



Illicit Discharge Detection and Elimination Program

Summary Report 2000-2010

A Comparison of Outfall Screening, Reporting,
and Inspection Programs

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Executive Summary

Kitsap County implemented a comprehensive IDDE program including mapping, sampling, inspection and public reporting. This report summarizes the activities and result of the program from 2000 to 2010. Results of this 10 year program are described including outfall visits, summer base flow water quality sampling, citizen reporting and inspection and municipal reporting programs. A comparison of the benefit of outfall screening, reporting programs and inspection programs are presented.

The following program components were accomplished:

- **SSWM located and visited over 1,500 discharge points** from 2000 to 2008.
- **363 outfalls were flowing and all were sampled.**
- **29 outfalls were contaminated with fecal coliform** and referred to the Kitsap County Health District. Seventeen outfalls (59%) were identified as false positives during follow up monitoring. Twelve outfalls are currently under investigation. Of the 12 sites, 3 are county owned and operated outfalls. The remaining 9 outfalls are privately owned, state-owned or are streams.
- **Approximately \$125,000 annually** was spent on the outfall visit and screening program.

Comparison of the screening, reporting and inspection programs:

- Visual screening from 2000-2008 identified 2 illicit discharges or connections.
- Outfall sampling from 2000-2008 has resulted in 12 investigation sites, with 3 that are county owned outfall sites.
- Reports to the water pollution hotline by citizens and field staff from 2008-2010 resulted in 93 confirmed illicit discharges.
- Property septic surveys, response to sewage complaints and deficient pump reports from 2008-2010 resulted in identification of 277 failing septic systems, of which only 6 discharged to the county stormwater system.

Kitsap County IDDE Program Recommendations:

- Stormwater utilities will benefit from their initial outfall screening program because outfalls will be visited, verified and obvious illicit discharges will be detected.
- IDDE field visits should focus on visual observations and water quality parameters shown to most likely indicate an illicit discharge.
- Reconsider the value of outfall water quality sampling compared to other methods, such as public education and citizen/municipal reporting hotlines, to identify illicit discharges.

- Increase education and outreach for the citizen/municipal reporting hotline and training non-municipal field staff to yield a higher number of identified illicit discharges.

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1. Introduction

In the 1980's several cities and urban counties initiated studies to identify and correct illicit discharges to their storm drain systems. The purpose of these first studies was to determine the magnitude of the problem of non-stormwater discharges entering the system. Problems found included direct connections of commercial laundries, commercial businesses and domestic sewage. Additionally, transient intermittent illicit discharges were found to be problematic including equipment washing, trash dumping, and vehicle washing.

Many of these first studies were performed in communities where development occurred as early as the 1800's. Therefore, the occurrence of illicit connections would be expected to be higher compared to communities where construction of separate storm and sanitary sewer systems dominate the landscape. In the Midwest and Eastern United States rates of cross-connection to the storm system from businesses was found to be as high as 38% (Washtenaw Co., 1988) when confirmed by dye testing. The first published report of a study in Washington was performed in Grays Harbor by Pelletier and Determan (1988). An inspection of 90 urban stormwater outfalls draining to Inner Grays Harbor revealed 32% flowing during dry weather and 21% as suspect for illicit discharge based upon water sample analysis or visual observation.

Early studies were the basis for the first guidance document for conducting illicit discharge detection and elimination (IDDE) programs titled "Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems" (EPA 1993). In 2004 a more comprehensive manual was published, "Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments" (Center for Watershed Protection, 2004).

The purpose of the IDDE Program is to identify and remove non-stormwater discharges entering the stormwater system. These pollutants are conveyed to receiving waters, such as streams, marine shorelines, estuaries, wetlands and lakes. Once delivered, these pollutants may harm aquatic life, cause negative aesthetic impacts and threaten public health. IDDE programs have multiple components to achieve prevention and correction of water pollution problems including: outfall mapping, outfall inspection, dry weather flow water sampling, ordinances, escalating enforcement, public education, citizen reporting hotline, and municipal field staff training to identify and report illicit discharges.

Unincorporated Kitsap County (Kitsap County) established its stormwater utility in 1994 and implements a comprehensive non-point pollution stormwater program (Puget Sound Action Team, 2005). In anticipation of the National Pollutant Discharge Elimination System (NPDES) stormwater permit Kitsap County and the City of Bremerton in the west sound Puget Sound region both implemented

IDDE programs independently in 2000 and 1997, respectively. Both communities based their programs upon the 1993 EPA guidance manual.

Kitsap County, along with over 80 other Western Washington communities, was issued its initial NPDES Phase II stormwater permit in 2007 and an IDDE Program is a requirement. With the County's outfall screening component of the IDDE program into its 7th year in 2007; the program elected to continue using the 1993 methods, which were adapted to local conditions and priorities. The permit recommends using the 2004 Guidance Manual (Pitt, 2004).

Each community in Western Washington developed their storm drainage system and sewage disposal systems (septic or sanitary sewer) according to local codes and ordinances. The results presented here may be of assistance to communities with a similar pattern of development, geology and priority water quality concerns.

Results of this 10 year program are described including outfall visits, summer base flow water quality sampling, citizen reporting and inspection and municipal reporting programs. A comparison of the benefit of outfall screening, reporting programs and inspection programs are presented.

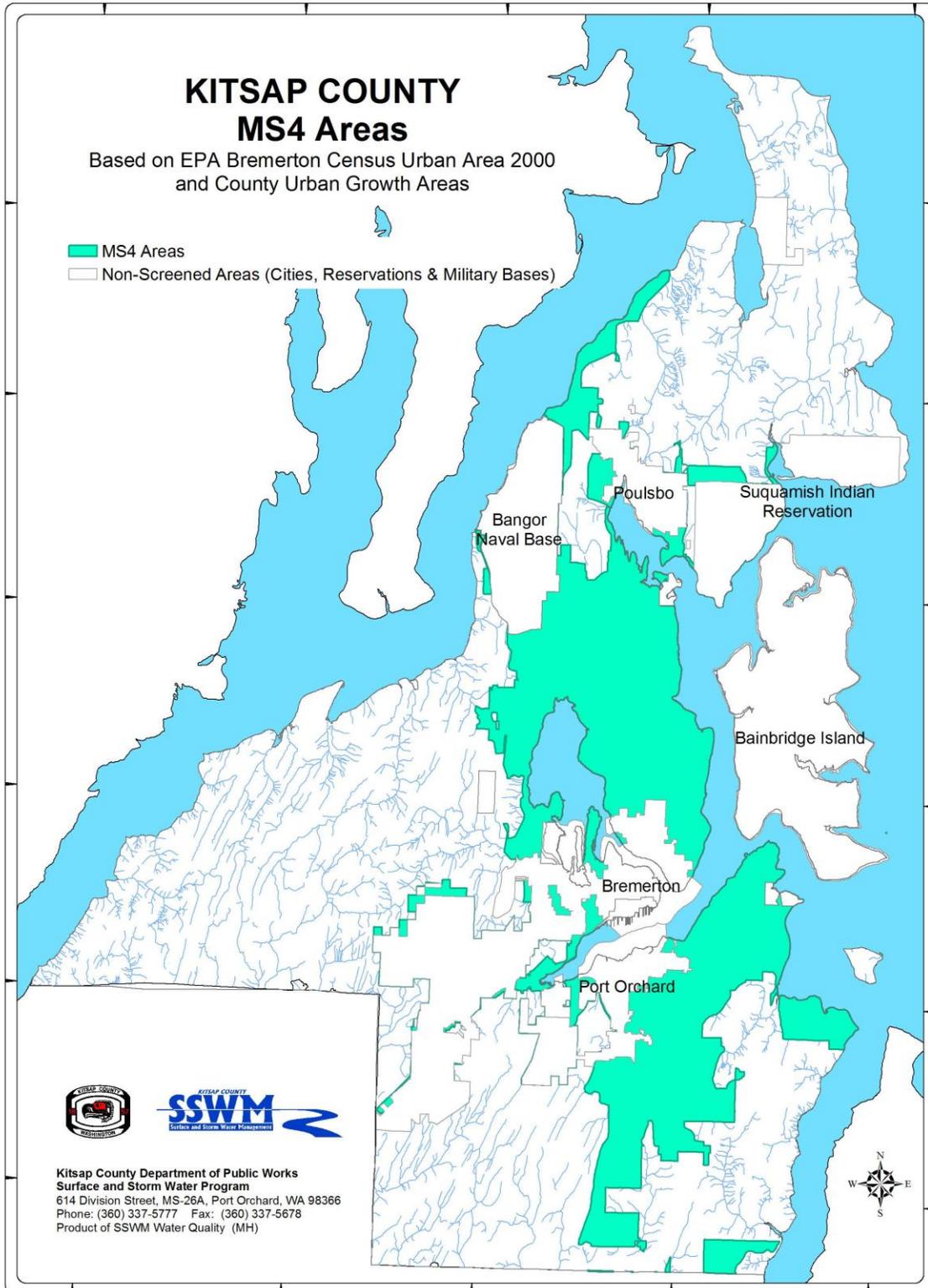
2. Project Area

Kitsap County has 156 miles of marine shoreline and numerous lowland streams. The marine waters host over 3,000 acres of shellfish beds clean enough for both commercial and recreational harvest. Shellfish harvest and primary contact recreational water health is a primary concern for residents as well as healthy local salmon runs.

Kitsap County was initially developed in the late 1800's with extensive timber harvest and land conversion to town centers for the Mosquito Fleet Ferry transportation system and farm lands. In the early 1900's more intense development resulted from the establishment of the Puget Sound Naval Shipyard in Bremerton, followed by the expansion of the community in the 1940's in response to shipbuilding for World War II. In the 1970's a second boom occurred in response to the establishment of the Bangor Submarine Naval Base. The County town center of Silverdale was intensely developed. The population of Kitsap County is 240,000. Kitsap County has a separate sanitary sewer collection system, and approximately half of the county is served by onsite (septic) sewage systems for sewage disposal.

Figure 1 is a map of the Kitsap County municipal separate storm sewer system (MS4).

Figure 1. Kitsap County MS4 Areas



The Kitsap County storm system is exclusive of the Cities of Port Orchard, Bremerton, Poulsbo and Bainbridge Island, and military and tribal lands. However, stormwater from the county system may flow into adjacent municipal systems, as well as receiving stormwater from adjacent municipal systems. No large rivers are found in Kitsap County. Additionally, several small lakes are located in the county.

Approximately 70 miles of shoreline are within the permit designated MS4 area. However, about 93 miles of marine shoreline was evaluated. SSWM's policy is to treat all receiving waters, whether in the designated MS4 or outside the MS4, as valuable water resources and subject to stormwater management activities, which will help protect and improve these resources. The remaining 63 miles of shoreline was not evaluated due to the lack of development and little or no stormwater infrastructure discharging to marine water.

Unincorporated Kitsap County's storm system includes rural areas with ditches and road cross culverts; urban centers with pipes, catch basins and storm facilities (ponds/vaults/tanks/swales); and residential areas with a combination of ditches, pipes, catch basins and storm facilities. The Surface and Stormwater Management (SSWM) Operation and Maintenance Program performs routine maintenance including cleaning over 10,000 catch basins, 254 oil/water separators, 306 manhole control structures, 1,089,792 lineal feet of pipe, inspection and maintenance of 475 stormwater ponds and 133 bio-filtration swales. Over 600 commercial properties are inspected annually and comply with maintenance standards.

Figure 2. Kitsap County storm system maintenance in residential neighborhood



3. Project Purpose and Timeline

Three major IDDE projects were implemented from 2000 to 2010 and will be summarized in this report. The projects are listed below.

- 1) 2000-2008: Screen all outfalls and sampled if flowing.
- 2) 2009: Implement the Water Pollution Hotline.
- 3) 2009-2010: Track investigated and confirmed illicit discharges reported to the Kitsap citizen reporting water pollution hotline or detected through agency sampling or site inspection programs.

4. IDDE Program Methods and Results

4.1. Field and Water Quality Methods

In general, the methods for the program were based upon the 1993 EPA guidance document (Pitt 1993) with local modifications made by the City of Bremerton (Cahall 1998). Interim status reports document the program progress, results and minor modifications (Olsen, 2002; Olsen and Heine 2003, 2004, 2006; and Olsen, Heine and Fohn 2010).

Outfall screening performed included both visual physical characteristics and, if flowing, water quality sampling. All screening was performed during the dry season (June-September) and following a minimum antecedent period of 3 days. The purpose was to assure that visual observations and discharge samples were representative of illicit discharges and base groundwater flow and the discharge quality were not influenced by storm event surface water runoff. Minimum pipe sizes screened was 6" and all ditches, and streams were screened. Both county and private discharge locations were screened.

Kitsap SSWM began mapping the stormwater system in 1993. The maps are maintained in GIS and, as of 2010, are considered to be over 95% complete. Maps were verified from 1993-1995 for multiple purposes including establishing the maintenance program, utility fee assessment, and local drainage studies and system improvement projects. However, the outfalls were not mapped during the intensive system mapping period. Staff first performed an office analysis to identify potential outfall locations. Outfalls were located and mapped in the field as a component of this program. For marine outfalls staff walked the shorelines to locate and map outfalls. For streams, the storm system maps were the sole source of the potential outfall location and stream walks were not performed. In most Puget Sound lowland streams located in rural counties the local Native American tribe walks the stream in the fall to perform salmon spawner surveys and the United States Fish and Wildlife Service performs stream surveys for stream classification purposes. Stream walks, as recommended by Pitt, et al

(2004), were considered to be an additional intrusive survey of private property owners.

SSWM monitoring staff collected the following information during field site visits: outfall latitude-longitude coordinates, a photo, a physical description, a description of flow, basic water quality parameters (multi-parameter probe), a fecal coliform sample, and a water sample for laboratory analysis. A list of the site information and activities are shown in Table 1. The analytical methods are described in SSWM's procedure manual (Olsen and Heine, 2008).

During the initial site visit if a visual observation of an illicit discharge was obvious, such as excessive suds or sewage odors, an investigation was immediately conducted.

Figure 3. Staff performing a site visit at a marine nearshore outfall



Figure 4. Staff record a discharge location to a stream



Table 1. Site Information Collected During Outfall Field Visit

Type	Description
Photo	Digital photo with jpg format.
Location and Identification	Lat. and Long. in degree and minutes (0.01) using a Magellan SportTrak GPS or Trimble GeoXH GPS.
General Information	Date, time, inspector, and weather.
Observations and Measurements	Flow present, physical condition of outfall, visual observation, diameter in inches and discharge temperature in. deg. C (0.5 deg).
Biological Samples	Fecal Coliform or <i>E. coli</i>
Chemical Samples	Conductivity, hardness, alkalinity, pH, turbidity, detergent, glycol, fluorescence (TPH*), ammonia, nitrate and phosphate.

*TPH=Total Petroleum Hydrocarbons

4.2. Illicit Discharge Water Quality Parameters and Interpretation of Results

The parameters selected were based upon the anticipated illicit discharges, which included human sewage, industrial waste water, wash water, irrigation runoff or vehicle fluid dumping. Fecal coliform or *E. coli* and ammonia are indicators of animal or human waste; detergent an indicator of wash water; alkalinity, pH, hardness, temperature and conductivity are indicators of industrial wash water; nitrate and phosphorus are indicators of irrigation runoff; and glycol and TPH are indicators of vehicle fluids.

Water quality parameter results were placed into one of four categories based upon sampling result concentrations. These categories identify the likelihood that the level of contamination indicated an illicit discharge. The four categories are *Obvious*, *Suspect*, *Potential* and *Unlikely*. These designations are recommended in the Center for Water Protection Guidance Manual (Pitt, 2004). The numeric limits were derived from a variety of sources including the 1993 Guidance Manual, industrial bench marks and limits, water quality standards, local data and experience (Olsen and Heine, 2008).

Table 2 shows the water quality screening test categories and the contamination levels designated for each category.

Table 2. Screening Test Result Designations

Test	units	Designation			
		Unlikely	Potential	Suspect	Obvious
Fecal Coliform	cfu*/ 100 mL	<200	200 to <500	500 to <2000	≥2000
Temperature	Deg. C	< 20	20 to <25	25 to <30	≥30
Conductivity	uS/cm	<300	300 to <500	500 to <1000	≥1000
pH-Low	Std. units	>6	6 to >5	5 to >4	≥4
pH-High	Std. units	<9	9 to <10	10 to <11	≥11
Turbidity	NTU	<25	25 to < 50	50 to <200	≥200
Detergent	ppm	<0.5	0.5 to <1	1 to <2	≥2
Glycol	ppm	<1	1.0 to < 2	2 to <5	≥5
TPH	fsu**	<200	200 to <500	500 to <1000	≥1000
Ammonia	mg/L as N	<0.1	0.1 to <0.2	0.2 to <1.0	≥1.0
Nitrate	mg/L as N	<1	1 to <3	3 to <10	≥10
Phosphate	ppm	<1	1 to <1.5	1.5 to <5	≥5
Alkalinity	mg/L as CaCO ₃	<200	200 to <500	500 to <1000	≥1000
Hardness	mg/L as CaCO ₃	<200	200 to <500	500 to <1000	≥1000

*colony forming unit

**raw fluorescence.

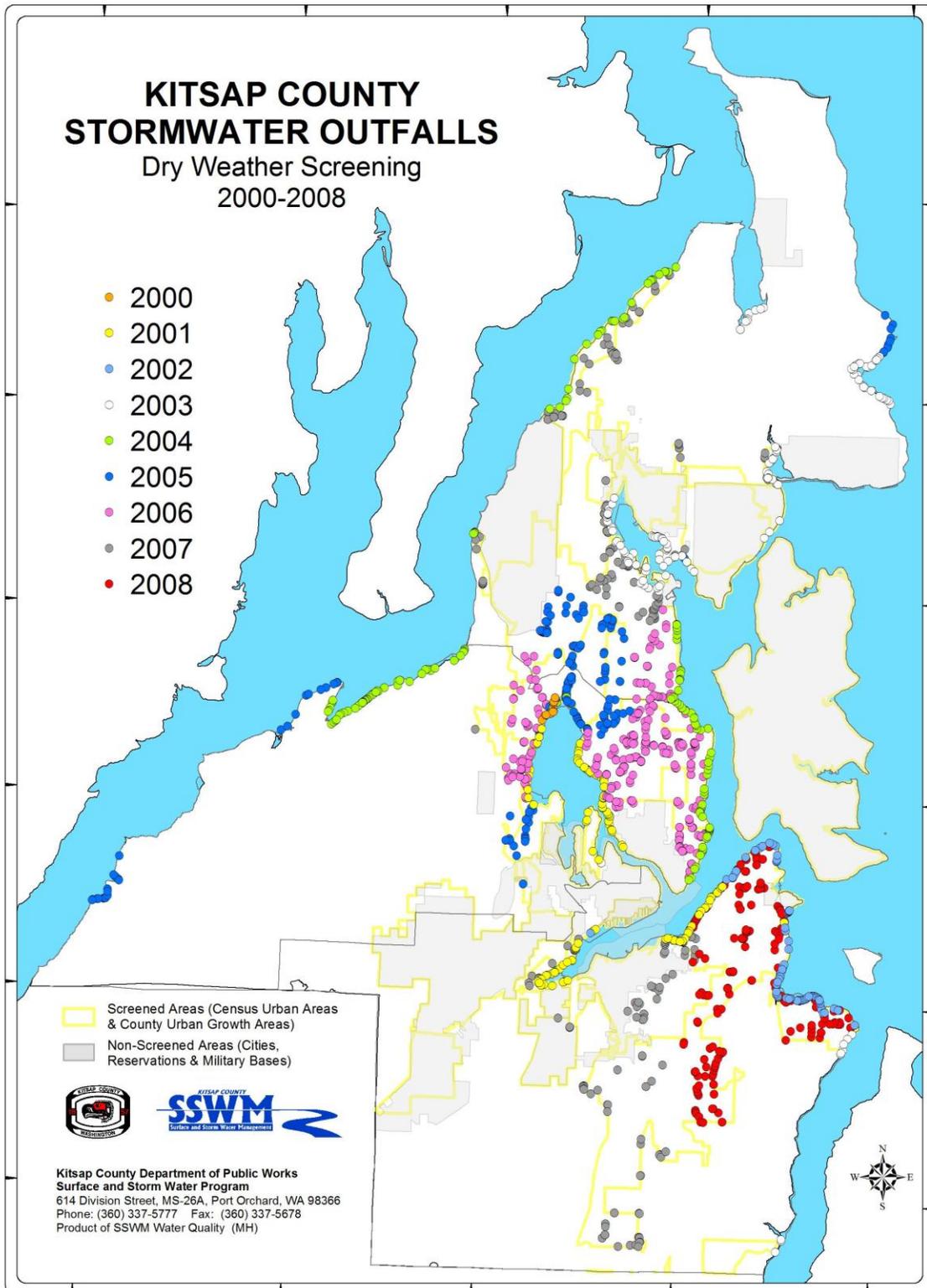
Data was collected from 2000-2008. Illicit discharge investigation and tracing sources was performed for sites with visual obvious signs of illicit discharges or a fecal coliform level of greater than 500 cfu/100ml. Locations suspected to be contaminated with human sewage were referred to the Kitsap County Health District (KCHD). KCHD performed follow-up confirmation sampling, source tracking and correction according to their Pollution and Identification Protocols (KCHD, 2003).

Outfall site visits were performed according to watershed followed by stream basin. Table 3 lists the inspection year, receiving water type and outfall discharge location or watershed. Figure 5 shows the year outfalls were visited.

Table 3. Outfall Site Visit by Year and Watershed or Creek Drainage

Year	Receiving Water Type	Watershed or Creek Drainage
2000	Marine	Dyes Inlet Watershed
2001	Marine	Dyes and Sinclair Inlet Watershed
2002	Marine	Sinclair Inlet
2003	Marine	Liberty Bay, Miller Bay, Appletree Cove (Kingston), Port Gamble Bay, Colvos Passage Watersheds
2004	Marine	Port Orchard Bay (East Bremerton), Hood Canal: Lofall and Seabeck Watersheds
2005	Marine	Appletree Cove (north), Hood Canal: Misery Point south to Stavis Creek and Holly Watersheds
2005	Freshwater	Barker Creek, Clear Creek, Chico Creek (Dyes Inlet Watershed)
2006	Freshwater	Strawberry Creek, Mosher Creek (Dyes Inlet Watershed), Enetai (Dee) Creek, Illahee Creek, Steele Creek, Small streams on the east and west side of Dyes Inlet, east side of Port Orchard Bay (Port Orchard Passage)
2007	Freshwater	Blackjack Creek (Sinclair Inlet), Burley Creek, Big & Little Scandia Creeks, Small streams around Liberty & Miller Bays, Sinclair Inlet, and Hood Canal
2008	Freshwater	Salmonberry Creek, Long Lake, and the remaining south urbanized areas of the county (Colvos Passage)

Figure 5. Outfall Points By Year Screened



4.3. Education and Inspection Methods to Identify, Investigate, Confirm and Track Illicit Discharges

4.3.1. Establishing the Citizen Reporting Hotline

In 2009 Kitsap SSWM lead the west sound regional effort to establish the Water Pollution Hotline. Kitsap SSWM partnered with the Kitsap County Department of Emergency Management, and the Cities of Bainbridge Island, Bremerton, Poulsbo and Port Orchard. The Kitsap County call center and phone number was selected to be the universal phone number for non-emergency spills. This call center, Kitsap 1, is used by county departments and is staffed during normal business hours. This reporting hotline was not only for citizen calls but was also for other agencies and non-stormwater field staff reporting.

A flow chart of spill types and the proper referral and notification procedures were developed. All municipal partners and the local Health District received training. The system was launched in February 2009.

4.3.2. Training Municipal Field Staff

In 2009 Kitsap County SSWM education and inspection staff trained field staff from county departments most likely to encounter spills. Staff from the following departments were trained: Community Development (building inspectors), Parks, Public Works, Facilities, Roads and Traffic. Additionally, summer help crews were trained in June of 2009 and 2010. The training focused on proper identification and reporting of illicit discharges.

4.3.3. Tracking IDDE Investigations and Corrections

Data from the Kitsap SSWM reporting system and KCHD system were reviewed for determination of the number of investigated and confirmed illicit discharges.

Kitsap SSWM developed a formal tracking system at the Kitsap 1 phone call center. Information collected included the number, type and locations of illicit discharge reports. Emphasis was placed upon collecting data such as illicit discharge volume, source and follow up action. Additionally, the distinction was made if the spill or discharge entered or was discharging from the storm drainage system. The NPDES permit explicitly requests reporting spills that are associated with the permittee's storm drainage system. It was important to make the distinction of spills into or from the storm system and spills that directly flowed into surface waters or did not leave the site. Spills on roads are identified as a stormwater illicit discharge in this tracking since roads are considered a component of the storm drainage system.

Kitsap SSWM funds the KCHD Pollution Identification and Correction Program and Complaint Response Program. KCHD data from the following programs was analyzed: property septic surveys in pollution project areas, septic complaints from citizens, and septic pump reports. Reports of failing septic systems directly discharging into or from the County storm drainage system were reviewed.

4.4. Locating, Identifying and Visual Outfall Screening

4.4.1. Outfall Types

The SSWM program screened both county stormwater outfalls and private outfalls. Monitoring staff located, inspected and screened a total of 1,536 discharge outfalls. Of the 1,536 outfalls visited, 1,039 (68%) outfalls were owned and operated by the County. Outfall types were pipes (921) or natural (486). Natural outfalls include streams, seeps, ditches and swales. Table 4 summarizes the classification of outfall types screened.

Piped outfalls were more predominant in marine systems at 78% of all outfalls, compared to freshwater systems, with 47% of all outfalls (Figure 6).

Six hundred thirty eight (638) outfalls discharge to marine waters (see Figure 7 for distribution by location and size). Approximately 1/3 of these outfalls are from the county storm (Figure 8) system and 2/3 are privately owned. Natural outfalls accounted for 22% of the discharge locations (see Figure 9 for locations). Only 2% of natural outfalls are from the county system (Table 4).

Eight hundred ninety eight (898) outfalls identified discharge to freshwater streams. The locations of piped outfalls and natural outfalls are shown in Figures 10 and 11. Over 80% of piped outfalls are from the county system and 20% are privately owned.

Table 4. Summary of Outfall Classifications

Outfalls to Marine Water		
Description	Number	% of Total
Total Outfalls	638	100
Total Piped Outfalls	495	78
County Piped Outfalls	198	31
Natural Outfalls	143	22
<i>Streams, seeps, etc.</i>	130	20
<i>Ditches and Swales</i>	13	2
Outfalls to Freshwater		
Description	Number	% of Total
Total Outfalls	898	100
Total Piped Outfalls	425	47
County Piped Outfalls	355	40
Natural Outfalls	473	53
<i>Ditches</i>	446	50
<i>Swales and other</i>	27	3

Figure 6. Fraction of Piped and Natural Outfalls to Marine and Freshwater.

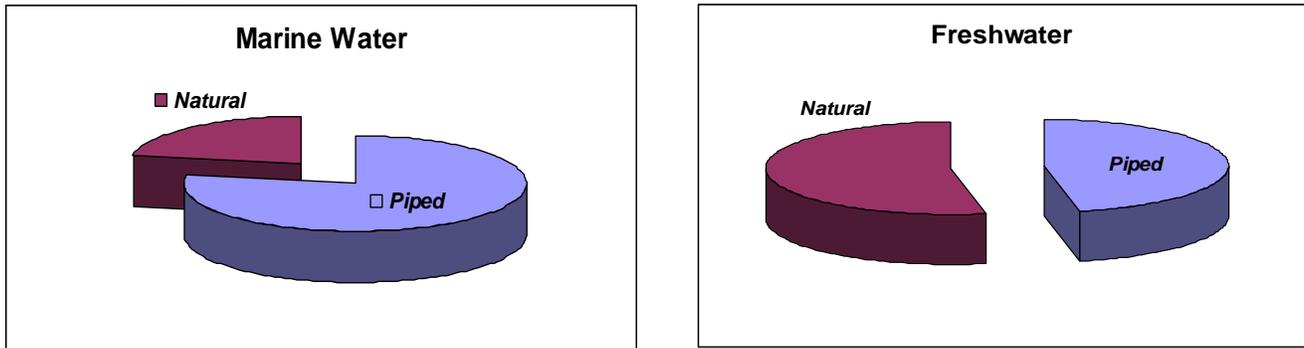


Figure 7. Marine Piped Outfalls Located in Unincorporated Kitsap County

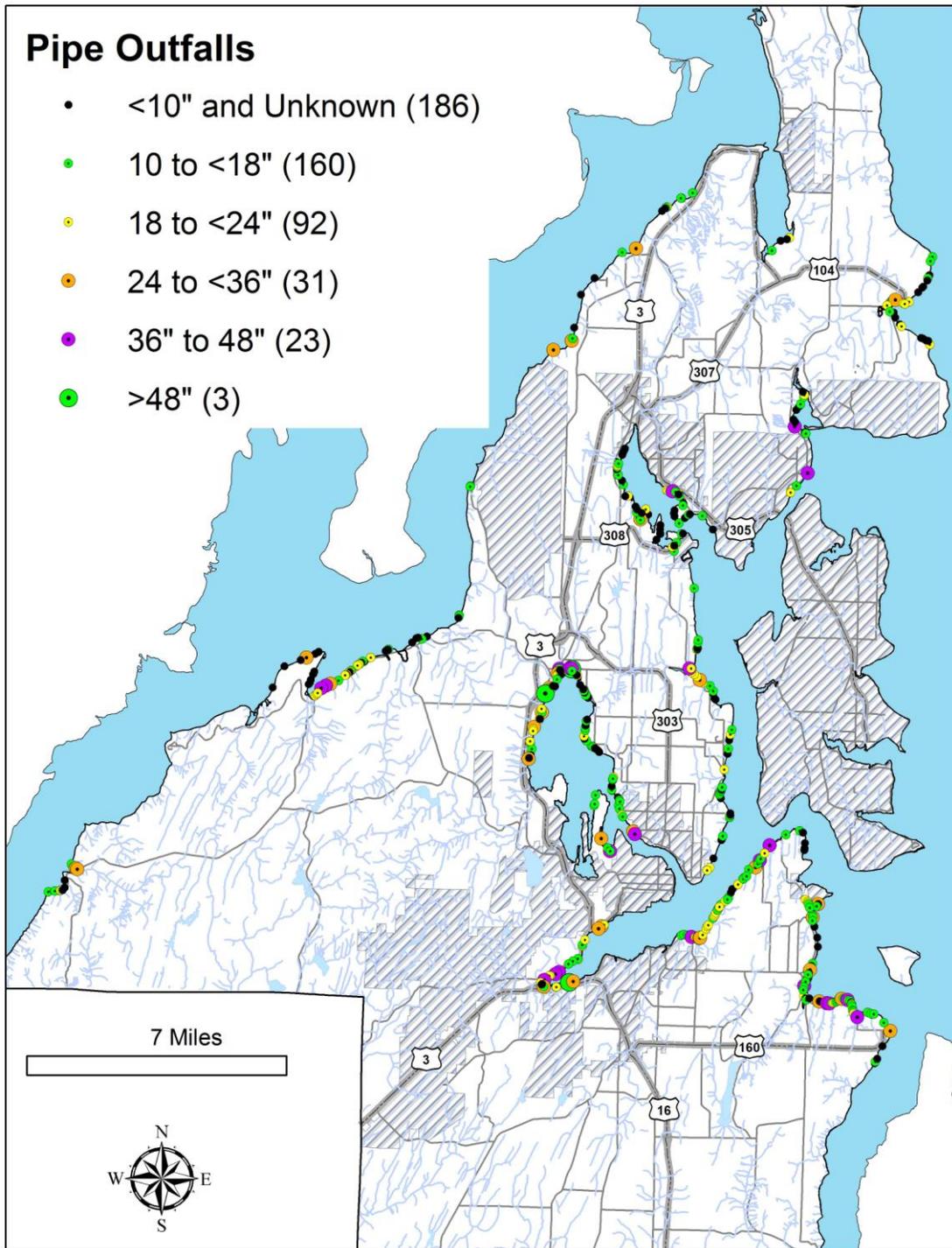


Figure 8. County Piped Outfalls Discharging to Marine Water

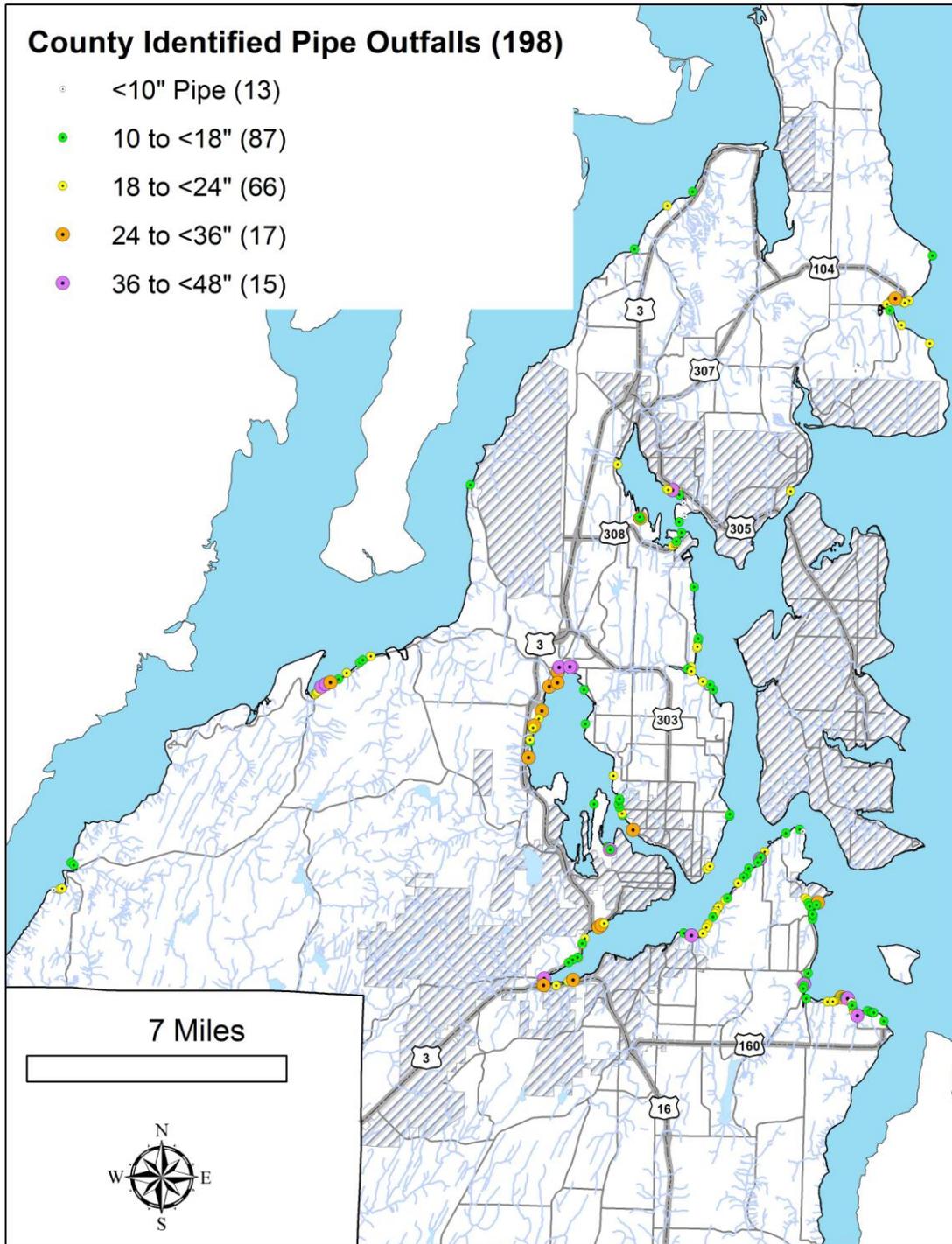


Figure 9. Natural Outfalls Discharging to Marine Water

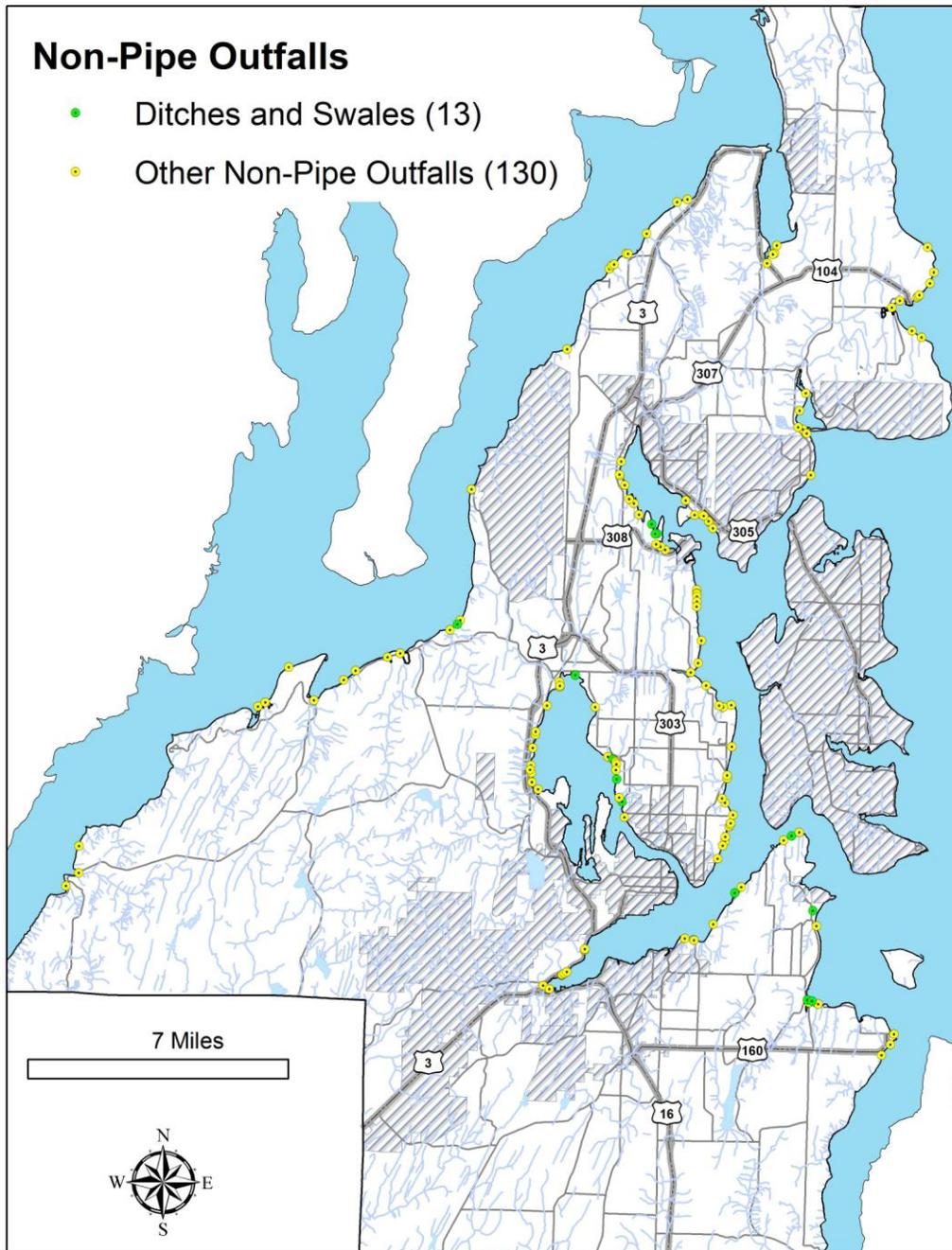


Figure 10. Piped Outfalls Discharging to Streams

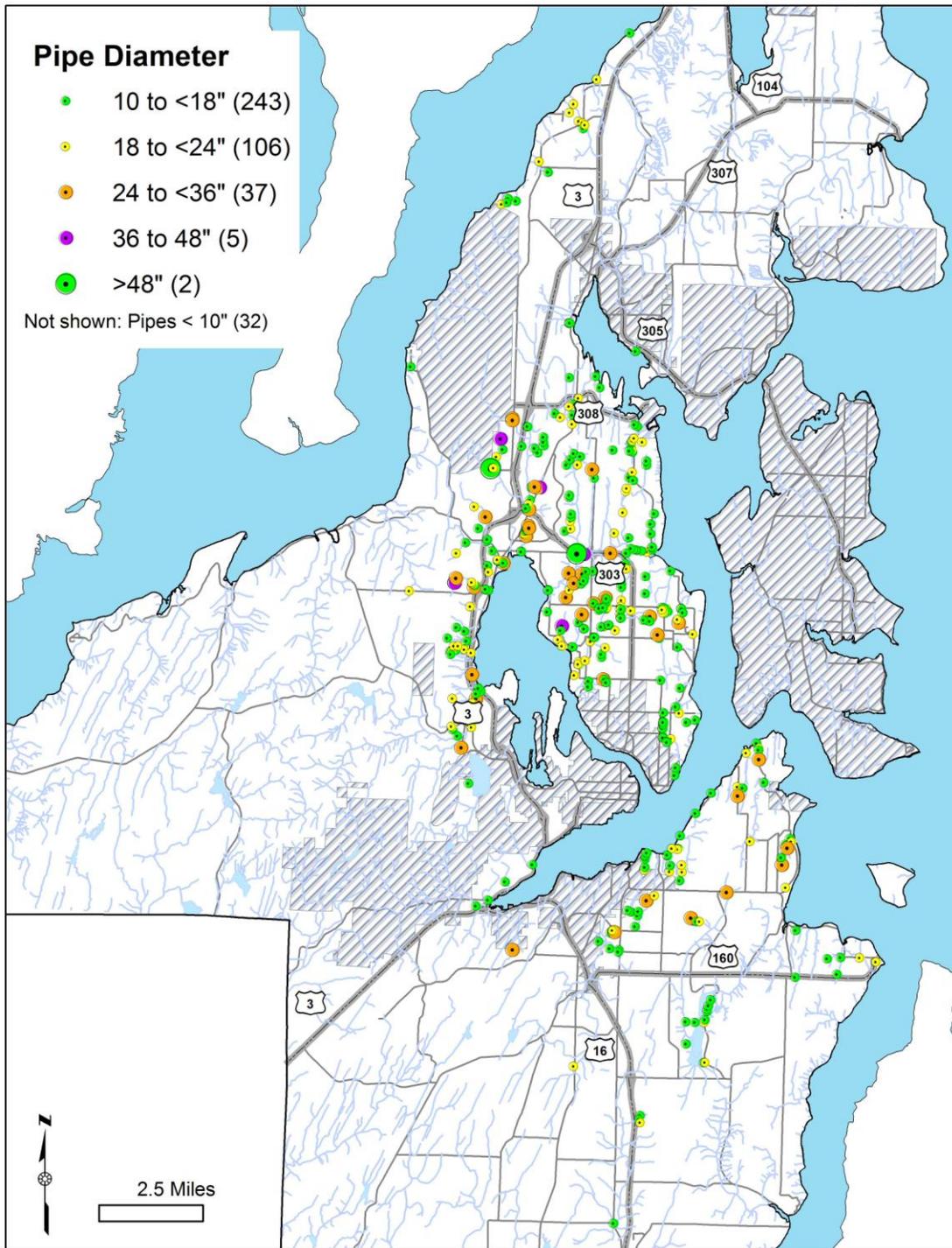
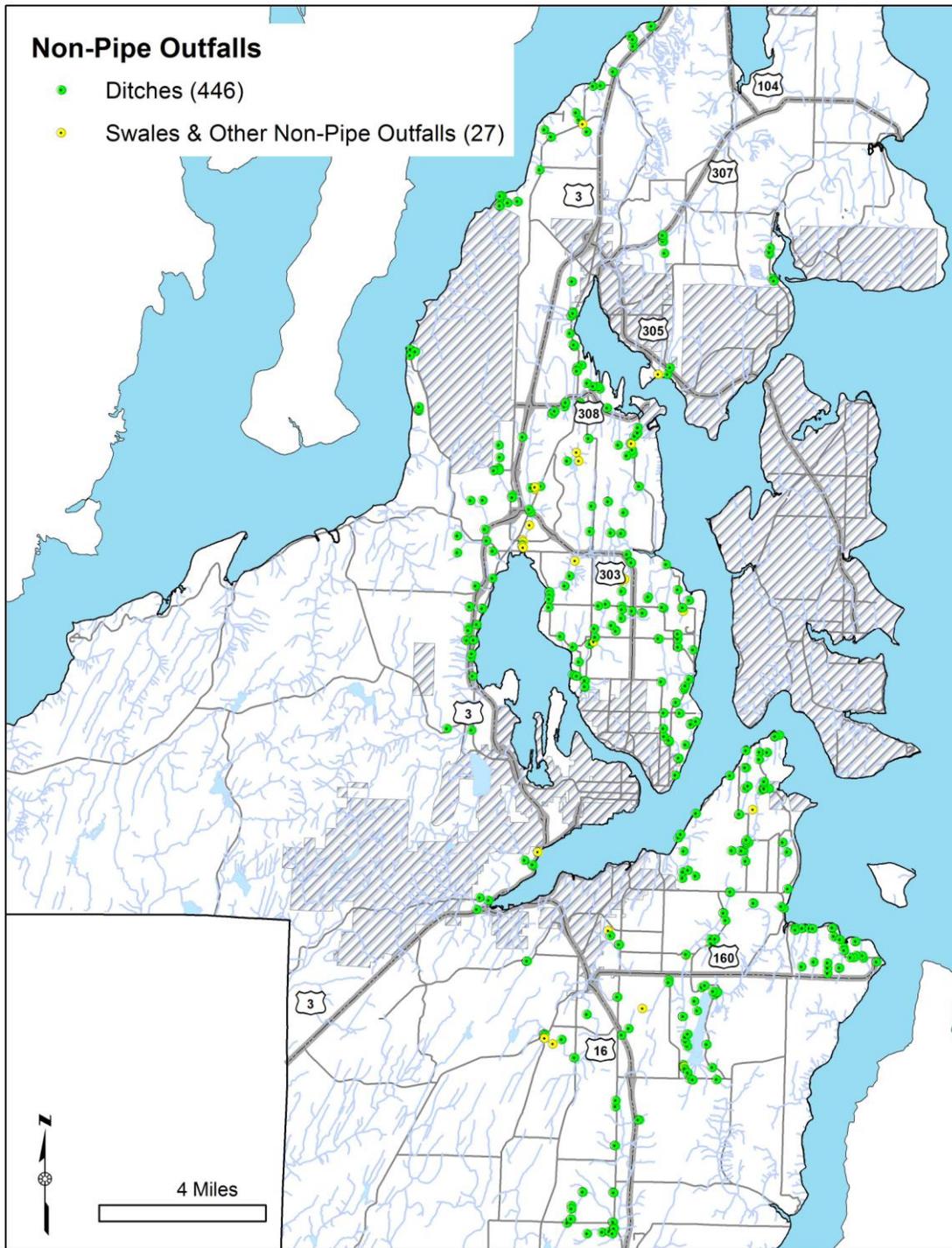


Figure 11. Natural Outfalls Discharging to Streams



4.4.2. Visual Screening

A total of 36 (2%) outfall sites of the 1,536 visited by the program had a visual indication of an illicit discharge. The most common visual indication was suds or sheen. Of these, 2 sites were confirmed to be an illicit discharge in follow up investigations. It was determined through follow-up monitoring and investigation that the 34 sites not confirmed were either false positives or intermittent illicit discharges.

4.4.3. Dry Weather Water Quality Screening

4.4.3.1. Marine Outfall Water Quality

A total of 638 outfalls discharging to marine water were located and inspected. Of those, 263 (41%) were flowing and sampled. Samples were evaluated for illicit discharge potential by water quality analysis.

Seawater contamination of marine outfall water samples was common. For this reason, the parameters of conductivity, hardness and alkalinity were employed as a primary indicator of seawater in the discharge and used as a secondary indicator of industrial discharge. Additionally, high chloride content from seawater interfered with the detergent, glycol and ammonia tests often resulting in a false positive. Once seawater test interference was discovered the three tests were not performed on samples with high conductivity.

Table 5 summarizes the screening results for the 263 marine outfalls sampled. Results indicative of Suspect or Obvious potential of illicit discharge were combined and tabulated (the far right column in Table 5); the following parameters had the highest frequency of detection in order: conductivity (21%), ammonia (12%), fecal coliform (11%), hardness (10%), detergent (8%) and glycol (8%). Since conductivity, detergent, ammonia and glycol suffered from seawater interference, the true indicators detected most frequently were fecal coliform and hardness. The parameters of temperature, pH, turbidity, TPH and alkalinity were detected infrequently (0-4%).

Table 5. Outfalls Discharging to Marine Water Sampling Results

Illicit Discharge Potential	Number of Outfalls	Unlikely %	Potential %	Suspect %	Obvious %	Suspect + Obvious
Fecal Coliform	263	79	10	8	3	11
Temperature	262	94	5	0	0	0
Conductivity	263	67	11	5	16	21
pH	263	96	4	0	0	0
Turbidity	261	97	2	2	0	2
Detergent	236	89	4	3	5	8
Glycol	245	91	1	3	5	8
TPH	228	100	0	0	0	0
Ammonia	245	76	13	8	4	12
Nitrate	210	70	26	3	0	0
Phosphate	253	85	11	4	0	4
Alkalinity	253	100	0	0	0	0
Hardness	249	88	2	1	9	10

4.4.3.2. Freshwater Outfall Water Quality

A total of 898 outfalls discharging to streams were located and inspected. Of those, 100 (11%) were flowing and sampled. Samples were evaluated for illicit discharge potential by water quality analysis.

Table 6 summarizes the screening results for the 100 freshwater outfalls sampled. Results indicative of Suspect or Obvious potential of illicit discharge were combined and tabulated (the far right column in Table 6). The following parameters had the highest frequency of detection in order: ammonia (22%), nitrate (8%), fecal coliform (4%), and turbidity (4%). The parameters of temperature, conductivity, pH, detergent, glycol, TPH, phosphate, alkalinity and hardness were detected infrequently (0-2%).

The high frequency (22%) of detecting ammonia was investigated. The ammonia level set for suspect or obvious contamination was greater than 0.2 mg/L. This level was selected from the 1993 Manual. There were 16 sites exceeding the level. Two sites had an additional chemical result for an illicit discharge-one was a high fecal coliform result and the other was a high detergent result. The remaining 14 sites did not have a high result for a sewage or wash water indicator. The contamination level may have been set too low, or ammonia levels may be a result of dilute wash water or a lack of a natural buffer to absorb nutrients as a result of a direct summer base flow runoff situation.

Table 6. Outfalls Discharging to Freshwater Sampling Results

Illicit Discharge Potential	Unlikely	Potential %	Suspect %	Obvious %	Suspect + Obvious
Fecal Coliform	87	9	1	3	4
Temperature	94	5	1	0	1
Conductivity	91	7	1	1	2
pH	100	0	0	0	0
Turbidity	95	1	4	0	4
Detergent	95	5	0	0	0
Glycol	97	3	0	0	0
TPH	99	1	0	0	0
Ammonia	61	17	20	2	22
Nitrate	58	34	8	0	8
Phosphate	97	1	2	0	2
Alkalinity	100	0	0	0	0
Hardness	99	0	1	0	1

The total number of outfalls discharging to marine water and streams was 1,536. One hundred and eighteen outfalls (8%) were identified as high priority outfalls based on high contaminant level (suspect or obvious screening test results). Figure 12 shows the type of contaminant level and the distribution geographically.

4.4.4. Investigation of Fecal Coliform Contaminated Outfalls

During the first round of screening from 2000 to 2008 29 of 118 outfalls (25%) have been referred to KCHD due to fecal coliform test results greater than 500 cfu/100ml. Most of these sites were confirmed with two or more samples with a geometric mean of 500 cfu/ 100 mL or greater. At this time KCHD has completed 17 (59%) of the referred outfall investigations. Follow up sampling at these sites showed no fecal coliform contamination. Twelve (41%) sites remain under investigation due to ongoing high fecal coliform contamination levels. The twelve remaining sites are categorized as follows: 7 are small or medium sized streams, 3 are county outfalls, 1 is a private outfall and 1 is a state-owned outfall. Table 7 summarizes the fecal coliform contaminated outfalls.

Table 7. Status of Fecal Coliform Contaminated Site Investigations

Total Number of Fecal Coliform Contaminated Sites	29
Follow up Sampling showed site was not contaminated	17 (59%)
Active Investigations	12 (41%)
<i>Small or medium-sized streams</i>	7
<i>County Outfalls</i>	3
<i>Private Outfall</i>	1
<i>State Outfall</i>	1

4.5. IDDE Outfall Screening Program Cost-Analysis

Approximately 250-350 outfalls per year were screened from 2000-2008. An analysis was performed of the cost of staff, field tests, laboratory tests, and laboratory equipment. The total program cost for outfall site visits, field data collection, sampling, water quality analysis and data management was determined to be approximately \$125,000 annually. This cost is similar to the costs described in the Center for Watershed Protection IDDE Manual (Pitt 2004, p. 36).

Figure 13. Kitsap County water quality laboratory, 2009



4.6. Identification of Illicit Discharges through Citizen and Inspection Programs

4.6.1. SSWM Public Reporting Hotline

The Water Pollution Hotline (Figure 15) was launched in February 2009. Municipal field staff were trained in fall 2009 through June 2010. Table 7 summarizes the number of calls to Kitsap 1 and the types of calls. “Citizen Direct” calls are reports to the Kitsap 1 call center, whereas “Citizen calls to other agencies” include phone calls to Ecology ERTS, KCHD and other local agencies.

Figure 14. Water Pollution Hotline Logo



The total number of calls to Kitsap 1 was 118 during the two year period of February 2009 through December 2010. The number of calls increased in the second year of the hotline, 47 in 2009 to 71 in 2010. Municipal staff reported suspected illicit discharges both years at similar rates (28 vs. 36).

Table 8. Number of Illicit Discharge Reports to Kitsap 1

	2009	2010
Total number of calls	47	71
Citizen Direct Calls	6	31
Citizen Calls to other agencies	13	4
Calls from Municipal Field Staff or local agency	28	36

The total number of reports (n=118) for the 2-year period of January 2009 to December 2010 were categorized according to spill material type: construction (paint, sediment, and concrete slurry), sewage (broken side sewers, pet waste, and septic systems), vehicle fluids (oil, gas, and antifreeze), wash water (equipment, vehicle, laundry water), grease/food (dumpsters) and other. Figure 8 shows the type of spill reports. The predominant spill type is vehicle fluids (38%) followed by wash water and construction (both at 14%). The 118 reports to Kitsap 1 resulted in 93 (79%) confirmed illicit discharges that were investigated and corrected for the two-year time period of January 2009 to December 2010.

Figure 15. Water Pollution Hotline Reports to Kitsap 1

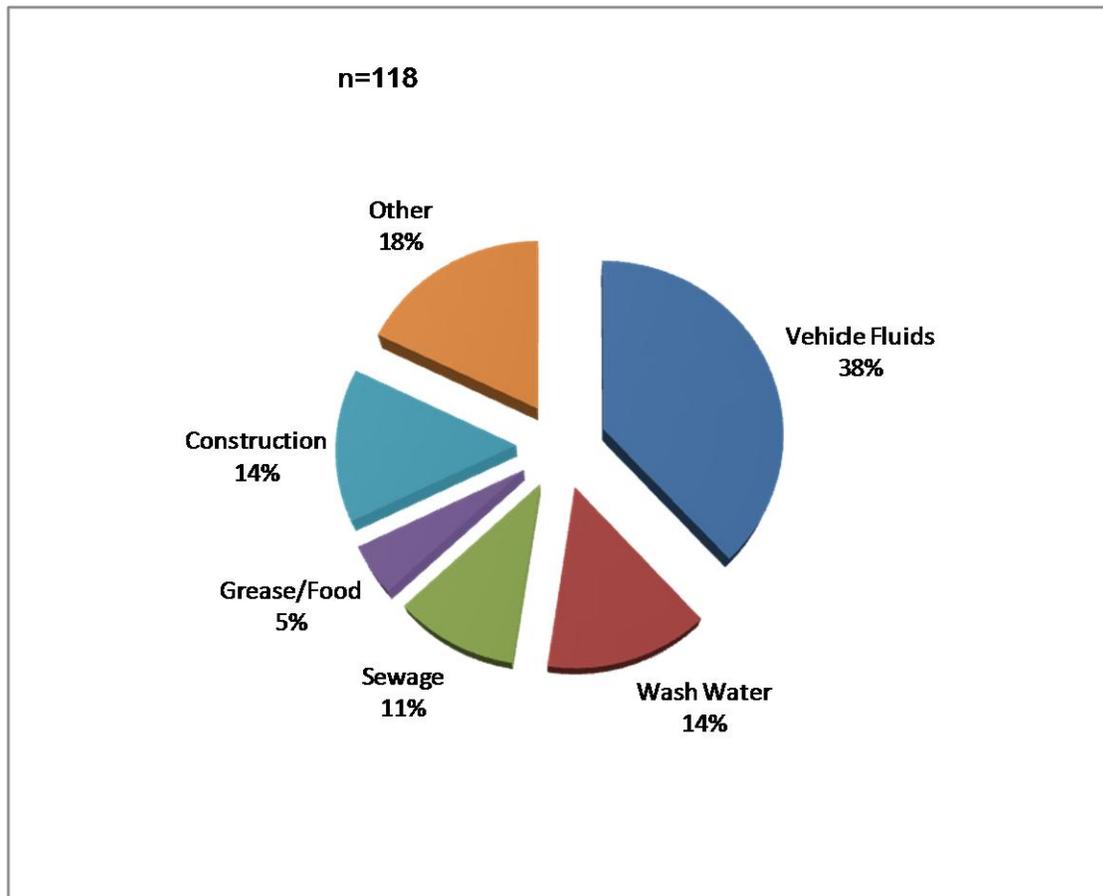


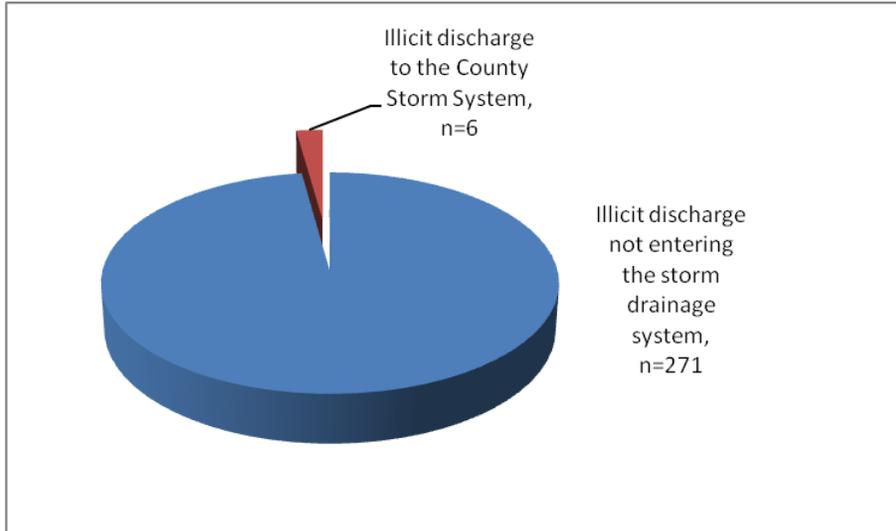
Figure 16. Report of an illicit discharge of wash water from municipal staff



4.6.2. KCHD Inspection Program Reporting

Failing on-site sewage (septic) systems are a threat to human health and shellfish beds. For the two-year period of January 2009 through December 2010 the KCHD, through citizen reports, PIC surveys and pump record reports, identified a total of 277 failing septic systems. Only 6 of the failing systems discharged to the county stormwater conveyance system. The remaining 271 systems discharged directly to local surface waters, discharged to private drainage systems, or were contained on the property.

Figure 17. Number of Failing Septic Systems Discharging to the Storm System in 2009 and 2010



5. Summary

From 2000 to 2010 Kitsap County implemented a comprehensive IDDE program including mapping, sampling, inspection and public reporting.

Mapping and Locating Outfalls to Marine and Freshwater Bodies: From 2000 to 2008 the SSWM located and visited over 1,500 discharge points to marine water and major streams.

- 1,039 sites were from the County stormwater system. Stormwater outfall pipes of 10" and greater, ditches and swales were evaluated from the county system.
- Piped outfalls were predominant for the marine shoreline at 78% of all discharge outfalls, whereas pipes to streams were less dominant at 47%.
- Ditches are the predominant natural outfall type to streams at 50% compared to only 2% to marine waters.

Marine Outfall Dry Weather Water Quality: A total of 638 outfalls discharging to marine water were located and inspected. Of those, 263 (41%) were flowing and sampled.

- The tests for conductivity, detergent, ammonia and glycol were deemed useless due to seawater interference.
- The indicators detected most frequently were fecal coliform (11%) and hardness (10%).

Stream Outfall Dry Weather Water Quality: A total of 898 outfalls discharging to streams were located and inspected. Of those, 100 (11%) were flowing and sampled.

- The following parameters were detected most frequently: ammonia (22%), nitrate (8%), fecal coliform (4%), and turbidity (4%).

Outfall Fecal Coliform Water Quality: A total of 29 outfalls were referred to KCHD due to high levels of fecal coliform. Seventeen outfalls (59%) were identified as false positives during follow up monitoring. Twelve outfalls are currently under investigation. Of the 12 sites, 3 are county owned and operated outfalls. The remaining 9 outfalls are privately owned, state-owned or are streams.

Program Cost: The program cost was estimated to be approximately \$125,000 annually.

SSWM Public Reporting Hotline: Kitsap County established the Water Pollution Hotline and received 118 calls from citizens and municipal staff from February 2009 through December 2010. Of these calls, 79% (93) of the reports were confirmed to be an illicit discharge.

KCHD Inspection Program Reporting: KCHD identified 277 failing septic systems from January 2009 through December 2010. Only 6 of these systems were discharging to the county storm drainage system.

6. Conclusions and Recommendations:

Kitsap County SSWM implemented an extensive IDDE outfall screening program from 2000-2008. The program visited over 1,500 outfalls and 68% were connected to the County stormwater drainage system. The benefits of the program include:

- Mapping of outfall locations
- Verifying outfall size, material and condition
- Visual inspection of outfalls
- Determination of presence and frequency of obvious illicit discharges
- Referral of fecal coliform contaminated outfalls to KCHD

The outfall screening program resulted in identifying three direct illicit discharges with 12 sites (of which 3 are county owned) in the investigation process. The investigation sites may be locations with long term fecal coliform problems that require extensive source tracking and identification efforts. Outfall screening provides a tool to identify potential continuous long-term illicit connections or discharges.

In 2009 Kitsap County SSWM focused on education and outreach for identifying and reporting illicit discharges. Initial data indicates that outreach to field staff and the public provides an effective means to identify and correct illicit discharges with 93 confirmed illicit discharges. Field inspections, field staff reporting and citizen reporting provide a tool to identify short-term intermittent illicit discharges; whereas outfall water quality monitoring is a tool to identify continuous illicit discharges and connections.

Kitsap County IDDE Program Recommendations:

- Stormwater utilities will benefit from their initial outfall screening program because outfalls will be visited, verified and obvious illicit discharges will be detected.
- IDDE field visits should focus on visual observations and water quality parameters shown to most likely indicate an illicit discharge. Fecal coliform was the most valuable water quality parameter. TPH, conductivity, hardness, temperature, and phosphate were the least valuable water quality parameters.
- Investigate a select number of sites with high ammonia levels to determine if the benchmark levels are adequate to indicate the potential presence of an illicit discharge.
- Reconsider the value of outfall water quality sampling compared to other methods, such as public education and citizen/municipal reporting hotlines, to identify illicit discharges.
- Increase education and outreach for the citizen/municipal reporting hotline and training non-municipal field staff to yield a higher number of identified illicit discharges.

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