90th percentile of 19 sampling results (5/24/05 through 11/5/07) collected at the creek mouth by the Whatcom County MRC and summarized on Table 1. Highest results were taken in late spring and early summer.
- A median flow of 5.03 cubic feet per second (cfs), based on the Terrell Creek flows gaged by the Whatcom County Marine Resources Committee from 6/22/06 through 10/3/07. Creek dimensions measured by DOH in July 2006 were approximated to fit within model restrictions.
- An extensive and shallow beach around the mouth of the creek.
- An average ambient velocity of 15 cm/second
- A median water depth of seven feet during ebb tide (based on soundings taken during the drogue study)
- Mixing of creek water with marine water in the wave zone.
- Other receiving water hydrographic data obtained from a previous evaluation for the Birch Bay WWTP closure zone conducted by DOH in May 2000.

The computer model predicts that the shellfish water quality standard of 14 FC/100 ml is met at a distance of 615 meters (670 yards) in the direction of ambient current from the location where the freshwater of the creek initially mixes with the marine water in the bay. The time of travel to get to this location is about 50 minutes. This distance corresponds to the approximate location of waypoint 210 on the drogue study (see Table 2 for drogue tracking data).

V. SUMMARY AND RECOMMENDATIONS

Water quality and stream flow monitoring results from 2004 to 2007, dilution modeling using CORMIX software, and a drogue study were used to establish a closure zone of 670 yards around the mouth of Terrell Creek. Creek water monitoring by third parties should continue to be reviewed by DOH staff on a regular basis to track whether this closure zone should be revised in the future.

FIGURE 1. RECOMMENDED PROHIBITED AREA FOR TERRELL CREEK

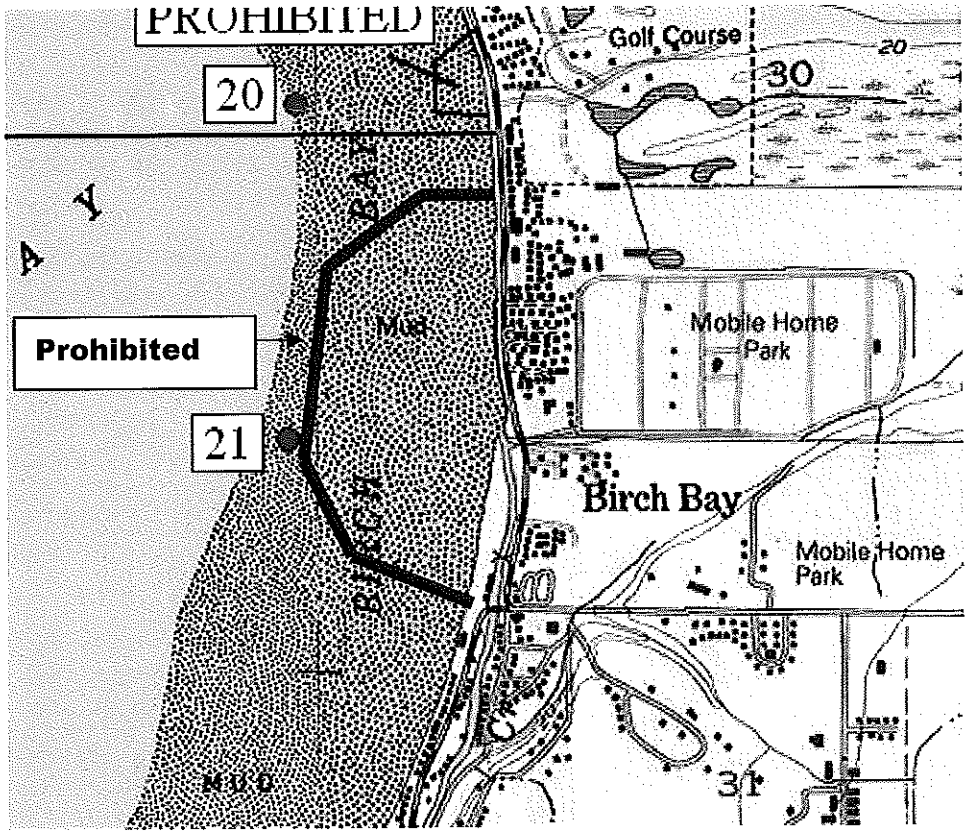

Table 1: MRC WQ and Flow Data from mouth of Terrell Creek

Date	Estimated Flow (cfs)	Fecal MPN/100mL	Log 10	Geometric mean	Loading, FC/day
5/24/2006	NA	130	2.11	130	NA
6/22/2006	3.37	120	2.08	125	9.89E+09
7/20/2006	2.35	10	1.00	54	5.75E+08
8/22/2006	NF	20	1.30	42	NA
9/19/2006	NF	292	2.47	62	NA
10/16/2006	3.38	152	2.18	72	1.26E+10
11/1/2006	1.05	39	1.59	66	1.00E+09
12/1/2006	frozen	16	1.20	55	NA
1/8/2007	162	21	1.32	50	8.32E+10
2/6/2007	55.2	31	1.49	47	4.19E+10
3/21/2007	150	1	0.00	33	3.67E+09
4/16/2007	6.03	16	1.20	31	2.36E+09
5/16/2007	5.03	1190	3.08	41	1.46E+11
6/13/2007	6.6	560	2.75	50	9.04E+10
7/11/2007	5.53	760	2.88	60	1.03E+11
8/8/2007	3.1	34	1.53	58	2.58E+09
9/5/2007	1.94	64	1.81	58	3.04E+09
10/3/2007	NF	34	1.53	56	NA
11/5/2007	NA	25	1.40	54	NA
90th %	131.04	600			
Median	5.03	34			

NF - no significant flow
NA - no measurement

Table 2 - Drogue tracking data - June 6, 2008

Waypoint	Time	Orange #	Depth (ft)	Tide Height (ft)	Elevation of Orange (ft)	Distance (miles)	Velocity (m/s)	Average velocity
194	8:10:00 AM	1		7.8		0.12	0.27	0.17
210	8:51:00 AM	1	7	6.6	-0.4	0.23	0.15	
218	9:26:00 AM	1	7	5.5	-1.5	0.16	0.12	
225	9:58:00 AM	1	14	4.5	-9.5	0.27	0.33	
201	8:30:00 AM	2		7.5		0.17	0.14	0.12
207	8:47:00 AM	2	6	6.6	0.6	0.1	0.08	
196	8:13:00 AM	3		7.8		0.12	0.21	0.17
201	8:30:00 AM	3		7.5		0.05	0.08	
207	8:47:00 AM	3	6	6.6	0.6	0.1	0.16	
214	9:09:00 AM	3	6	6	0	0.11	0.14	
211	9:03:00 AM	4	6	6	0	0.37	0.15	0.15
201	8:30:00 AM	6		7.5		0.17	0.14	0.15
204	8:40:00 AM	6	4	7.1	3.1	0.07	0.19	
202	8:31:00 AM	7		7.1		0.21	0.17	0.15
208	8:50:00 AM	7	6	6.6	0.6	0.08	0.11	
213	9:07:00 AM	7	6	6	0	0.09	0.14	
205	8:40:00 AM	8	4.5	7.1	2.6	0.16	0.10	0.11
221	9:46:00 AM	8	6	4.5	-1.5	0.28	0.11	
203	8:36:00 AM	9	6	7.1	1.1	0.23	0.16	0.14
223	9:54:00 AM	9	14	4.5	-9.5	0.37	0.13	
198	8:26:00 AM	10		7.5		0.13	0.12	0.13
206	8:42:00 AM	10	5	7.1	2.1	0.06	0.10	
222	9:51:00 AM	10	13	4.5	-8.5	0.35	0.14	
209	8:51:00 AM	11	6	6.6	0.6	0.32	0.16	0.14
212	9:05:00 AM	11	7	6	-1	0.07	0.13	
224	9:57:00 AM	11	14	4.5	-9.5	0.25	0.13	
195	8:11:00 AM	12		7.8		0.12	0.25	0.15
202	8:31:00 AM	12	7	7.1	0.1	0.11	0.15	
217	9:23:00 AM	12	7	5.5	-1.5	0.23	0.12	
200	8:29:00 AM	13		7.5		0.18	0.16	0.13
215	9:10:00 AM	13	6	6	0	0.17	0.11	
220	9:32:00 AM	13	9	4.9	-4.1	0.12	0.10	
211	9:03:00 AM	16	6	6	0	0.37	0.15	0.15
197	8:14:00 AM	17		7.8		0.1	0.17	0.13
199	8:28:00 AM	17		7.5		0.06	0.11	
216	9:11:00 AM	17	6	6	0	0.18	0.15	
219	9:32:00 AM	17	8	4.9	-3.1	0.11	0.14	
211	9:03:00 AM	18	6	6	0	0.37	0.15	0.15
211	9:03:00 AM	19	6	6	0	0.37	0.15	0.15
193	8:04:00 AM			7.8				