

Data Management Systems for Wastewater

Prepared for the Massachusetts Health Officers Association

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Outline

- Stone Environmental, our background
- The need for decentralized wastewater management
- The role for data management systems
- IWIMS, a GIS-enabled Integrated Wastewater Information Management System
- Putting IWIMS to use, examples from several communities



Stone Environmental, Inc.



- Established in 1992 in Montpelier, Vermont
- Approximately 40 staff members
 - Geologists, soil and environmental scientists, water resource specialists,
 - GIS specialists, programmers, database specialists
 - Administrative specialists
- Four Scientific Services Groups
 - Wastewater and Water Resources
 - Applied Information Management
 - Investigation and Remediation
 - Agrochemical Fate and Risk Assessment



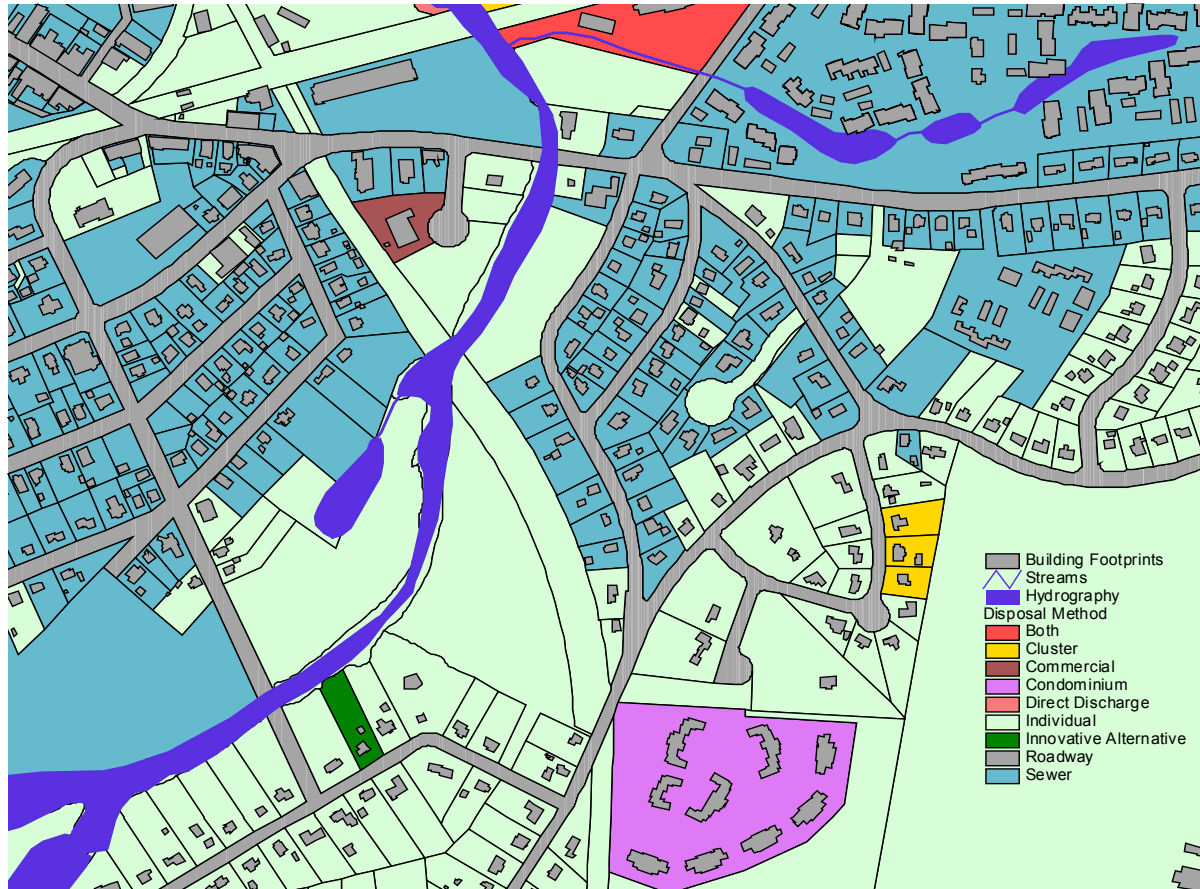


The Need For Decentralized Wastewater Management

- Protect public health
- Protect environmental resources
- Maintain property values
- Better understanding of a complex system!

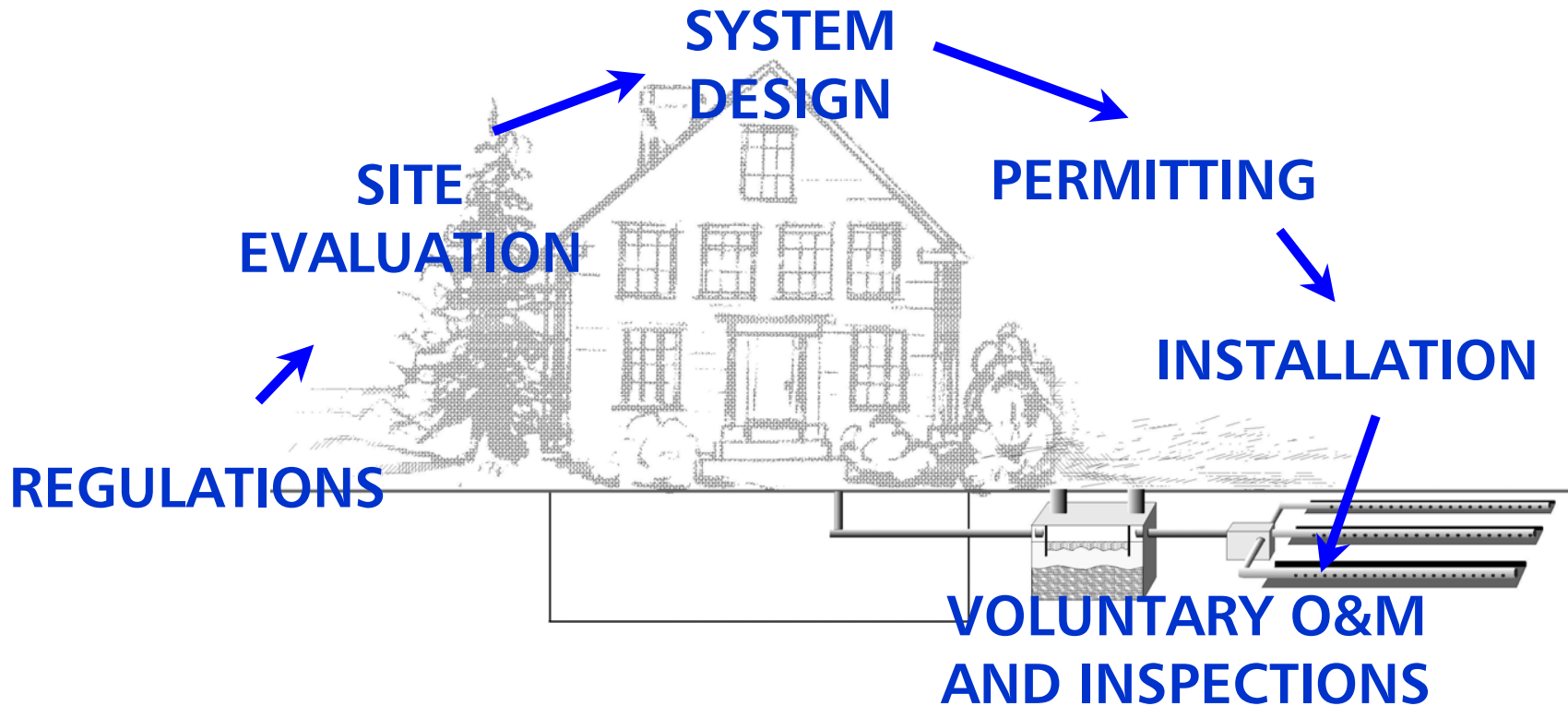


Complexities of Decentralized Wastewater Management





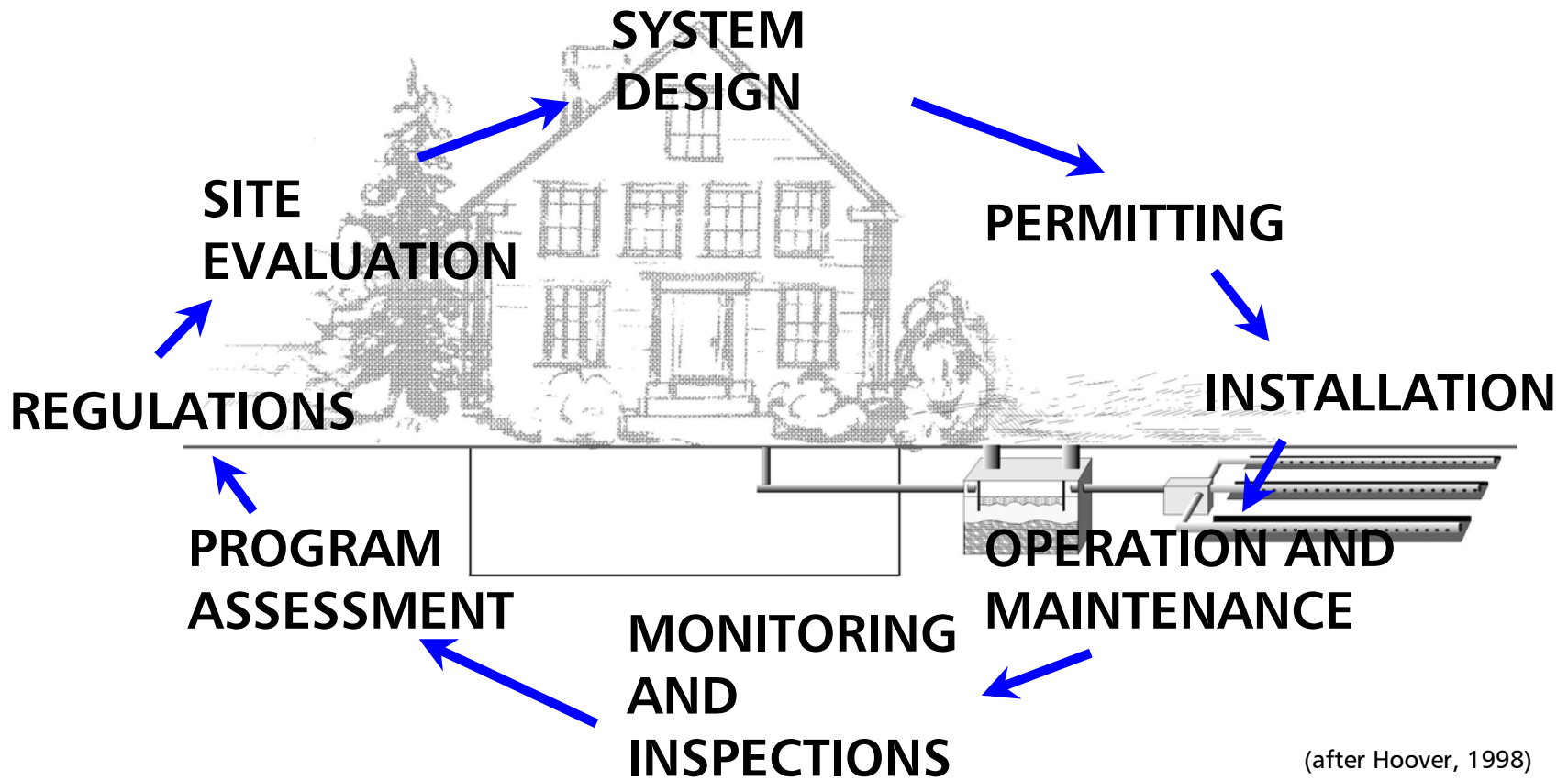
Passive Management Model



(after Hoover, 1998)



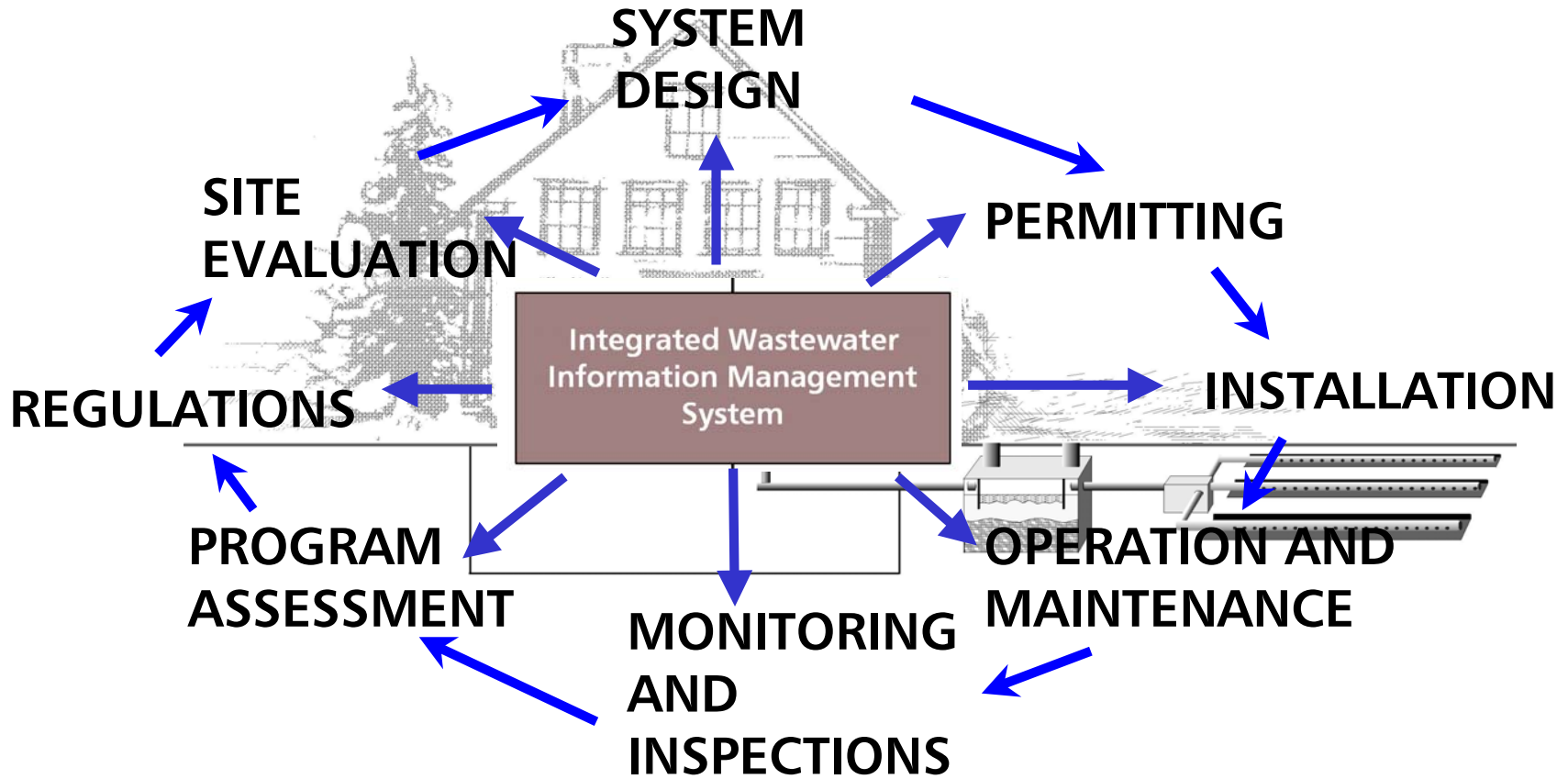
Active Management Model



(after Hoover, 1998)

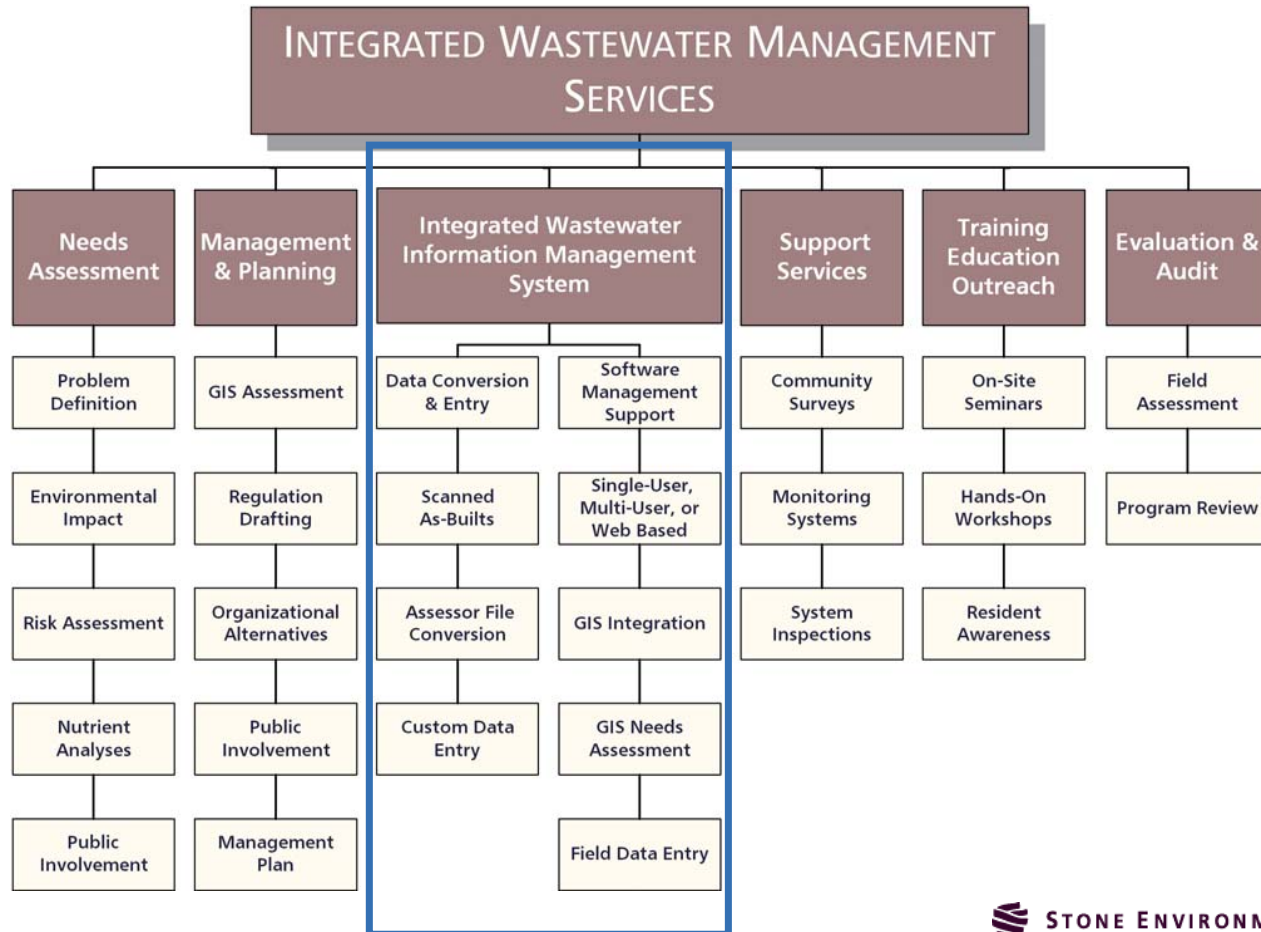


Most Effective Management Model





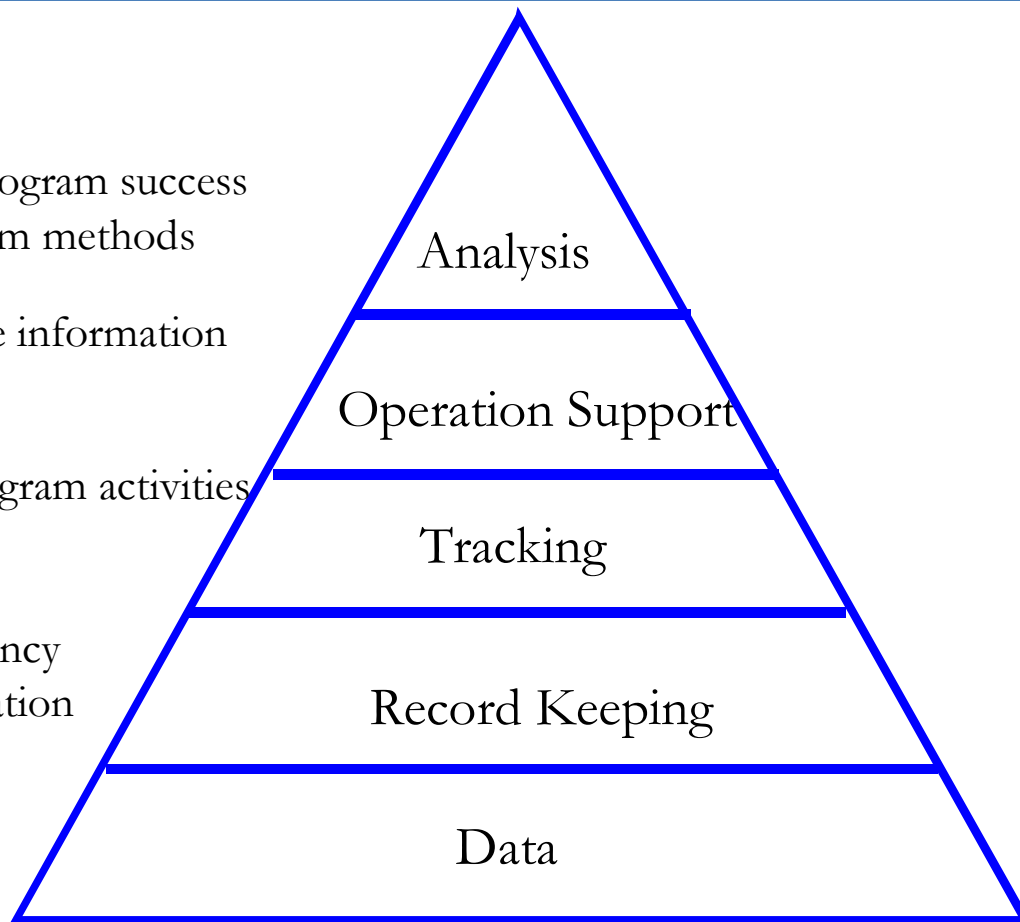
Integrated Wastewater Management





Implementation of a Wastewater Data Management System

- Assessment of program success
- Update of program methods
- Evaluate database information
- Initiate actions
- Reporting on program activities
- Summarize data
- Maintain consistency
- Organize information





What Information Will a Decentralized Wastewater Data Management System Maintain?

- Parcels
 - Ownership
 - Contacts
- Onsite Systems
 - System type
 - System design
- Maintenance
 - Pumpouts
 - Repairs
- Septage Data
 - Pump rates
 - Sludge depth
- Inspections
 - Results and conditions
 - Scheduling
- Permits
 - Issuing
 - Updating
- Monitoring
 - Water quality
 - Effluent
- Notifications
 - Scheduled maintenance
 - Regulatory actions



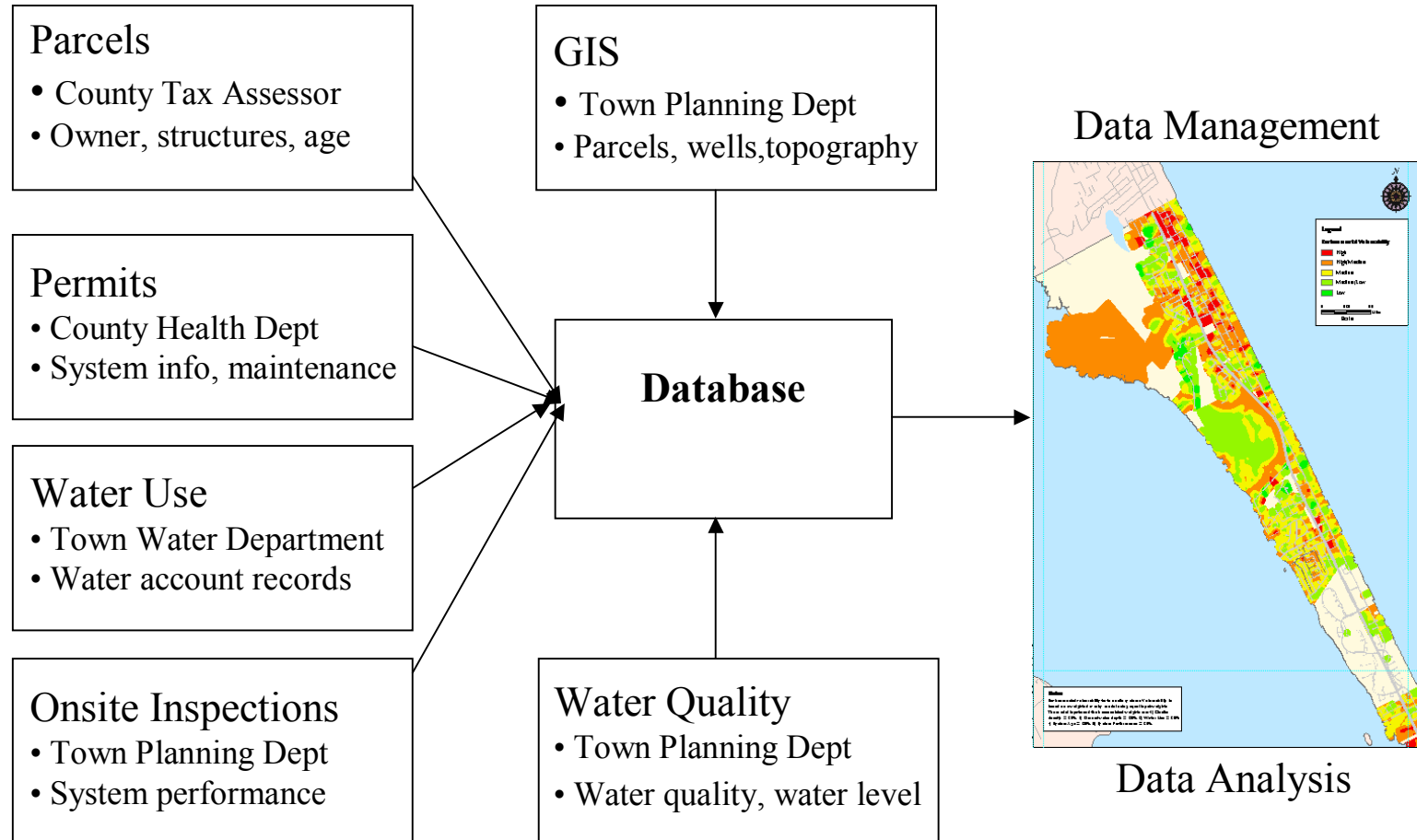
Getting Started: The Foundation Datasets

- Import electronic data
 - Assessor's data
 - Parcel ID, Address, Owner, Owner's address, Structure information, Land use
 - Existing Health Department databases
 - Existing monitoring well and analytical data

- Manual data entry of historical data
 - System and component data
 - Scanned as-builts
 - Permits
 - Inspection

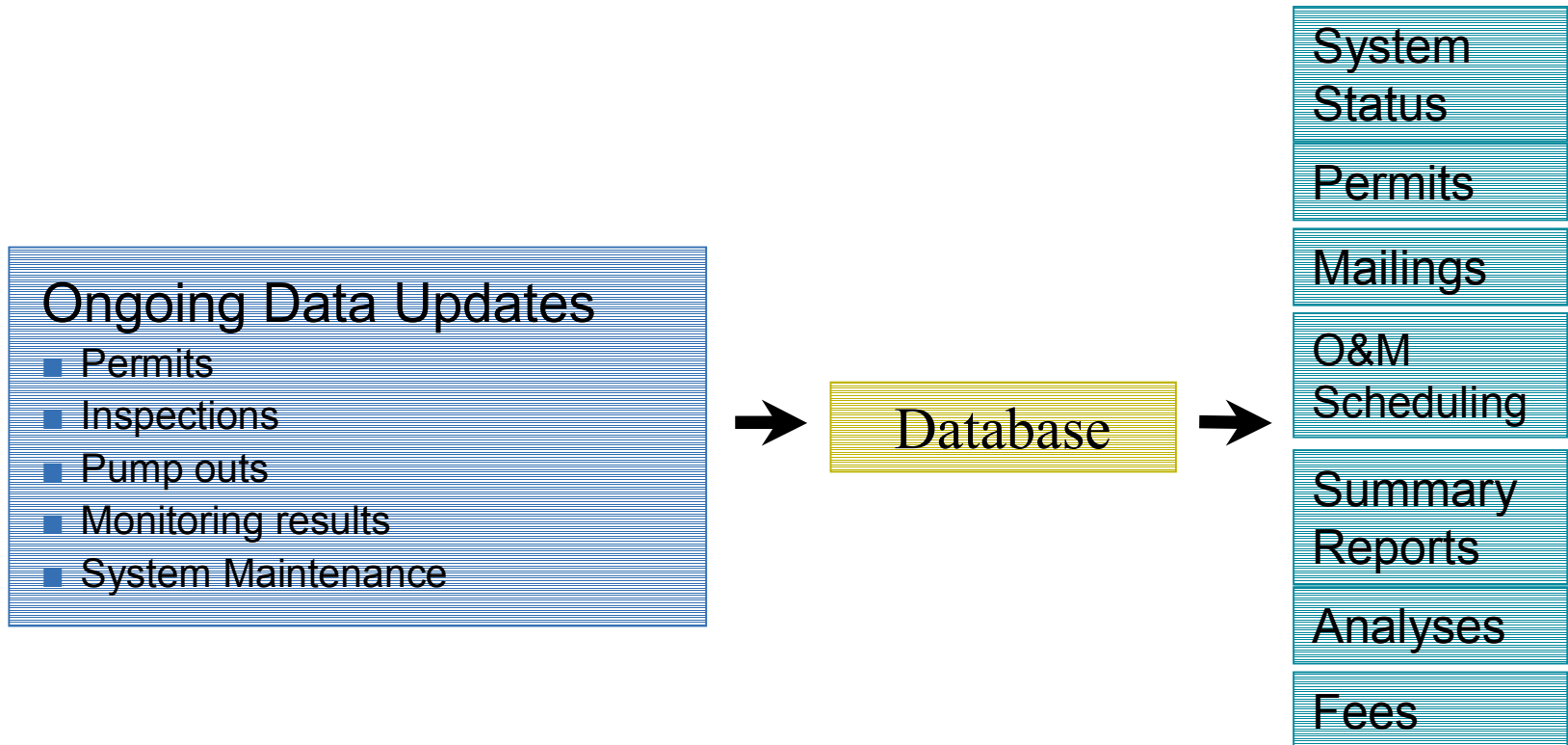


Building An Integrated Wastewater Data Management System





Putting an Integrated Wastewater Information Management System to Work





A Recap of The Benefits

- Enhance performance of decentralized systems
- Avoid costly centralized sewer options
- Protect property values and the environment
- Enhance efficiency of administrative processes
- Enable analysis of program effectiveness and needs



IWIMS: A GIS-Enabled, Integrated Wastewater Management System

- Comprehensive
- User friendly
- Scalable
- Role based
- Custom fit
- Secure
- Web based





Benefits of Web Based Design

- Central data set accessible to all users
 - Health Officers
 - Sanitarians
 - Assessors
- Data is available at any location with Internet access
- No software to install or manage on the user's machines
- Facilitates support and upgrades




IWIMS Demo

- <http://iwimsdemo.stone-env.com>



Enter and Maintain Parcel Information

Systems Components Structures Contacts Parcels

[Add Image To Parcel] - [View Parcel's Images]  [Map It](#)

Parcel ID

Street Number Street Fraction

Unit Number Street Name

Property Name Area

Owner **MAXINE ROBERGE** Trust Name

Road Frontage ft Parcel Size acres

Occupancy Use

Last Sale Date

Parcel Edited Yes

Comments

List Of Structures On Parcel	
Structure ID	Structure Type
191	Single Family Dwelling

Systems Related To This Parcel			
System ID	System Type	Parcel ID	Street Address
246589	Conventional	4452008016	23316 Main St



Enter and Maintain Onsite System Information

Systems **Components** **Parcels** **Structures** **Permits** **Inspections**

[23316 Main St]

[System ID: 246589] [Add Image To System](#)
[Parcel ID: 4452008016] [View System's Images](#)

Install Date	<input type="text" value="10/12/1996"/>	City Approval Date	<input type="text" value="12/23/1996"/>
System Type	<input type="text" value="Conventional"/>	Discharge Type	<input type="text" value="Single Family Residential"/>
As-Built On File	<input type="text" value="Yes"/>	Source Of Design Flow	<input type="text"/>
Design Flow	<input type="text" value="1200"/>	Design Bedrooms	<input type="text" value="8"/>
Percolation Rate	<input type="text" value="20.000"/>	Percolation Category	<input type="text" value="Sand"/>
Garbage Disposal	<input type="text" value="No"/>	Industrial Waste Receptor	<input type="text" value="No"/>
Separation to Ground Water (feet)	<input type="text" value="15.000"/>	Low Elev Pt of Discharge	<input type="text"/>

Comments

Settling/Conveyance

Related Components	
Component Type	Parcel ID
Septic Tank	4452008016
Drainfield/Leachfield	4452008016
Septic Tank	4452008017

Related Structures			
Structure ID	Structure Type	Address	Select
190	Single Family Dwelling		<input type="checkbox"/>
191	Single Family Dwelling		<input type="checkbox"/>



Enter and Maintain Detailed Permit and Permit Condition Information

Permits **Contacts** **Systems**

[System ID: 246589] [Generate Operating Permit Printout](#)

Permit Type: Permit Status:

Permit ID: Compliance Inspection Number:

Permit Date: Permit Exp. Date:

Plan Check Exp. Date:

Permittee: MAXINE ROBERGE Grantor:

Designer: MOORE Contractor: GARCIA

Permit Fee: Fee Paid:

Comments:

Permit Conditions						
Condition	Frequency	Period	DueDate	Conditions Met?		
Monitoring	1	Years	12/20/1997	Yes	<input type="checkbox"/>	Edit
Monitoring	1	Years	12/20/1998	Yes	<input type="checkbox"/>	Edit
Monitoring	2	Years	12/20/2000	Yes	<input type="checkbox"/>	Edit
Monitoring	2	Years	12/20/2002	Yes	<input type="checkbox"/>	Edit
Monitoring	4	Years	12/20/2006	No	<input type="checkbox"/>	Edit

days



Enter and Maintain Inspection Information

Systems **Components** **Parcels** **Structures** **Permits** **Inspections**

[Inspection ID: 4]
[System ID: 246589]

Inspection Result: Inspection Date:

Inspection Type:

Owner: MAXINE ROBERGE Inspector: SMITH

Inspection Conditions

Action	Component Type	Due Date	Comment	
<input type="text" value="New Inspection Condition"/>	<input type="text" value="Sand Filter"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Delete Selected"/>



Record System Maintenance

Systems **Components** **Parcels** **Structures** **Permits**

System Maintenance

Maintenance ID:

Component Type	<input type="text" value="Septic Tank"/>
Action	<input type="text" value="Pump"/>
Contractor	<input type="text" value="PICK"/>
Date Complete	<input type="text"/>
Gallons	<input type="text"/>
Comments	<input type="text"/>



Maintain Key Onsite Management Contacts

Parcels **Contacts**

Contact ID 8506, Bob Jones

First Name	<input type="text" value="Bob"/>	Last Name	<input type="text" value="Jones"/>
Company	<input type="text" value="Septic Solutions"/>	Street Number	<input type="text" value="234"/>
Street	<input type="text" value="Hill"/>	Unit	<input type="text"/>
Direction	<input type="text"/>	Fraction	<input type="text"/>
Address 2	<input type="text"/>	City	<input type="text" value="Montpelier"/>
State	<input type="text" value="VT"/>	ZIP Code	<input type="text" value="05602"/>
Area Code	<input type="text"/>	Phone	<input type="text"/>
FAX	<input type="text"/>	Email	<input type="text"/>

Comments

Status Entries For Bob Jones

Contact Type	Status	Select
Registered Inspector	Active	<input type="checkbox"/> Edit

Records of Correspondence With Bob Jones

Parcel	Date	Type	Action	Initials	
	02/02/2002	Inspector registration	Mailed	MFW	Edit
	06/01/2002	Inspector registration	Received	MFW	Edit

Contacts

Contact Type	<input type="text" value="Registered Inspector"/>	Contact Status	<input type="text" value="Active"/>
License Type	<input type="text" value="Reg. Env. Health Spec."/>	License Expiration Date	<input type="text"/>
License Number	<input type="text"/>	NAWT Cert Exp Date	<input type="text"/>
City Training Date	<input type="text"/>		



Monitor Water Quality

Monitoring Well Information

Well ID: Install Date (mm/dd/yyyy):

Parcel St. Address: [See Parcel Info](#)

Associated System ID:

Well Registration # Longitude

Location Desc. Latitude

Boring Depth (ft. bg.) Well Purpose

Well Depth (ft. bg.)

Elevation Ground (ft. amsl.) Data Source

Elevation TOC (ft. amsl.)

Inner Diameter (inches) Reference Source

Outer Diameter (inches)

Top of Screen (ft. bg.) Comments

Bottom of Screen (ft. bg.)

Depth to Bedrock (ft. bg.)

Protective Casing

Well Use

Permission (Yes/No)

Access (Yes/No)

Temporary Well (Yes/No)

bg. = below ground; amsl. = above mean sea level

Analytical Results

Click on the "Analyte / Method" to edit details.

Analyte / Method	Date	Concentration
Total Coliform/Unknown10		2 mpn/100mL
Fecal Coliform/Unknown11		<2 mpn/100mL
TDS/Unknown12		620 mg/L
Chloride/Unknown13		95 mg/L
Boron/Unknown14		0.477 mg/L
Sulfate/Unknown15		77.1 mg/L
Nitrate-N/Unknown17		23 mg/L
Nitrite-N/Unknown18		<0.03 mg/L
Ammonia-N/Unknown16		<0.1 mg/L
TKN/Unknown19		0.18 mg/L
Phosphate as P/Unknown20		<0.05 mg/L
BOD5 at 20C/Unknown21		5.3 mg/L
Surfactants as MBAS/Unknown23		<0.05 mg/L

To Add a new Analytical Result to the table above, fill out the form below then click on "Add Result" button.

Analyte / Method

Concentration

Units

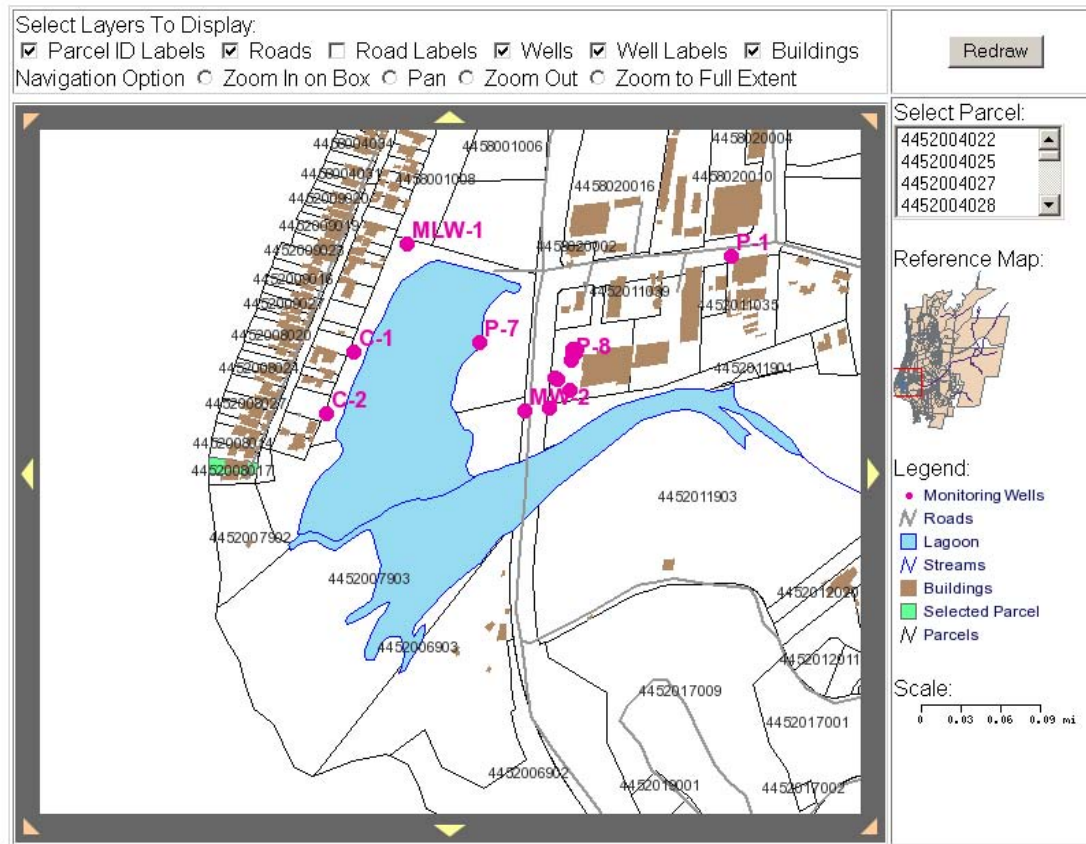
Date Analyzed (mm/dd/yyyy)

Analytical Lab



Integrate Onsite Data with the IWIMS GIS Map Viewer

IWIMS Map Viewer





Search IWIMS for Critical Data

- Parcel search
 - Residential
 - Commercial
- Onsite system search
 - Conventional
 - Alternative
- Permits and inspections searches
 - Operating permits
 - Failed inspections
- Contacts search
 - Homeowners
 - Maintenance Providers



Parcel Search Example

Search Form

Parcels

Search For A Parcel You can use the "*" as a string wildcard.

Property Name

Street Number

Street Name

Parcel ID

Occupancy Use

- Single Residential
- Single Residential / Pool
- Single Residential / Therapy Pool
- Single Residential / ?
- Single Residential / Condominium
- Single Residential / Condo Conversion
- Single Residential / Cooperative
- Single Residential / Vacant
- Double, Duplex, or Two Units
- Three Units (any combination)
- Three Units / Vacant
- Four Units (any combination)
- Five or more apartments or units
- Commercial / Vacant land
- Stores
- Store combination (with office or residential)
- Store combination / Lift
- Store and residential combination
- Shopping center (neighborhood, community)

Owner Name

Trust Name

Search Result

Parcels

Results [1-25] of [79]

[<< Previous](#) [\[26\]](#) [\[51\]](#) [\[76\]](#) [Next >>](#)

Parcel ID	Street Address	Owner
4452008016	23316 Main St	ROBERGE
4452008017	23314 Main St	STAMEY
4452008018	23406 Main St	CHRISTOPHERSO
4452008019	23402 Main St	DUCHARME
4452008020	23360 Main St	DOZIER
4452008022	23354 Main St	SALMON
4452008023	23350 Main St	BENEDETTO
4452008024	23346 Main St	HERRIN
4452008025	00112 Main St	MCCRACKEN
4452008026	23338 Main St	LIM
4452008027	23334 Main St	DOLL
4452008028	23330 Main St	DERBY
4452009015	23456 Main St	FERRIS
4452009016	23418 Main St	KUTZ
4452009017	23416 Main St	LEJEUNE
4452009018	23438 Main St	ASHBY
4452009020	23450 Main St	DORE
4452009021	23446 Main St	CURTIS
4452009022	23444 Main St	HIGLEY
4452009023	23430 Main St	TOLLE
4452009024	23426 Main St	JEFFERS
4452009026	23414 Main St	KEMPF
4452009027	23410 Main St	OSHEA
4452010002	23501 Main St	PATEL
4452010003	23457 Main St	MILNE



Search for I/A Systems

Search Form

Search For A System (Use "*" as a string wildcard)

System ID

System Type

Discharge Type

Install Date

Street Name

Street Number

Parcel Owner

Search Result

Systems Matching Search Criteria ...			
System ID	System Type	Parcel ID	Street Address
205723	Advanced Treatment	4452013005	03644 Satterly Rd
246584	Advanced Treatment	4452009022	23444 Main St
246585	Advanced Treatment	4452017001	03700 Satterly Rd
246586	Advanced Treatment	4452008020	23360 Main St
246588	Advanced Treatment	4452011039	03901 Cross Rd



Summarize Permits, Inspections, and Maintenance

Installation for New Construction

Related Permits		
Permit ID	Permit Type	Permit Exp. Date
NC-11	Installation for New Construction	01/09/1997
OP-243	Operating Permit	12/20/2004

Passes

Inspection Events	
Inspection ID	Inspection Result
4	Passes

System Maintenance Records			
Component Type	Action	Date Complete	
Septic Tank	Pump	06/01/2000	Edit
Septic Tank	Pump	06/01/2003	Edit



Create Your Own Customized Reports

New Report

Include in Result	Filter				Options	
	Operator	Value	Boolean	Add Condition	Action	Order By
<input type="checkbox"/> Install Date	=		AND	Add	None	No
<input type="checkbox"/> Date of Plans	=		AND	Add	None	No
<input checked="" type="checkbox"/> System Type	=	Advanced Treatment	AND	Add	None	No
<input type="checkbox"/> Discharge Type	=		AND	Add	None	No
<input type="checkbox"/> Garbage Disposal	=		AND	Add	None	No
<input type="checkbox"/> Ind Waste Rec	=		AND	Add	None	No
<input type="checkbox"/> Perc Rate Measureme	=		AND	Add	None	No
<input type="checkbox"/> Perc Rate Category	=		AND	Add	None	No
<input type="checkbox"/> Design Flow	=		AND	Add	None	No
<input type="checkbox"/> Source of Design Flow	=		AND	Add	None	No
<input type="checkbox"/> As Built on File	=		AND	Add	None	No
<input type="checkbox"/> Design Bedrooms	=		AND	Add	None	No
<input type="checkbox"/> Permit ID String	=		AND	Add	None	No
<input type="checkbox"/> Permit Issue Date	=		AND	Add	None	No
<input type="checkbox"/> Permit Expiration date	=		AND	Add	None	No
<input checked="" type="checkbox"/> Permit Type	=	Operating Permit	AND	Add	None	No
<input type="checkbox"/> Permittee	=		AND	Add	None	No

Output Options: HTML Vertical Report Name: Record Limit:

Distinct Return IDS from lookup tables

Report Results

LastName	PermitExpDate	State	City	FirstName	MailAddressSt	PermitDate	MailAddressNum	ZipFormat
JACKSON	2004-05-19	CO	DENVER		Middlebrook Rd	2000-05-19 00:00:00	00717	80202
ROBERGE	2004-12-20	NY	NEW YORK MAXINE		Jones Dock Rd	1996-12-20 00:00:00	00119	11111



Print Homeowners Notifications Based on Operation and Maintenance Criteria

Add Notification

Name	<input type="text"/>
Type	<input type="text" value="Generate Mailing List"/>
<input type="button" value="Add Notification"/>	
Report Name	Select
Operating Permit Notice	<input type="checkbox"/>
Pumped After 2001	<input type="checkbox"/>
Sales After 2004	<input type="checkbox"/>


Notifications Summary

Notification	# Meeting Date Criteria	Last Notified	
<u>PumpingNote</u>			<input type="button" value="Mailing List"/> <input type="button" value="Update Database"/> <input type="button" value="Delete"/>
<u>Operating Permit Notices</u>			<input type="button" value="Mailing List"/> <input type="button" value="Update Database"/> <input type="button" value="Delete"/>

[Add New Notification](#)



Print Customized Permits

City of DemoCity 123456 West Avenue ! DemoCity, DemoState ! 12345-6789 Phone (098) 765-4321 ! Fax (123) 456-7890 ! www.city.demo.demo.us	
OPERATING PERMIT ONSITE WASTEWATER TREATMENT SYSTEM WASTEWATER MANAGEMENT PROGRAM	
<p>Democity Municipal Code Section 15.12.050 authorizes the issuance of an "Operating Permit" for Onsite Wastewater Treatment Systems (OWTS) that are determined to be in compliance with all applicable Democity Codes and Ordinances. The OWTS located at the above address has been determined to be in compliance and the use of the system as designed and intended is hereby authorized. Failure to operate and maintain the OWTS in strict conformance to all approvals, applicable Federal, State and City laws and ordinances shall be justification for revocation of this Operating Permit and a misdemeanor violation punishable by up to \$1000.00 per day and up to six (6) months in jail per day per violation.</p>	
SYSTEMTYPE: Conventional	OWTS OWNER'S MAILING ADDRESS:
OPERATING PERMIT NUMBER: OP-243	00119 Jones Dock Rd
EFFECTIVE DATE OF OPERATING PERMIT: 12/20/1996	NEW YORK, NY
EXPIRATION DATE OF OPERATING PERMIT: 12/20/2004	11111
OWTS LOCATION: 23316 Main St	MAINTENANCE CONTRACTOR:
OWTS OWNER: ROBERGE, MAXINE	Garcia
ADVANCED TREATMENT SYSTEM: No	O&M CONTACT PHONE NUMBER:
ASSESSOR PARCEL NUMBER: 452008016	
STRUCTURE SERVED: NA	
CONDITIONS OF APPROVAL:	
Monitoring	
POST IN A CONSPICUOUS PLACE	
 Recycle Paper	



Utilizing IWIMS to Empower Management Plan Development: Nags Head, North Carolina

- Coastal community in North Carolina's Outer Banks
- A very popular tourist destination, experiencing significant growth
- 85% reliance upon onsite systems
- Strongly committed to protecting their natural resources and quality of life
- Involved in developing an active management plan





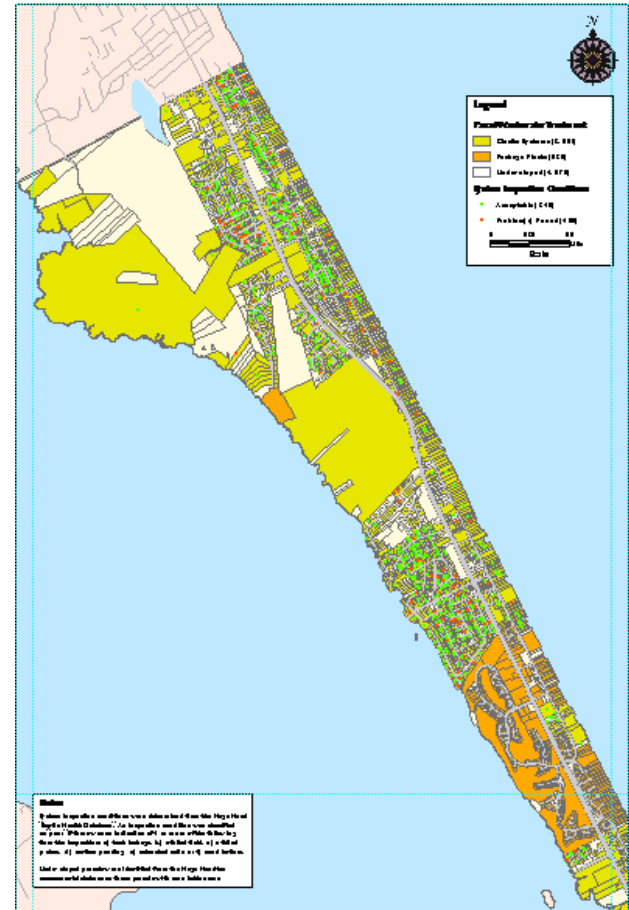
Data Collected and Processed for Management Plan Development

- Onsite System Inspection Database
 - 1,151 Inspections on 1,009 properties
 - July 2000 thru September 2004
- Dare County Health Department Permits
 - 1,219 permits on 1,119 properties
 - January 1998 thru August 2004
- Municipal Water Use
 - 121,559 meter readings on 4,114 properties
 - August 1999 thru July 2004
- Water Quality Database
 - 46,069 measurements from 48 locations
 - February 2001 thru June 2004



Putting IWIMS Data and GIS to Work: System Inspections

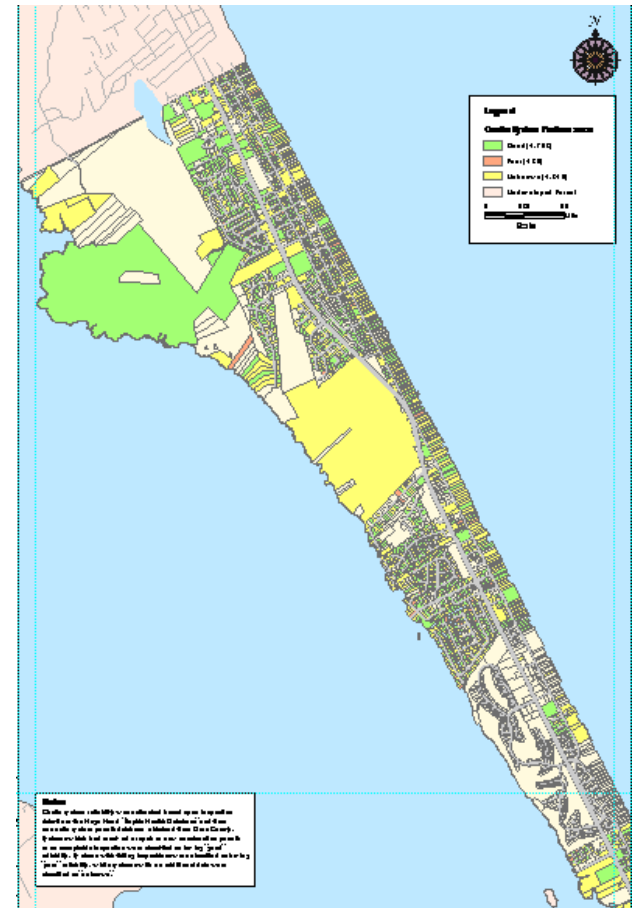
- Evaluate locations of onsite systems
- Track inspection results





Putting IWIMS Data and GIS to Work: System Performance

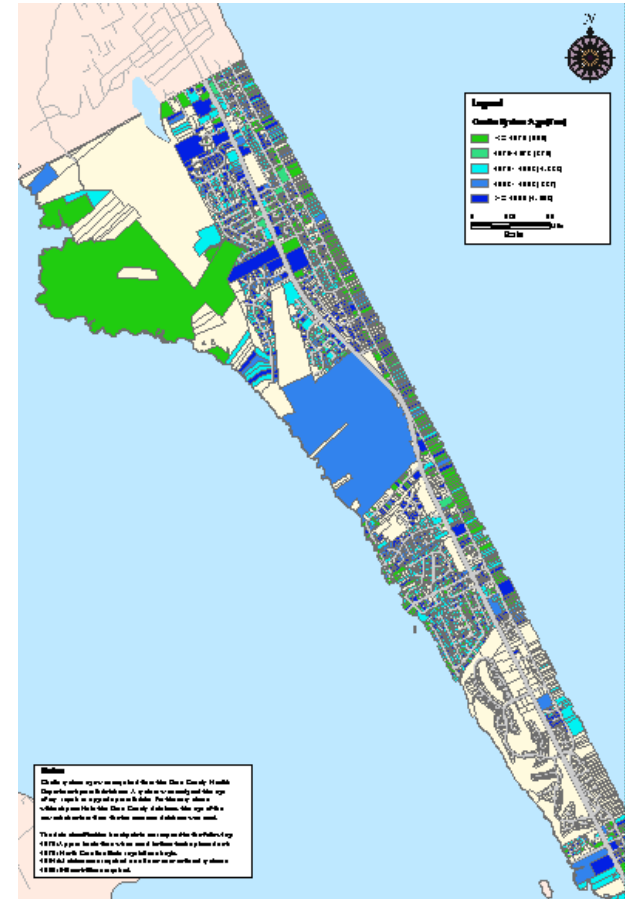
- Locate systems with poor performance
- Construct customized performance metrics





Putting IWIMS Data and GIS to Work: System Age

- Evaluate systems from various regulatory eras
- Prioritize maintenance schedules





Putting IWIMS Data and GIS to Work: Water Use

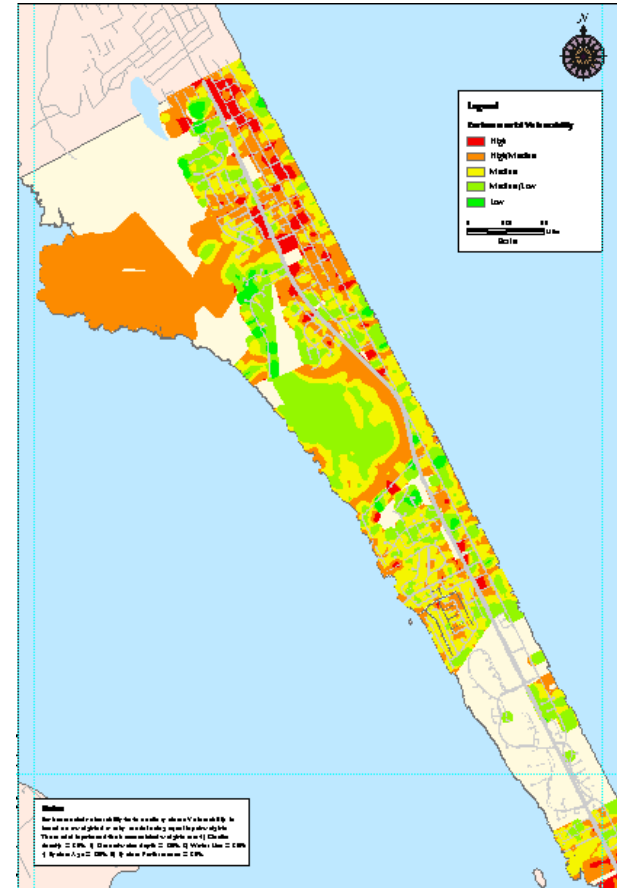
- Identify systems experiencing excessive use
- Send notifications to homeowners
- Modify management strategy





Putting IWIMS Data and GIS to Work: Preliminary Risk Assessment

- Combine IWIMS data to perform risk analysis
- Continue to update management plan strategy through periodic review of community-wide onsite system conditions





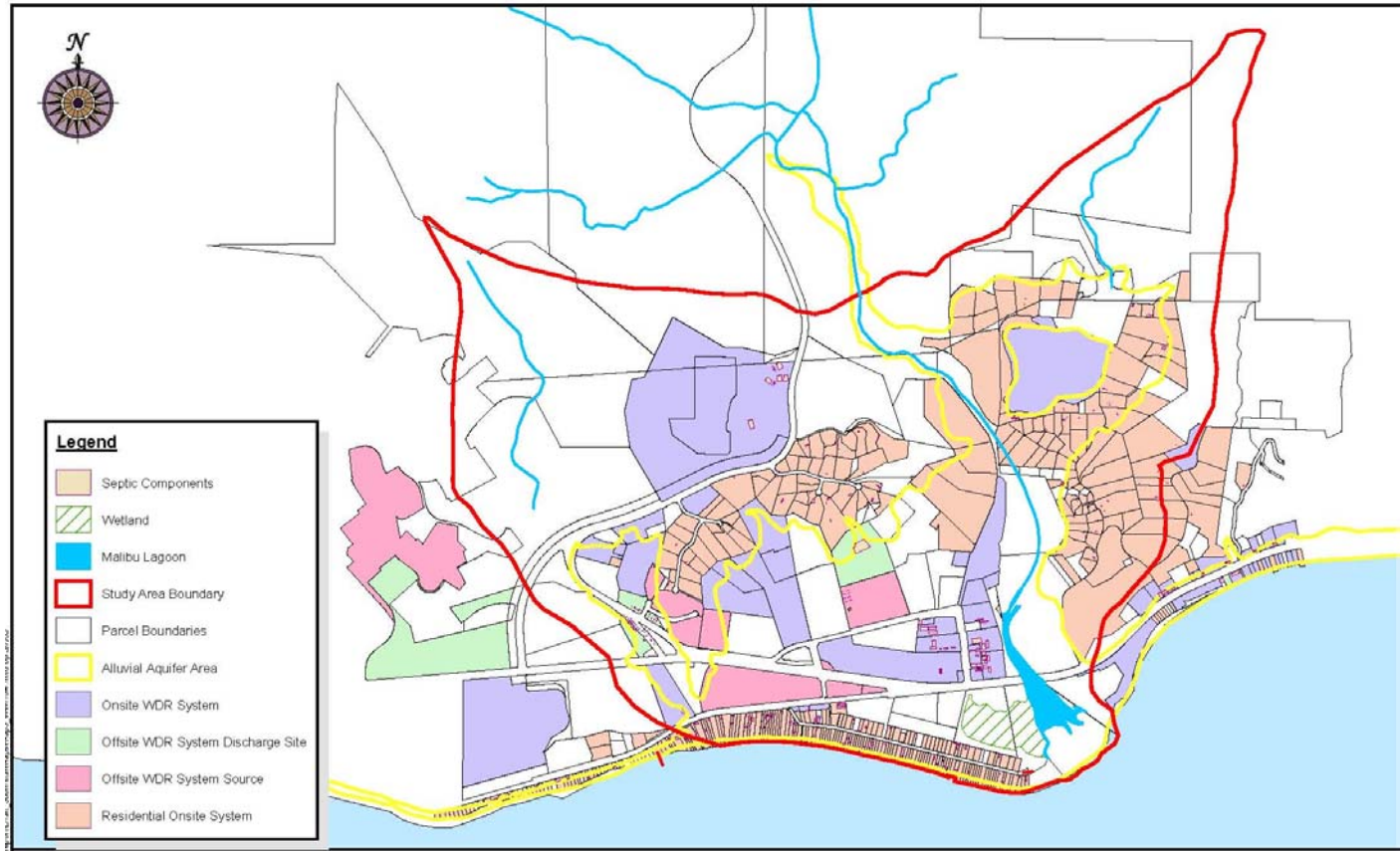
Managing Onsite Systems to Protect Water Quality: Malibu, California

- Steady increase in development contributing to water quality concerns (Surfrider Beach)
- State required either sewer system or a clear demonstration of how septic systems will be managed and risk reduced
- Malibu undertook a risk assessment analysis to develop an onsite system management strategy



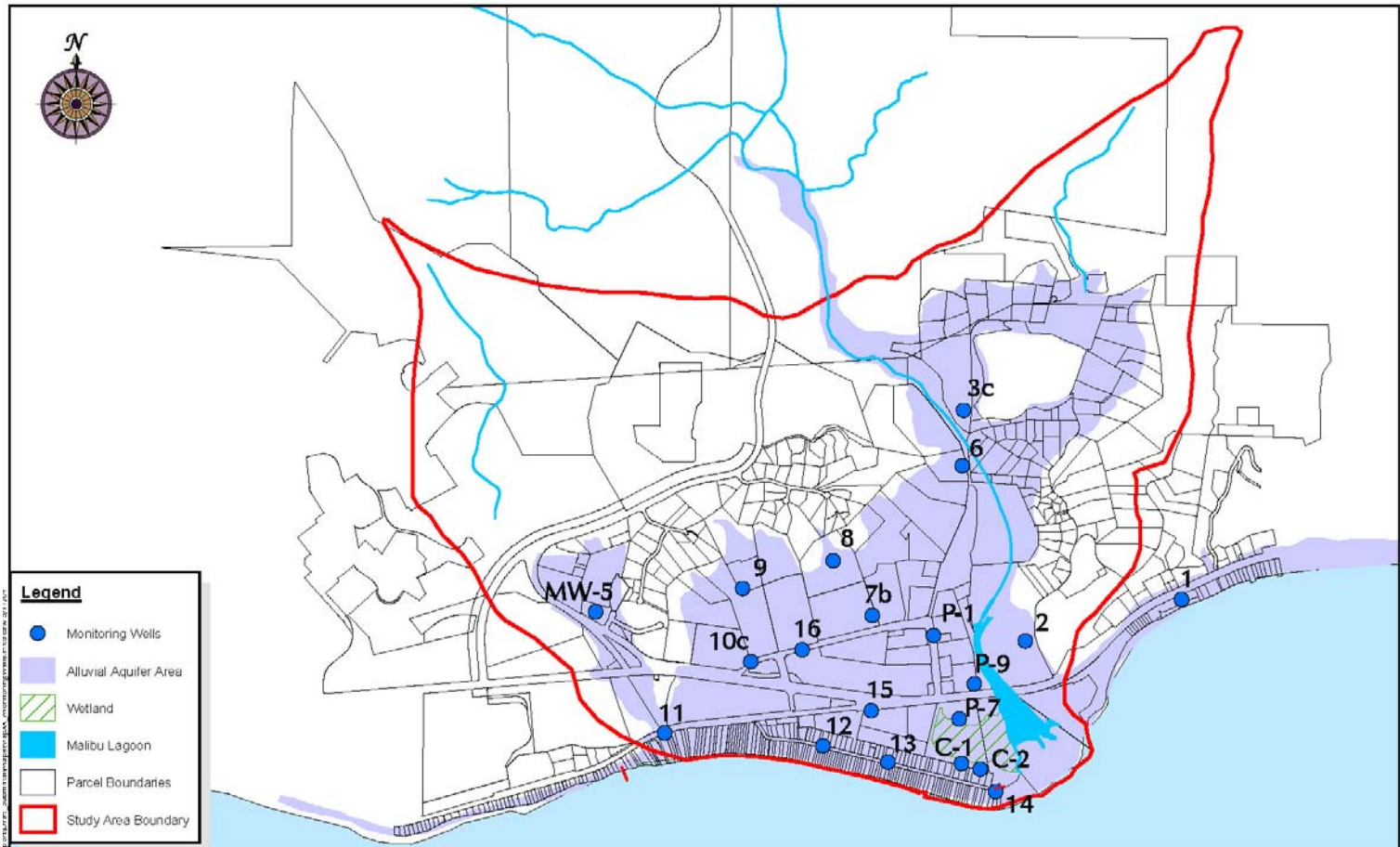


Understanding Wastewater Flow Sources and Nutrient Loading





Monitoring of Groundwater Quality





Implementation of an Integrated Wastewater Data Management System

■ Populate the database

- Customized data import tools
 - Parcel data
 - Inspections
 - GIS data layers
- Manual data entry through user friendly forms
 - Permits
 - Design Info

■ Local customization

- Print ready permits
- Data entry forms



For the Protection of Environmental Quality





Closing Remarks

- Active management of decentralized wastewater is the ideal and achievable strategy
- Integrating a data management system is an essential component to a successful, efficient management plan
- IWIMS is a web-based solution to managing decentralized wastewater and related GIS data
- GIS analysis of IWIMS data facilitates better understanding of the data and assessment of the management program