



**Clark County NPDES
Illicit Discharge Detection and
Elimination Screening**

Quality Assurance Project Plan

Version 2.0 March 2007

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Illicit Discharge Detection and Elimination Screening Project Quality Assurance Project Plan

Purpose of the Quality Assurance Project Plan

Clark County Public Works Water Resources (Water Resources) follows the general Quality Assurance Project Plan (QAPP) format defined by the State of Washington Department of Ecology (Ecology) (Lombard and Kirchmer, 2001). Water Resources requires a QAPP for each monitoring project. The plan addresses project design, schedule, methods of data collection and management, quality assurance and quality control requirements, data analysis, and reporting.

Background and Problem Statement

Illicit discharges are broadly defined as polluted, non-stormwater discharges entering the storm sewer system. Examples include improper cross-connections, leaking sewer lines or septic systems, and illegal dumping of materials such as waste oil or paint. Illicit discharges may contribute to exceedences of water quality criteria in receiving waters during baseflow conditions, and may also increase pollutant levels in stormwater.

Section S5.C.8 of Clark County's 2007 Phase I Municipal Stormwater Permit requires an ongoing program to detect, remove, and prevent illicit connections and illicit discharges entering the county's municipal separate storm sewer system (MS4).

The Illicit Discharge Detection and Elimination Screening (IDDE Screening or Screening) project includes field screening and source tracking and is one component of a larger set of county activities designed to meet the requirements in Section S5.C.8. Additional permit-required illicit discharge prevention activities are not within the scope of the IDDE Screening project, including: the development and maintenance of an MS4 map; the development and enforcement of county ordinances prohibiting illicit discharges; preventing, responding to, containing, and cleaning up spills or improper disposal; construction and maintenance inspections; training for county crews to recognize and report violations, and; creating and publicizing a citizen complaint hotline.

Clark County first implemented a systematic Storm Sewer Screening project in the year 2000. Details of that implementation are provided in annual project reports, in particular the Storm Sewer Screening Project 2002 Annual Summary and Final Project Review (Clark County Public Works, April 2003).

The IDDE Screening project was designed and initiated during 2006, drawing upon experience gained during the 2000 – 2002 screening project and on updated guidance contained in *Illicit Discharge Screening: A guidance manual for Program Development and Technical Assessments* (Center for Watershed Protection, October 2004). In particular, the project was structured to focus more effectively on the types of discharges routinely encountered during the earlier screening project. These include bacterial contamination and inappropriate discharge of commercial washwater.

Version 2.0 of this QAPP applies to IDDE project activities beginning in 2007. Version 2.0 updates certain aspects of field procedures and data management to increase project efficiency based on observations from the 2006 project.

Organization and Schedule

Project Staff

Water Resources activities are administered through Clark County Public Works as part of the county's NPDES Clean Water Program.

Client: Earl Rowell, Water Resources Manager
Supervisor: Rod Swanson, Senior Planner
Project Manager: Chad Hoxeng, Natural Resources Specialist II
Technical Support: Jeff Schnabel, Natural Resources Specialist III
QC Coordinator: Jeff Schnabel
Project Team: Chad Hoxeng
Jason Wolf, Natural Resources Specialist I
Bob Hutton, Natural Resources Specialist III
Jeff Schnabel

Laboratory Contracts

Laboratory water quality analyses for the project are performed by TestAmerica Laboratories (TA), an Ecology-accredited laboratory located in Beaverton, Oregon.

Laboratory: TestAmerica
Address: 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
Phone: 503-906-9200
Contact: Howard Holmes or Mary Fritzman-Smith

Other laboratory and field investigation services are contracted on an as-needed basis with appropriate agencies or laboratory facilities.

Project Timeline

The IDDE Screening project follows several steps in each watershed, including: initial screening, follow-up investigations, and referrals for source removal.

The initial screening step proceeds systematically through county watersheds in tandem with Water Resources' Stormwater Needs Assessment Program (SNAP) and in response to NPDES permit requirements. Initial screening in each subwatershed is expected to require no more than one year.

Subsequent followup investigations or source removal tasks lag behind initial screening work due to the time required to plan and carry out the activities. The timing and order of followup investigations depends on the number, complexity, and severity of problems discovered during initial screening.

Project Description

The goal of the IDDE Screening project is to detect, isolate, and eliminate illicit discharges to and from Clark County's MS4.

Project objectives are to:

- Identify dry-weather flows at MS4 outfalls
- Conduct dry-weather field screening and analytical testing to detect illicit discharges
- Conduct and/or coordinate followup investigations to isolate sources when suspected illicit discharges are detected
- Refer suspected illicit discharges to appropriate staff or agencies for source removal
- Perform followup inspection or monitoring to confirm that source removal activities are successful

The IDDE Screening project fulfills or partially fulfills the requirements under Clark County's 2007 Phase I Municipal Stormwater permit sections S5.C.8.b.i, vi., and vii.

The project is based on methods found in *Illicit Discharge Screening: A guidance manual for Program Development and Technical Assessments* (Center for Watershed Protection, October 2004).

The IDDE Screening framework

The framework shown in Figure 1 outlines the general approach of the Screening project. The process begins with systematic outfall screening using a series of physical and water quality indicators. Screened outfalls may be non-flowing, flowing, or an obvious illicit discharge. Obvious illicit discharges are immediately referred for removal or scheduled for further investigation to isolate the source. Field and analytical results from flowing outfalls are interpreted using a flowchart and selected industrial discharge benchmarks. Non-flowing outfalls are assessed for possible intermittent discharges and may be sampled using off-hours monitoring, caulk dams, sandbags, or other methods to capture intermittent flow.

If an illicit discharge is suspected, further steps are taken in an attempt to isolate the specific source. Depending on the type of discharge, this may include investigations of the upstream storm drain network, the upland drainage area, a specific business or pollution-generating site, septic systems, or sanitary sewer infrastructure. These followup investigations may be performed by county departments or by other agencies.

When a source or source area has been isolated to the extent practicable, the case is referred to the appropriate agency or county department for removal. County technical assistance staff, code enforcement officers, or health department staff may be involved, in addition to local wastewater districts and the state Department of Ecology.

Following source removal, effectiveness monitoring is completed to confirm the source has been eliminated.

Limitations

Illicit discharge screening projects cannot locate and remove *all* illicit discharges or inappropriate connections to the MS4. Illicit discharges may be continuous, intermittent, or transitory. Continuous discharges are generally the easiest to detect and often produce the greatest pollutant load. Intermittent discharges occur over a shorter period of time and are harder

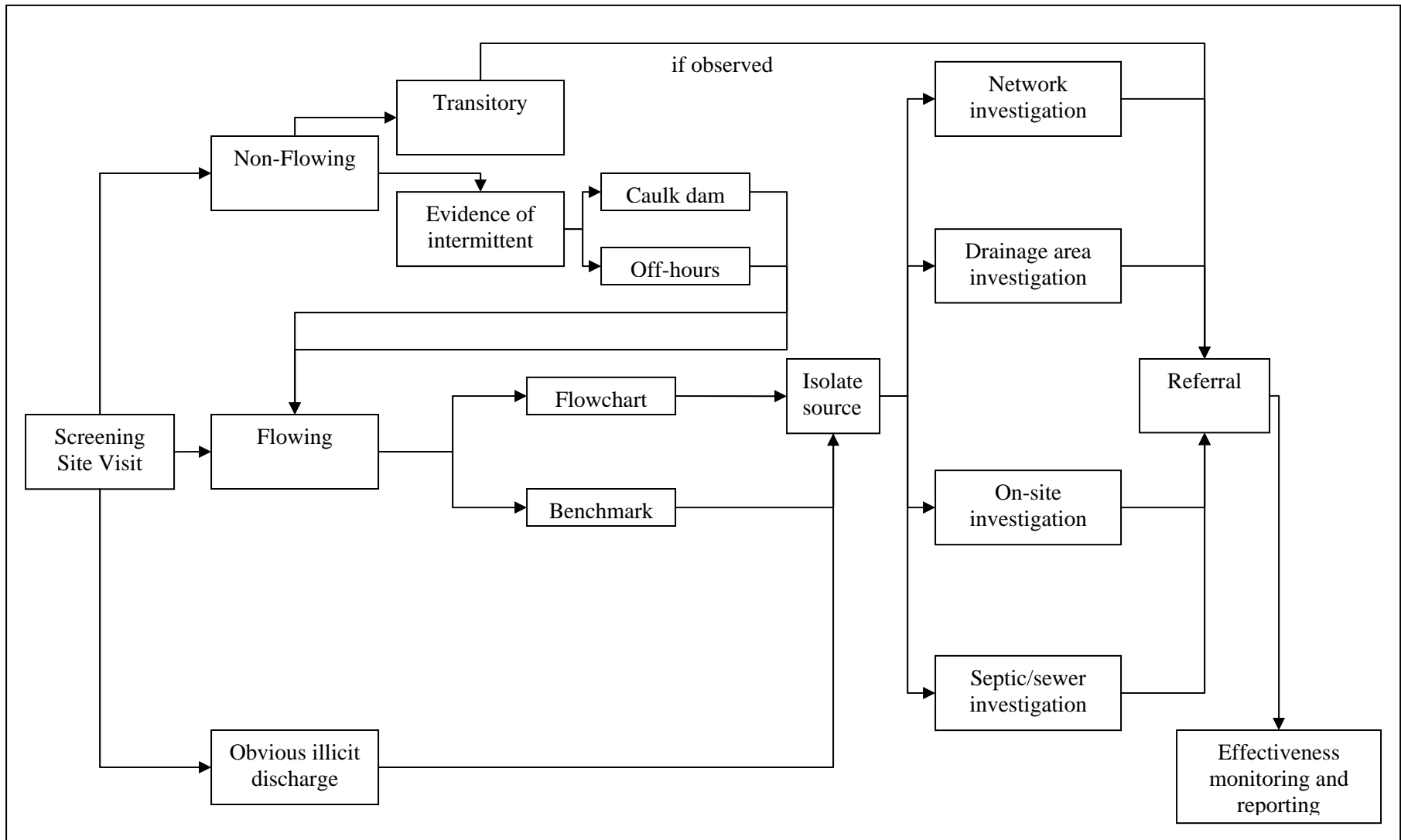


Figure 1. IDDE Screening project framework. (adapted from Center for Watershed Protection, October 2004)

to detect. The IDDE Screening project utilizes specialized sampling methods in an attempt to capture intermittent discharges. Transitory discharges are usually due to a singular event such as illegal dumping or an industrial spill. Such discharges are not likely to be detected by an illicit discharge screening project, but may have significant water quality impacts.

Successful elimination of illicit discharges also depends on effective coordination and cooperation between agencies that manage storm, sanitary, and septic systems, including: Clark County Water Resources, Clark County Public Health, local wastewater utilities, and the Department of Ecology. Budget and resource limitations may impact the ability of various agencies to respond to illicit discharges discovered through the IDDE Screening project.

Sampling Design

Subwatershed prioritization

Water Resources utilizes a systematic framework called the Stormwater Needs Assessment Program to direct and coordinate many Water Resources section activities, including the IDDE Screening project. IDDE Screening is implemented according to a prioritization schedule determined under the SNAP framework. The basin prioritization takes into account a range of watershed factors including current and projected land use, existing water quality, amount of stormwater infrastructure, hydrologic conditions, and regional watershed management initiatives.

Mapping/Outfall locations

Water Resources stormwater infrastructure staff update the county MS4 map on an ongoing basis. Additional updates, including detailed ditch mapping, will generally be completed in the early stages of needs assessments under the SNAP.

Additionally, streams may be surveyed for stormwater impacts, including stormwater outfalls, during the needs assessment process. Previously unknown outfalls discovered during this process are added to the MS4 map.

When feasible, initial screening in a subwatershed is implemented after updated MS4 mapping has been completed. However, the Screening project is a required activity under the stormwater permit and will proceed using the available mapped outfalls at the time screening is initiated, regardless of the status of mapping activities.

Selection of initial screening sites

Because most county subwatersheds have a relatively small number of stormwater outfalls, the project attempts to screen every known MS4 outfall based on the available MS4 map. When possible, private outfalls to streams are also screened.

Initial screening frequency/schedule

A flexible field schedule is required for initial screening, due to the necessity of monitoring during dry weather. Each outfall is visited a single time during the initial screening process. Outfalls with potential illicit discharges may be re-visited one or more times as part of followup investigations.

Screening indicators

Initial screening is a systematic monitoring approach that describes each outfall and utilizes a series of indicator characteristics selected for their ability to discern illicit discharges. Table 1 outlines the outfall descriptions, physical indicators, field measurements, and laboratory analyses utilized during initial screening. Outfall descriptions and certain physical indicators are noted at

each screening site, regardless of whether water is present. Additional physical indicators, field measurements, and samples for laboratory analysis are collected at each outfall where ponded or flowing water is observed.

Table 1. IDDE Screening indicators

Category	Indicators	
Outfall description:	type	shape and dimensions
	material	
Physical indicators:		
<i>flowing outfalls:</i>	floatables	
	odor	
<i>flowing and non-flowing outfalls:</i>	deposits/stains	
Field measurements (flowing only):	discharge (estimated)	temperature
	pH	turbidity
	conductivity	
Laboratory analyses (flowing only):	fecal coliform	potassium
	ammonia	surfactants (as MBAS)
	hardness	

Interpreting Indicator Data

As shown in Figure 1, two methods are routinely used to interpret indicator data, identify outfall flow types, and confirm illicit discharges.

Flow chart

The flow chart method utilizes several indicators to distinguish four major discharge types commonly found in residential watersheds. These include sanitary wastewater, washwater, tap water, and natural water sources. The flow chart method is recommended by the Center for Watershed Protection because it is a relatively simple technique utilizing four indicators that are safe, reliable, and inexpensive to measure (October 2004). Figure 2 outlines the flow chart method.

The flow chart separates clean flows from contaminated flows using detergents (measured as surfactants), and separates washwater from sanitary wastewater using the ammonia/potassium ratio. The flow chart used by Clark County has been modified slightly to incorporate fecal coliform bacteria as an additional indicator of potential sewage contamination.

Benchmarks

Commercial and industrial sites produce discharges that are often not composed of either sewage or washwater. The Center for Watershed Protection identifies seven indicators that serve as commercial/industrial flow benchmarks: ammonia, color, conductivity, hardness, pH, potassium, and turbidity. Two of these indicators (ammonia and potassium) are incorporated into the flow chart method described above. The remaining indicators are included in the list of standard indicators utilized by the project, with the exception of color. Color is not measured as a routine indicator, but may be measured in cases where substantial discharge coloration is apparent.

Initial benchmark values established by the CWP (October, 2004) may be refined for local conditions as the project progresses and a larger amount of local data becomes available for comparison.

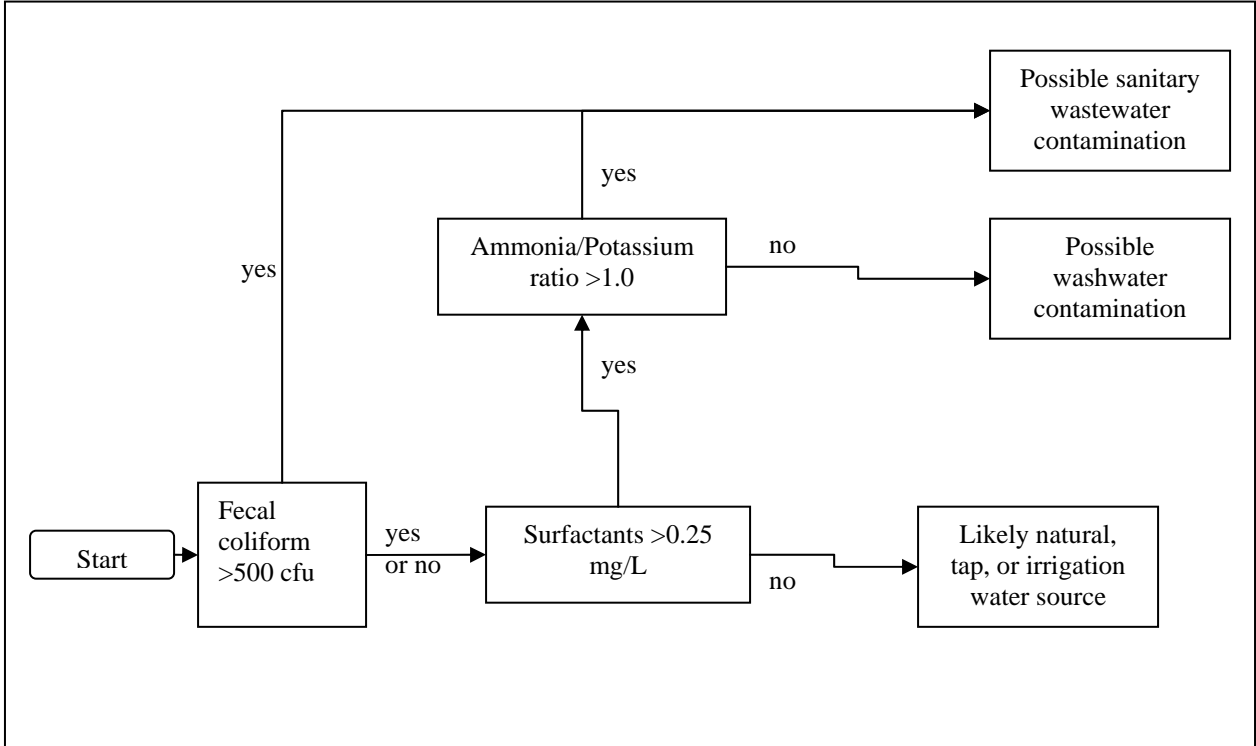


Figure 2. The IDDE Screening flowchart method to identify illicit discharges in residential watersheds (adapted from Center for Watershed Protection, October 2004)

Professional judgment

The project is intended to provide flexibility to enable staff to respond to water quality problems as determined by all available qualitative and quantitative information.

Best professional judgment (BPJ) is also used to interpret screening data. In some cases, BPJ may indicate that results exceeding a benchmark are the result of natural or background factors, or stem from a source other than an illicit discharge. Conversely, if visual or qualitative observations indicate the presence of an illicit discharge, then a followup investigation may be pursued despite the lack of data exceeding a benchmark or flowchart target. A site with multiple indicator results slightly below benchmark levels may also warrant followup.

Followup Investigations

Section S5.C.8.b.vii of the 2007 permit requires that a source investigation be initiated within twenty-one (21) days of the discovery of a suspected illicit discharge. The four general methods utilized to isolate the source are storm drain network investigations, drainage area investigations, on-site investigations, and septic system investigations. In some cases a combination of methods may be used. Each method is described in more detail below:

Storm drain network:

Network investigations are generally performed by the monitoring staff, possibly with assistance from operations and maintenance staff. These investigations involve strategically inspecting manholes or other infrastructure within the MS4 to isolate discharges to a specific segment. Once the correct segment has been identified, an on-site investigation may be used to locate the discharge. Network investigations may be as simple as observing the flow pattern within manholes, or as complex as a series of additional indicator monitoring sites spread through a section of the MS4.

Drainage area:

Drainage area investigations are generally performed by monitoring staff or Water Resources Waste Reduction Specialists. Drainage area investigations examine land use or other characteristics of the drainage area to pinpoint the area producing the discharge. This approach works best when initial screening suggests an obvious discharge source. In this case, a simple windshield survey of the drainage area may be enough to isolate the source.

On-site:

On-site investigations are typically performed by Water Resources Waste Reduction Specialists or by other agencies such as local wastewater utilities. On-site investigations are used to trace the source of an illicit discharge within a pipe segment. These investigations target a single suspected source or small number of possible sources and often involve dye or video testing.

Septic/sewer system:

Sanitary sewer investigations are performed by local wastewater districts, while septic system inspections are performed by Clark County Public Health.

Referrals for source removal

The Screening project seeks to isolate sources to the extent that the correcting entity is able to proceed without significant further monitoring once the referral has been made. Sites may be referred for source removal activities at any stage of investigation if an illicit discharge source can be identified with a reasonable degree of accuracy. Section S5.C.8.b.vii of the 2007 permit requires that illicit *connections* to the MS4 must be terminated within six (6) months of source confirmation.

In many cases the agency responsible for correcting the problem may also be involved in monitoring to assist in identifying the source. In particular, this applies to septic/sewer investigations and some types of onsite investigations.

Referrals typically follow one of several patterns:

- 1) Illicit discharges identified through chance observations by monitoring staff or through public complaints are referred immediately for technical assistance initiated by Water Resources Waste Reduction Specialists.
- 2) Illicit discharges identified and isolated during initial outfall screening are referred to Waste Reduction Specialists, other county departments (e.g. Community Development, Public Health), or the appropriate agency (e.g. wastewater utility, Department of Ecology)
- 3) Illicit discharges isolated during followup investigations are referred to the appropriate department or agency at the conclusion of the investigation.

Lead responsibility for coordination of investigation and removal activities

The IDDE project manager serves as the point of contact and coordinator for followup investigations, up to and including the referral to the correcting agency. From that point on, oversight and tracking of removal activities becomes the responsibility of Water Resources Waste Reduction Specialists. Following completion of removal activities, the IDDE project manager is responsible for designing and overseeing completion of effectiveness monitoring.

Some followup investigations may be planned independently by IDDE project staff; however, in cases where the assistance of other agencies is required a meeting will be held with appropriate agency staff to develop an investigation plan, typically including staff from the Public Health Department Resource Protection Program and Clark Regional Wastewater District. Funding for followup investigations is addressed on a case-by-case basis.

Effectiveness monitoring

Effectiveness monitoring is completed following source removal activities. Typically this involves re-sampling the affected outfall to confirm removal, and may also be accomplished through on-site inspection.

Repeat screening

At the discretion of the project manager, outfalls may be subject to initial screening activities for two years in a row. Typically, this applies to outfalls where initial screening suggested a possible illicit discharge, but followup investigations failed to confirm the presence of a discharge. Such outfalls may be considered high risk for future discharges and a repeat visit may be warranted the following year. After two successive years with no illicit discharge found, the site will typically not be re-visited.

Quality Objectives

Measurement Quality Objectives

Analytical methods, reporting or precision limits, and Measurement Quality Objectives (MQO) for accuracy, precision, and bias are listed in Table 2. Data quality objectives and quality control procedures for laboratory parameters are detailed in TestAmerica quality assurance documents.

Collection, preservation, transportation, and storage of samples follow standard procedures designed to reduce most sources of sampling bias. Analytical bias is minimized by adherence to the methods listed in Table 2. The laboratory employs quality control procedures appropriate to the analytical procedures, including analysis of method blanks, matrix spikes, and check standards.

Table 2. IDDE Screening analytical methods and reporting or precision limits.

Characteristic	Method	Resolution/ Reporting Limit	Accuracy	Precision	Bias	Reference
		conc./ units	Units / % error	%RSD	%REC	lab
Temperature	Thermistor	0.01 C	± 0.15 °C	NA	NA	
pH	Glass electrode	0.01 units	± 0.2 pH units	NA	NA	
Conductivity	Electrode	4 digits	± 0.5% of reading	NA	NA	
Turbidity	Nephelometric	0.01 NTU	± 2% of reading	NA	NA	
Ammonia	Colorimetric	0.05 mg/L	25%	10%	5%	EPA 350.1
Fecal coliform	Membrane filtration	2 cfu/100 mL	NA	28%	NA	SM 9222
Total hardness	Calculation (Ca+Mg)	0.66 mg/L	25%	10%	5%	SM 2340B
Surfactants	Methylene Blue active substance (MBAS)	0.1 mg/L	25%	10%	5%	SM 4500C
Potassium	ICP	1.0 mg/L	25%	10%	5%	EPA 200.7

Field Procedures

General

For purposes of initial screening, “dry weather” means no measurable rainfall (<0.01”) in the 48 hours preceding screening. If rain has fallen in the general vicinity within 48 hours, screening will typically not be conducted. Regardless of the length of antecedent dry periods, screening is also not performed if local conditions suggest that storm-related flow is still occurring at a site. Sources of current rainfall information include the National Weather Service website (<http://www.weather.gov/climate/index.php?wfo=pqr>) and the Salmon Creek Treatment Plant automated rainfall recording at 397-6118 ext. 7030.

Equipment calibration, quality assurance, and field data collection protocols for data collected by the project are described in Standard Procedures for Monitoring Activities: Clark County Water Resources Section (2002). Field activities are generally conducted by 2-person field crews. Sample containers for laboratory delivery are labeled in indelible ink with the following information:

- Clark County
- IDDE Screening
- Location ID
- Date and Time

Water quality samples are collected in properly preserved bottles prepared by the laboratory, and stored on ice or refrigerated until delivery to TA. Water quality samples are picked up by laboratory personnel within 24 hours of collection. Formal Chain of Custody documentation is maintained for all samples sent to TA.

Outfall descriptions, physical indicators, and certain field measurements are recorded electronically using tablet PCs or handheld data collection platforms such as a Trimble GeoExplorer GPS unit.

Records are cross-checked for consistency between labels, custody documents, data sheets, and other relevant data.

Water samples are generally collected using a 1-L sample bottle or long-handled dipper. Other techniques may be used as necessary (e.g. sampling bucket lowered on a rope, cut-off milk container for collecting very low flows, etc).

Field measurements for pH, conductivity, and water temperature are recorded with a calibrated YSI 6920 multi-probe. Turbidity is measured in the field using a Hach 2100P turbidimeter, and color (if assessed) is measured using a standard Hach color wheel.

Digital photographs are taken only for outfalls where water samples are collected and/or where an illicit discharge is suspected during initial screening. Long-term photo storage is limited to those locations where followup investigations are performed or where illicit discharges are confirmed.

Ditch outfall procedures

Ditch outfalls (as opposed to piped system outfalls) comprise a high percentage of the existing stormwater outfalls in many areas, but tend to exhibit a very low occurrence of dry weather flow and illicit discharges. Standard procedures for ditch outfall screening are described below:

Depending on the data collection platform being used, crews may opt not to enter data in the field for dry ditch outfalls. In these cases, data may be entered directly into the database in the office to reduce field time. The exception is ditches where water samples are collected or where illicit discharges are suspected: in these cases, data must be logged in the field.

For flowing ditch outfalls, if flow is sufficient to collect samples relatively quickly and with no contamination, samples are collected for all standard characteristics. However, in many cases, ditch outfalls have very low flows that are difficult or impossible to sample effectively. In these cases, staff attempt to collect a clean sample for fecal coliform only. Field meter measurements are collected only if there is sufficient flow to submerge the sensors or if a sufficient volume can be collected in a clean container to obtain measurements.

Unreachable or hidden outfalls

If a mapped outfall cannot be located or is unreachable due to vegetation, terrain, property access, or other hazards, one of several options may be pursued:

- a) Skip the outfall. Further steps taken by the project manager may include:
 - i) contact Public Works Operations and request a crew to clear vegetation and/or locate the outfall.
 - ii) contact landowner for access permission
 - iii) remove the outfall from consideration under IDDE Screening
- b) If the outfall is from a stormwater facility and the facility is obviously dry, assume the outfall is also dry and complete as much of the data collection as possible. In most cases, such outfalls will also be referred to Operations for vegetation clearing.
- c) Locate the nearest “upstream” accessible point (manhole, ditch access point, etc) and perform the screening at that location. Note the change under a comment field in the data entry form.

Safety

Field crews are instructed to make safety the highest priority. Field crews consist of a minimum of two persons, at least one of which must have completed certified flagger training. Safety vests are worn at all times when outside the vehicle. Road signs, stop/slow paddles, and traffic cones are utilized as needed.

Screening locations may be located in areas where access is difficult due to steep slopes and heavy vegetation. Crews should use caution with machetes and when traversing difficult terrain.

If a field crew feels a particular location cannot be visited safely, the location should not be visited and an alternative sampling location should be used.

Laboratory Procedures

Ammonia, surfactants (MBAS), fecal coliform, total hardness, and potassium analyses are conducted by TestAmerica. All procedures are performed according to TA's Ecology-approved quality assurance program and according to accepted conventions for data manipulation and reporting as described in Standard Methods (APHA, 1992). Table 2 shows the constituents measured, analytical methods, and reporting limits.

Quality Control

Laboratory QC

Laboratory check standards, matrix spikes, analytical duplicates, and blanks are analyzed in accordance with the TA Quality Assurance Program. All QC results are reported to Water Resources staff along with sample data. Laboratory data reduction, review, assessment and reporting are performed according to the TA Quality Assurance Program.

Field QC

Field QC sample types, frequencies, and definitions for IDDE Screening water quality samples are found in Table 3. A standard 10% duplication rate is used for laboratory water quality samples and field meter measurements, except for bacteria samples which are duplicated at a rate of 20%. One transfer blank and one transport blank are collected annually.

All meters are calibrated and maintained in accordance with the manufacturer's instructions. Check standards for conductivity and turbidity are used to verify the accuracy of field meters. A NIST-certified thermometer (National Institute of Standards and Testing) is used to verify the accuracy of temperature sensors. Calibration logs are completed during each calibration and are archived in Water Resources files. Calibration drift in pH meters is checked against pH buffer solutions. These activities are used to confirm that field instruments are attaining stated accuracy and resolution specifications.

Corrective Actions

Data quality problems encountered in the analysis of QC samples are addressed as needed through re-calibration, modifications to the field procedures, increased staff training, or by qualifying results appropriately. Documentation of corrective action steps includes problem identification, investigation procedures, corrective action taken, and effectiveness of the corrective action.

Table 3. IDDE Screening QC sample types, frequencies, and definitions.

Field QC sample type	Frequency	Definition
Field measurement replicate	10% of samples	repeat field meter measurements
Sample duplicate (bacteria) (all other)	20% of samples 10% of samples	duplicate sample collected for laboratory analysis
Transfer blank	Annually	D.I. water sample collected in field with sampling equipment
Transport blank	Annually	D.I. water sample prepared in office and carried through field trip

Data Management Procedures

Project data related to IDDE Screening is stored in three separate databases with information linked using a unique outfall ID.

Clarkstorm Database

The Clarkstorm SDE database stores locations and descriptive attributes for the mapped MS4, including stormwater outfalls. Each outfall stored in Clarkstorm is assigned a unique ID. These mapped outfalls form the sample location set for the IDDE Screening project.

Clarkstorm includes a table named PWFieldLocs which associates Clarkstorm features with data stored in the two databases discussed below, using the UNIQUEID field assigned in Clarkstorm. The Clarkstorm database is available to users as a series of shapefiles stored in \\olympus\gisdata\clarkgis\avdata\shapes\clarkstorm.

IDDE Screening Database

The IDDE Screening database is a series of SQL tables with an Access front-end to facilitate data entry and management. This database stores information collected during field screening visits, in addition to overall project tracking information including investigations and referral activities. The IDDE Screening database front-end is located under Water Resources on the NT05 server at: W:\PROJECT\011111, outfall screening\MONITORING\Data\Entry tracking.

Water Quality Database

The Water Quality Database (WQDB) is a series of SQL tables with an Access front-end to facilitate data entry and management. This database was designed to store water quality data from most Water Resources monitoring projects in a centralized location. Field measurements and laboratory analytical results from the IDDE Screening project are stored in this database. The WQDB front-end is located under Water Resources on the NT05 server at: W:\NON-PROJECT\Collective Databases\Monitoring\WQ Database. Each user has an individual folder for access to the database entry forms.

Audits and Reports

Audits

The project manager and QC coordinator periodically review the field data, methods, lab results, and data management activities to make an assessment of the program and identify corrective actions or method revisions.

Reports

Screening project results are reported annually in an overall project summary, and individual case report appendices are prepared for each location requiring a followup investigation. Both report types conform to a standardized template for consistency and brevity, and to ensure inclusion of metrics required for annual stormwater permit reporting to Ecology.

The annual summary report is produced at the conclusion of each calendar year. Summaries address project activities and methods, overall results and program tracking, data accuracy and completeness, and adaptive management suggestions for future monitoring. An overall summary of site visits, illicit discharges located, followup activities, and outfall status is included. Reports are peer reviewed by Water Resources staff. Reports are posted on the county's website to facilitate dissemination of information to the public.

Individual case studies address the followup techniques, status of followup and removal activities, and available effectiveness monitoring data. For lengthy followups, case studies are updated periodically to reflect case status.

Data Review, Verification, and Validation

During each sample trip, field crews review data entry fields and forms to confirm that all necessary field measurements and samples have been collected. Laboratory QC results are reviewed and verified by NCA staff and documented in data reports to Water Resources. Upon receipt, laboratory data are reviewed for errors, omissions, and data qualifiers prior to data entry.

Data verification involves examination of QC results analyzed during the project to provide an indication of whether the precision and bias MQOs have been met. To evaluate whether precision targets have been met, pairs of duplicate sample results are pooled and an estimate of standard deviation is calculated. This estimate, divided by the mean concentration of the duplicate results and converted to percent, is used to judge whether the %RSD target has been met.

To evaluate whether bias targets have been met, the mean percent recovery of the check standards should be within +/- %bias target of the true value (e.g. true value +/- 10%). Unusually high blank results indicate bias due to contamination that may affect low-level results. To evaluate whether the target for reporting limit has been met, results will be examined to determine if any of the values exceed the required reporting limits.

Data validation consists of a detailed examination of the complete data package using professional judgement to assess whether the procedures in the SP's and QAPP have been followed. Data validation is performed by the project manager and QC coordinator.

Data Quality Assessment

Taking into account the results of data review, verification, and validation, an assessment will be made as to whether the data are of sufficient quality to attain project objectives.

References

APHA (1992). *Standard Methods for the Examination of Water and Wastewater*, 18th ed.

Clark County Public Works, Water Resources Section. (June 2002). *Standard Procedures for Monitoring Activities, Clark County Water Resources Section.*

Lombard, S. and C. Kirchmer. (February 2001). *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies.* Washington State Department of Ecology. Publication No. 01-03-003, revision of Publication No. 91-16.

TestAmerica – Portland, OR. (December 2006). *Quality Assurance/Quality Control Manual*