VTrans NPDES Small MS4 Permit (MS4 GP 3-9014) Compliance - Illicit Discharge Detection and Elimination (IDDE): Outfall Assessment - Final Report

VERMONT AGENCY OF TRANSPORTATION (VTRANS)

Operations Division

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1.0 Introduction

This report, prepared by VHB Pioneer (VHBP), details the completion of the investigation of the Vermont Agency of Transportation (VTrans) MS4 outfalls for the Illicit Discharge Detection and Elimination (IDDE) program. Under the National Pollution Discharge Elimination System (NPDES) small Municipal Separate Storm Sewer System (MS4) Permit all state transportation departments, including VTrans, are defined as non-traditional MS4 entities and are subject to permit requirements. The Department of Environmental Conservation (VT DEC) administers Vermont General Permit (GP) 3-9014 (Amended February 19, 2004) which requires in GP 3-9014, Section 4.2.3 *Illicit Discharge Detection and Elimination,* that MS4 entities, including VTrans, develop an IDDE program to identify, monitor, and remediate stormwater outfalls with illicit discharges.

Under General Environmental Services Contract (CN# 0984775) with VTrans, VHB Pioneer (VHBP) conducted round one and round two of the Phase I outfall assessments during Spring and early Summer 2009, in order to identify any illicit discharges associated with VTrans MS4 designated outfalls in Chittenden County in Vermont. VHB Pioneer conducted a screening process, outlined in *Illicit Discharge Detection and Elimination; A Guidance Manual for Program Development and Technical Assessments* (Center for Watershed Protection [CWP] [CWP, 2009])to identify VTrans outfalls most likely to have an illicit discharge. Each of these priority outfalls was then visited in the field to ascertain the presence or absence of an illicit discharge. The results of this investigation comprise this report.

1.1 Legislative and Regulatory Background

In 2003, VTrans implemented a Stormwater Management Plan (SWMP - http://www.aot.state.vt.us/ops/TechnicalServices/stormwater/managing.htm) to meet the NPDES Phase II and non-traditional MS4 requirements. According to the VTrans Operations Division, Stormwater Compliance website;

> *"VTrans is committed to the full implementation and enforcement of the SWMP which has been designed to reduce the discharge of pollutants from the VTrans non-traditional small MS4 to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act."* (VTrans, 2009).

The Vermont Department of Environmental Conservation (VT DEC) administers GP 3-9014 under the authority of the United States Environmental Protection Agency (EPA) through the NPDES program. According to the EPA, a MS4 is a conveyance or system of conveyance that is owned by a state, city, town, village, or other publicly funded entity that discharges to waters of the U.S., and/or is designed or used to collect or convey stormwater flow (including storm drains, pipes, ditches etc.) (EPA, 2009). The NPDES Phase I regulations were issued by the EPA in 1990 and required medium and large urban areas with populations of generally more than 100,000 residents to apply for and receive permit coverage for their stormwater discharges. (EPA, 2009). Phase II of the NPDES Stormwater Program, issued in 1999, has different requirements. This permit requires that small and non-traditional MS4s, which are generally fewer than 100,000 residents, in urbanized areas such as

Chittenden County in Vermont, obtain NPDES permit coverage for their stormwater discharges. (EPA, 2009). In Vermont there are currently three publicly owned "non-traditional" separate storm sewer systems (MS4), including VTrans, that are required to come into compliance with the regulations associated with the MS4 General Permit (VTrans, 2009). The other systems belong to the University of Vermont (UVM) and the Burlington International Airport (BTV) (VTrans, 2009). As a non-traditional MS4 entity, VTrans is required to comply with the MS4 General Permit requirements, including highways, transportation facilities, and VTrans maintenance facilities located within their right-of-way (ROW) (VTrans, 2009). This report will detail what has already occurred (past history), and what the next steps are to ensuring that VTrans is meeting the requirements of the MS4 General Permit.

1.2 Illicit Discharge Detection and Elimination (IDDE)

The term "illicit discharge" is defined by the EPA 40 CFR 122.26(b)(2) as "any discharge to an MS4 that is not composed entirely of stormwater" with some exceptions covered under a NPDES permit allowed. The exceptions provided for by the EPA include - among others - any discharges resulting from fire fighting activities, landscape irrigation, rising ground waters, residential car washing and also discharges from NPDES permitted industrial sources (EPA, 2009B). This information is contained on the EPA Fact Sheet 2.5 – *Illicit Discharge Detection and Elimination Minimum Control Measures*, which is located on Pages 1 through 4 of Appendix 1.

Illicit discharges are considered "illicit" because traditional stormwater systems, unlike sewer systems, are not designed to accept, process, or discharge non-storm

water wastes. Illicit discharges enter the storm sewer system through direct connections (i.e., piping) or indirect connections (i.e., cracked pipes, spills or wastes dumped directly into a drain) [UNE, 2009]).

2.0 Project Description

2.1 Overview

The IDDE Project consisted of four primary steps; outfall screening, field assessment, data QA/QC and database generation. The first step, outfall screening, was conducted to prioritize the list of 869 outfalls into those most likely to be associated with an illicit discharge using base mapping information provided by VTrans. The second step, the field assessment, consisted of an individual visit to each of the 332 outfalls identified during the screening process to document the existing conditions. The third step, data QA/QC, involved checking for errors and evaluating the GIS model for accuracy. During the QA/QC step the original project design was modified to include field investigation of 41 additional outfalls not identified by the screening with the purpose of further evaluating the screening methodology. The results of this additional investigation are detailed in section 3.3.3 of this report. The fourth and final step, database generation, included the preparation of an Overall Project Area Site map and the compilation of the collected GIS data onto a data CD, which are provided in Appendix 8 of this report.

As a result of this project, 341 outfalls associated with 40 miles of VTrans MS4 roads were assessed. An ESRI® File Geodatabase, project mapping, and a Trimble® data dictionary were produced (included on the data CD in Appendix 8). In addition, during the course of the project, bi-weekly updates were provided to Craig Digiammarino, Operations Environmental Coordinator of the Stormwater Compliance Management Program at VTrans, and these are included on Pages 1 through 8 of Appendix 2.

2.2 *Study Area*

Within the designated VTrans MS4 area, as shown on the Overall Project Sitemap, which is included in Appendix 8 of this report, the project area for the IDDE outfall assessments included eight cities and towns in the Lake Champlain Basin in Chittenden County of Vermont: Burlington, Colchester, Essex, Milton, Shelburne, South Burlington, Williston and Winooski. Another four towns are included within the project area; however, no outfall assessments were done in these areas. These towns include Fairfield, Jericho, St. Albans and Underhill. Please refer to the Overall Project Area site map included in Appendix 8 of this report for an aerial photographic view of this area. Outfalls were surveyed on 18 separate roads. Table 1, provides a summary of all the VTrans stormwater outfalls inventoried in each City or Town.

Table 1: Outfall Assessment Survey Summary

Town	State and U.S. Roadways Included	Number of Outfalls Screened	Outfalls Investigated by VHB Pioneer
Burlington	I-189	5	5

Table 1: Outfall Assessment Survey Summary			
Town	**State and U.S. Roadways Included**	**Number of Outfalls Screened**	**Outfalls Investigated by VHB Pioneer**
Colchester	US-7, VT-15	87	42
Essex	I-289, VT-15, VT-117, VT-15, US-2A	167	76
Fairfield	-----	4	0
Jericho	-----	40	0
Milton	US-7	3	2
Shelburne	US-7	82	38
South Burlington	US-7, I-189, I-89, VT-116, Williston Rd	265	122
St. Albans	-----	49	0
Underhill	-----	1	0
Williston	US-2, US-2A, Industrial Ave	130	41
Winooski	I-89, VT-15	36	15
Totals:	-----	869	341

3.0 Methods & Materials

3.1 Outfall Screening

As part of the field preparation for round one of IDDE outfall assessments, VHBP conducted an outfall screening analysis using ArcGIS® software on a database originally prepared by VTrans during the 2003-2004 field season. The database contained a total of 869 VTrans MS4-designated outfalls. The purpose was to identify

priority outfalls to be investigated in the field. This screening method, detailed in Table 2, was performed using data provided by VTrans, VT DEC, the Vermont Center for Geographic Information (VCGI), and the Chittenden County Regional Planning Commission (CCRPC).

Each outfall has been evaluated according to the six criteria detailed in Table 2:

Table 2: VTrans MS4 Outfall Priority Outfall Screening Criteria	
Attribute	**Criterion**
1: Past Reports	Past discharge complaints and reports: taken from hazardous waste sites and sources
2: Poor Dry Weather Water Quality	Poor Dry Weather Water Quality: upstream contamination based on available biomonitoring data
3: NPDES Permit Density	Density of generating sites or industrial NPDES permits: Also includes VT stormwater permits
4: Outfall Density	Density of outfalls along streams
5: Old Industries	Presence of older industrial operations: historical aerial review (40 year threshold)
6: Septic Presence	Density of aging septic systems

For every criterion, each outfall was assigned a Priority Outfall Score (POS) of 1 (low risk of an illicit discharge occurring), 2 (Moderate risk of an illicit discharge occurring) or 3 (High risk of an illicit discharge occurring). The final POS score was the average of all six criteria scores, set on a continuous scale between 1 and 3. Below is a discussion of the methods used to assign risk scores for each criterion:

Criterion 1: Past Reports: Existing records of spills, dumping, and/or contaminants in the vicinity of outfalls were used to prioritize outfall assessments. Outfalls located nearby existing contamination sources were considered to be of higher risk of recent discharge. Specifically, previous

locations of known discharges were converted into a grid for the entire study area that was divided into three density categories:

- low (less than 10 reports per square mile (sq. mi.), score = 1)
- moderate (10-20 per sq. mi., score =2)
- high (greater than 20 per sq. mi., score =3).

These scores were assigned to VTrans MS4 outfalls that fell within a particular density category.

Criterion 2: Poor Water Quality During Dry Weather Conditions: Water quality sampling data indicative of upstream contamination (e.g., high *E. coli*, metals, etc.) were also used to prioritize outfall assessment. Biomonitoring data typically obtained from water sampling during dry weather conditions in September and October were compiled for all streams in the study area that had been sampled in the past five years. Sites that were most recently listed as not meeting class B2-3 biocriteria were selected and upstream reaches were identified. VTrans MS4 outfalls within 100 meters of these reaches were assigned a "high" risk score of 3, outfalls between 100 and 500 meters from these reaches were assigned a "moderate" score of 2, and all other outfalls were assigned a "low" score of 1.

Criterion 3: Density of Generating Sites or Industrial NPDES Permits: Proximity of outfalls to NPDES permit and density of nearby permitted sites was used to prioritize outfall assessment. The EPA website states that there are nine NPDES individual permit sites in Chittenden County Vermont (USEPA 2009A). These sites include the IBM Corporation in Essex Junction, the Village of Essex Junction Wastewater Treatment Facility (WWTF), the

City of Burlington WWTFs (three locations), the City of South Burlington WWTFs (two locations), the Town of Hinesburg WWTF, the Town of Winooski WWTF. Vermont Stormwater discharge permits, Act 250 permits and "EPA-regulated Facilities" were also included in this analysis and they were assessed using the same density method employed for Criterion 1 above.

Criterion 4: Outfall Density by River Mile: Outfall density was interpolated from the total VT DEC and VTrans MS4 outfalls as in step 1 above, and then overlaid on a map of study area streams, resulting in a density of outfalls per stream segment. Stream segments were then subdivided into three density categories: low (less than 20 outfalls per segment, score =1), moderate (20-50 per segment, score=2) and high (more than 50 per segment, score=3). These values were assigned to any VTrans MS4 outfalls within 30 meters of a stream segment, rounding up in cases of overlap.

Criterion 5: Presence of Older Industrial Operations: Historic aerial photography of the study area was reviewed to identify sites with defunct industrial facilities more than 40 years old that are in close proximity to current VTrans MS4 outfalls. Selected aerial photographs taken in 1962 were overlaid on 2008 imagery of the study area. A visual survey identified sites that had been used for industrial activities in 1962 but have since been decommissioned or abandoned. The located sites were clustered on the Burlington waterfront and along the river in Winooski. VTrans MS4 outfalls within 1,000 meters of these sites were assigned a "high" risk score of 3,

outfalls between 1,000 and 2,000 meters from these sites were assigned a "moderate" score of 2, and all other outfalls were assigned a "low" score of 1.

Criterion 6: Presence of Aging Septic Systems: E911 data and existing sewer service maps were used to determine areas where there are more than 100 older drain fields per square mile. VTrans MS4 outfalls in these areas were given priority for assessment. Town sewer coverage maps and additional data showing stormwater drainage infrastructure were overlaid on the E911 address dataset. All E911 addresses in the study area *not* located within 200 meters of any of the above coverage areas were considered potential septic tank sites, and they were evaluated as in Criterion 1 above.

For example, outfall number 114 is located on the Hinesburg Road in South Burlington near the intersection with Deane Street. It is situated within a moderate density zone for Criterion 1 (see figure 1), so it receives a "Past Reports" score of 2. The outfall is located on a stream reach with a high risk of poor water quality, and within a high density zone for existing industrial discharge sites, so it receives a score of 3 on both criterion 2 and criterion 3. The outfall is in an area with low total outfall density, it is not located within 2,000 meters of any old industrial operations, and it is located in an area with a low density of probable septic systems, so it receives a score of 1 on Criteria 4 through 6. As such, outfall 114 receives scores of 2, 3, 3, 1, 1 and 1 on the six screening criteria, which averages to a POS of 1.83.

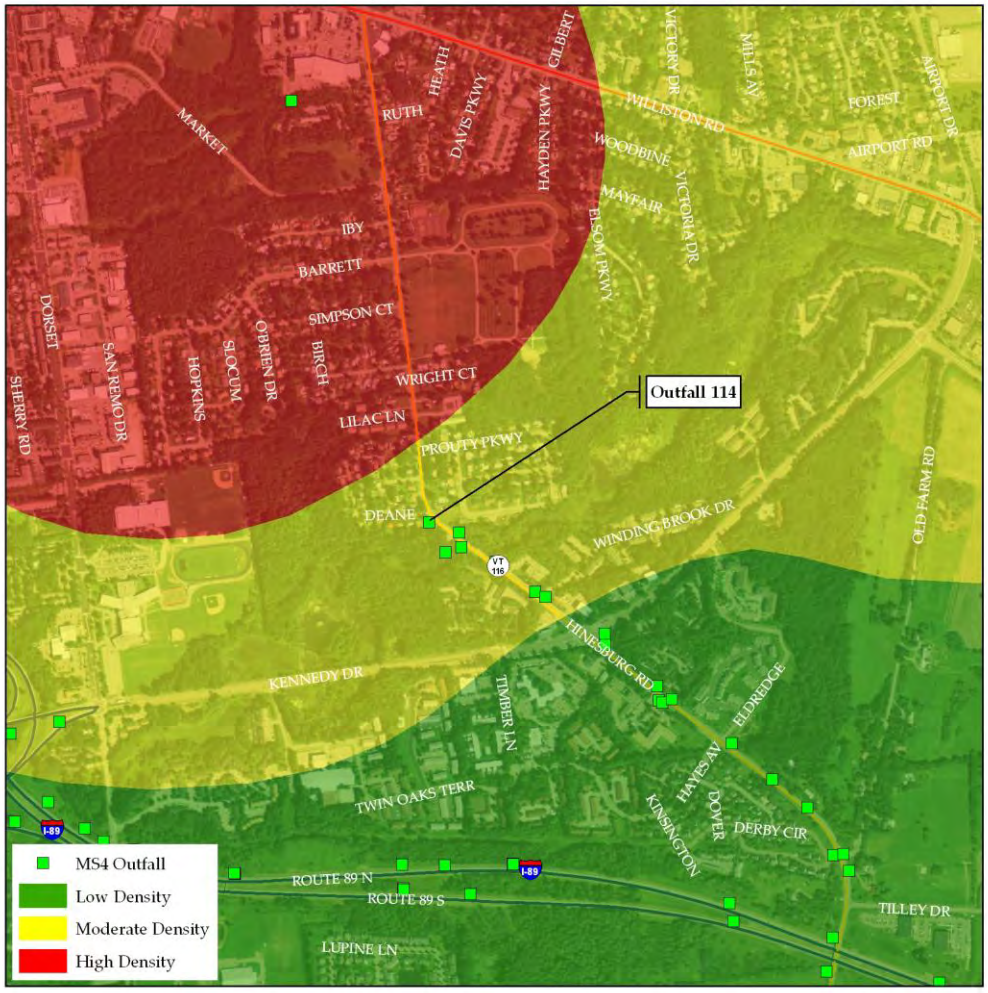

Figure 1: Example Outfall Showing Density of Past Discharge Reports (Screening Criterion 1)

A secondary round of priority outfalls was produced after the completion of round one of the VTrans MS4 outfall assessments. The purpose was to select an additional set of outfalls that round one of GIS analysis had not classified as being "priority". As part of the secondary round of field assessments, these outfalls were visited in the search of illicit discharges.

3.2 Outfall Investigation

3.2.1 Field Preparation

Field preparation began with a plan to visit each of the identified outfalls and several steps were taken before commencing the field work. First, VHBP applied for approval for working within the VTrans ROW and received safety protocol for working on limited access highways under the Vermont Title 19 - Section 1111 Access Permit from VTrans. While the permit application was being reviewed by VTrans, VHBP started work on generating the project database which would store the collected field data. This included an electronic filing system, or database, for all project data including Geographic Information Systems (GIS) data and the Outfall Reconnaissance Inventory (ORI) field form, originally developed by the Center for Watershed Protection and Robert Pitt. (CWP, Robert Pitt 2004). This form allowed for recording of the characteristics present at each outfall accessed. The ORI form was also converted into Trimble® Data Dictionary form for use on a mobile GPS data collection unit. A copy of the ORI form data dictionary is included on the data CD, which is included in Appendix 8 of this report.

Once the Title 19 - Section 1111 permit was approved by VTrans and returned to VHBP the next step was to ensure that the proper safety equipment was in place. This included the following items: high-visibility ANSI Class II, Level II safety vests, and a high-density strobe light for the field vehicle. It was clearly explained in the permit that these items needed to be used all times while working within the VTrans right-of-way (ROW) on limited and non-limited access highways in Vermont, and that extreme care and safety precautions needed to be taken when working along the Interstate.

After acquiring all the requisite safety equipment and training, VHBP prepared an ArcView® .mxd GIS project with orthophotos, roads and the selected outfalls. This project data were used to plan the field investigation and also uploaded to the mobile data collectors (GPS units) for use as a navigation aid during the outfall assessment.

3.2.2 Outfall Assessment

Throughout the project, VHBP personnel examined outfalls only during "dry weather" conditions. This is defined as less than 0.10 inches of precipitation during a 48 hour period of time. VHBP used a two person field crew at all times while in the VTrans ROW. Equipped with the proper safety attire and equipment as previously mentioned, VHBP personnel went into the field each day with mobile GPS units containing digital maps showing the locations of each of the priority outfalls and the data dictionary containing the ORI form. One vehicle was used during the project to transport VHBP personnel to the outfall locations. The high density beacon was placed on top of the field vehicle and was turned on when pulling over on to the shoulder of the road. The vehicle was parked as far off the traveled portion of the road as possible to ensure that no adverse effects on traffic flow were being made, especially for limited access highways (e.g., I-89, I-189 and I-289) within the project site.

Using the equipment mentioned above, VHBP personnel navigated to the outfalls in the field. Once field personnel arrived at the outfall outlet, a photograph was taken of the outfall and the digital ORI form and hardcopy ORI form were filled out. If possible illicit discharge indicators such as odors, suds or oil sheens were noted in

either the flowing water or at the outlet pool, further upstream investigation of the outfall was done. The purpose was to try and locate the source of the potential illicit discharge and where it was entering the VTrans ROW. If only very minor or no issues were found at the outfall outlet, VHBP personnel moved on to the next priority outfall.

Per CWP protocol, outfalls were classified as either "unlikely", if no indicators were present, or the outfalls received a "potential or "suspect" score if two or more indicators were present at the outfall outlet using the entries located on the ORI form. An outfall was rated as a "potential" source of an illicit discharge if it had two or more indicators present either in the pool at outfall outlet, inside the culvert itself (e.g., pipe benthic growth), or in the flowing water present at the outfall. In order for an outfall to receive a "suspect" score, it needed to have three or more indicators present. Indicators that were present in the "potential" or higher scoring outfalls included oil sheens, suds, excessive algae, excessive vegetation, pipe benthic growth, colors and odors.

Located in Section 5 of the ORI form (Pages 1 and 2 of Appendix 3), the "Pool Quality" entry was filled in if any of the following indicators were present at the outfall outlet or outlet pool; odors, colors, suds, excessive algae, floatables, or oil sheens. If one or more of the above mentioned indicators were found at the outfall outlet or outlet pool, the outlet received a poor pool quality rating.

3.3 Database Generation

3.3.1 Data QA/QC

Project data were backed up daily and included downloading, correction, and exporting of the collected GPS data using Trimble® GPS Pathfinder Office software. The data were then loaded into a GIS database on the VHBP server for storage. All photographs of the outfalls were downloaded from the cameras each day and put into the project folder labeled with the corresponding date. The outfall photographs are included on Pages 1 through 59 of Appendix 4. The hardcopy ORI forms were checked for errors or omissions on a daily basis, and then scanned to a digital format (PDF) and placed in a folder on the server.
The final QA/QC review steps were as follows:

Task #1: The scanned ORI forms, which are included on Pages 1 through 704 of Appendix 5, were compared with the GIS data, checking for errors or inconsistencies. A random assortment of outfalls from different days of fieldwork was reviewed. In the event an error was found it was noted and then corrected.

Task #2 was checking for gaps or omissions (i.e., blank attributes) in the GIS data. Blank entries were filled in with data from the hardcopy ORI forms.

Task #3 involved checking the outfall photograph database for errors or omissions. Also, as part of this step, the photographs were renamed based on their outfall ID number.

A detailed summary of the QA/QC review results is provided in Section 4.3.1 of this report.

3.3.2 Data Storage

The ESRI® File Geodatabase housed both the model results and the collected field data. Folders organized by date collected were set up on the server to store the photographs. Along with the photographs, the hardcopy ORI forms were scanned to PDF format and were placed on the server for storage. A blank ORI form is included on Pages 1 and 2 of Appendix 3.

3.3.3 Additional Field Investigation

A secondary field investigation, focused primarily on the more rural areas within the VTrans MS4 study area of Chittenden County was conducted for 37 outfalls. The round one GIS analysis indicated high POS for outfalls in the more urban areas such as commercial zones, high-density residential neighborhoods, and industrial complexes within the study area and low POS in more rural areas. It was expected that we would find a lower incidence of illicit discharges in these rural areas due to round one of GIS analysis assigning them a low POS score, or an "unlikely" chance of having an illicit discharge. In order to examine the effectiveness of the selection of the priority outfalls based upon the GIS analysis and POS, a secondary round of VTrans MS4 outfall assessments of a sample of low POS score outfalls was needed. Section 4.0 provides the results of both the round one and secondary rounds of the IDDE outfall assessments.

4.0 Results

4.1 Outfall *Screening*

Round one of the GIS screening of the VTrans MS4 outfalls was successful. With the GIS data inputs that were provided by VTrans, VT DEC, and others, VHBP was able identify the high priority outfalls (POS greater than 1.0), resulting in 332 outfalls

selected for field investigation. The GIS analysis gave these outfalls the greatest chance or the "more likely" chance of having a potential illicit discharge present. Based on the combined scores for each of the six criteria listed in Table 3, VTrans MS4 outfalls with a greater than 1.0 POS score were selected as priority outfalls. Outfalls which received a POS score of 1.0 were considered less likely to have an illicit discharge, based upon the available data inputs. The GIS screening model results, as well as the complete GIS dataset can be found on the data CD, which is included in Appendix 8 of this report.

Table 3: VTrans MS4 Outfall Descriptive Statistics for GIS Selected Outfalls

Criterion Number	#1	#2	#3	#4	#5	#6	Priority Outfall Score
Criteria Type	Past Spill Reports	Water Quality	NPDES Permits	Outfall Density	Historic Industry	Septic Systems	
Mean	1.53	1.30	1.85	1.23	1.21	1.01	1.35
Median	1	1	2	1	1	1	1.17
Mode	1	1	2	1	1	1	1
Minimum	1	1	1	1	1	1	1
Maximum	3	3	3	3	3	3	2.33

4.2 Outfall Assessment

Round one of IDDE outfall assessments by VHBP personnel commenced on May 14, 2009, and were concluded on June 24, 2009. The focus during of the IDDE outfall assessment fieldwork was primarily on urban, or "hot spot" areas within the study area. The "hot spot" areas include areas which have a high commercial and or residential density. Examples of "hot spot" areas include the US Route 7 (Shelburne Road) corridor in the cities of Burlington and South Burlington and along the US

Route 2 area in the Town of Williston. These areas were deemed as possible locations in which illicit discharges may be occurring though the GIS screening. The area along Shelburne Road in the cities of South Burlington and Burlington proved to an area where illicit discharge indicators were present at several of the outfalls inventoried. Seven outfalls out of 17 in this area showed such indicators as oil sheens, suds, as well as odors in some cases. The most common indicators that were present were oil sheens and suds. The least common indicators that were present were colors and odors. Outfall damage was also included in the overall outfall score. Although no specific illicit discharge sources were found in this area, several outfalls were deemed as receiving overland stormwater flow from the nearby filling stations present along much of the Shelburne Road area. These outfalls were scored as either "potential" or "suspect" outfalls, which will require additional investigation, including water quality sampling (See Section 5.2 below). Also included in the outfall assessments was a secondary investigation of the more rural areas within the study. This includes the towns of Essex, Colchester and Shelburne. The stormwater drainage and flow patterns are not as well documented as the more urban areas mentioned above. The purpose of this investigation was to determine the effectiveness of the GIS screening analysis by examining an area where all the outfalls received a low POS score.

Of the 869 screened VTrans MS4 outfalls, 332 priority outfalls were chosen for investigation. Of the 332 priority outfalls proposed for investigation, 28 outfalls were not located in the field by VHBP personnel due to either errors (duplicates) in the original VTrans MS4 outfall dataset, or recent construction activities at some locations (e.g. VT-15 in Essex near I-289) resulting in the removal or relocation of VTrans outfalls. An additional 41 outfalls, of which four were not located while in

the field, were inventoried during the secondary round of the Phase I assessments, resulting in a total of 341 VTrans MS4 outfalls investigated during the IDDE Phase I field assessment. A complete list of the VTrans MS4 outfalls that were not located in the field by VHB Pioneer personnel can be found on the included Data CD. Out of the 341 outfalls investigated in the field, VHBP classified 32 outfalls as either missing or buried and no confirmed illicit discharges were found. However, 41 (13 percent) outfalls scored as a "potential" and a total of 4 (1 percent) were classified as "suspect". These outfalls combined make up approximately 14 percent of the total outfalls investigated (See Table 4 below).

The determining factor as to why these outfalls received reduced scores was due to the poor pool quality found at the outfalls. A total of 51 (17 percent) of the outfalls investigated were recorded as having poor pool quality. A total of 27 (62 percent) out of the 43 priority outfalls had poor pool quality as the result of either suds or oil sheen being present in the pool. Another three outfalls had excessive algae, and only one outfall had an odor present in the outlet pool. The source of the oil sheens present in the outlet pools is the result of overland storm water flow. This was most prevalent in the US Route 7 (Shelburne Road) area in South Burlington and also along US-2 in Williston, and sections of I-89 in the cities of Burlington and Winooski, where 21 (12 percent) out of 172 outfalls had oil sheens present.

The secondary round of outfall assessments was conducted on July 15, 2009 in the Towns of Colchester and Essex, Vermont. A total of 37 outfalls were investigated during this additional one-day field reconnaissance effort. This additional effort was conducted in order to; assess the results of the GIS analysis to see if proved to be effective in choosing the priority or "hot spot" areas, and to provide an on-the-

ground check of the more rural areas within the investigation area which were not selected for GIS analysis.

At the conclusion of the outfall field investigation, VHBP personnel compared the likelihood of finding a suspect or potential illicit discharge between the selected "priority" outfalls (POS >1.0) and outfalls that were identified as "non-priority" (POS =1.0) by the GIS analysis. This comparison of results between the selected and not-selected outfalls allowed for an assessment of the overall effectiveness rating for the GIS analysis. The analysis determined that, among the outfalls investigated, 14 percent (43 out of 304) were potential or suspect illicit discharge outfalls in the GIS selected group. The non-selected group had approximately 5 percent (two out of 37) potential or suspect illicit discharges. Based upon the round one outfall assessment results shown below in Table 4, it can be seen that the GIS selected outfalls were over 2.5 times as likely to have a potential or suspect illicit discharges present than those outfalls not selected. Further assessment of the GIS model, including an evaluation of the typical outfall impacts found in the field and the associated land use may result in changes that could improve the likelihood of finding illicit discharges. However, the current model was used to effectively screen the original outfall inventory and pre-select outfalls that were more likely to be illicit discharges.

Table 4: GIS Analysis Comparison – Frequency of potential or suspect outfalls found based on POS.	VTrans MS4 Outfalls Field Assessment		Totals
	Round 1 "Selected Outfalls" (POS >1.0):	Round 2 "Outfalls Not Selected" (POS = 1.0):	
Outfalls Selected (from the original 869) for Investigation via GIS screening:	332	41	373
Total Number of Outfalls Investigated:	304	37	341
Number (and Percentage) of Outfalls "Not Found" in the Field:	28 (8.4%)	4 (9.8%)	32
Number (and Percentage) of Potential or Suspect IDDE Outfalls Based on Field Evaluation:	43 (14.1%)	2 (5.4%)	45

4.2.1 GE Healthcare Facility Investigation

On May 13, 2009, VHBP field personnel identified what was thought to be an active illicit discharge occurring at GE Healthcare (formerly IDX) facility on Shelburne Road in the City of South Burlington. When VHBP personnel arrived at VTrans MS4 outfall number 57151 a sewage type smell and slight brown discoloration in the water was present. After further upstream reconnaissance VHBP traced the source to a water pump hose which was draining the southern stormwater pond at the GE Healthcare facility into a nearby catch basin. This was reported to VTrans immediately following VHBP field personnel's return to the office. After further discussions with Tom Dipietro of the City of South Burlington Stormwater Utility Department, it was explained that the odor was anaerobic, with the solids in the pond resulting from the pond being drained within the previous week due to construction activities.

Mr. Dipietro also took water samples from the GE Healthcare stormwater pond and also at outfall number 57151 and sent it to the laboratory for an *e. coli* analysis. The sampling results, which are included on Pages 1 through 4 of Appendix 6 of this report, indicate lower than state standard levels of *e. coli* were present at both sites. The conclusion was that this was not an illicit discharge and no violations had taken place.

4.3 Database Generation

4.3.1 Data QA/QC

Throughout the project, VHBP personnel took care to ensure that the data collected were organized after each day in the field. Data was uploaded to the server on a daily basis and reviewed for consistency. After the completion of round one of outfall assessments, VHBP conducted a QA/QC review of the database, checking for errors, inconsistencies, and omissions. The first step was to choose a random selection of 75 (24 percent of total) outfalls that were inventoried and review them. After this a thorough analysis of both the GIS database and the hardcopy ORI forms was completed. The process included checking for blanks, typographical errors, or omissions in the data. The two datasets were also compared to ensure that the entries on each were consistently the same. The end result of the QA/QC review showed that the overall dataset had very little error. The resulting error rate was 2.6 percent, or 34 errors out of a possible 1,275 total entries.

A QA/QC review of the photograph database resulted in one missing outfall photograph (outfall # 93), which is a less than 0.01% error rate. As a result, a

photograph of Outfall 93 is not included in the outfall photograph inventory, which can be found on Pages 1 through 59 of Appendix 4.

4.3.2 Data Storage

The data storage option implemented for this project was ESRI® File Geodatabase, which makes it possible to house and organize the collected data throughout the duration of this project in one location. The photograph and hardcopy field form storage methods also proved to work very well. All involved personnel in this project understood the storage hierarchy and importance of staying organized, which made for a very smooth and efficient field data collection exercise and also QA/QC review process.

All data collected throughout this project is provided on the CD provided in Appendix 8. The CD contains the data collected on the GPS units, which is stored in the File Geodatabase. The CD also contains the photographs taken, and the Trimble® data dictionary (digital ORI form). Also provided on pages 1 through 20 of Appendix 7 are tables containing the collected outfall assessment data. These spreadsheets contain a record for each outfall inventoried by VHBP personnel. The spreadsheets also contain a hyperlink field, which once clicked on, provides the viewer with the photograph taken by VHBP of the outfall.

5.0 Recommendations

5.1 IDDE Program Compliance

Under Vermont GP-9014 requirements VTrans is required to implement an IDDE program consisting of the identification, monitoring, and remediation of illicit discharges found at stormwater outlets. The conclusion of this IDDE outfall assessment consists of the initial identification step, ensuring that VTrans is successful in meeting the requirements of the IDDE program; the remaining steps will include water quality sampling of the field-identified priority outfalls. Any illicit discharges that are confirmed as part of future investigations would require remediation efforts. Continued monitoring should be done at the priority outfalls as identified in the field, to determine the source of the water quality inputs.

5.2 Phase II – IDDE Outfall Assessment

It is the recommendation of VHBP that a secondary round of outfall assessments be conducted for the 45 potential or suspect illicit discharge outfalls identified as a result of the outfall assessment and subsequent data analysis. This additional investigation will include another visit to each of the high priority outfalls. Once there, a comparison can be done to check for changing or deteriorating conditions by comparing the data with the initial field assessment (round one and two) completed by VHBP. Also, as part of the secondary round assessment protocol, water quality sampling would be conducted at outfalls which show indicators such as oil sheens, suds, discolorations, and odors. The water samples would be collected either at the outfall outlet if flowing, or from the outlet pool. Once collected the samples would be taken to a certified laboratory for the appropriate analysis based upon observed

conditions (e.g., Volatile Organic Compounds (VOCs), *E. coli*, or Cleaning Agents). The water quality results, field investigation results, and the on the ground reconnaissance will be used to ascertain the presence or absence of an illicit discharge. If pollutants are present the follow-up investigation will search for the source(s) of the illicit discharge. Once the source is found, a remediation plan or strategy should be developed to improve the water quality at the outfall and surrounding areas. Depending on whether the illicit discharge is found to be a continual type discharge (e.g. illegal hook-up into drainage system) or a one-time event (e.g. spill or illegal dumping); the continued monitoring of these outfalls should be done to ensure that improving water quality conditions are occurring as of the result of the remediation activities.

At the conclusion of the secondary assessment round, a report documenting the results of the additional field investigation and water quality sampling would be produced. The completion of this task would serve as the second step of the IDDE program process.

6.0 References

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