Technical Support for Assessment, TMDL Tracking and Implementation System (ATTAINS) Redesign Planning (EP-C-12-054, TO 1)

Workgroup 4 'Improved Assessment Methods'

Recommendations Report

FINAL

August 2014

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Acronym List

Acronym	Description
ACE	Army Core of Engineers
ADB	Assessment Database
ATTAINS	Assessment TMDL Tracking & Implementation System
BASINS	Better Assessment Science Integrating point & Non-point Sources
BenMap	Environmental Benefits Mapping and Analysis Program
CWA	Clean Water Act
EDAS	Ecological Data Application System
EN	Exchange Network
EPA	Environmental Protection Agency
GIS	Geographic Information System
GRTS	Grants Reporting and Tracking System
IR	Integrated Reporting
NHD	National Hydrography Dataset
NWIS	National Water Information System
NWQ Portal	National Water Quality Portal
QA	Quality Assurance
STORET	STOrage and RETrieval Data Warehouse
USGS	United States Geological Survey
WG	Workgroup
WQS	Water Quality Standards
WQX	Water Quality Exchange Network
XML	Extensible Markup Language

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Executive Summary

The ATTAINS re-design project is part of the larger Water Quality Framework, which seeks to better integrate EPA's existing data systems (ATTAINS, NHD*Plus*, STORET/WQX, GRTS). The Framework will first focus on the ATTAINS data system. This project seeks to leverage state and EPA Regional staff knowledge to refine the process used to submit Integrated Reporting (IR) data to EPA and then make that data visible to the public. One goal of this Workgroup will be to redesign the ATTAINS data system and make it the system of record for Strategic Measures reporting to reduce the reporting burden on states.

Timeline for new ATTAINS system:

- Late 2014 – Begin designing new system (Oct/Nov)
- Early 2015 – Begin system development
- Late 2015 – New system is ready to use
- 2016 – States can continue to use current system to submit data; however, EPA will be looking for approximately 10 states to volunteer to use the new system. Lessons learned from the volunteer states will be used to tweak the system.
- Compile lessons learned and list of needed changes from 2016 release of ATTAINS system
- 2018 – Finalize system and transition all states to new system

This project consists of four workgroups: WG1 – Data Elements and Schema, WG2 – Data Exchange Methodology, WG3 – Performance Measure Evaluation and WG4 – Improved Assessment Methods.

Workgroup 4 evaluated tools and methods that can be used to discover monitoring data and automatically screen that data against water quality criteria to aid in state water assessments. One of the goals of this effort is to bridge ATTAINS and STORET by supporting state efforts to automate portions of the assessment process by providing tools or services that can help states to automate the screening of monitoring data against state water quality criteria or provide information on water quality trends. Several states have already automated components of the assessment process, and EPA hopes to not only learn from their experience, but to also find ways to facilitate the transfer of those capabilities to other states.

The purpose of this report is to identify potential approaches, challenges, and recommended solutions to better enable states to develop the capability to both discover relevant monitoring data for assessments as well as to perform automated screening of monitoring data against water quality criteria.

1. Background

The drivers for this workgroup come from the Water Quality Framework (Framework) and the Integrated Reporting (IR) retrospective review study that was conducted by EPA. The Framework and retrospective study both identified assessing waters, discovering data and preparing the IR report as the priority areas to reduce state burden. EPA is exploring automated technology solutions to assist states in reducing their effort to assess water data across six steps or assessment components (Figure 1).

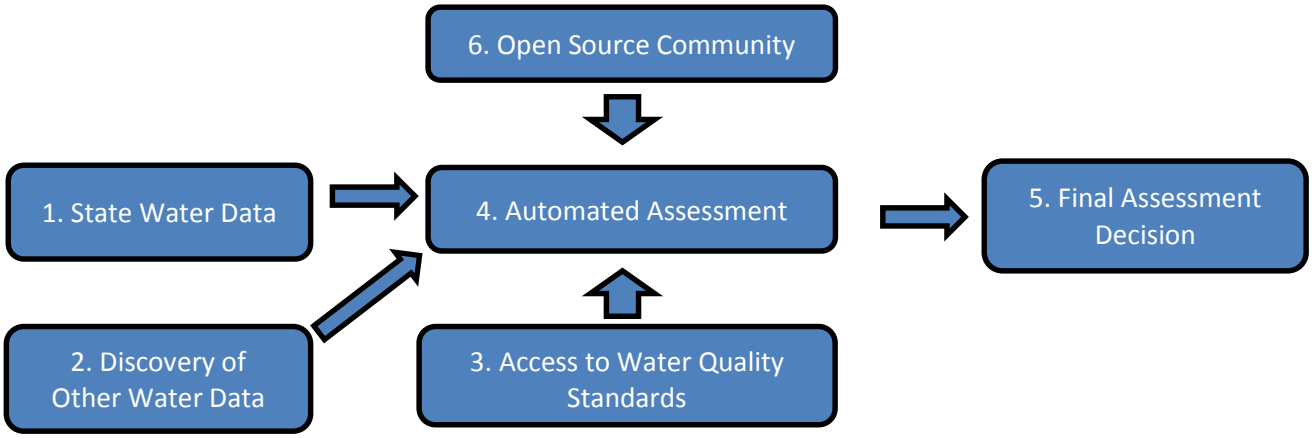

Figure 1 - Automated Assessment Components

The six components are:

1. State Water Data: Identifies the state water quality data repository and how the data are made available.
2. Discovery of Other Water Data: Identifies the other data sources the state uses in their assessment process and how these data are incorporated into their analysis.
3. Access to Water Quality Standards: Identifies the source of water quality standards and how these are made available for analysis.
4. Automated Assessment: Identifies the approaches or algorithms states use to compare water qualtiy data to water quality thresholds.
5. Final Assessment Decision: Identifies the process and views states take to make the final assessment decision.
6. Open Source Community: Identifies the means to share learned lessons and technologies.

The workgroup was tasked with evaluating tools and methods that can be used to discover monitoring data and automatically screen that data against water quality criteria to aid in state water assessments.

The workgroup discussed the following topics:

- Review Automated of Assessment Processes.
- Evaluate existing methods and tools for automated assessments.
- Discuss Discovery Tools: What tools can be developed to assist states to find data from other sources (e.g. USGS, ACE)?
- Discuss Seamless Integration of Data: How can states seamlessly integrate data from multiple sources (e.g. STORET, USGS, ATTAINS)?
- Identify ways to improve the overall assessment process.
- Identify gaps in the six automated assessment components.
- Propose solutions to close the identified gaps.

The reminder of this report discusses the initial findings and proposed solutions developed by the workgroup.

2. General Approach and Findings

The workgroup was initiated in November 2013, and during that meeting EPA requested a collection of current approaches, and this list was compiled and discussed by the workgroup (See Section 2.1). The WG's biweekly meetings resumed in February 2014. EPA held 10 meetings for the WG via conference call and webinar, in which 19 States participated. During the meetings the WG discussed topics and viewed demonstrations of fully and partially automated state assessment tools (See Section 2.2).

2.1 Status of State Assessment Processes

In order to compile a list of current automated assessment approaches, EPA asked the workgroup members to provide a brief description of their state's automated assessment approaches and/or tools. EPA provided an outline to the workgroup members to facilitate gathering this information (See Appendix B). Responses were received from 15 workgroup members.

The brief descriptions were provided in MS Word template contained four questions on current processes to perform automated assessments, the types of software utilized, a list of monitoring data sources, and any identified information and technology gaps. The table below summarizes the responses received from the 15 workgroup members (Table 1).

Table 1 –Summary of Automated Assessment Tools/methods currently used by workgroup members

Topic	Response
State Water Data	Each of the 15 responding states has some means to store water quality data. Of the responses, 1 pulls from STORET and 8 use Oracle for their state database.
Data Discovery of Other data Sources	9 identified that they pull data from external sources for inclusion in their assessment analyses.
Access to Water Quality Standards Information	6 indicated that they have an external water quality standards table, 7 insert standards information directly or manually into the analysis spreadsheet, and 2 have a standards table within their statistical analysis tool, either R or SAS.
Automated Assessment Routines	5 use Excel, 4 use Access, and 5 use Oracle to run their assessment routines. 3 states use "R" software as part of their assessment routines.
Identified Gaps	11 states that identified a gap in automated assessment processes and procedures, 4 states identified a need for assistance in incorporating and utilizing data from external sources, and 2 states identified a gap in formatting water monitoring data for the WQX schema.

2.2 State Presentations

Several states presented on the automated components used in their assessment process and shared their experiences with the workgroup. The purpose of these presentations was not only to learn from these state experiences, but to also find ways to facilitate the transfer of those capabilities to other states.

2.2.1 South Carolina Presentation

Presenter(s): David Chestnut (chestnde@dhec.sc.gov), Bryan Rabon (raboneb@dhec.sc.gov)

Brief Description: SC demonstrated the pieces they developed to store water monitoring data and water quality standards. They also showed the algorithms developed in "R" they developed to measure water quality data against thresholds and the output tools used to display results.

2.2.2 Oklahoma Presentation

Presenter(s): Monty Porter (Monty.Porter@owrb.ok.gov)

Brief Description: OK demonstrated a spreadsheet which contains columns to insert water monitoring data and water quality standards, and provides built in algorithms to measure data against thresholds.

2.2.3 Colorado Presentation

Presenter(s): Arne Sjodin (arne.sjodin@state.co.us)

Brief Description: CO demonstrated a spreadsheet which contains columns to insert water monitoring data and water quality standards, and provides built in algorithms to measure data against thresholds.

2.2.4 Mississippi Presentation

Presenter(s): Valerie Alley (Valerie_Alley@deq.state.ms.us)

Brief Description: MS demonstrated their system enSPIRE built through a collaborative effort with AL DEM and KY DOW to contain a water data repository, water quality standards tables, and an analysis function.

2.2.5 Wisconsin Presentation

Presenter(s): Aaron Larson (AaronM.Larson@wisconsin.gov)

Brief Description: WI demonstrated the WATERS system they developed which contains water monitoring data, water quality standards tables, algorithms to measure data against thresholds, output tools, and other data viewing capabilities.

2.2.6 California Presentation

Presenter(s): Karen Worcester (kworcester@waterboards.ca.gov), Dave Paradies (dave_paradies@thegrid.net)

Brief Description: CA demonstrated their Central Coast Water Quality Data Assessment for 303(d) and Healthy Watersheds system. The systems accesses CA water quality data and water quality standards, measures data against thresholds, and generates scorecards to aid in decision making.

2.2.7 New Hampshire Presentation

Presenter(s): Ken Edwardson (Kenneth.Edwardson@des.nh.gov)

Brief Description: NH demonstrated their Oracle tool which pulls water data, contains algorithms to measure against thresholds, and provides a user interface for making final decisions. Further, NH demonstrated their spreadsheet tool to graphically display WQ data paired up with local weather and flow data to assist in final decisions.

3. Findings and Discussion on Identified Gaps

After the workgroup reviewed the state presentations (See Section 2), they discussed gaps in the automated assessment process. The workgroup was able to identify several gaps for each of the six automated assessment components (Figure 1). The sections below discuss the gaps identified for each automated assessment component.

3.1 State Water Data

Gathering ambient water quality data within the state multiple agencies was identified as an area that posed the greatest difficulty in assessing water quality data and preparing an IR report. The state water data questions pertained to ambient discrete data samples, although state data may also include continuous monitoring data records. Often the data (both ambient discrete or continuous monitoring).are not available in the same format, and it requires additional time to convert the data for analysis. Table 2 provides a description of the gaps identified by the workgroup.

Table 2 - Identified Gaps for State Water Data

Automated Assessment Component	Tracking #	Identified Gap
State Water Data	6.1.1	Develop process to store, access, and incorporate continuous monitoring data.
	6.1.2	Establish data quality level within WQX to inform the user on the type of data and enable the user to extract necessary data.
	6.1.3	Determine WQX compatibility with other data systems, e.g. Ecological Data Application System (EDAS)
	6.1.4	Conduct more WQX trainings

3.2 Discovery of Other Water Quality Data

States often need to gather Water Quality Data from outside sources in order to conduct water quality assessments. These data can be both ambient discrete or continuous monitoring data records. This process can be cumbersome for states as other data sources are not easily discoverable or available for insertion to an analytical tool, and the workgroup identified several gaps related to this process. Table 3 provides a description of the gaps identified by the workgroup.

Table 3 - Identified Gaps for Discovery of Other Water Quality Data

Automated Assessment Component	Tracking #	Identified Gap
Discovery of Other Water Quality Data	6.2.1	Provide information on available data discovery tools.
	6.2.2	Training on retrieving data from the Water Quality (WQ) Portal.
	6.2.3	Validate data from WQ Portal and ensure it matches data available in EPA STORET and USGS NWIS.
	6.2.4	Address data QA and duplicate data issues within EPA STORET and the WQ Portal.
	6.2.5	Facilitate making QA documentation available on datasets to reduce the burden on states that have to search for QA documents associated with a given dataset.
	6.2.6	Enable other data discovery information such as research papers, journal reports, state reports, references, and information gathering activities (e.g. internet libraries and articles). Some states need to evaluate these sources and they don't fit nicely into a database structure. Find ways (i.e. formats) to deal with this information. Where should or could this data be stored? What format best handles this information?
	6.2.7	Explore data migration, data integration and data ownership issues.
	6.2.8	Standardize characteristics for the data available in the WQ Portal.

Many states identified Gap 6.2.7 as a very common problem. If a state would like to analyze data using external data, the state often must conduct additional steps to format the data to be compatible with the state's data system or analysis tools.

3.3 Access to Water Quality Standards (WQS)

Access to WQS are critical to performing water quality assessments. These thresholds are listed in a state's WQS documents and are used to screen against monitoring data to perform water quality assessments. Since these threshold values exist in a hard copy, states need additional time to manually pull the threshold values out of WQS documents and maintain them in a more usable electronic format. Table 4 provides a description of the gaps identified by the workgroup.

Table 4 - Identified Gaps in Access to WQS

Automated Assessment Component	Tracking #	Identified Gap
Access to WQS	6.3.1	Maintain a national table of WQS for states to reference. Build "R" code to enable states to access input files that are downloads from the WQS tables.
	6.3.2	Provide GIS tools that will help states determine which standards apply to which waterbodies and to capture the beneficial uses to aid in applying numeric criteria.

EPA did note that maintaining WQS on a national level would be very difficult to do.

3.4 Automated Assessment

States identified that performing the initial water quality assessment is a very time consuming step. While states have developed some automated approaches to lessen the assessment burden, and the workgroup identified several gaps which still exist. Table 5 provides a description of the gaps identified by the workgroup.

Table 5 - Identified Gaps in Automated Assessment

Automated Assessment Component	Tracking #	Identified Gap
Automated Assessment	6.4.1	Develop the ability for states to make modular comparisons, (e.g. where the state would enter the values to compare a parameter value to a set criteria that is applicable across parameters), thus a state could look at assessment methodologies instead of parameters.
	6.4.2	Deliver "R" Scripts in small packages to allow states to choose just the code needed.
	6.4.3	"R" Packages: create scripts that can read through each monitoring location and compare to criteria. This approach will allow users to create the data in the proper csv format, or have an option to translate the data to the standard format, to enable the R package to read and analyze the data.
	6.4.4	Develop an expanded feature set to address complex scenarios like metals thresholds which are not just a straight calculation.

3.5 Final Assessment Decision

The final assessment decision is usually made by a scientist or program manager that reviews the results of the initial assessment along with other available information. States identified the need to better facilitate the post-assessment review of data and the assessment decision. Table 6 provides a description of the gaps identified by the workgroup.

Table 6 - Identified Gaps in Final Assessment Decision

Automated Assessment Component	Tracking #	Identified Gap
Final Assessment Decision	6.5.1	For states using ADB to report this information, manually entering the analysis into ADB is really tedious. Need the ability to the jump between the state's auto assessment system and associated conclusions and the upload to EPA's

Automated Assessment Component	Tracking #	Identified Gap
		system to enable options when uploading data (maybe via XML) or batch upload to ADB (or similar).
	6.5.2	Requires the engagement of the local person to review the assessment results with other available information to make a final decision.
	6.5.3	Need tools to facilitate the post-assessment review of the data and the assessment results with staff in different program areas to determine final assessment decision.
	6.5.4	What tools are available to assist in the public review process that states have to conduct? Need some means/methods to facilitate public access to draft final decisions.
	6.5.5	Need to develop multiple ways to show the data and enable review by other state programs and/or the public.

3.6 Open Source Community

Currently, there is no mechanism for states to share information on automated assessment methods. Creating a place for states to share ideas and code for applications was identified as a critical need for states. The workgroup identified several gaps with this component. Table 7 provides a description of the gaps identified by the workgroup.

Table 7 - Identified Gaps in Open Source Community Tools and Sharing

Automated Assessment Component	Tracking #	Identified Gap
Open Source Community	6.6.1	Provide access to tools/automated assessment methods that have already been developed by other states.
	6.6.2	Offer contractor support to assist states to modify existing code/applications to suit needs of other states.
	6.6.3	Provide a tool that was developed by a state, and make it "generic" so it can be applied and/or customized to other states.
	6.6.4	Provide more R training to assist states in modifying code to make comparisons. Provide EPA specific forum to discuss R code.
	6.6.5	Review the tools that other states have built as a starting point.
	6.6.6	Host a GitHub account to provide the code and packages.
	6.6.7	Provide a moderated site so that packages and/or code created by the states can be made generic and qualified.
	6.6.8	Create a code repository for EPA and the states to store the code they are willing to share (similar to EPA's BenMAP, which is an open source application actively being worked on by EPA, multiple contractors, and an independent stakeholder). Actively managed by someone who's

		responsible for reviewing, testing, and verifying documentation before it gets merged into the main project for sharing.

The workgroup was able to identify multiple gaps for each of the automated assessment components. Appendix C contains a table of all the gaps compiled by the six automated assessment components. After gathering information on existing gaps, the workgroup focused on identifying solutions (See Section 4).

4. Identified Solutions and Areas Where EPA Can Provide Support

The workgroup provided solutions and identified areas where EPA support can help close the gaps identified in Section 3. This section discusses the possible solutions for each automated assessment component and highlights the gaps that still require further exploration.

4.1 State Water Data – Identified Solutions

Table 8 provides the gap and suggested solutions for Section 3.1: State Water Data Automated Assessment Components as well as an additional solution that fulfill requirements not identified in the gap analysis (See Solution 7.1.2). The state water data questions pertained to ambient discrete data samples, however state data may also include continuous monitoring data records.

Table 8 – State Water Data: Identified Solutions

Tracking #	Identified Gap	Tracking #	Identified Solution/Possible EPA Support
6.1.1	Develop process to store, access, and incorporate continuous monitoring data.	7.1.1	Provide means to hold all the continuous monitoring data so the public can access it.
		7.1.2	Provide assistance on reviewing other data storage solutions, e.g. Aquarius to understand how they will work with state and EPA systems.

The other gaps from Section 3.1 still require further exploration:

6.1.2 - Establish data quality levels within WQX to inform the user on the type of data and enable the user to extract necessary data.

6.1.3 - Determine WQX compatibility with other data systems, e.g. EDAS

6.1.4 - Conduct more WQX trainings

4.2 Discovery of Other Water Quality Data – Identified Solutions

Table 9 provides the gap and suggested solutions for Section 3.2: Discovery of Other Water Quality Data as well as an additional solution that fulfill requirements not identified in the gap analysis (See Solution 7.2.2). These data can be both ambient discrete or continuous monitoring data records.

Table 9 – Discovery of Other Water Quality Data: Identified Solutions

Tracking #	Identified Gap	Tracking #	Identified Solution/Possible EPA Support
6.2.5	Facilitate making QA documentation available on datasets to reduce the burden on states that have to search for QA documents associated with a given dataset.	7.2.1	Assist in making the NJ automated process for making QA reviewed data available. Make it easier for states to query for data and elements that meet specified QA requirements.
		7.2.2	EPA identifies or filters data based on some sort of quality measurement so that the states can easily pull only the data of this quality.

The other gaps from Section 3.2 still require further exploration:

6.2.1 - Provide information on available data discovery tools and options.

6.2.2 - Training on retrieving data from the National Water Quality (NWQ) Portal.

6.2.3 - Validate data from NWQ Portal and ensure it matches data available in STORET and NWIS.

6.2.4 - Address data QA and duplicate data issues within STORET and the Portal.

6.2.6 - Enable other data discovery information such as research papers, journal reports, state reports, references, and information gathering activities (e.g. internet libraries and articles). Some states need to evaluate these sources and they don't fit nicely into a database structure. Find ways (i.e. formats) to deal with this situation. Where should or could this data be stored? What format best handles this information? Consider exploring a similar format that National Environmental Methods Index uses to make the information available.

6.2.7- Explore data migration, data integration and data ownership issues (This is a common problem: if a state has the analysis piece in their database, then they have to bring external data into their local system, where they may not want it, in order to analyze it).

6.2.8 - Standardize characteristics for the data available in the WQ Portal.

4.3 Access to Water Quality Standards (WQS) – Identified Solutions

Table 10 provides the gaps and suggested solutions for Section 3.3: Access to Water Quality Standards information as well as additional solutions that fulfill requirements not identified in the gap analysis (See Solutions 7.3.3 and 7.3.4).

Table 10 – Access to Water Quality Standards: Identified Solutions

Tracking #	Identified Gap	Tracking #	Identified Solution/Possible EPA Support
6.3.1	Maintain a national table of WQS for states to reference. Build "R" code to enable states to access input files that are downloads from the WQS tables.	7.3.1	Maintaining an accessible water quality standards table and designated uses which are geospatially linked to water bodies
6.3.2	Provide GIS tools that will help states determine which standards apply to waterbodies and capture the beneficial uses to aid in applying numeric criteria.	7.3.2	EPA could help to tie WQS to stream segments.
		7.3.3	Leverage the new catchment approach to discover data, WQS, assessed waters. Consider scenarios where states use high resolution NHD and the catchments are medium resolution NHD, causing multiple WQS within a catchment.
		7.3.4	Determine if there is something EPA can pull from BASINS to download water quality data?

There are no other gaps from Section 3.3.

4.4 Automated Assessment – Identified Solutions

Table 11 provides the gap and suggested solutions for Section 3.4: Automated Assessment as well as an additional solution that fulfills requirements not identified in the gap analysis (See Solutions 7.4.2).

Table 11 – Automated Assessment: Identified Solutions

Tracking #	Identified Gap	Tracking #	Identified Solution/Possible EPA Support
6.4.4	Develop an expanded feature set to address complex scenarios like metals thresholds which are not just a straight calculation.	7.4.1	Scripts that address complex queries. NM has developed several hardness dependent metals scripts that calculate the criterion for a particular sampling event. NM is exploring ways to best share these scripts.
		7.4.2	EPA could consider developing a suite of tables, scripts, code and use guidance for specific chemical parameters that users could apply to their data and threshold values to facilitate making assessments.

The other gaps from Section 3.4 still require further exploration:

6.4.1 - Develop the ability for states to make modular comparisons, (e.g. where the state would enter the values to compare a parameter value to a set criteria that is applicable across parameters), thus a state could look at assessment methodologies instead of parameters.

6.4.2 - Deliver "R" Scripts in small packages to allow states to choose just the code needed.

6.4.3 - "R" Packages: create scripts that can read through each monitoring location and compare to criteria. This approach will allow users to create the data in the proper csv format, or have an option to translate the data to the standard format, to enable the R package to read and analyze the data.

4.5 Final Assessment Decision – Identified Solutions

Table 12 provides a suggested solution for Section 3.5: Final Assessment Decision requirements not identified in the gap analysis (See Solutions 7.5.1).

Table 12 – Final Assessment Decision: Identified Solutions

Tracking #	Identified Gap	Tracking #	Identified Solution/Possible EPA Support
		7.5.1	EPA could help to identify and make available state tools, approaches or scorecards for other states to leverage.

The other gaps from Section 3.5 still require further exploration:

6.5.1 - For states using ADB to report this information, manually entering the analysis into ADB is really tedious. Need the ability to the jump between the state's auto assessment system and associated conclusions and the upload to EPA's system to enable options when uploading data (maybe via XML) or batch upload to ADB (or similar).

6.5.2 - Requires the engagement of the local person to review the assessment results with other available information to make a final decision.

6.5.3 - Need tools to facilitate the post-assessment review of the data and the assessment results with staff in different program areas to determine final assessment decision.

6.5.4 - What tools are available to assist in the public review process that states have to conduct? Need some means/methods to facilitate public access to draft final decisions.

6.5.5 - Need to develop multiple ways to show the data and enable review by other state programs and/or the public.

4.6 Open Source Community – Identified Solutions

Table 13 provides the gap and suggested solutions for Section 3.6: Open Source Community as well as an additional solution that fulfills requirements not identified in the gap analysis (See Solution 7.6.2).

Table 13 – Open Source Community: Identified Solutions

Tracking #	Identified Gap	Tracking #	Identified Solution/Possible EPA Support
6.6.1	Provide access to tools/automated assessment methods that have already been developed by other states.	7.6.1	EPA maintain a forum for states to share ideas and code for state developed applications.
6.6.4	Provide more R training to assist states in modifying code to make comparisons. Provide EPA specific forum to discuss R code.		EPA explore options to establish or support a forum for states to share ideas and code for state developed applications, e.g. leverage the R list serve established by NJ, USGS GitHub and others.
		7.6.2	EPA could develop a forum to share state developed solutions and use guidance. EPA could consider developing a suite of tables, scripts, code and use guidance for specific chemical parameters that users could apply to their data and threshold values to facilitate making assessments.

The other gaps from Section 3.6 still require further exploration:

6.6.2 - Offer contractor support to assist states to modify existing code/applications to suit needs of other states.

6.6.3 - Provide a tool that was developed by a state, and make it "generic" so it can be applied and/or customized to other states.

6.6.5 - Review the tools that other states have built as a starting point.

6.6.6 - Host a GitHub account to provide the code and packages.

6.6.7 - Provide a moderated site so that packages and/or code created by the states can be made generic and qualified.

6.6.8 - Create a code repository for EPA and the states to store the code they are willing to share (similar to EPA's BenMAP, which is an open source application actively being worked on by EPA, multiple contractors, and an independent stakeholder). Actively managed by someone who's responsible for reviewing, testing, and verifying documentation before it gets merged into the main project for sharing.

4.7 Funding – Identified Solutions

In addition to the gaps and solutions discussed in the previous sections, the WG expressed the need for additional funding opportunities that would focus on Water Quality Framework and automation related projects. When the WG suggested the use of the Exchange Network grants, some states explained that these grants are often "lost" within the state funding streams and are not available the program level. There was a suggestion for EPA to provide Framework or other targeted funding so the states would be better able to assign funding for specific Framework related projects.

Appendix A

Meeting minutes from Workgroup 4 conference calls.

Appendix B

Outline developed by EPA for WG members to provide a description of their state's automated approach for performing assessments or screening of water quality monitoring data against water quality criteria.

Appendix C

Compiled table of gaps identified by the WG. See Section 3 for complete discussion.