

Annual Report of Accomplishments 2005
1/18/2006

Institutions: The Ohio State University, Michigan State University, University of Minnesota, University of Wisconsin, Wisconsin DNR, Purdue University, Hoosier Riverwatch – Indiana DNR, Iowa DNR – IOWATER

Project Title: Building the Capacity of *E. coli* Monitoring by Volunteer Networks: A Multi-State Effort

Program: National Integrated Water Quality Program, Extension Education Project, 110

This report captures the status of 2005 activities of the six states participating in the project. The outline is structured to review the six overall goals of the project and activities associated with each project goal. Each goal is followed by an update of tasks completed during 2005.

- **Goal 1** – Build the capacity of Volunteer Monitoring programs to understand and use the most appropriate bacteria testing protocols (test kits) and watershed sampling strategies with their volunteers.
- **Goal 2** – Develop a comprehensive training program for volunteers on *E. coli* bacteria testing in targeted watersheds in a six state area.
- **Goal 3** – Develop and disseminate educational materials about *E. coli* and associated health risks, monitoring and sources.
- **Goal 4** – Increase awareness and acceptance of the use of volunteer collected water quality data in various watershed programs, including watershed assessments and TMDL development.
- **Goal 5** - Share results of our work with other states across the country, primarily via the National Monitoring Facilitation Project efforts.
- **Goal 6** – Demonstrate how to set up an appropriate watershed – based *E. coli* sampling strategy utilizing volunteer networks and begin collecting usable data

2005 Accomplishments Summary:

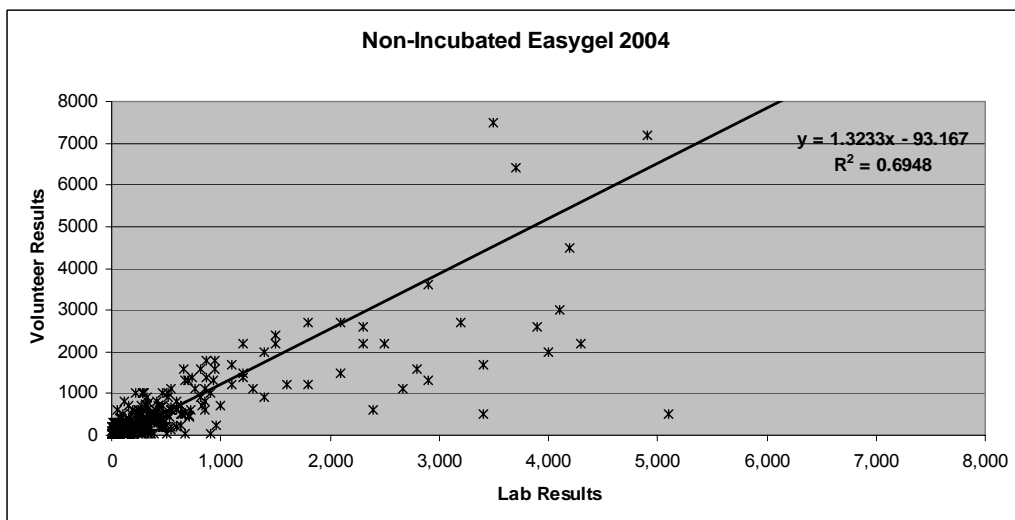
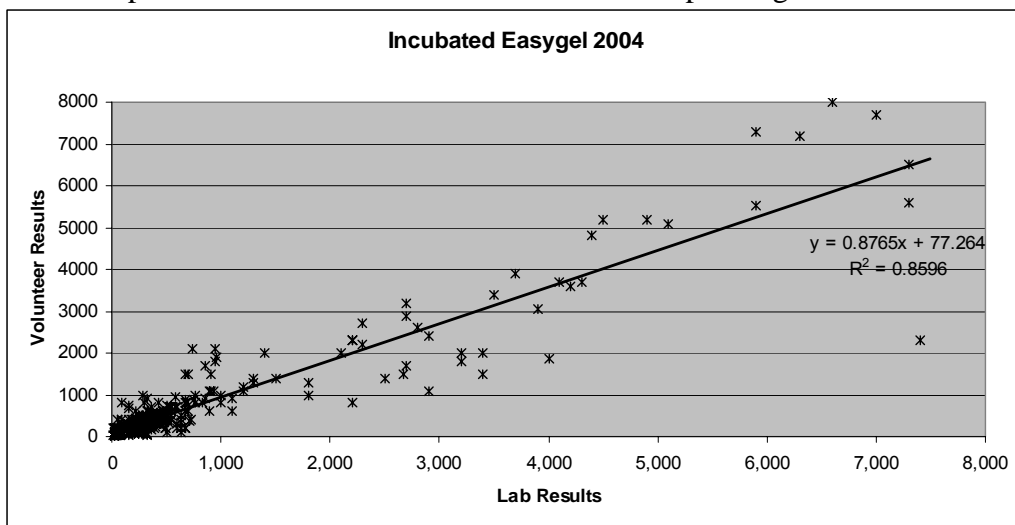
Thirty-eight trained volunteers collected and analyzed samples from 59 stream sites across six Great Lakes states, averaging 20-60 hours per volunteer (depending on the state). They analyzed samples for *E. coli* bacteria using six different test kits and sent sample splits to certified lab for confirmation. The Easygel® - Incubated and 3M Petrifilm™ test kits provided accurate results and ranked highest in volunteer preference and confidence. Training and supporting materials were developed and piloted at volunteer training workshops. The project website was strengthened and five presentations were made at national meetings to share the results of the research and outreach, and engage others in the project.

Goal 1 – Build the capacity of Volunteer Monitoring programs to understand and use the most appropriate bacteria

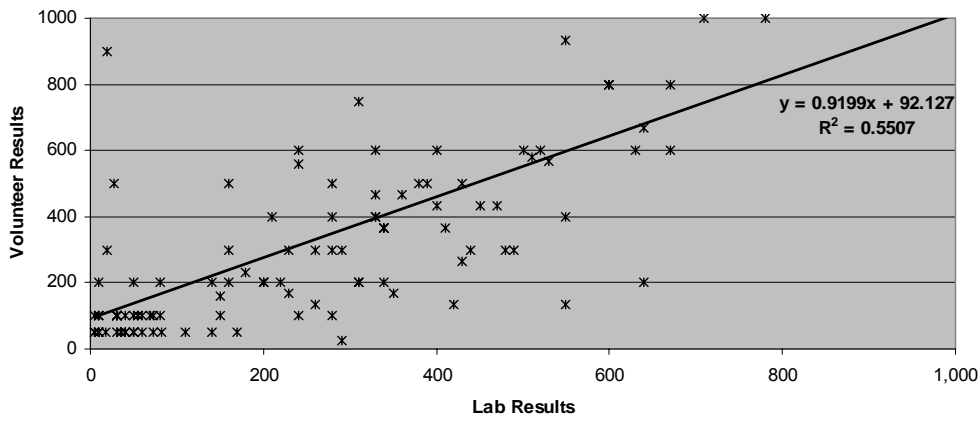
Five test kits have been evaluated for two complete sampling seasons (2004 and 2005) by Indiana and Iowa volunteers. Based on the comparison of 2004 home test kit and certified lab results and user preferences in Iowa and Indiana, the Minnesota, Ohio Michigan and Wisconsin volunteers used two recommended home test kits and sent split samples for certified lab analysis. All volunteers were surveyed at the end of the 2005 sampling season to assess their preferences and confidence in the different test kits.

Statistical analysis of the combined data for all six states is ongoing. Challenges include compiling data from streams with very low bacteria concentrations and those with high concentrations; correcting for analyses below detection limits; and a relatively small sample size for some methods. We analyzed for correlations between home lab test kit results and certified lab analysis, using straight numeric values and log values. We compared test results at critical thresholds of decision-making (235 cfu and 1000 cfu) to see whether the home test kits accurately identified those thresholds. We also investigated changes over time to see whether volunteers with more experience achieved more accurate results.

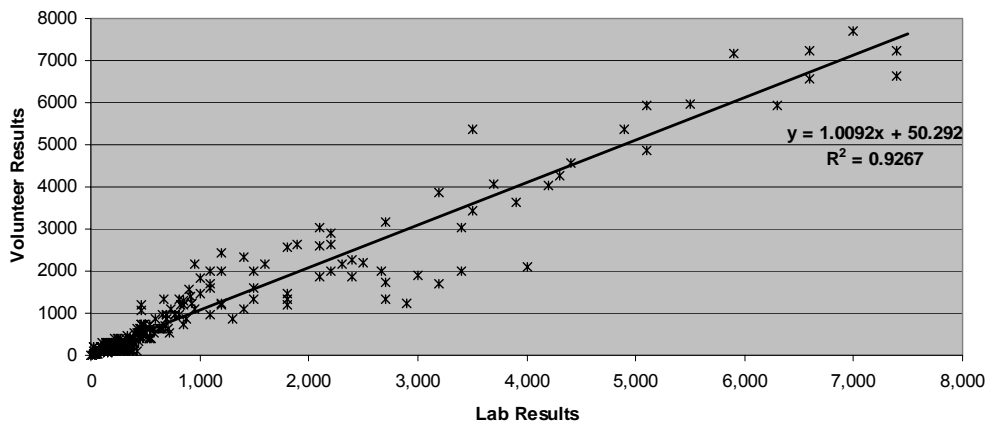
The following ten graphs compare Indiana and Iowa volunteer results with lab results for 2004 and 2005. Graphs for the combined six-state data sets are pending.



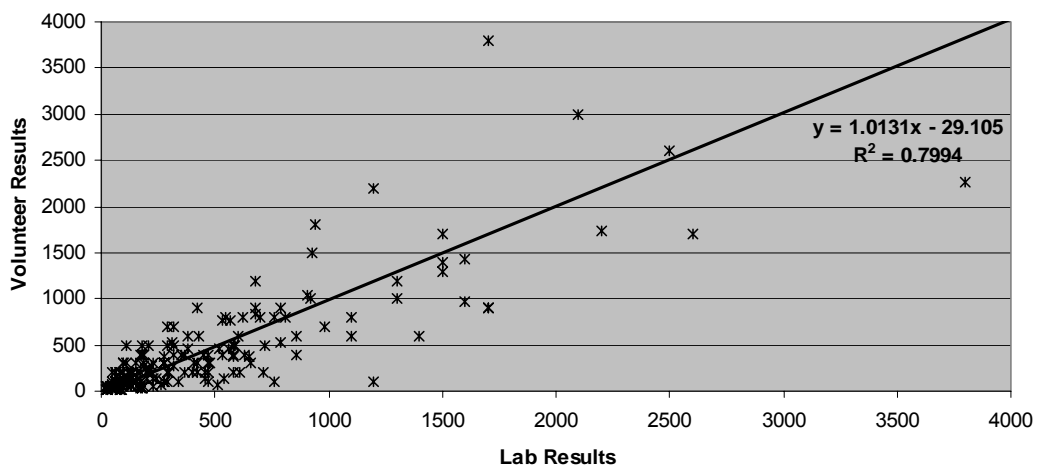
Coliscan MF 2004



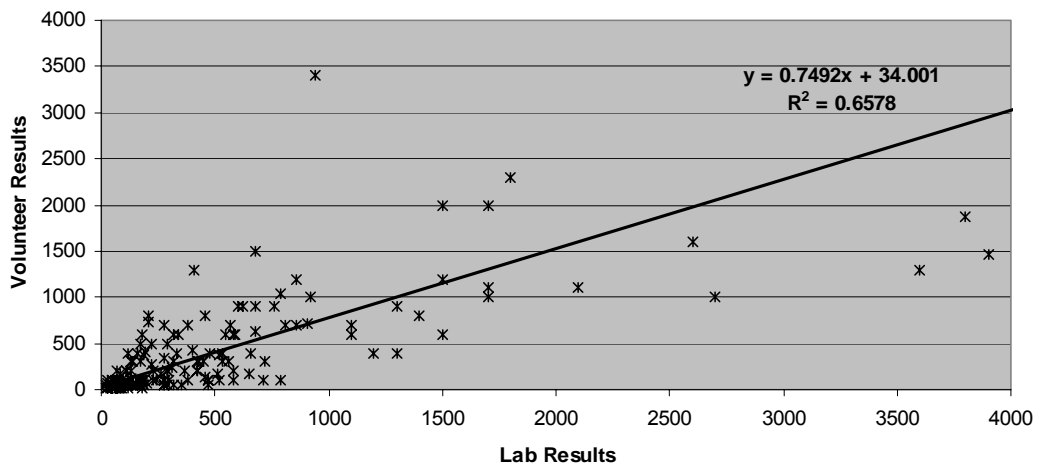
IDEXX Colisure 2004



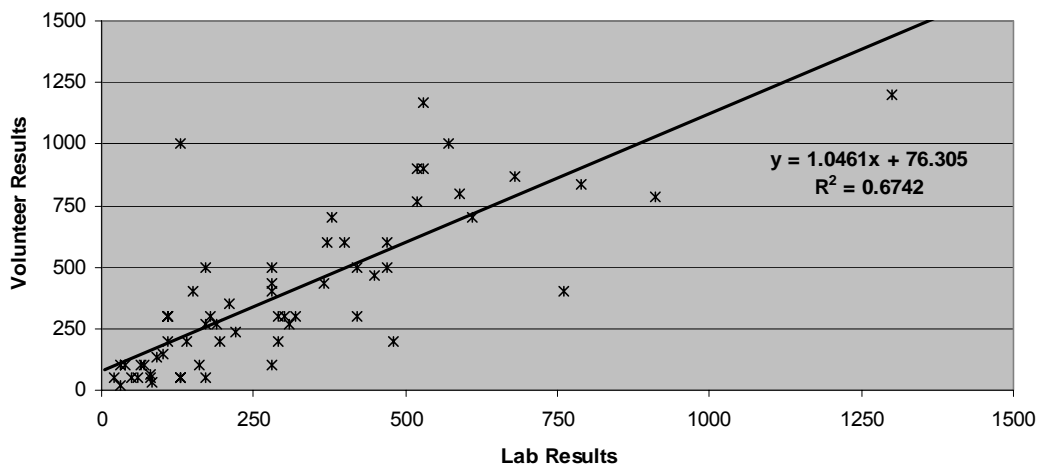
Incubated Easygel 2005



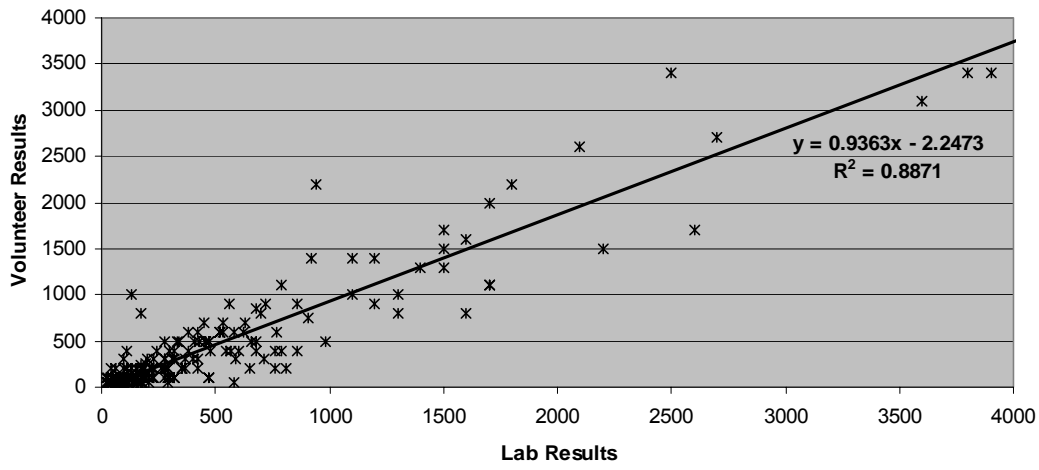
Non-Incubated Easygel 2005



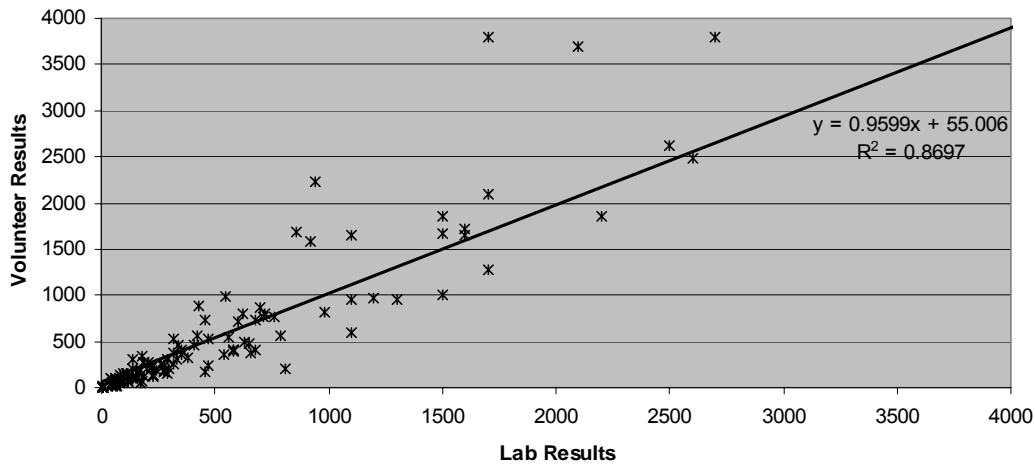
Coliscan MF 2005



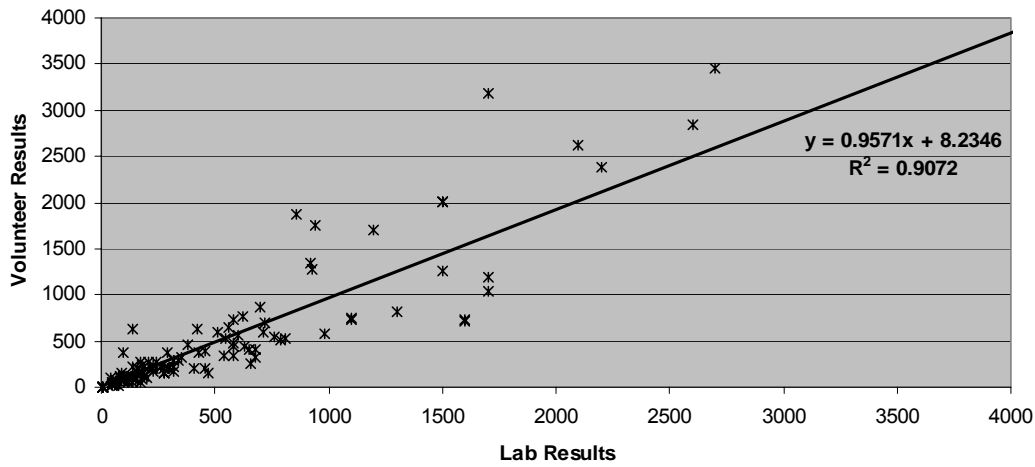
3M Petrifilm 2005



IDEXX Colisure 2005



IDEXX Colilert 2005



The following four tables show results of comparing the test kits results with certified lab analysis, at the critical threshold levels of 235 cfu and 1000 cfu. “Agree” indicates that **both** the test kit and lab gave a result above or below the threshold. “Disagree” indicates that the test kit and lab didn’t agree, with values on opposite sides of the threshold. The four methods tested in Michigan, Minnesota, Ohio, and Wisconsin are highlighted for comparison.

Percent of samples with test kit and lab values **both** either above or below the 235 cfu value. 2005 Indiana and Iowa data combined.

Rank	Agree	Disagree
ColSu48	84.1	15.9
3MPet48	83.4	16.6
ColSu24	83.2	16.8
3MPet24	83.1	16.9
ColLer24	79.4	20.6
EGI48	78.9	21.1
ColMF48	78.4	21.6
ColMF24	76.8	23.2
EGI24	75.3	24.7
EGNI48	71.9	28.1
EGNI24	60.5	39.5

Percent of samples with test kit and lab values **both** either above or below the 1000 cfu value. 2005 Indiana and Iowa data combined.

Rank	Agree	Disagree
3MPet24	94.7	5.3
3MPet48	94.6	5.4
ColMF24	93.9	6.1
ColMF48	93.8	6.2
ColSu48	93.5	6.5
ColSu24	92.5	7.5
EGI48	89.7	10.3
ColLer24	89.1	10.9
EGI24	88.7	11.3
EGNI24	87.0	13.0
EGNI48	85.4	14.6

Percent of samples with test kit and lab values **both** either above or below the 235 cfu value. 2005 Michigan, Minnesota, Ohio, and Wisconsin data combined.

Rank	Agree	Disagree
Pet24	87.9	12.1
EGI24	84.2	15.8
Pet48	80.8	19.2

EGI48	75.9	24.1
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Percent of samples with test kit and lab values **both** either above or below the 1000 cfu value. 2005 Michigan, Minnesota, Ohio, and Wisconsin data combined.

Rank	Agree	Disagree
EGI24	94.6	5.4
Pet24	94.1	5.9
EGI48	89.9	10.1
Pet48	88.1	11.9

Volunteer Perceptions and Attitudes

Volunteer perceptions and attitudes were surveyed at the start and conclusion of the sampling season. The following is a summary of the survey results. These results will be shared in upcoming presentations and via the project and National Facilitation websites.

Volunteers in Indiana and Iowa tested six *E. coli* test methods during 2005. Four methods were tested in Indiana (Coliscan Easygel® - incubated, 3M Petrifilm™, Coliscan Easygel® - not incubated, and Coliscan MF method), and five methods were tested in Iowa (Coliscan Easygel® - incubated, 3M Petrifilm™, Coliscan Easygel® - not incubated, Colisure® with IDEXX Quanti-Tray/2000™ and Colilert® with IDEXX Quanti-Tray/2000™). At the end of the monitoring season, volunteers were asked to rank their confidence in the test methods they had used over the past 4-6 months.

Mean ranking scores were used to assess which method the volunteers felt most confidence in using. The method with the smallest mean was the method in which the volunteers had most confidence in using. For Indiana this was the Coliscan Easygel® - Incubated; this was followed by the 3M Petrifilm™. For Iowa the preferred method was the Colisure® with IDEXX Quanti-Tray/2000™; close behind was 3M Petrifilm™ and this was followed by Colilert® with IDEXX Quanti-Tray/2000.

Minnesota, Michigan, Ohio and Wisconsin volunteers were trained to use two test methods: Coliscan Easygel® -Incubated and 3M Petrifilm™. Immediately following training sessions, volunteers were asked to rank how easy it was to learn each of the two methods. Of those who responded, 16 volunteers preferred 3M Petrifilm™ compared to 6 volunteers who indicated a preference for Coliscan Easygel® -Incubated. End-of-season confidence rankings by volunteers in Michigan, Minnesota, Ohio, and Wisconsin showed nearly equal split among volunteers. Thirteen people had most confidence using Coliscan Easygel, while 16 people had most confidence using 3M Petrifilm.

This table summarizes the monitoring efforts in each state during 2005. Twelve project training workshops were held training a total 45 volunteers, of whom 38 are actively participating in the study.

2005 Citizens Monitoring Bacteria Volunteer Participation Summary

	Indiana	Iowa	Michigan	Minnesota	Ohio	Wisconsin
Number of volunteers monitoring	6	4	6	7	7	8
Number of training workshops held	1	1	1	4	2	3
Number of volunteers trained in 2005	6	1	7	12	7	12
Hours per sampling (Min)	3	3.5	2	1.5	1.5	2
Hours per sampling (Max)	6	9.5	4	4	4	4
Average hours per sampling event	4.50	5.25	3	2.3	2.7	3
Average number of site visits in 2005	9.4	12.5	6.2	20.1	5.7	5
Average hours per volunteer in 2005	41.4	60.25	24.7	47.6	22.8	18.375
Number of sampling days in 2005	47	50	37	69	40	38
Sum of volunteer hours for 2005	207	241	148	333	159.5	147
Other <i>E.coli</i> workshops held	5	5	2	0	0	0
Other volunteers trained in <i>E.coli</i>	89	53	32	0	0	0
Number of samples collected in 2005	110	153	47	145	63	40
Number of replicates analyzed in 2005	440	765	282	870	378	252
Number of sites sampled in 2005	12	13	8	13	8	5

Goal 2 – Develop a comprehensive training program for volunteers on *E. coli* bacteria testing in targeted watersheds in a six state area.

The project team with Michigan as the lead state has produced and piloted a training manual for monitoring *E. coli*. Twelve volunteer training workshops were held among the six states in 2005.

The project also produced a **Citizen Monitoring Bacteria Data Sheet** which allows volunteers to organize and effectively collect like data in all six states (see next page).

CITIZENS MONITORING BACTERIA DATA SHEET

Date ____/____/____	Volunteer ID _____	Current Weather
Collection Time ____:____ (am/pm)	Site ID _____	<input type="checkbox"/> Clear/Sunny <input type="checkbox"/> Overcast <input type="checkbox"/> Showers <input type="checkbox"/> Rain (Steady) <input type="checkbox"/> Storm
Monitor's Name _____		Worst Weather in Past 48 hrs.
Stream/River Name _____		<input type="checkbox"/> Clear/Sunny <input type="checkbox"/> Overcast <input type="checkbox"/> Showers <input type="checkbox"/> Rain (Steady) <input type="checkbox"/> Storm

Stream Flow	Air Temp _____ (°C)	Transparency _____ (cm/inches) or _____ NTU (<i>optional</i>)
<input type="checkbox"/> High		
<input type="checkbox"/> Normal	Water Temp _____ (°C)	
<input type="checkbox"/> Low		

Stream assessment comments and observations:

For each method, record the volume of water (in mL) used when plating the Easygel samples. Note the incubation temperature and the time samples were placed in the incubator. After incubating for 24 hours and again at 48 hours, count how many colonies you see on each plate. To calculate the number of *E. coli* colony forming units (CFUs) per 100 mL, divide 100 by the number of mL of sample you used and multiply that result by the number of colonies you counted. You now have the estimated number of CFUs in 100 mL of sample.

Test Method	Sample Volume (mL)	Number of <i>E. coli</i> colonies counted @ 24 hours	Number <i>E. coli</i> (calculated) CFU /100mL @ 24 hours	Number of <i>E. coli</i> colonies counted @ 48 hours	Number <i>E. coli</i> (calculated) CFU /100mL @ 48 hours
EASYGEL – Sample 1		A		A	
EASYGEL – Replicate 2		A		A	
EASYGEL – Replicate 3		A		A	
3M Petrifilm – Sample 1	1 mL	B		B	
3M Petrifilm – Replicate 2	1 mL	B		B	
3M Petrifilm – Replicate 3	1 mL	B		B	

Incubation temperature: _____ °C

Time samples were placed in incubator: _____

A = count dark blue and purple colonies; **B** = count blue colonies with gas

Bacteria analysis comments & observations (include the time samples were counted if different from 24 or 48 hours):

Goal 3 – Develop and disseminate educational materials about *E. coli* and associated health risks, monitoring and sources.

Educational programming has been incorporated into each of the 12 volunteer training workshops held in 2005. Pre- and post-tests used at these trainings contained questions concerning associated health risks, monitoring protocol and discussed possible sources of *E. coli*.

For 2006 Minnesota has agreed to take the lead in the development of additional educational material development such as fact sheets which can be used with less technical non - formal programs.

Goal 4 – Increase awareness and acceptance of the use of volunteer collected water quality data in various watershed programs, including watershed assessments and TMDL development.

Each state has been working with their respective Extension and state water quality agencies to make them aware of this six state project. The US EPA Region 5 staff has met with the project team on two occasions in 2005 to discuss the early findings of the project. It has been suggested that this project be used in potentially training other watershed projects in Region 5 or perhaps nationally with *E. coli* monitoring. While test kit analysis is ongoing, reliability results from this three-year investigation will provide crucial information for state agencies charged with using volunteer monitoring data.

Several states have implemented credible data legislation which will place added importance upon volunteer data as state budget and agency resources continue to diminish.

Goal 5 - Share results of our work with other states across the country, primarily via the National Monitoring Facilitation Project efforts.

Website

A project web site has been developed and updated regularly throughout 2005 by the University of Wisconsin. The site URL is www.usawaterquality.org/volunteer/Ecoli/ . The website provides links to the National Monitoring Facilitation Project as well as our project research methods, volunteer survey data & tools, training manual and educational information.

Presentations

Presentations concerning the project were given at the following state, regional and national conferences:

“Midwest Bacteria Project” 5th Annual Water Monitoring Conference, Ames, IA. January 13-14, 2005. (oral presentation)

“Building the Capacity of Volunteer Monitoring for *E. coli* in the Upper Midwest” 4th National Conference: Nonpoint Source & Stormwater Pollution Education Programs, Chicago IL, October 17-20, 2005. (poster presentation)

“Building the Capacity of Volunteer Monitoring for *E. coli* in the Upper Midwest”, USDA – CSREES National Water Quality Conference, La Jolla, CA. February 6 – 10, 2005. (poster presentation)

“Bacteria Monitoring in the Upper Midwest: Developing Consistent Training and Monitoring Methods” USDA – CSREES National Water Quality Conference, La Jolla, CA. February 6 – 10, 2005. (oral presentation)

“The Hunt for Red *E. coli*: The Ongoing Search for Accepted Volunteer Data” 18th Annual National Conference, Enhancing the States’ Lake Management Programs “Protecting Lakes and Reservoirs in Urbanizing Areas”, Chicago, IL. April 26-29. (oral presentation)

Volunteer Monitoring for *E. coli*: Developing Consistent Training and Monitoring Methods, Michigan Water Quality Extension Educators Workshop, May 2005 (oral presentation).

Goal 6 – Demonstrate how to set up an appropriate watershed – based *E. coli* sampling strategy utilizing volunteer networks and begin collecting usable data.

All six states have set up successful volunteer sampling and training programs. The data is being used differently depending on the state structure and affiliation of the volunteers. Examples of volunteer affiliations include local watershed groups, Soil & Water Conservation Districts, health departments and statewide networks such as IOWATER and Hoosier Riverwatch.

The prestigious national newsletter *The Volunteer Monitor* has selected the project to be featured in an upcoming issue. The project recently submitted a “Top of the Fold” article for the region 5 CSREES regional website.