BREMERTON-KITSAP COUNTY HEALTH DISTRICT
ENVIRONMENTAL HEALTH DIVISION
WATER QUALITY PROGRAM

LONG LAKE AREA
SANITARY SURVEY PROJECT

FINAL REPORT

By

Mike McNickle
Sanitary Survey Program Coordinator

and

Keith Grellner, R.S.
Water Quality Program Manager

June 1998

Funded by:

KITSAP COUNTY
SSWM
Surface and Storm Water Management

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1998 LONG LAKE SANITARY SURVEY PROJECT

FINAL REPORT

EXECUTIVE SUMMARY

In October 1997, the Health District initiated intensive stream and stormwater monitoring in the Long Lake area. Results of the monitoring found that 18 of 39 (46%) monitoring stations exceeded the State Class AA freshwater standard for fecal coliform bacteria (FC). From observations of the area, the Health District determined the likely cause of the contamination was failing on-site sewage systems (OSS) and poor animal waste management practices.

Therefore, based on the historical and current water quality data, the Long Lake Area was rated Number 1 (most in need of a sanitary survey) in *the 1997-98 Priority Area Work List for the Health District's Sanitary Survey Program* (BKCHD, 1997). In January 1998, the Health District began the Long Lake Area Sanitary Survey Project to identify and correct failing OSS and properties with poor animal waste management practices. The 1998 Long Lake Sanitary Survey Project is the first intensive OSS inspection project that has been conducted in the Long Lake area. Many other water quality related projects have been conducted on Long Lake, but the focus of those studies was on aquatic weeds and eutrophication management issues.

The Long Lake sanitary Survey Project area was found to have an OSS failure rate of 10% (18 of 228), which falls in the mid-range of OSS failure rates for other areas surveyed in Kitsap County over the last 10 years (3% to 16%). All but one of the failing OSS was either standard gravity OSS or pump-to-gravity OSS. The one failing alternative-type OSS found was a sand filter/pump to gravity system.

At the time this report was completed, four of the 18 failing OSS had been repaired. Three of these system repairs were "simple fix" repairs, including repairing d-boxes and broken pipes. The fourth was a complete system replacement repair with an alternative-type OSS. Fourteen (14) of the 18 failing OSS are still in the process of being repaired. The Health Distinct anticipates that all failed OSS will be repaired by the end of 1998.

Seven stormwater monitoring stations were found to be contaminated with fecal coliform bacteria above Health District action levels ($\geq$200 FC/100 ml.) from either failing OSS or agricultural waste in the upland areas surrounding the project boundary. Follow-up investigations are necessary to determine the source(s) of the pollution in order to abate water quality problems.

Based upon the conclusions of the Long Lake Sanitary Survey Project, the Health District offers the following recommendations to the residents of the project area:

1. The Health District should continue sanitary survey work efforts in the Long Lake area drainage basin during the 1998-99 wet season. These efforsts should include:

    - Re-inspecting all OSS categorized as suspect and non-conforming to determine their functional status (approximately 14 homes); and

    - Attempting to inspect the OSS which were classified either "vacant", "did not participate", or "denied access" during the project (41 homes).

2. Long Lake area property owners should continue to educate themselves about the proper operation and maintenance guidelines/requirements associated with the use of their OSS.

3. The Health District should investigate the sources of contamination at the seven (7) stormwater monitoring stations identified as "hotspots".

4. The Health District should continue to monitor the stormwater and in-lake monitoring stations established during the project to assess water quality improvements and/or declines as a result of the 1998 Long Lake Sanitary Survey Project.

LONG LAKE AREA SANITARY SURVEY PROJECT

FINAL REPORT

1.0 INTRODUCTION

In October 1997, the Health District initiated intensive stream and stormwater monitoring in the Long Lake area. Results of the monitoring found that 18 of 39 (46%) monitoring stations exceeded the State Class AA freshwater standard for fecal coliform bacteria (FC). From observations of the area, the Health District determined the likely cause of the contamination was failing OSS and poor animal waste management practices.

Therefore, based on the historical and current water quality data, the Long Lake Area was rated Number 1 (most in need of a sanitary survey) in *the 1997-98 Priority Area Work List for the Health District's Sanitary Survey Program* (BKCHD, 1997).

In January 1998, the Health District began the Long Lake Area Sanitary Survey Project to identify and correct failing OSS and hobby farms with poor animal waste management practices. The purpose of this report is to summarize the findings of the project. This project is funded by the Kitsap County Surface and Storm Water Management Program (SSWM).

2.0 PROJECT AREA HISTORY AND DESCRIPTION

2.1 HISTORY

Long Lake, like most other lakes in Western Washington, was formed by glacial activity during the last Ice Age, approximately 10,000 years ago. Lakes of this typeoccupy depressions carved out in the surface of the glacial drift laid down by the glacier as it receded through the area. As the glacier receded, the meltwaters flowed into these depressions and were captured. Long Lake lies in a north-south position, clearly illustrating the direction the glacier receded as it created the lake.

Numerous studies have been performed on Long Lake, the first dating back to 1953 when the United States Geological Survey (USGS) measured lake levels. In 1953, the average depth was 15, while the maximum depth reached 30 feet. This fact is very important as will be discussed below. In 1963, state and local officials began to notice an increase in aquatic weeds and a reduction in water clarity, which is a clear indication of eutrophication. Eutrophication is the natural aging process that all lakes goes through. Basically, a lake is created with a basin filling with water. At that time, the lake is considered oligotrophic, were there is very little algae, plants or animals in the lake, and very good water quality.

As the lake ages, algae, plant and animal growth continues until the lake reaches the eutrophic stage, where high numbers of aquatic weeds, and algae are found, as well as poor water quality (due to reduced dissolved oxygen levels and low opacity). From this point forward, the lake is transforming into a wetland, with the eventually filling of the wetland with sedimentation. Finally, terrestrial vegetation takes over and the lake disappears.

In 1969, residents were alarmed at the rapid increase of aquatic weed infestation occurring in Long Lake. Over this period, the Health District warned that the lake may be contaminated with sewage from failing on-site sewage systems (OSS). In response, Long Lake residents formed the Long Lake Community Club to generate funds to remove the aquatic weed infestation. In 1972, the aquatic weeds were removed from the lake via mechanical weed cutters and manual harvesting. However, the weeds and algae blooms returned within two years.

In 1974, the Health District issued warnings to swimmers that the water might be contaminated with sewage emanating from failing OSS. This determination was based on some monitoring ata collected in the swimming area of Long Lake. Uncontrolled discharge of stormwater from rapidly expanding development along the shoreline was documented. Improperly managed development was increasing the amount of sediment load the lake received. In response to resident complaints, Kitsap County hired Northwest Environmental Consultants and Entranco Engineers, Inc. to conduct a comprehensive water quality study of Long Lake.

Following a year of water quality monitoring, Entranco Engineers, Inc. concluded that Long Lake was advancing rapidly to an eutrophic condition (Entranco, 1975). In their report, Entranco recommended reversing the eutrophication process by revising land use and stormwater drainage policies, dredging the lake and the outlet area (Curley Creek), draw down the lake level in summer to kill the weeds, and apply alum to control nutrients.

In 1978, the dredging portion of the plan was implemented. By the end of the dredging process, approximately 60,000 cubic yards of material was removed from the north end of the lake and outlet channel. In 1979, the summer drawdown of the lake occurred (the lake level was lowered six feet) which killed aquatic weeds and facilitated a clean-up of the shoreline area. Then in 1980, alum was applied to help clarify the water, and the lake bottom was covered with a flocculant layer. As a result, there was a noticeable reduction in nutrients (especially phosphorous) in the lake water, and there was a significant reduction in aquatic weeds and algae blooms.

To study the effects of the plan, Dr. Eugene Welch from the University of Washington monitored the results of the dredging, the drawdown, and the alum application from 1982 through 1994. In summary, he found that the alum treatment was effective at reducing internal loading of phosphorous for nine years (Welch, 1994). By 1989, the phosphorous concentrations returned to pre-treatment levels. He also found that the drawdown was successful at reducing aquatic weeds by 84%. However, by 1989, the aquatic weeds returned to pre-drawdown levels found in the lake between 1980-81.

Washington State Department of Ecology, through its Lake Water Quality Assessment Program (LWQAP), classified the lake as eutrophic in 1991. In 1994, the LWQAP ranked Washington State lakes according to need for management of eutrophication related concerns. Long Lake was ranked third for all lakes.

2.2 DESCRIPTION

The area investigated during the project is shown in **Figure 1** and **Figure 2**. The project area is bounded on the west by Clover Valley Road SE, Philips Road SE, and SE Dormar Drive, on the north and east by Long Lake Road SE, and on the south by SE Mullenix Road.

Long Lake is 339 acres in size, drains 9.4 square miles of watershed, and has 5.1 miles of shoreline. Long Lake is fed primarily by Salmonberry Creek, on the southwestern side of the lake, and secondarily by numerous small streams all around the lake. Long Lake discharges to Curley Creek on the north side of the lake, which is a salmon bearing stream.

The Long Lake area includes a variety of homes ranging from the very old to new. According to area residents, many of the homes along the lakefront were originally constructed as vacation homes and were only occupied intermittently, primarily during the summer months. Most of these homes are now occupied year round, but a few of them still remain as only vacation homes.

There are a total of 228 homes in the project area. One hundred and thirty six (136) of these are lakefront homes and 92 are in the immediate upland areas. Lot sizes range from 0.25 acres to 1.25 acres and larger. Due to the timeframe in which development occurred in this area, the majority of the OSS in the project area are standard gravity or pump to gravity type OSS.

According to rainfall information collected by Kitsap County Public Utility District #1 at Station #27 - Kingsbury, average annual rainfall in the project area is 46 inches. The majority of this rainfall occurs between the months of October and April, a period of time generally classified as the "wet season".

As presented in the *Soil Survey of Kitsap County Area, Washington* (SCS, 1980), the soils within the project area boundary primarily consist of Harstine gravely sandy loam, Kapowsin gravely loam, Bellingham silty clay loam, Mukilteo Peat, Neilton gravely sand, Norma fine sandy loam, Ragnar fine sandy loam, and Kitsap silt loam. Harstine and Kapowsin series soils are considered poor for OSS due to a shallow cemented hardpan layer (ranging from 20 - 40 inches in depth). Bellingham series soils are considered poor for OSS due to a tendency for ponding in wet weather and a slow percolation rate. Mulkiteo, Neilton, Norma and Ragnar series soils are considered poor for OSS due to a tendency to pond in wet weather, and are poor filters for septic tank effluent. Kitsap series soils are also considered poor for OSS due to ponding, wetness and severe slopes.

Figure1 Sanitary Survey Location Map

Overall Map (completed)

Figure 2 Project Area Boundary

Boundary Map (completed)

3.0 HISTORY OF OSS PERFORMANCE IN THE LONG LAKE AREA

The 1998 Long Lake Sanitary Survey Project is the first intensive OSS inspection project that has been conducted in the Long Lake area. Many other water quality related projects have been conducted on Long Lake (as discussed earlier), but their focus was on aquatic weeds and eutrophication management issues. However, a review of Health District complaint records and sewage permits on file for homes in the project area shows that 25 OSS complaints in the project area have been responded to, by the Health District since 1991. Seven (7) repairs of failing OSS have been made since 1991. The status of the remaining 18 complaints is unknown.

4.0 GOALS AND OBJECTIVES

The goals of the Long Lake Area Sanitary Survey Project are to protect human health and the environment by locating and correcting failing OSS, and to help prevent future failing OSS through public education on proper OSS operation and maintenance.

To meet these goals, the following objectives were developed and implemented during the project period:

1. Identify and correct failing OSS and poor animal waste management practices in the survey area;
2. Determine the impacts of failing OSS and poor animal waste management practices in the survey area; and
3. Educate homeowners and/occupants about proper operation and maintenance of OSS, Best Management Practices (BMP's) for animal waste control, and the state of OSS performance in the Long Lake area.

5.0 PROJECT DESIGN AND METHODS

Work conducted during the survey project consisted of the following specific tasks:

- On-Site Sewage System Survey. The OSS survey consisted of an OSS record search, homeowner/occupant interview, field survey, and if necessary, a dye test. The purpose of the on-site survey was to identify and confirm failing on-site sewage systems. Based upon the results of each survey, each OSS was categorized in one of the following rating categories (see **Appendix A** for rating category criteria):

  1. Failing;
  2. Suspect;
  3. Non-Conforming;
  4. No Records; or
  5. No Apparent Problems.

- Other Non-Point Sources Identification/Correction. This portion of the project included identifying farms with poor animal waste management practices impacting the water quality of Long Lake and educating homeowners about the impacts of over-fertilizing to water quality in Long Lake.

All OSS survey work performed during the project was conducted according to the methods contained in the *Manual of Protocol for Conducting On-Site Sewage Systems Surveys in Kitsap County, Washington* (BKCHD, 1995). The Health District's survey protocol manual has been approved by both the Washington Department of Ecology and State Health. This document is available to interested persons upon request.

All water sample collection activities in support of OSS survey work and sampling events were conducted according to applicable Puget Sound Estuary Program Protocols (Tetra Tech, Inc., 1990). Fecal coliform analyses were performed using the Most Probable Number (MPN) Multiple Tube A-1 Method, SM 9221E (APHA, 1995).

Standard Health District quality assurance/quality control procedures for sampling events include one trip blank per event, and a minimum of 10% of the daily number of field samples collected in duplicate. The purpose of the trip blank is to ensure that there is no cross contamination during sample collection and transport. The purpose of collecting field duplicates is to try to account for variability associated with random distribution of bacteria, field sampling technique, and laboratory analysis.

6.0 RESULTS AND DISCUSSION

6.1 OSS SANITARY SURVEY

The sanitary survey of OSS was conducted from January to June 1998. During this period, a total of 228 residences were visited, including 136 lakeside and 92 upland homes. In addition, OSS records were evaluated (if available), residents were interviewed, OSS were dye-tested (when necessary), and OSS were rated according to the protocols set forth in the Health and Ecology approved *Manual of Protocol for Conducting OSS Surveys in Kitsap County, Washington* (BKCHD, 1997). **Table 1** and **Figures 3 and 4** summarize the project period OSS survey results.

As shown in Table 1 and Figure 3:

- A project total of 18 OSS failures were found for an OSS failure rate of 10%. As presented in *Criteria for Rating On-Site Sewage System Sanitary Survey Results* in **Appendix A**, OSS are classified as failing for reasons including: (1) Collected water sample result from bulkhead drains, curtain drains, or other pipes and seeps, at or above 500 FC/100ml. and positive dye test results; (2) Visually positive dye-test observed and documented; (3) Straight discharge (gray or black water) from any indoor plumbing is observed and documented, etc. **Figure 5** shows the approximate locations of OSS failures. A descriptive list of the OSS failures is contained in **Appendix B-1**.

- A project total of 14 suspect OSS were found, or 7% of the 228 residences surveyed during the project period. OSS are classified as suspect generally for one, or combination of, the following reasons: (1) Illegal repairs or alterations have been made to the system; (2) No evidence of a septic tank or drainfield exists; or (3) dye test results were inconclusive. A descriptive list of the suspect OSS is contained in **Appendix B-2.**

- A project total of 27 non-conforming OSS were found, or 14% of the 228 residences surveyed. As presented in **Appendix A**, OSS are classified as non-conforming generally for one or more of the following reasons: (1) Repairs or alterations have been performed on the OSS without a permit; (2) Additional bedrooms have been added to home without a permit; or (3) Field inspection suggests that non-conforming conditions exists (such as insufficient setbacks from surface waters or wells, no reserve area/damaged reserve area, vehicular traffic on drainfield, etc.) in regards to the OSS components.

- A project total of 23 OSS were rated as having no records, or 12% of the 228 residences surveyed. As presented in **Appendix A**, OSS are classified as having no records if: (1) no completed/signed Sewage Disposal Permit is on file at the Health Distinct or in possession of the owner/occupant at the time of inspection; and (2) No non-conforming, suspect nor failure criteria were observed at the time of inspection.

TABLE 1
SUMMARY OF OSS SANITARY SURVEY RESULTS
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998

	OSS RATING CATEGORY											
	FAILING		SUSPECT		NON - CONFORMING		NO RECORDS		NO PROBLEMS		NO DATA[1]	
	#	%	#	%	#	%	#	%	#	%	#	%
LAKESIDE 136 (60%)	13	10%	10	7%	14	10%	21	15%	55	40%	23	17%
UPLAND 92 (40%)	5	5%	4	4%	13	14%	2	2%	50	54%	18	20%
PROJECT TOTALS 228 (100%)	**18**	**8%**	**14**	**6%**	**27**	**12%**	**23**	**10%**	**105**	**46%**	**41**	**18%**

1. Forty (41) OSS from the project area are not included in the project totals. Twelve (12) residents did not respond (5%) [all attempts to contact failed], sixteen (16) residences were vacant (7%), and thirteen (13) residents denied access for the field inspection (6%).

FIGURE 3
RESULTS BY RATING CATEGORY
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998

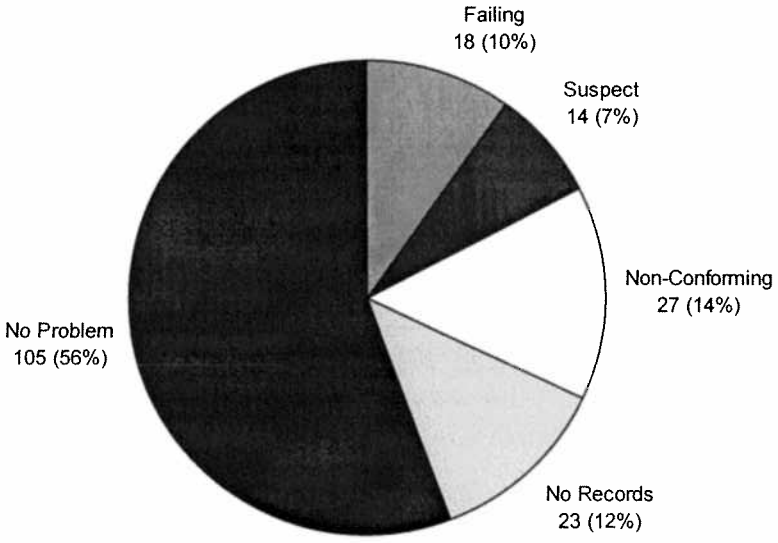


FIGURE 4
SUMMARY OF VISITED RESIDENCES IN PROJECT AREA
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998

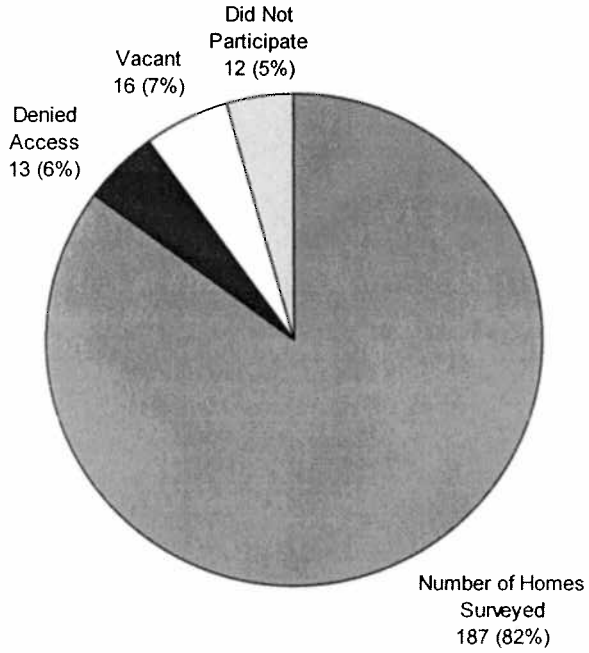
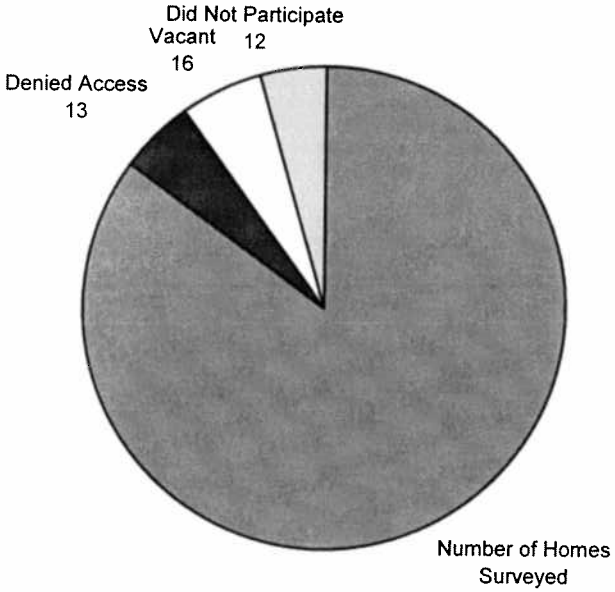


FIGURE 5
SUMMARY OF VISITED RESIDENCES IN PROJECT AREA
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998



- A project total of 105 OSS were rated as no apparent problems, or 56% of the 228 residences surveyed. As presented in **Appendix A**, OSS are classified as no apparent problems if (at the time of the inspection), the OSS appeared to be functioning properly and in conformance with on-site sewage regulation in effect at the time of its installation.

As shown in **Figure 6**, the 10% failure rate found in the Long Lake area is in the middle range of failure rates (3% - 16%) found in other areas of Kitsap County surveyed by the Health District over the last ten years. As illustrated in Figure 5, there does not appear to be any specific pattern or trend to the locations of failing OSS in the project area. Twenty-three (23) of the 32 (70%) failing or suspect OSS were located adjacent to the lake, while eight (30%; four failures and four suspects) were not (they were upland). With respect to direct sewage impacts to Long Lake, two of the 18 (11%) OSS failures was found to be directly discharging sewage effluent to Long Lake. The remaining 16 (89%) of the other OSS failures were surfacing failures within the yard area of the residence.

As discussed in **Section 6.2**, although certain portions of storm water system along the Long Lake area were noted to contain elevated levels of fecal coliform bacteria, the actual impact on Long Lake from these storm waters would appear to be nearly negligible at this time due to relatively low flow volumes.

The following factors have been related to OSS failure in previous surveys:

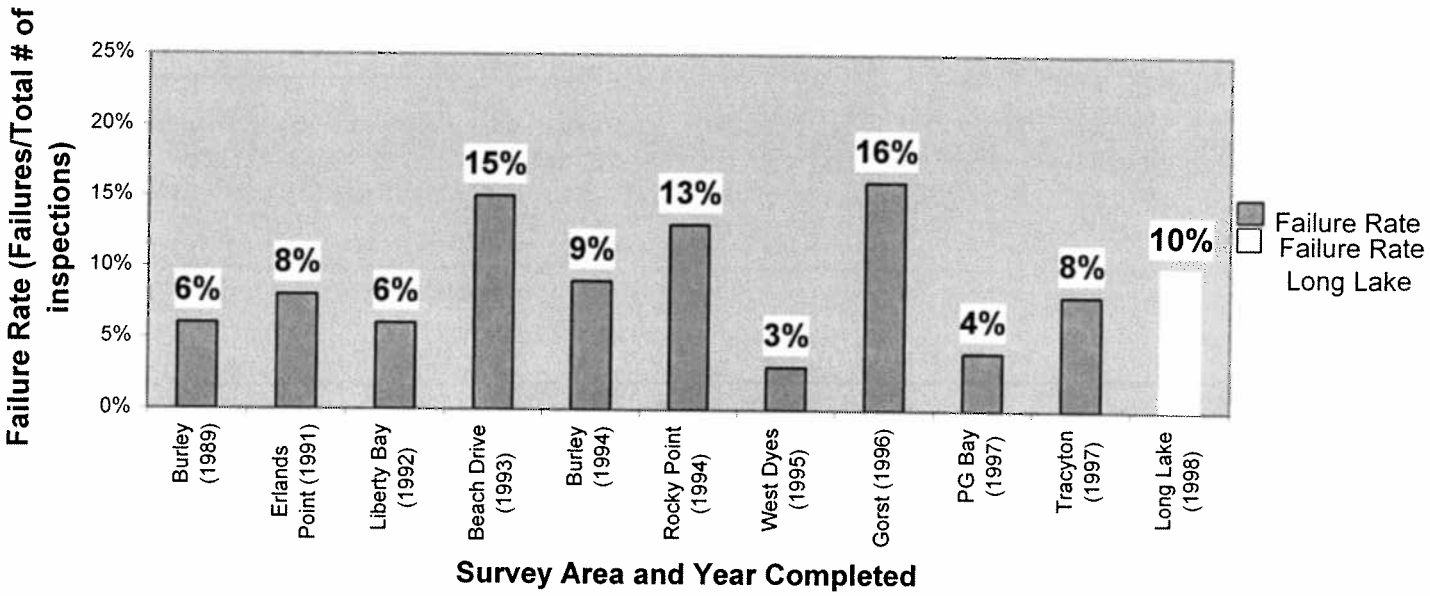
- Age of the OSS;
- Close proximity of the OSS to surface water bodies;
- Poor soil types and shallow depth to water table/impervious layer;
- Inadequate or lack of maintenance of the OSS; and
- Number of previous repairs (failure history).

Of these, age of the OSS and lack of proper homeowner maintenance of the OSS have been the most prevalent causes of failure. Relative to these factors, the Long Lake survey results showed that:

- 17 (94%) of the 18 failing OSS's were 15 years old or older;
- 14 (78%) of the failing OSS's had not been properly maintained (i.e., checked every three to five years and pumped when necessary);
- 11 (61%) of the failing OSS's were located less than 100 feet from Long Lake; and
- Two (11%) of the failing OSS's had failed, and been repaired, at least once in the past.

As shown above, age of the OSS and maintenance of the OSS would appear to be the two factors most in common with failing OSS the Long Lake area. As shown in **Appendix B-1**, 12 failures have been linked to the age and size of the system, and/or improper operation and maintenance. Six of the failing OSS were linked to system abuse through poor installation or damage to the drainfield area by vehicular traffic.

Figure 6
Comparison of Sanitary Survey Results



All but one of the failing OSS was either standard gravity OSS or pump-to-gravity systems. The one failing alternative-type OSS found was a sand filter/pump to gravity system. Thirteen (13) alternative OSS were identified and inspected during the entire survey.

At the time this report was completed, four of the 18 failing OSS had been repaired. Three of these system repairs were "simple fix" repairs, including repairing d-boxes and broken pipes. The fourth was a complete system replacement repair with an alternative-type OSS (Glendon Biofilter). Fourteen (14) of the 18 failing OSS are still in the process of being repaired. The Health Distinct anticipates that all failed OSS will be repaired by the end of 1998.

New state and local regulations require that all OSS be properly maintained and operated. The requirements of Bremerton-Kitsap County Board of Health Ordinance 1995-14, *Regulations for Operation and Maintenance of On-Site Sewage Treatment Systems* are being phased in. Currently, all standard gravity septic systems require a septic tank inspection every three years. Additionally, all alternative septic systems serving new homes, repairs, and/or re-sale of homes are required to have ongoing operation and maintenance. Starting January 1, 1998, alternative septic systems serving shoreline (both marine and freshwater) homes and homes that were previously granted waivers will be required to have ongoing operation and maintenance. And finally, starting January 1, 2000, all other pre-existing alternative septic systems will be required to have ongoing operation and maintenance.

OSS operation and maintenance education was one of the primary focuses of the Long Lake Sanitary Survey Project. Health District staff provided homeowners with educational brochures and (if available) a copy of the sewage disposal permit/as-built on file at the Health District for their home. Health District staff emphasized to homeowners that proper operation and maintenance is crucial to prevent future septic system failures and protect water quality in Long Lake.

6.2 STORMWATER AND STREAM MONITORING RESULTS

Stormwater sampling events were conducted on November 18, 20, and 24, 1997, and again on January 7, 1998. The purpose of these events was to help pinpoint sources of nonpoint pollution problems, mainly OSS failures. During these events, samples were collected from all flowing stormwater ditches, streams and creeks flowing into Long Lake. These flows were mapped and subsequently analyzed for FC bacteria, and six stormwater stations and one in-lake station were analyzed for nitrate-nitrogen, ammonia and phosphorus. The results are summarized in **Table 2** and **3**.

All of the sampled discharge points with fecal coliform concentrations greater than 200 FC/100ml. (an "action level" established by the Health District) warrant further study and are illustrated in **Figure 7**; this "action level" is twice the State Class A freshwater fecal coliform standard of 100 FC/100ml. (Chapter 173-201A WAC). Fecal coliform concentrations at, or above, 1,600 FC/100ml. are generally considered strong indicators of raw sewage because, using standard dilutions, the uppermost limit of the MPN test is $\geq$1,600 FC/100 ml..

On November 24, 1997 and again on January 7, 1998, selected stormwater stations (**see Table 3**) were sampled for nutrients. The purpose of testing selected stations for nitrate-nitrogen, ammonia and phosphorus was to aid in identifying sources of nonpoint pollution, such as poor agricultural waste management, failing OSS, or improper fertilizer application practices. The introduction of these nutrients, especially phosphorous, into Long Lake allows aquatic plants to multiply quickly because it is the limiting nutrient for freshwater and all are considered pollutants above naturally-occurring levels. The six stormwater stations were sampled to show the amount of nutrients entering the lake, while the in-lake station was selected to collect a sample for comparison to incoming flows.

Currently, there are no State water quality standard for the nutrients sampled. However, any additional amount of nutrients in flows entering Long Lake are contributing to the eutrophication process. These sources must be identified and corrected. A detailed list of stormwater survey sample collection points is contained in **Appendix C**.

By looking at both the FC data and the nutrient data, several stormwater flows were determined to be "hotspots" (Station # LSW5, LSW7, LSW11, LSW14, LSW15, LSW32 and LSW35). See **Appendix C** for the descriptions of these stations. Generally, as found in other project areas, the poor water quality found in these upland stations are most likely either failing OSS and/or agricultural waste management problems. Further investigation is necessary to identify and correct these sources of pollution.

TABLE 2
SUMMARY OF STORMWATER SURVEY RESULTS
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998

Date	Rainfall: 48 hours previous to sampling (inches)[a]	# of Stations Sampled	# of Stations with FC Results ≥ 200 - 1600 FC/100 ml.	% of Total	# of Stations with FC Results ≥ 1600 FC/100 ml.	% of Total
November 18, 1997	0.69	19	6	32%	0	0%
November 20, 1997	1.74	25	5	20%	1	4%
November 24, 1997	1.23	28	6	21%	1	4%
January 7, 1998	0.46	34	4	12%	0	0%

a. Source of data: Kitsap Public Utility District, Station 27, Kingsbury Site.

TABLE 3
SUMMARY OF NUTRIENT SAMPLING
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998

Station #	Date(s) Sampled		Rainfall: 48 hours previous to sampling (inches)[a]		Nitrate-Nitrogen (mg/l)		Ammonia (mg/l)		Total Phosphorous (mg/l)	
LSW5	11/24/97	1/7/98	1.23	0.46	0.76	0.69	<0.05	0.07	0.03	0.02
LSW6	11/24/97	1/7/98	1.23	0.46	0.71	0.66	<0.05	0.06	<0.01	<0.001
LSW7	11/24/97	1/7/98	1.23	0.46	0.71	1.01	<0.05	0.05	0.26	0.03
LSW14	11/24/97	1/7/98	1.23	0.46	2.22	1.73	<0.05	0.05	0.07	0.05
LSW32	11/24/97	1/7/98	1.23	0.46	2.03	1.25	<0.05	<0.05	<0.01	0.01
SM01	11/24/97	1/7/98	1.23	0.46	1.02	0.69	<0.05	<0.05	0.02	0.04
LK01	N/A	1/7/98	N/A	0.46	N/A	0.65	N/A	0.06	N/A	0.05

a. Source of data: Kitsap Public Utility District, Station 27, Kingsbury Site.

Figure 7 Summary of Stormwater Monitoring Results

Map (still need)

The major input into Long Lake is Salmonberry Creek located on the south-west side of the lake. Through the on-going SSWM Water Quality Monitoring Program, sampling data has shown that the station at the mouth of Salmonberry Creek (SM01) currently meets State water quality standards. Salmonberry Creek will continue to be monitored monthly and if water quality begins to decline and the mouth station no longer meet State standards, the Health District will investigate, identify and correct pollution sources. As shown in **Appendix C**:

- A total of 106 stormwater samples were collected between November 1997 and June 1998;
- Only 21 (20%) of these stations had sample results $\geq$ 200 FC/100ml;
- Three out of the seven (43%) of the stations monitored for nutrients with significantly higher-than-background values may be linked to pollution sources.

It is possible that many of these sources can be linked to failing OSS and poor agricultural waste management problems on upland properties adjacent to these corridors. This part of the proejct will be conducted during the next wet season.

7.0 CONCLUSIONS

The findings of the Long Lake Area Sanitary Survey Project are:

- The Long Lake area is an older, semi-rural area with some sections of high density housing. According to residents, some of the original homes on the lakefront were vacation homes that are now used year around. Some of the of the property parcels were platted and developed prior to existing OSS regulations. In general, the natural physical conditions of the area --- primarily the surface and groundwater conditions and soil depth and type --- in combination with high density housing in some areas and 46 inches of rainfall on average are generally not the best conditions for the long-term utilization of standard gravity OSS.

- The Long Lake sanitary Survey Project area was found to have an OSS failure rate of 10% (18 of 228), which falls in the mid-range of OSS failure rates for other areas surveyed in Kitsap County over the last 10 years (3% to 16%). All 18 failures were located at residential sites, and all should be repaired by October, 1998.

- Based upon survey results and field observations, it appears that all of the property parcels in the project area are individually repairable, if necessary, according to current OSS regulations and technology. However, it appears that most OSS failures will be required to be repaired with alternative-type OSS. Alternative-type OSS are generally more expensive than standard gravity OSS, and have more intensive operation and maintenance requirements.

- Seven stormwater monitoring stations are contaminated with fecal coliform bacteria above Health District action levels (≥200 FC/100 ml.) from either failing OSS or agricultural waste in the upland areas surrounding the project boundary. Follow-up investigations are necessary to determine the source(s) of the pollution in order to abate water quality problems.

8.0 RECOMMENDATIONS

Based upon the conclusions of the Long Lake Sanitary Survey Project, the Health District offers the following recommendations to the residents of the project area:

1. The Health District should continue sanitary survey work efforts in the Long Lake area drainage basin during the 1998-99 wet season. These efforts should include:

    a) Re-inspecting all OSS categorized as suspect and non-conforming to determine their functional status (approximately 14 homes); and

    b) Attempting to inspect the OSS which were classified "vacant", "did not participate", or "denied access" during the project (41 homes).

2. Long Lake area property owners should continue to educate themselves about the proper operation and maintenance guidelines/requirements associated with the use of their OSS.

3. The Health District should investigate the sources of contamination at the seven (7) stormwater monitoring stations identified as "hotspots".

4. The Health District should continue to monitor the stormwater and in-lake monitoring stations established during the project to assess water quality improvements and/or declines as a result of the 1998 Long Lake Sanitary Survey Project.

9.0 REFERENCES

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APPENDIX A

CRITERIA FOR RATING ON-SITE SEWAGE SYSTEM SANITARY SURVEY RESULTS

APPENDIX B

DESCRIPTION OF OSS FAILURES AND SUSPECTS IDENTIFIED DURING THE SURVEY

APPENDIX B

TABLE B-1
ANALYSIS OF OSS CLASSIFIED AS FAILING
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998

Street Number	Street Name	Type of Repair Required*	Current Repair Status	Possible Reason(s) for Failure
8022	Long Lake Road SE	Complete	Design In	No Drainfield
5448 A	Long Lake Road SE	Complete	Design In	Hydraulic Overload/Age
5448 B	Long Lake Road SE	N/A	Design In	Hydraulic Overload/Maintenance
7564	Long Lake Road SE	Complete	Design In	Hydraulic Overload/Age
7644	Long Lake Road SE	Simple	Complete	Broken Greywater Pipe
7554	Long Lake Road SE	Complete	Design In	Drainfield Destroyed
7724	Long Lake Road SE	UNK	In Progress	Connected w/Curtain Drain
6435	Clover Valley Road	Simple	In Progress	Broken/Exposed DF Pipe
7231 B	Clover Valley Road	Complete	Unknown	Outhouse in Use
7457	Clover Valley Road	Complete	In Progress	Hydraulic Overload/Maintenance
4648	SE Inwood Court	Complete	Design In	Direct Discharge to Lake
4530	SE Firmont Drive	Simple	In Progress	Broken Greywater Pipe
4501	SE Firmont Drive	Complete	Complete	Direct Discharge to Lake
4489	SE Firmont Drive	Simple	Complete	Broken D-Box
4625	SE Greenshores Dr.	Simple	Complete	Broken Pipe
8553	Dormar Drive SE	Simple	In Progress	Hydraulic Overload
8451	Dormar Drive SE	Complete	Design In	Hydraulic Overload
4629	SE Mullenix Rd.	Complete	Design In	Hydraulic Overload

* Complete Repair = Total OSS Replacement
Simple Repair = Broken Pipe Or Other Type Of Fix Not Requiring A Permit

APPENDIX B (Continued)

TABLE B-2
ANALYSIS OF OSS CLASSIFIED AS SUSPECT
LONG LAKE SANITARY SURVEY PROJECT
JANUARY - JUNE 1998

Street Number	Street Name	Reason(s) for Suspect Rating
7272	Long Lake Road SE	Dye found in samplers --- No FC* in water samples
8000	Long Lake Road SE	Back-ups occur frequently in downstairs toilet
6980	Long Lake Road SE	Dye found in samplers --- No FC in water samples
6650	Long Lake Road SE	Dye found in samplers --- No FC in water samples
7598	Long Lake Road SE	Dye found in samplers --- No FC in water samples
7798	Long Lake Road SE	Dye found in samplers --- No FC in water samples
7138	Long Lake Road SE	Drainfield under water in winter
6945	Clover Valley Road	Dye found in samplers --- No FC in water samples
7021	Clover Valley Road	Dye found in samplers --- No FC in water samples
7555	Clover Valley Road	Dye found in samplers -- No FC in water samples
4588	SE Inwood Lane	Has surfaced in past while doing laundry
4564	Firmont Drive SE	Gurgling sounds in drainfield, has occasional back-ups
4562 B	Greenshores Drive	Drainfield shared with main building/heavily compacted
8312	Dormar Drive	Dye found over septic tank --- No FC in water samples

* = Fecal coliform bacteria

APPENDIX C

DESCRIPTIONS OF STORMWATER STATIONS

APPENDIX C
DESCRIPTIONS OF STORMWATER STATIONS

Station Name	Number of Samples	GMV (FC/100 ml.)	Station Description
LSW1	4	50	Head of Lake at Upton Road
LSW2	4	2	Drainage 100 yards east of LSW1
LSW3	3	40	Drainage 150 feet east of LSW2
LSW4	4	50	Culvert underroad South of Curley Creek
LSW5*	4	23	Between Curley Creek and Bills VCR Repair
LSW6*	3	2	Culvert under road across from white mobile home
LSW7*	4	23	Culvert under road 300 yards west of LSW4
LSW8	4	2	Culvert under road just north of Gillio Court
LSW9	3	2	Culvert under road near "Private Road" sign
LSW10	4	11	Culvert under road at a clearing for a private lot
LSW11	4	1600	Drainage down driveway
LSW12	4	70	Culvert under road near driveway with a many mobiles
LSW13	1	2	Concrete culvert with white pipe in it
LSW14*	4	1200	Culvert just north of LSW11
LSW15	1	23	At base of hill at Long Lake View Estates sign
LSW16	3	50	Culvert under road near 7410 Long Lake Road
LSW17	1	23	Near 7418 Long Lake Road
LSW18	2	4	Culvert under road near house with flow in yard
LSW19	3	23	Flow off driveway with strong oil smell, south of LSW12
LSW20	3	4	Flow under road 100 yards south of LSW12
LSW21	2	2	Culvert near 7845 Long lake Road
LSW22	3	2	Flow under road just east of new wood paneled house
LSW23	3	2	Culvert under road 200 feet south of LSW22
LSW24	4	2	Culvert north of 8693 Long Lake Road
LSW25	1	2	Small stream just north of SE Delta Place
LSW26	1	2	Last culvert near intersection of Long Lake and Mullenix
LSW27	4	130	1st culvert west on Mullenix past intersection w/Long Lake
LSW28	4	2	Small flow just west of Wyvern Drive
LSW29	1	14	Culvert due west of 5170 Mullenix
LSW30	4	8	Culvert under road 200 yards west of LSW28
LSW31	1	13	Culvert 100 yards east of Lawrence
LSW32*	4	2	Culvert under road just past dirt driveway on south side
LSW33	4	2	Culvert under road 200 yards west of LSW32

* Nutrient Sampling Station

APPENDIX C
DESCRIPTIONS OF STORMWATER STATIONS (CONTINUED)

Station Name	Number of Samples	GMV (FC/100 ml.)	Station Description
LSW34	4	4	First culvert on Dormar Drive past intersection
LSW35	4	300	Second culvert on Dormar next to new pink house
LSW36	1	80	Third culvert on Dormar 100 feet north of LSW35
LSW37	1	30	100 feet south of Dormar Tunrnaround area
LSW38	1	23	Near 7555 Clover Valley Road
LSW39	1	80	Culvert at end of SE Firmont Drive
SM01*	4	30	Mouth of Samonberry Creek
LK01*	1	50	In Lake Station - Near PFA

* Nutrient Sampling Station

APPENDIX D

EXAMPLE NOTICE AND ORDER TO CORRECT VIOLATION LETTER