

USDA's High Priority Performance Goal for Water

September 2012



*Recommendations for a Performance Measures
Framework to Assess Condition of the Resource
and Effectiveness of Actions*



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EXECUTIVE SUMMARY

This report presents US Department of Agriculture's (USDA) proposed multi-agency framework for assessing and reporting on the Department's Water Resources High Priority Performance Goal (HPPG). Implementation of this framework will ultimately enable USDA agencies and their partners to build high-performing programs and make wise and strategic investments to achieve this vital goal of protecting and enhancing the Nation's water resources. This report was developed by a cross agency Work Group that includes representatives of the Natural Resources Conservation Service (NRCS), US Forest Service (USFS), Farm Service Agency (FSA), Agricultural Research Service (ARS), and National Agricultural Statistical Survey (NASS). We recommend two complementary types of assessments that need to be made: Condition and Effectiveness.

Condition assessments (sometimes called status assessments) track the current health of the resource in relation to key parameters and detect potential problems that can be prioritized for intervention. In the case of water resources, these "vital signs" include the quality, quantity, distribution and timing of water in our nation's streams, rivers, lakes and aquifers over the long-term. The Work Group recommends the USDA implement a Watershed Condition Assessment Framework as follows:

1. The basic unit of analysis should be HUC 10-12 Watersheds, although some condition measures may be best conducted at larger scales. Although ultimately we would like to see assessments of all such Watersheds in the US, we recommend initially starting with a few priority regions. Since both condition data and the underlying conditions themselves generally change relatively slowly, these condition assessments only need to be made every few years. We recommend that condition assessments be made on a regular cycle, perhaps every 5 years.
2. We recommend a candidate set of water quality and water quantity indicators that can be integrated into a condition assessment framework. Measurements of these indicators should mostly come from existing data sources that are analyzed and/or incorporated into appropriate models. For each indicator, we will also have to develop condition ratings using an evaluation scale that determines when the indicator is within an "acceptable range of variation." Initial indicator measurements and condition ratings may in many cases be qualitative, categorical, and/or rely on inferences from modeling efforts, but we should seek to adaptively improve the precision of the framework over time.
3. The existing US Forest Service "Watershed Condition Classification" portion of the Watershed Condition Framework and the NRCS Rapid Watershed Assessments and related efforts provide excellent starting points for this work, and our proposed ongoing work should build on this work, creating a common set of standards that can integrate information across different agencies.
4. Completing and then implementing a common Condition Framework will require collaboration across USDA agencies as well as with other key partners in the Advisory Committee on Water Information (ACWI). We recommend formation of a cross-agency working group that is staffed at the national and regional/state level with individuals who have it in their job descriptions to do this work. This working group should be tasked with developing and pilot testing a first draft of this framework by the end of FY12.

Effectiveness assessments examine whether a given intervention has led to its desired impacts. They are analogous to the tests that a doctor will conduct to determine whether a recommend treatment is

having its desired effect and thus needs to be continued, concluded, or modified. Effectiveness assessments generally focus on intermediate outcomes as opposed to the ultimate desired impacts. They are the primary basis for adaptive management and for learning. In the context of water resources, they gauge the performance of specific water conservation practices. The Work Group recommends the USDA implement a Watershed Effectiveness Framework as follows:

1. The basic unit of analysis should be both Managed HUC 10-12 Watersheds within priority landscapes and the specific interventions implemented at each site within these watersheds.
2. Here again, we recommend a candidate set of effectiveness indicators that can be assessed for different types of High Impact Targeted (HIT) Practices. Immediate short-term site impacts will need to largely be calculated through modeling exercises. Existing Conservation Effectiveness Assessment Project (CEAP) and other initiatives will be extremely good cores for this work, although they will need to be extended beyond crop lands. NRCS is currently developing the capability to model the water quality impacts of conservation practices during conservation planning within Conservation Delivery Streamlining Initiative, the next generation conservation planning tool scheduled for release to the field beginning in fiscal year 2013. Longer term watershed impacts must be linked to the Condition Framework measures at appropriate scales.
3. Site and watershed measures will need to be integrated into existing data collection efforts. In particular, these measures should be incorporated into regular business processes as part of the newly developing Conservation Delivery Streamlining Initiative.
4. Again, completing and then implementing this Condition Framework will require collaboration across USDA agencies as well as with other key partners in the Advisory Committee on Water Information (ACWI). We recommend formation of a cross-agency working group that is staffed at the national and regional/state level with individuals who have it in their job descriptions to do this work.

In sum, this report provides specific recommendations for both condition and effectiveness frameworks to assess USDA's Water Resources High Performance Priority Goal. We believe that these frameworks will enable USDA agencies and their partners to build performance measures into their programs and use the results to improve their work and guide future investments so as to more efficiently and effectively achieve this vital goal.

Although our Work Group has put considerable effort into developing the proposed frameworks, it will take substantial effort to operationalize and then implement the frameworks outlined in this report. We thus strongly recommend that USDA appoint a small, focused follow-on team to take these recommendations and develop a specific system for operationalizing them. This work, which should include pilot-testing of the specific indicators as well as the development of appropriate data collection and sharing mechanisms, should be completed by the end of FY 12. It will be essential that this implementation take place in an iterative and adaptive fashion and that it build on the substantial work already completed by USDA agencies and their partners. It is also imperative that this work be done collaboratively across relevant agencies and their partners.

FORWARD

The availability of clean, abundant water is critical to our country's future. As the single largest federal investor in on-the-ground conservation on private and public lands, USDA plays a unique and significant role in protecting our nation's water resources. Building on years of advances by USDA conservation and science agencies, the Department is moving into a new era of results-based, landscape scale conservation investment that will protect these resources more efficiently and effectively, and encourage innovations that attract private capital and create non-regulatory incentives for a variety of stakeholders to invest in sustainable water resource management practices.

One key to this new era of water resource management is the ability to measure the performance of our investments at a watershed scale – across *public and private* lands. This requires USDA agencies to take a unified approach to developing performance measures to assess the effectiveness of our actions and the condition of the resource over time so that Americans can answer questions like:

- How clean is the water in my local rivers and streams?
- If they need restoration, are we using our tax dollars as effectively and efficiently as possible to improve water quality?
- What are we learning from these investments?

This report recommends a series of practical steps to expand USDA's growing capacity to measure our performance at a landscape scale. One important next step is to integrate the efforts of the US Forest Service, Natural Resources Conservation Service and the Farm Service Agency as they each move forward to develop new data collection methods, refine their models, and create user friendly decision support tools -- all of which contribute to their ability to measure outcomes and guide investments. Collaboration with USDA's science agencies -- including the Agricultural Research Service, the National Institute for Food and Agriculture, the National Agricultural Statistical Survey, and the Office of Chief Economist -- will further leverage resources and move the Department toward a "One USDA" strategy for managing for water. A common framework, set of indicators, and uniform or complementary data collection and sharing protocols will, also in turn, simplify our collaboration with other federal and state agencies working on protecting water quality and water quantity.

Recognizing budget resource constraints, this report's recommendations are based on the following principles: build on the excellent work USDA agencies are already doing on performance measures, but link that work at a scale never before achieved; work within existing budget capacity by minimizing reporting burdens and working with existing data wherever possible; and pilot our integrated initiatives, with the intention of adaptively expanding as resources allow.

USDA's Unique Role

In what some term a radical idea, Secretary Vilsack has made protecting water resources a USDA priority. The Secretary recognizes that clean abundant water and healthy ecosystems are critical to the nation's sustainable agricultural production; to ensuring healthy urban and rural communities; and to supporting thriving business sectors including manufacturing, tourism, and recreation.

Clean water and healthy ecosystems are also part of our national heritage. The twin pressures of population growth and climate change have added a sense of urgency to addressing the nation's water resource challenges.

USDA's role is significant. More than a dozen USDA agencies have programs that in some way affect the nation's water resources. Three of these agencies, the USFS, NRCS and FSA, implement programs that apply to more than 1.5 billion acres of public and private land or more than 65% of acres in the continental United States. The USFS manages 194 million acres of public forest and grasslands. NRCS and the FSA administer easement and financial assistance programs to farmers, ranchers and forest land owners who manage more than 1.4 billion acres of land. In fiscal year 2011, these investments totaled more than \$10 billion, a large percentage of which affect water. Even with projected budget cuts, USDA is expected to remain the federal government's single largest investor in on-the-ground conservation programs affecting the quality and abundance of the nation's fresh water resources.

These land management practices protect the nation's headwater streams – the source of drinking water for 60% of all Americans. These practices also help ensure healthier flows in rivers including during floods and droughts, provide vital wildlife habitat, protect fresh and saltwater fisheries, and preserve crucial interior and coastal wetlands.

In establishing this water resources priority, the Secretary challenged the Department to achieve a High Priority Performance Goal that leverages multiple agencies' resources to deliver results that matter and that can be measured. The Fiscal Year 2009 & 2010 goal was to *Accelerate the protection of water resources by applying High Impact Targeted Practices on 6 Million Acres of public and private land in 4 Landscapes of National Interest*. In addition to this 6 million acre output deliverable of "acres treated with conservation practices", the Secretary challenged his team to develop the Department's capacity to measure improvements in water quality, quantity and watershed health on an "all lands" scale.

Because the Department manages programs on both public and private lands, it is uniquely positioned to pursue innovative watershed scale conservation programs that coordinate the expertise and align the resources across multiple agencies. This raises certain challenges. It also creates the opportunity for USDA to pursue strategies that match the resource needs and develop models that can be scaled to include other federal and state agencies.

Summary of Recommendations

The good news is that USDA is already making significant investments in our capacity to measure and assess performance. NRCS and ARS have collaborated on developing the Conservation Effects Assessment Project. NRCS is poised to roll out the Conservation Deliver Streamlining Initiative. NRCS and ARS have collaborated on developing the multi-tiered Monitoring and Assessment Framework for the Gulf of Mexico. The Forest Service has developed the Watershed Condition Framework. Interagency collaboration is taking place through the ARS, NRCS, NIFA Partnership Management Team, interagency work to develop a multi-tiered water quality monitoring framework and the HPPG work group. However agencies continue to collect vast amounts of valuable data that sit in unconnected systems, and they invest considerable sums in

models and decision support tools that operate independent of other programs, losing the opportunity to leverage resources. This report's recommendations would bring the Department to a new level of interagency alignment and efficacy.

An interagency team of staff experts began work in 2011 to produce a common USDA performance measures framework for assessing and reporting USDA's investments to improve water quality and quantity. Building on agency knowledge and experience, the team has developed two sets of metrics that are constant across practices, programs and agencies, and which can be used at various watershed scales. First is a set of effectiveness measures that will tell us if our resources are being used. The second is a set of condition measures that will tell us the true scope of the problem we are trying to solve, help us prioritize our work and measure the long term impacts of our work – are rivers and streams cleaner, is there sufficient water to meet the needs of both humans and fish and wildlife?

The recommendations in this report contained in this report include:

- By way of a formal agreement signed by agency leadership, create a cross-agency work group made up of representatives from NRCS, USFS, FSA, ARS, NIFA, NASS and OCE at the headquarters and regional/state level with dedicated time in their workplans to:
 - Adopt and begin to implement a USDA condition and effectiveness framework with a prioritized indicators based on existing data in FY12 & 13;
 - In FY12 and 13, integrate existing short term effectiveness measures into CEAP; integrate longer term impacts to the Watershed Condition Framework.
 - Recommend FY14 changes to agencies' data collection priorities and protocols to increase data collection on priority indicators; include budget assessment of these changes.
 - Task a smaller group of NRCS and USFS staff to integrate the NRCS and FS frameworks and models.
 - Establish a common set of standards for collecting, managing and reporting on relevant condition and effectiveness indicators. These standards can be used to shape, organize and streamline existing agency data systems, and ultimately – if desired – set a future course for the development of more integrated systems.
- Build the Performance Measures Framework into all USDA priority landscape scale restoration initiatives that focus on improving water quality and quantity, as resources allow. These would include the Mississippi River Basin, Gulf of Mexico, Great Lakes Restoration and Chesapeake Bay Restoration initiatives. Initially, this will be done in a handful of pilot watersheds and will expand as resources become available.
- Begin to tie USDA's Performance Measures Framework initiatives to performance measure initiatives that are being undertaken by other federal partners, notably the US Geological Survey, the Environmental Protection Agency, and the US Army Corps of Engineers.

The Value of These Performance Measures

Underpinning our ability to deliver results that matter is our ability to measure and evaluate our effectiveness at a watershed scale. This improves our work, increases efficiency and accelerates the protection of water resources. Better metrics also allow us to more accurately value conservation practices, satisfying growing private and public sector demand for greater precision as States seek to meet water quality TMDLs, multiple stakeholders look to monetize ecosystem services, and food retailers look to launch sustainability indices for their products. Importantly, it also allows agriculture to more powerfully document its contribution to addressing the most critical natural resource concern of our generation.

The frameworks and metrics proposed in this report are in their own quiet technical way, truly revolutionary. With these measures we can put into place conservation practices that are built to last.

I. Introduction: A Need to Assess Condition and Effectiveness

This report presents US Department of Agriculture's (USDA) proposed multi-agency framework for assessing and reporting on the Department's Water Resources High Priority Performance Goal (HPPG). Implementation of this framework will ultimately enable USDA agencies and their partners to build high-performing programs and make wise and strategic investments to achieve this vital goal of protecting and enhancing the Nation's water resources.

In July 2009, USDA's Natural Resources and Environment Mission Area formed a Work Group that includes representatives of the Natural Resources Conservation Service (NRCS), US Forest Service (USFS), Farm Service Agency (FSA), Agricultural Research Service (ARS), and National Agricultural Statistical Survey (NASS). The Work Group was charged with developing a cross-agency performance measurement framework for the USDA Water Resources HPPG that would be primarily based on existing data sets and that could ultimately be implemented on a national basis, while minimizing the reporting burden on agency staff and partners. This report presents the first iteration of this framework and recommendations for ongoing development and implementation.

1. USDA's High Priority Performance Goal for Water

As stated in the USDA FY 2012-2013 High Priority Performance Goal (HPPG) statement: Protecting and enhancing the Nation's water resources is recognized as one of the most critical issues of our time.... With 87 percent of America's surface supply of drinking water originating on land that USDA programs impact in some way, the Department has a key role to play in addressing the challenges facing the Nation's water resources.... While the agricultural and forestry communities have made good progress in improving water quality and water use efficiency, we need to accelerate our efforts. Furthermore, climate change and population growth are generating greater uncertainty and demand for water resources among agricultural, industrial and municipal users.

To meet this challenge, USDA established as its original FY 2010-11 HPPG for Water Resources: Goal: By the end of 2011, accelerate the protection of clean, abundant water resources by implementing high impact targeted (HIT) practices on six million acres of national forest and private working lands in priority watersheds.

This original goal was then refined in version 2.0 for FY 2012-13:

Goal 5: Improve Water Quality, Quantity, and Aquatic Ecosystem Health within Priority Watersheds on Public and Private Working Lands. By September 30, 2013, further accelerate the protection of clean, abundant water resources by implementing high impact targeted (HIT) practices through USFS, NRCS and FSA programs on 4 million acres in priority landscapes. Implement in two to four watersheds an interagency outcome metric to quantify improvements in water quality, such as reductions in tons of sediment, nitrogen or phosphorus entering water bodies.

To both assess progress towards this goal and as part of the goal itself, the USDA needs to build on its HPPG efforts and progress during FY 2010-11 to develop a comprehensive outcomes-oriented performance measures system across its agencies for its work on water resources.

2. Two Assessment Needs: Condition and Effectiveness

In assessing progress towards any resource management goal, there are two complementary types of assessments that need to be made:

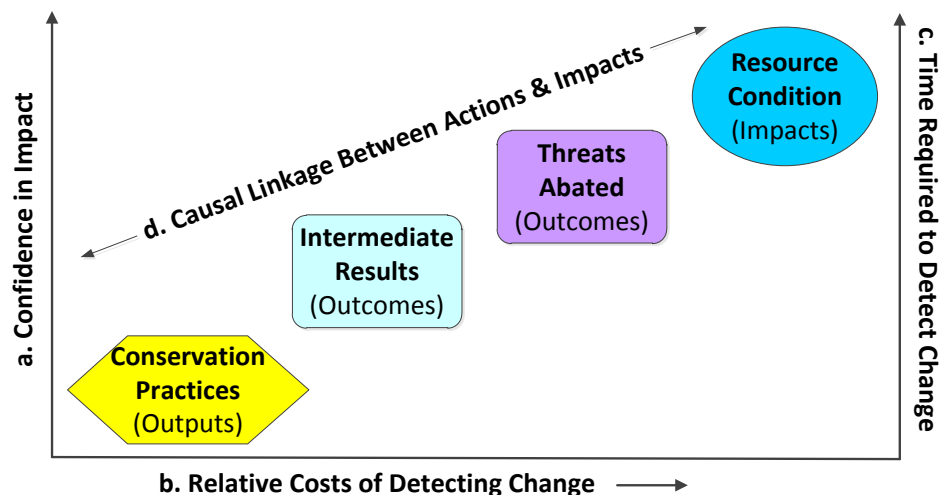
- *Condition assessments* (sometimes called status assessments) examine how a resource is doing over time. Just as a doctor will monitor key vital signs such as blood pressure or urine samples during an annual physical to determine the overall health of the patient, condition assessments are used to assess the current health of the resource in relation to key parameters and to detect and prioritize potential problems that might require intervention. Condition assessments thus track what we ultimately care about – the “health” of the resource in question. In the case of water resources, these “vital signs” include the quality, quantity, distribution and timing of water in our nation’s streams, rivers, lakes and aquifers over the long-term. Ideally, these condition assessments would be made for all watersheds, regardless of whether or not interventions are being made in them, so that we know which watersheds are “healthy” and which require treatment.
- *Effectiveness assessments*, by contrast, examine whether a specific intervention or set of interventions has led to its desired impacts. They are analogous to the tests that a doctor will conduct to determine whether a recommended treatment is having its desired effect and thus needs to be continued, concluded, or modified. Effectiveness assessments generally focus on intermediate outcomes as opposed to the ultimate desired impacts (see Figure 1). They are the basis for adaptive management and for learning. In the context of water resources, they assess the performance of specific water quality improvement or water use efficiency practices. They are typically only conducted on those sites and watersheds where interventions are being undertaken, or that are being used as experimental controls.

Figure 1. Effectiveness vs. Condition Assessments

Measuring the effectiveness of a conservation action requires more than counting short-term outputs such as dollars obligated or the number of specific conservation practices implemented. But paradoxically, we also cannot rely solely on measures of the ultimate impacts – the condition of the resources of interest – to measure effectiveness. This is because, as depicted in the diagram, as confidence in our measures increases, the cost of measurement and the time required to detect change also generally increase. To this end, the best

effectiveness measures require defining a theory of change or a results chain that links actions through outcomes to the ultimate impact, and then collecting data at key points along this chain. Condition measures require repeated assessments of the resource over long time periods.

Source: Adapted from [CMP 2008](#)

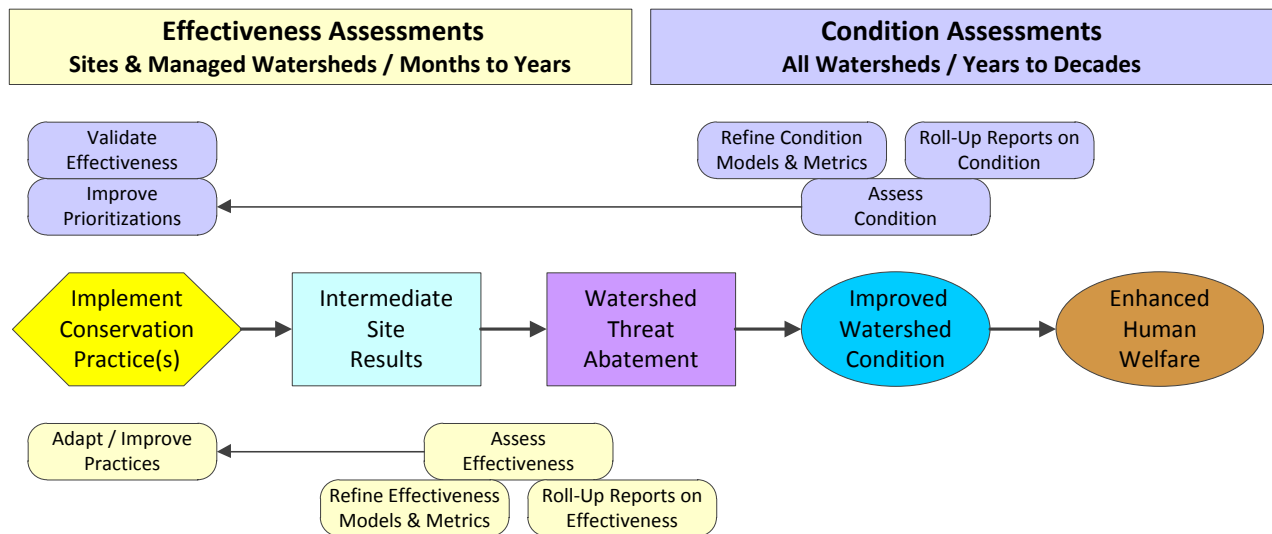


Condition and effectiveness assessments are not completely independent from one another – the sum total of all effectiveness measurements should in theory ultimately lead to observable changes in the condition of the resource. But as shown in Figures 1 & 2, they occur at different spatial scales and across different time frames. Just as you would not want to use an hour hand to time a short sprint race, in a similar fashion you would not want to use condition measures to determine the effectiveness of any one particular action. Conversely, just as you would not want to use a minute hand to track an event lasting weeks or years, you would not want to use short-term effectiveness measures to track long-term changes in resource condition.

In sum, effectiveness assessments are best employed to report short-term progress, determine whether resources allocated to any given action are being used well, and to adaptively improve practices. Condition assessments are best used to determine the full scope of the problem and needs, to prioritize needs, and to validate effectiveness over the long-term. Together, the two types of measures can be used to determine the amount and best deployment of resources required to meet different policy objectives.

Figure 2. The Relationship Between Effectiveness and Condition Assessments

Effectiveness assessments take place at the scale of specific field and forest sites and across specific Watershed Management Areas where conservation practices are implemented. They typically provide results on a time scale ranging from months to a few years and are used for reporting, to improve effectiveness models and metrics, and most importantly, to adaptively improve the implementation of conservation practices. Condition assessments ideally are conducted across all watersheds, regardless of whether the watersheds are being managed or not. They typically provide results on a time scale of many years to decades and are used for reporting, to refine condition models and metrics, and most importantly, to validate effectiveness assessments and improve prioritizations of watersheds for action.



3. Who Will Use this Performance Measures Framework

USDA agencies and their partners currently collect vast amounts of data across their programs for various management purposes that sit in unconnected data systems. The performance measures framework outlined in this report is NOT intended to replace these systems, or to serve as the primary tool for day-to-day technical management of agency work. Instead, the performance measures framework in this report provides a set of common standards for collecting, managing, and reporting on relevant condition and effectiveness indicators. These standards can be used to shape, organize, and streamline existing agency data systems, and ultimately, if desired, set a future course for the development of more integrated systems.

These data can then be used to generate performance reports for key audiences including:

- USDA Leadership—USDA Secretary, NRCS Chief, FSA Administrator, Forest Service Chief, and other key leaders
- Oversight and Coordination Agencies—Office of Management and Budget (OMB), Council on Environmental Quality (CEQ), Office of Science and Technology Policy (OSTP)
- Appropriations: US Congress and Key Committees, Congressional Budget Office (CBO)
- Key Natural Resource Management Partner Agencies—Department of the Interior including Fish and Wildlife Service (FWS), National Park Service (NPS), US Geological Survey (USGS), and Bureau of Land Management (BLM); Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA); Relevant State and Local Agencies
- Stakeholders and General Public—Key private sector and non-profit partners; taxpayers.

Importantly, all data would be made available in a form that protects the privacy of private land owner information, in accordance with Section 1619 of the Farm Bill. Specific details of how data will be collected used to ensure privacy and seamlessness across USDA will need to be developed going forward.

4. Team and Methodology

In July 2009, USDA’s Natural Resources and Environment Mission Area formed a cross-agency Work Group that includes representatives from the Natural Resources Conservation Service (NRCS), US Forest Service (USFS), Farm Service Agency (FSA), Agricultural Research Service (ARS), and National Agricultural Statistical Survey (NASS). In mid-2011, this group partnered with Foundations of Success (FOS), a nonprofit organization that specializes in developing performance measures for conservation work, to develop the performance management framework outlined in this report. In the interest of time and efficiency, the group did not conduct extensive external consultation, but instead relied on the expertise of its members.

As stated above, our Work Group’s charge was to develop a cross-agency performance measures framework for assessing the USDA Water Resources HPPG that would be primarily based on existing data sets and that could ultimately be implemented on a national basis, while minimizing the reporting burden on agency staff and partners. Furthermore, we wanted to create a “good” workable

framework that could be implemented fairly quickly and adaptively improved over time, rather than trying to create the “perfect” framework right off the bat. To this end, the Work Group adopted a continuous improvement approach, with expectations that this framework would be developed, tested, and then adapted and refined over time.

Strategic thinking is ultimately about making choices – a good strategic plan lays out not just what you will do, but also what you will NOT do, and the rationale for both. To this end, the Work Group used a series of tools and techniques developed by the Conservation Measures Partnership as part of the *Open Standards for the Practice of Conservation* that help natural resource managers to frame their issues and then make a series of strategic choices as to how to best approach them. These choices include deciding on an appropriate unit of analysis, developing a high-level model of the situation to frame the issues, identifying information needs and associated indicators and data collection methods, evaluating the utility and feasibility of each indicator/method, and then making recommendations for moving forward. In this report, we attempt to lay out those choices along with our rationale for each choice.

Section 2 of this report focuses on Assessments of Watershed Condition, Section 3 focuses on Assessments of the Effectiveness of Key Practices, and Section 4 presents our overarching recommendations.

II. Proposed Framework & Indicators to Assess Watershed Condition

Condition assessments (sometimes called status assessments) examine how a resource is doing over time. Just as a doctor will monitor key vital signs such as blood pressure or urine samples during an annual physical to determine the overall health of the patient, condition assessments are used to assess the current health of the resource in relation to key parameters and to detect potential problems that might require intervention. Condition assessments thus track what we ultimately care about – the “health” of the resource in question. In the case of water resources, these “vital signs” include the quality, quantity, distribution and timing of water in our nation’s streams, rivers, lakes and aquifers over the long-term. They can also include the benefits that these resources provide to humans. Specific examples of condition assessment questions might include:

- What is the current condition of a given stream or watershed?
- How has the condition of this stream or watershed changed over the past ten years? Over the past fifty years?
- How does the condition of this stream or watershed compare to others in our State or major basin? How does its condition compare to established standards for stream or watershed health? To established public health standards for drinking water and other human uses?
- Does this stream or watershed require management action? If so, what type(s)?
- What is our desired future condition for this stream or watershed as a result of this management?

1. Units of Analysis, Sampling Frame, and Timing for Condition Assessments

Units of Analysis

Condition assessments can be made at many different scales, depending on the types of management questions being asked. In the case of a freshwater resource such as a stream or a lake, at the smallest scale, one could consider the condition of the resource at a specific sampling point as the *unit of analysis*. The assessment could also be extended to cover a small pond or a specific stream reach. But since water resources are inextricably linked with their surrounding ecosystems, it generally makes more sense to pick watersheds as the unit of analysis for condition analyses. Here again, there is a wide spectrum of options based on the standard Hydrologic Unit Codes (HUC) ranging from:

- ➡ HUC 12 Subwatersheds – 6th level, avg of 40 sq mi, ~160,000 total units
- ➡ HUC 10 Watersheds – 5th level, avg of 227 sq mi, ~22,000 total units
- HUC 8 Subbasins – 4th level, avg of 700 sq mi, ~2,200 total units
- HUC 6 Basins – 3rd level, avg of 10,596 sq mi, 370 total units
- ➡ HUC 4 Subregions – 2nd level, avg of 16,800 sq mi, 222 total units
- HUC 2 Regions – 1st level, avg of 177,560 sq mi, 21 total units

As a general rule, there are tradeoffs inherent in the choice of the size of the unit of analysis. Smaller units tend to be more homogenous in terms of their size and condition, and as such, can be better represented by a single condition rating. Larger units, on the other hand, require greater numbers of measurement points that then need to be integrated to achieve a level of certainty of condition

ratings. Assessments made at smaller scales thus generally present a higher resolution picture of the true condition of the resource. However, the trade-off is that they require more data collection and data processing to make measurements at many small units, even assuming that data are available at these smaller scales. The key is thus to find the “Goldilocks” unit that is neither too big or too small, but is “just right.” In this case, the Work Group felt that HUC 10-12 Watersheds/Subwatersheds were likely to be in this Goldilocks zone for most condition questions, although there may be some condition questions that will be better answered at larger scales, for example building on current NRCS efforts to assess condition for HUC-4 Subregions.

Sampling Frame

Ideally we would want to do periodic condition assessments of all Watersheds in the country at our chosen spatial scale to track changes in their condition over time. Realistically, however, we need to be more strategic in determining our *sampling frame* as to where to deploy our limited monitoring resources. Some options include:

- Assess all HUC 10-12 Watersheds in the country
- Assess a (random) sample of HUC 10-12 Watersheds across the country
- Select Priority River Basins/Subbasins and statistically sample Watersheds within them
- Assess a few pilot areas



At this point, we are recommending that we use the priority river basins identified under the HPPG for the first phase of this work. Over time, as the data model becomes more robust, we can then expand this effort to additional watersheds, ultimately covering the entire country.

Timing

In an ideal world, we would be able to track the health of each Watershed on a continuous basis. In our world of limited resources, however, we instead need to make our assessments at periodic time intervals that could range from:

- Hours
- Days
- Months
- Years
- Multi-years
- Decades



As discussed above, since most condition measurements tend to change fairly slowly, we generally recommend that full condition assessments only be made every 4 – 5 years. To most efficiently use our resources, these assessments would ideally be tied to ongoing business practices such as the development of USDA’s Strategic Plan. However, even if full assessments are only undertaken every few years, measurements for certain key indicators (e.g., daily rainfall, stream flow) will have to be made on a more frequent or continuous basis.

Finally, it is worth noting that although we have laid out specific options and choices for sampling unit, sampling frame, and timing, these choices are not necessarily independent from one another. There are trade-offs that can be made across these dimensions that also need to be considered.

2. Approach for Watershed Condition Assessments

Any assessment requires a systematic approach to help guide the selection of indicators that will answer critical information needs. Following the *CMP Open Standards for the Practice of Conservation*, the Work Group developed a conceptual model for a Generic HUC 10-12 Watershed as shown in Figure 3.

The model starts with the selection of three *focal conservation targets* (sometimes called focal conservation “elements” or “components”) represented by the green ovals in the center blue box:

- Surface Water – Streams, rivers, lakes and other open water features.
- Groundwater – Aquifers and other groundwater systems. Note that the ground watershed does not necessarily equal the surface watershed.
- Wetlands and Floodplains – Ecosystems that are at least periodically inundated. This would include most riparian areas.

These focal targets represent the Work Group’s scope of what is meant by *Water Resources*. As shown by the additional green *Ecological Values* and the brown *Human Welfare Values / Ecosystem Services* targets, the *Water Resource* targets are important not only in their own right, but because they provide critical habitat and services for plants and animals and for human needs as shown by the arrows linking the *Water Resource* targets to the others.

The *Water Resource* targets are themselves affected by a number of potential *stress factors* (sometimes termed “impairments”) represented by the pink boxes. These stresses represent the key impairments that could potentially affect our conservation targets and include:

Altered Hydrological Regime

- Quantity and Timing of Water – Too much (flashiness/flooding) or too little water (low flow) at the wrong times. It also includes the distribution of the water in the watershed and net interbasin transfer.
- Loss of Connectivity – Loss of ability to have water move through system either laterally (e.g. from river to floodplain and back) or vertically (from surface to groundwater and back)

Pollution (Water Quality)

- Inappropriate Sediment Regime – Too much or too little sediment
- Excess Nutrients – Too many nutrients entering the system, especially nitrogen (N) and phosphorus (P)
- Other Contaminants – Other types of pollution, including pesticides and toxic chemicals.

Further to the left of the pink stress factors are the various *direct threats* that are the primary sources of the stresses. These direct threats are represented by orange factor boxes, and the arrows show the most important causal links between the direct threats and the stresses. For example, *Water Withdrawal for Agricultural Demand* or for *Municipal Demand* can contribute to the low flow stress in a given stream system or aquifer. One use of this model would be to help determine the major causes of a given threat, such as water withdrawal or pollution. In this generic model, the percent

contribution for each factor is shown as xx%. But in any real watershed, if we could obtain estimates of the relative contribution of the different factors (as well as the overall magnitude of the problem), we would then know which factors we might want to target with our intervention efforts.

Finally, behind the direct threats are a series of contributing factors, which in this model, are subsumed under the boxes labeled *Various Drivers*. In any given real world watershed, relevant contributing factors could be expanded as needed to help in understanding the system and selecting optimum intervention points. As in any modeling exercise, this model is meant to be a simplified representation of reality – we choose to highlight those aspects of the system that are most relevant to our management decisions.

3. Candidate Indicators to Assess Watershed Condition

Once we agreed on the basic conceptual model for a Generic HUC 10-12 Watershed, our next step was to develop potential metrics that could be used to assess the condition of that Watershed. As outlined in the *CMP Open Standards*, an *indicator* is “a measurable entity related to a specific information need, such as the status of a target.” Any given indicator can be collected through different data collection *methods*, each of which has differing accuracy, reliability, feasibility, and costs. In general, due to limited budgets, we assumed that little or no new primary data would be collected. Instead almost all of the “monitoring” indicators that we recommended involve gathering and analyzing existing data already being collected by the USDA and its partners.

The team first generated a list of potential indicators that could be used to assess the condition of a generic watershed (the left-hand column in Table 1). Each candidate indicator is linked to one particular factor in our conceptual model, as shown in the second column, and then is described in more detail along with potential data collection methods in the third column.

The team then went through and rated each indicator in terms of its importance and its current feasibility to collect and analyze data about the indicator as follows:

Relative Importance of Information		Feasibility to Collect/Analyze Information Today	
1 = Low	Least useful to assess condition	1 = Low	Not technically feasible
2 = Med	Some utility to assess condition	2 = Med	Feasible only with great effort / expense
3 = High	Useful to assess condition	3 = High	Reasonably feasible with some effort
4 = Very High	Very useful to assess condition	4 = Very High	Readily feasible

Using these two criteria, the team rapidly assessed each indicator both in terms of how useful it might be to help assess the condition of 10-12 digit HUC Watersheds and the feasibility of methods for collecting and analyzing data about the indicator. Note that feasibility included both whether data already existed and the amount of work it might take to access/collect those data and analyze them for the purposes of determining watershed condition on a systematic basis. This analysis includes both assessing indicators directly and/or incorporating them into appropriate watershed models. Finally, the team then considered both the importance and feasibility criteria to determine a final overall priority recommendation for each indicator as shown in the right-hand column of Table 1.

Figure 3. Conceptual Model for a Generic HUC 10-12 Watershed

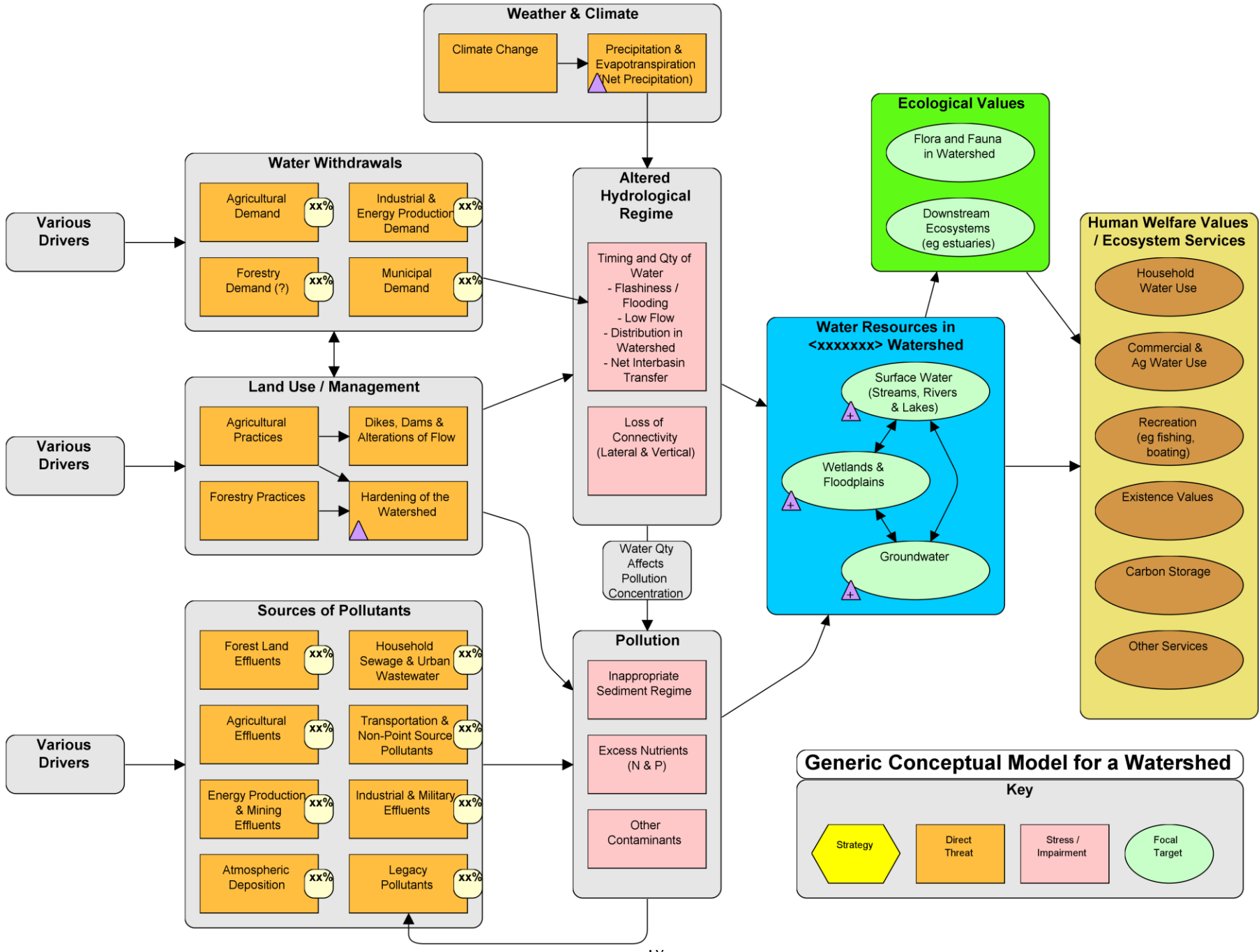


Table 1. Candidate Indicators for Condition of a Generic HUC 10-12 Watershed

Indicators correspond to Conceptual Model in Figure 2. A List of key acronyms is provided at the end of the table.

Candidate Indicator	Associated Factor	Details and Data Sources / Collection Methods	Importance Feasibility 1=Low, 2=Med, 3=High, 4=V High 1=Low, 2=Med, 3=High, 4=V High	Overall Priority
▲ G1. Groundwater Quantity	Groundwater	Change in groundwater levels at key monitoring points over time Utilize USGS well network available through NWIS to assess changes in groundwater levels over time In future, potentially use: - National Water Census information - National Groundwater Monitoring Network being developed through ACWI	3.5 Key story to tell in places where drawdown cone is substantial (eg Great Plains, Midwest, Las Vegas, parts of TX). 1.5 Data currently only available in a few locations. May be more feasible in future.	Medium Pilot research to tell story in a few key places
▲ G2. Groundwater Nitrate + Nitrite as N Concentration	Groundwater	Change in N concentration measured as NO _x at key monitoring points over time Most data would come from state monitoring efforts supplemented by USGS well network and NAWQA	4.0 Ecologically important for groundwater fed ecosystems and to look at the contribution to surface water N. 2.5 Statistical data exists generally, but data within any one watershed would need to be gathered up. Hard to average across points because of spatial heterogeneity in source and aquifers. Ground watershed does not equal the surface watershed. Need to change concentration data to load to get at ecological effects.	High Need to start
▲ G3. Groundwater Reduced Nitrogen Concentration as Ammonium (NH₄⁺ as N)	Groundwater	Change in N concentration measured as NH ₄ ⁺ at key monitoring points over time Most data would come from state monitoring efforts supplemented by USGS well network and NAWQA	4.0 Ecologically important for groundwater fed ecosystems and to look at the contribution to surface water N. Importance depends on presence of specific threats at the location (e.g. especially important for areas with CAFOs). 1.5 Much less monitoring focuses on NH ₄ ⁺ as opposed to NO _x . Some statistical data exists, but data within any one watershed would need to be yarded up. Hard to average across points because of spatial heterogeneity in source and aquifers. Ground watershed does not equal the surface watershed. Need to change concentration data to load to get at ecological effects.	Low Wait for better data
▲ G4. Groundwater Pesticides	Groundwater	Change in pesticide concentration (Scan of Volatile & Semi-Volatile Organic Compounds) at key monitoring points over time Most data would come from state monitoring efforts supplemented by USGS NAWQA	2.5 Ecologically important to assess acute and chronic toxicity to key organisms and humans. 2.0 Some limited statistical assessments currently available, but not generally for specific watersheds.	Medium Second tier priority

Candidate Indicator	Associated Factor	Details and Data Sources / Collection Methods	Importance Feasibility 1=Low, 2=Med, 3=High, 4=V High 1=Low, 2=Med, 3=High, 4=V High	Overall Priority
▲ S1. Stream/River Peak Flow	Surface Water (Streams, Rivers & Lakes)	Peak flow in relation to historical average at key gauges in each watershed; peak lake level is a separate indicator that is not a high priority Most data would come from USGS National Streamflow Information Program; for select instrumented watersheds additional data exists from FS and ARS In future, to help characterize ungauged watersheds, potentially use: - USGS Water Census information - ACWI procedures under development	3.0 Important to track peak flows for ecological and flood impact reasons. 2.5 Statistical tools available to extrapolate from lower watershed data back to upper watershed. Data collection capacity is atrophying through USGS loss of funding.	High This is key
▲ S2. Stream/River Low Flow	Surface Water (Streams, Rivers & Lakes)	Current Q7-10 in relation to historic Q7-10 at key gauges in each watershed Most data would come from USGS National Streamflow Information Program; for select instrumented watersheds additional data exists from FS and ARS In future, to help characterize ungauged watersheds, potentially use: - USGS Water Census information - ACWI procedures under development	4.0 Low flow is vital for ecological function. 2.5 Statistical tools available to extrapolate from lower watershed data back to upper watershed. Data collection capacity is atrophying through USGS loss of funding.	Very High Must do
▲ S3. Steam/River. Timing of Peak Flow	Surface Water (Streams, Rivers & Lakes)	Date of spring peak flow in relation to historical average date at key gauges (can be watershed outlet gauge for HUC 12-14 watersheds) Most data would come from USGS National Streamflow Information Program; for select instrumented watersheds additional data exists from FS and ARS	4.0 Timing of peak spring flow is important for ecosystem phenology and as assessment of climate change. 3.0 Data collection capacity is atrophying through USGS loss of funding.	Very High Relatively easy for existing gauges
▲ S4. Stream/River Change in Time from Inception of Event to Peak Flow	Surface Water (Streams, Rivers & Lakes)	Time (minutes or hours) from point of deflection to the peak flow at watershed outlet and key sub-basin locations in relation to the “normal” pattern for the watershed Most data would come from USGS National Streamflow Information Program; for select instrumented watersheds additional data exists from FS and ARS	4.0 Good measure to assess how well the watershed is functioning hydrologically. 1.0 USGS is dropping lots of stations and Forest Service not collecting these data. Would require extensive work to assemble data.	Low Might be worth exploring
▲ S5. Hardening of the Watershed	Hardening of the Watershed	% impervious surface in watershed Data from NASA / USGS remote sensing in appropriate map layers	3.5 Indirect measure of flashiness. Provides argument to keep “open space” lands undeveloped. 4.0 Data need to be compiled for target watersheds once per cycle	Very High Easy

Candidate Indicator	Associated Factor	Details and Data Sources / Collection Methods	Importance Feasibility 1=Low, 2=Med, 3=High, 4=V High 1=Low, 2=Med, 3=High, 4=V High	Overall Priority
▲ S6. In Stream Nitrate + Nitrite as N Concentration	Surface Water (Streams, Rivers & Lakes)	Change in N concentration measured as NO _x at key monitoring points over time Measured by utilities at appropriate water intakes and by USGS at select gauging stations Also state and EPA collected data at select stations	4.0 Important in its own right for human health purposes; also key input into nitrogen loading. 2.5 Data collection is patchy across space and time. Would need to engage with utilities, states and other actors. Also issue of N stored in groundwater which needs to be factored into any inferences from data.	High Needs to be done
▲ S7. In Stream Load of Nitrate + Nitrite	Surface Water (Streams, Rivers & Lakes)	Total N measured as NO _x load per year at the outlet of the watershed Multiply NO _x concentration * stream flow volume to get load estimates for ecological purposes	4.0 Load is the ecologically relevant parameter for nutrients 2.0 Requires combining NO _x concentration measurements with actual monthly stream flow measurements.	High Needs to be done!
▲ S8. In Stream Load of P	Surface Water (Streams, Rivers & Lakes)	Total P load per year at the outlet of the watershed; need to look at both suspended/dissolved vs bed load Multiply concentration of P * stream flow volume to get load estimates for ecological purposes Talk to U Wisconsin -- help frame the P threshold levels for small systems? Chesapeake and Gulf of Mexico for big picture....ARS folks	4.0 Less of a human health issue, but critical for ecological function. 1.5 Requires combining P concentration measurements with actual monthly stream flow measurements. Not just concentration * flow because a portion of P transport is along with sediment. Problem with the stored P in the lakes in the entrained in the system. Can do in some places.	Low Pilot research
▲ S9. Sediment Budget	Surface Water (Streams, Rivers & Lakes)	Ideally, quantitative assessment of annual sediment budget (kg/year) in relation to historical averages based on assessments at key gauges in the watershed; Ideally would track dissolved + suspended + bed load Realistically, qualitative assessment (P/F/G/VG) of sediment health/risk for each stream reach Some USGS and Forest Service monitoring of sediment in limited locations around country; Broad classifications exist for types of streams in relation to sediment regime, but no change measurement	4.0 Critical for ecological health. 1.5 Quantitative Assessment: Very little systematic information exists to track change. 2.5 Qualitative Assessment: Still requires site-specific recon / assessment.	Med Do the qualitative assessment for now; Pilot quant research to tell story in a few key places
▲ S10. Surface Water Temperature	Surface Water (Streams, Rivers & Lakes)	Average daily water temperature in relation to historical average for that date at key locations in the watershed USGS NWIS, FS, ARS, EPA & State data	3.5 Important for ecological function; single most reason for listing water as impaired in forest lands. 3.0 Needs yarding up.	Very High
▲ S11. Changes in Declared Impaired Waters	Surface Water (Streams, Rivers & Lakes)	Status of and changes in 303(d) list by reaches or water bodies Most current data from state 303(d) reports, compiled with lag time by EPA	4.0 Important to track. 4.0 Standards vary by state under clean water act making national comparisons of impairment difficult.	Very High

Candidate Indicator	Associated Factor	Details and Data Sources / Collection Methods	Importance Feasibility 1=Low, 2=Med, 3=High, 4=V High 1=Low, 2=Med, 3=High, 4=V High	Overall Priority
△ X1. Net Precipitation	Precipitation & Evapotranspiration	Average net precipitation (precipitation less evapotranspiration) for the watershed at appropriate time scales relative to other indicators Most data from NOAA; additional data available from NRCS, FS, ARS, and others	4.0 Technically not a condition indicator per se, but important data used to normalize other indicators. 3.0 Data exist, but requires some work to translate.	Very High
△ WF1. % of "Functional" Floodplain in Basin	Wetlands & Floodplains	Area in acres of functionally intact floodplain / wetland as a % of pre-settlement condition; need to factor in changes in hydroperiod due to upstream hydrological modifications; assess once per cycle NASA / USGS / FEMA? Data sources	4.0 Important. 2.0 Easy with structural modification / problem with not enough water to get at function. Will require some work to yard up and interpret the data.	Med Start on a pilot basis
△ WF2. Wetland Pesticides	Wetlands & Floodplains	Change in pesticide concentration (Scan of Volatile & Semi-Volatile Organic Compounds) at key monitoring points over time NRCS and State monitoring efforts USGS NAWQA may cover this in some locations?	2.0 Often overlooked. 1.0 Some data sets in a few places, but not uniform. Purely aspirational.	Low Purely aspirational

List of Key Acronyms in Table 1	
ACWI	Advisory Committee on Water Information (OMB chartered with DOI as lead)
NWIS	National Water Information System
NAWQA	National Water Quality Assessment

An indicator measurement in and of itself does not say anything about the condition of a resource. Instead, the measurement must be put into a context that can be either an established standard or a relative assessment. For example, if during a medical checkup your doctor says that you have a resting pulse rate of 90 beats/minute, this is only meaningful in the context of either a) the range of “normal” pulse rates for individuals of your age and other demographic parameters, and/or b) your pulse rate at previous checkups. Similarly, a given low flow reading in a stream or concentration of pesticides found in groundwater must be put in some context in order to assess the health of the system. This context is generally characterized by *condition ratings* – assessments of what range of each indicator is considered good or poor status.

The Work Group took considerable effort in developing our recommendations in Table 1 to select indicators that would allow for these types of condition ratings. For example, for S1, Stream/River Peak Flow, the indicator is “*Peak flow in relation to historical average at key gauges in each watershed.*” The key here is that the peak flow measurement is in relation to historical averages. As stated above, this analysis can be done either directly and/or by constructing the appropriate models of the watershed.

Even stating the indicator in a manner that allows for some comparison, however, is not sufficient for establishing condition ratings. The critical step involves specifying for each indicator what constitutes “healthy” versus “not healthy” states. These specifications can be made either qualitatively in reference to established criteria, or quantitatively in reference to specific thresholds or recognized standards. Often in natural resource systems, indicators will vary naturally over time and it is helpful to define an “acceptable range of variation” as shown in Figure 4. Once this acceptable range of variation has been defined and incorporated into relevant models, then a given indicator measurement can be used to determine whether the condition is inside or outside this range of variation, or if desired, a more nuanced assessment scheme can be developed that classifies condition as “stop light” red-yellow-green colors, or with even more levels. For example, as shown in Figure 4, the CMP *Open Standards* use a four-point rating system tied to the acceptable range of variation. In a similar fashion, NRCS soil condition classifications with reference to acceptable edge of field pollutant losses are on a three-point scale “highly vulnerable,” “moderately vulnerable” and “low vulnerability.”

The Work Group developed a few sample condition ratings as shown in Figure 5. Going forward, if this system is to be implemented, we would have to decide on a standard assessment scheme and develop detailed condition ratings for all proposed indicators. It is important to note, however, that ratings can initially be qualitative and/or rough estimates and then be refined over time as more information becomes available.

Figure 4. Defining Acceptable Range of Variation Under the *Open Standards*

Source: CMP 2008.

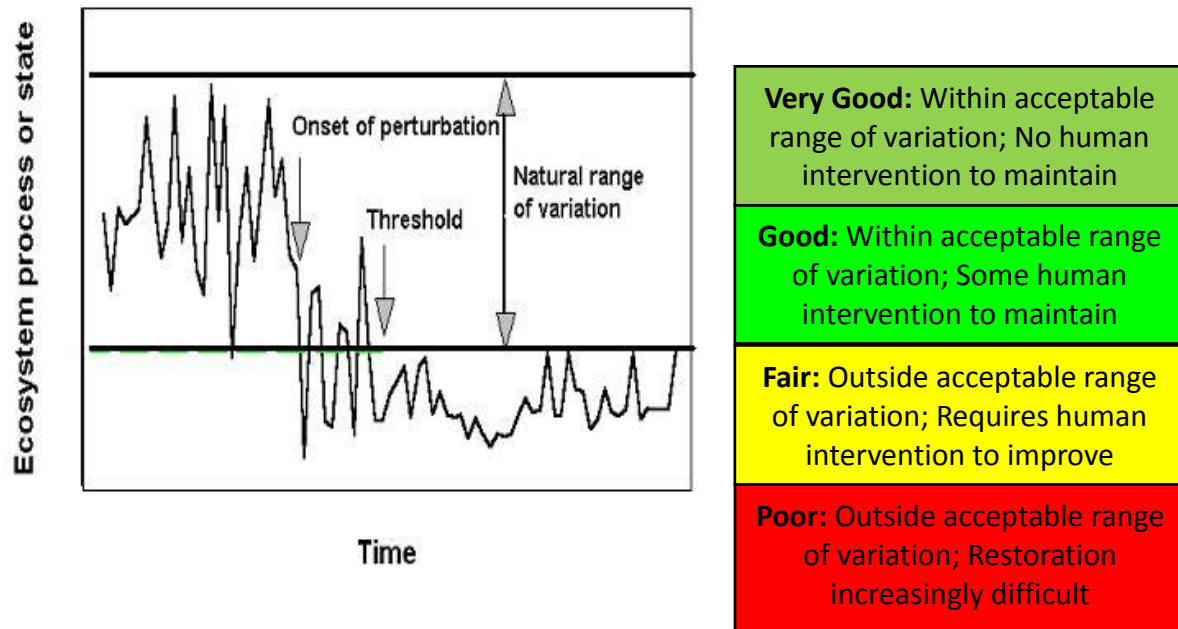


Figure 5. Illustrative Condition Ratings for Proposed Groundwater Indicators

Note the different types of comparisons being proposed. Some are quantitative, others qualitative.

Item	Poor	Fair	Good	Very Good	Comparison
Groundwater					
▲ G1. Change in Groundwater Quantity	>20% < 1990 - or - >20% > 1990 level	5-20% < 1990 - or - 5-20% > 1990 level	1-5% < 1990 - or - 1-5% > 1990 level	≈ 1990 level	Two-tailed relative to 1990 benchmark (<i>too little or too much is a problem</i>)
▲ G2. Groundwater Nitrate + Nitrite as N Concentration	>> EPA Std	> EPA Std	~ EPA Std	< EPA Std	Relative to external EPA drinking water standard
▲ G3. Groundwater Reduced Nitrogen Concentration	Lots	Some	Little	None	Relative to qualitative threshold
▲ G4. Groundwater Total Pesticides	>100 µg/l	10-100 µg/l	1-10 µg/l	< 1 µg/l	Relative to quantitative assessment

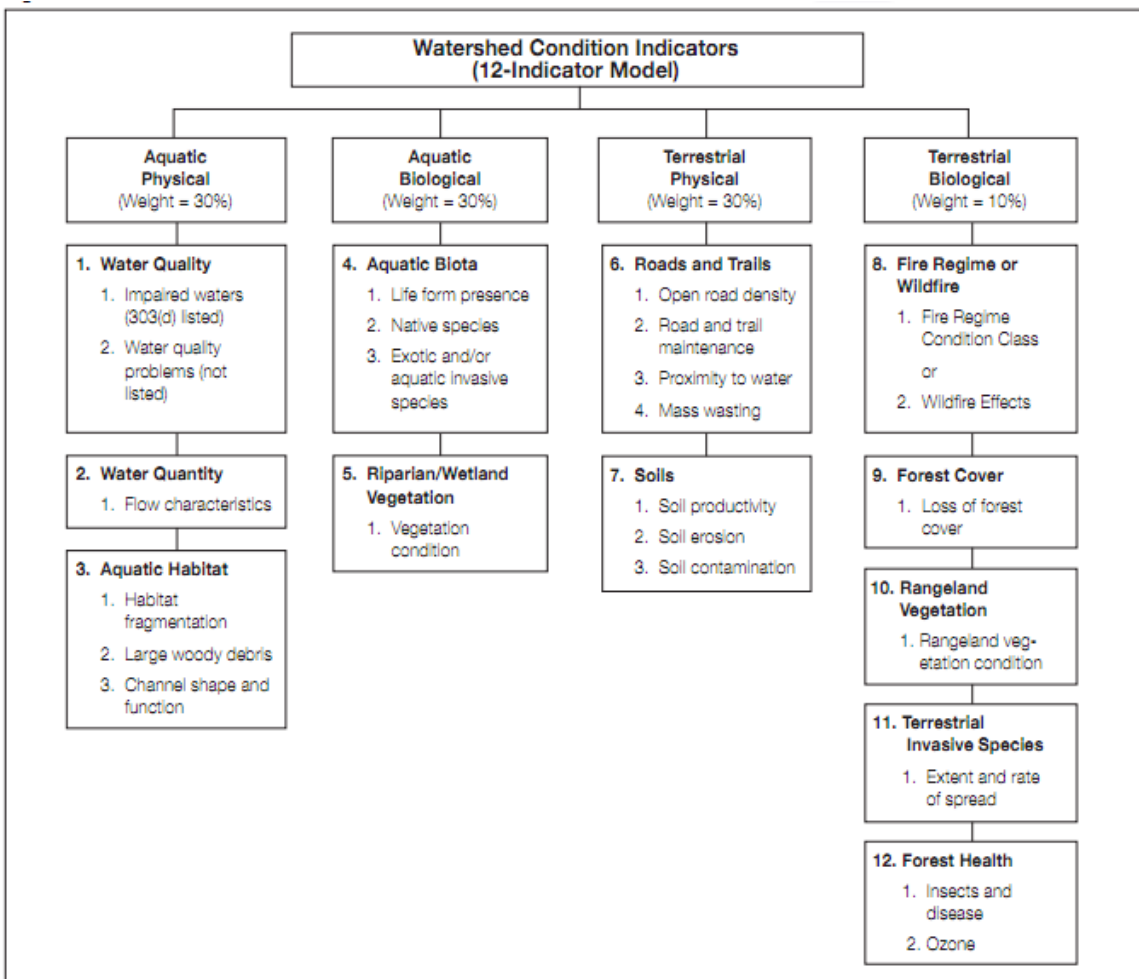
4. Crosswalk with Other Water-Related Condition Frameworks and Models

Our Work Group is not the first entity to have attempted to develop a condition framework related to water resources. As shown in the summary in Table 2, several other agencies and organizations have also proposed and/or even implemented frameworks that substantially overlap with the framework proposed in this report.

One of the most relevant of these frameworks to this report is the *Watershed Condition Framework* developed by the US Forest Service (US Forest Service 2011). The recently completed first iteration of Watershed Condition Classification portion of this framework is an ambitious and impressive effort to systematically examine the condition of all watersheds containing Forest Service lands. As shown in Figure 6, these condition assessments are largely qualitative assessments of various aspects of a HUC 12 watershed's condition. As discussed in more detail in Section 3, these condition assessments take place in the context of a broader watershed management cycle.

Figure 6. Indicators in the Forest Service Watershed Condition Classification

Source: [US Forest Service 2011](#)



A second highly relevant framework is the *Rapid Watershed Assessment* methodology developed by the NRCS. Rapid watershed assessments are conducted by watershed planning teams traveling through each watershed, meeting with landowners and conservation groups, inventorying agricultural areas, identifying conservation opportunities and current levels of resource management, and estimating impacts of these opportunities on the local priority resource concerns. These assessments provide initial estimates of where conservation investments would best address the concerns of landowners, conservation districts, and other community organizations and stakeholders, and help land-owners and local leaders set priorities and determine the best actions to achieve their goals.

In addition to frameworks, USDA agencies have developed many models and tools in the disciplines of hydrology and hydraulics that will support the development of condition assessments and help reduce the need for resource intensive primary data collection. Key examples include:

- *Computer Program for Project Formulation Hydrology (WinTR-20)* – A single event watershed scale runoff and routing model that computes direct runoff and develops hydrographs resulting from any synthetic or natural rainstorm. WinTR-20 may be used to evaluate flooding problems, alternatives for flood control (reservoirs, channel modification, and diversion), and impacts of changing land use on the hydrologic response of watersheds.
- *NRCS Geo-Hydro System* – This ARC-View GIS interface for modeling watersheds is based on the GISHydro2000 system developed at the University of Maryland, and can be modified for use in any watershed. Required spatial data layers include Digital Elevation Model (DEM), soil data, and 30 m² land uses. A stream layer such as National Hydrograph Dataset (NHD) can be included along with other data layers such as roads, streams, Hydrologic Unit Code (HUC) maps, and more.
- *"Technical Release 55" (TR-55)* – This technical bulletin and accompanying software presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable to small watersheds, especially urbanizing watersheds, and is perhaps the most widely used approach to hydrology in the US. Originally released in 1975 as manual worksheets, TR-55 has been updated to provides a number of techniques that are still useful for modeling small watersheds. TR-55 specifically recommends the use of more precise tools, such as TR-20, if the assumptions of TR-55 are not met.
- *Agricultural Non-Point Source Pollution Model (AGNPS)* – AGNPS is a joint USDA - Agricultural Research Service (ARS) and NRCS system of computer models developed to predict non point source pollutant loadings within agricultural watersheds. It contains a continuous simulation surface runoff model designed to assist with determining BMPs, the setting of TMDLs, and for risk & cost/benefit analyses. The set of computer programs consist of: (1) input generation & editing as well as associated databases; (2) the "annualized" science & technology pollutant loading model for agricultural-related watersheds (AnnAGNPS); (3) output reformatting & analysis; and (4) the integration of more comprehensive routines (CCHE1D) for the stream network processes; (5) a stream corridor model (CONCEPTS); (6)

an instream water temperature model (SNTEMP); and (7) several related salmonid models (SIDO, Fry Emergence, Salmonid Total Life Stage, & Salmonid Economics). Not all of the models are electronically linked but there are paths of common input/output that, with the use of standard text editors, can be linked.

- *Agricultural Policy/Environmental eXtender (APEX) Model* – Many of the above functions and parameters have been integrated into key agricultural research models such as the single-field *Environmental Policy Impact Climate (EPIC)* model and the *Soil and Water Assessment Tool (SWAT)*. These two models have evolved over time to become key tools that are used worldwide for analyzing environmental problems and impacts. The Agricultural Policy/Environmental eXtender (APEX) model was developed as a multi-field version of EPIC by the Blackland Research and Extension Center in Temple Texas. APEX is a flexible and dynamic simulation tool for conservation effects capable of simulating a broad range of agricultural landscapes, including whole farms and small watersheds. This model is currently being used actively by NRCS for performance measurement.

Although the work cited above has made major strides in improving our collective ability to assess watershed condition, it needs to be taken to the next level. As the authors of the Forest Service Condition Framework report themselves conclude:

We propose a two-tiered approach to verify and monitor watershed conditions. Tier 1 emphasizes verifying for performance accountability. Tier 2 emphasizes monitoring linkages between watershed restoration treatments and the effect they have on aquatic habitat conditions. Because of budget constraints, emphasis in the near term is on performance accountability (Tier 1). Over the long term, our goal is to develop a monitoring approach system that can link changes in watershed condition on the landscape to improvement to stream channel and aquatic habitat conditions (Tier 2). (US Forest Service 2011, p. 21)

There thus seems to be considerable potential to build on this existing work to develop the next generation of condition framework across all of the USDA agencies and their partners. It may also make sense to coordinate with the developers of the other frameworks noted in Table 2.

Table 2. Crosswalk of Proposed Condition Assessment Framework with Related Frameworks

ITEM	USDA HPPG Condition Assessment	US Forest Service Watershed Condition Framework	National Fish Habitat Partnership Action Plan	NRCS Rapid Watershed Assessment	Other?
Reference	This report	USFS 2011	NFHP 2010	NRCS Website , Title 390, National Watershed Program Handbook	
Focus	Water resources	Prioritize watersheds for restoration work	Fish habitat	Target watersheds for additional conservation due to condition/vulnerability	
Scope	Proposed for key regions	All watersheds that contain any FS Lands	National	Any targeted watershed	
Units of Analysis	HUC 10-12 Watersheds	HUC 12 (6 th Level) Subwatersheds	Stream reaches, Estuaries	HUC 8-10	
Key Indicators Types	Water quantity, timing & distribution Water quality	Aquatic physical Aquatic biological Terrestrial physical Terrestrial biological	Risk factors to aquatic habitat structure and function	31 indicators are outlined in the NWPM including a variety of environmental, social, and economic factors	
Rating Scale	4 point VG, G, F, P	3 point - Functioning properly - Functioning at risk - Functionally impaired	5 point VL, L, M H, VH	None	
Current Status	Initial concept	Initial assessment completed	2010 Report	Approved NRCS methodology in policy	
Communication Mechanism	TBD	Printed report Online map	Printed report Online map	Printed reports, radio bridges, reports to Congress, briefings for internal and external stakeholders	
Updates	Proposed every 4-5 years	Currently planned for 4-5-year intervals	Planned for 5-year intervals	Project specific	

5. Data Collection, Analysis and Communications

If we are to implement a water resources condition assessment framework along the lines outlined in the previous sections, it will require a substantial investment of time and other resources to finalize and operationalize the framework itself and then to aggregate and analyze the data on a periodic basis in order to implement the framework. Furthermore, this work will have to take into account USDA's differing abilities to collect data on public versus private lands; all data collected under this framework must be made available in a form that protects the privacy of private land owner information, in accordance with Section 1619 of the Farm Bill.

Several (not necessarily exclusive) options as to who could do this work include:

- Individuals in relevant USDA agency offices in Washington are assigned this work
- Data collection and analysis is integrated into workplans for key individuals in each relevant regional office
- USDA forms a partnership with other federal agencies to collect and analyze this information
- USDA contracts with or offers grants to outside entities to complete this work

It is also worth noting that different options above may be necessary for data collection versus data analysis/model development versus management of the overall assessment effort.

In addition to the human resources required to do this work, it will also demand IT support including the ability to analyze display geographic information. Existing agency GIS systems such as the one used to manage the Forest Service's Watershed Condition Classification data and make it available on the internet (Figure 7), or the ones used for State Resource Assessments (Figure 8) represent good examples of IT systems that could potentially be used for this work, both for analytical purposes and to communicate the results to key audiences. Ultimately, we would envision the condition results from our work presented in map form similar to these examples.

Figure 7. Illustrative Example of Map-Based Summary of Watershed Condition

This screen shot taken from the current Forest Service Watershed Condition Framework [mapviewer](#).

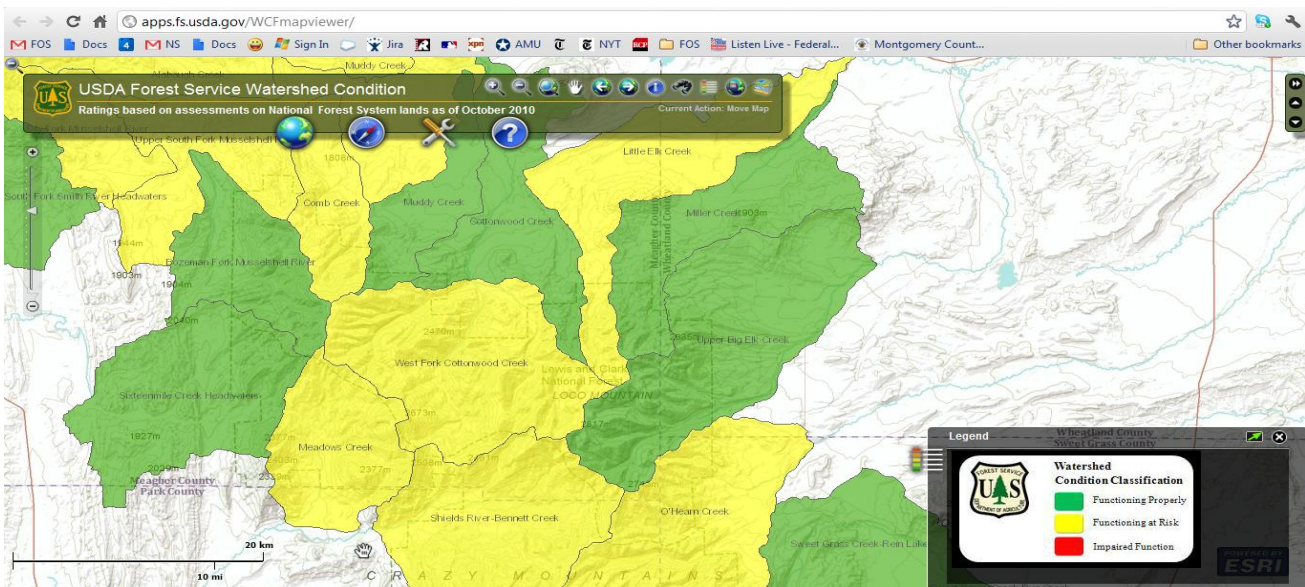
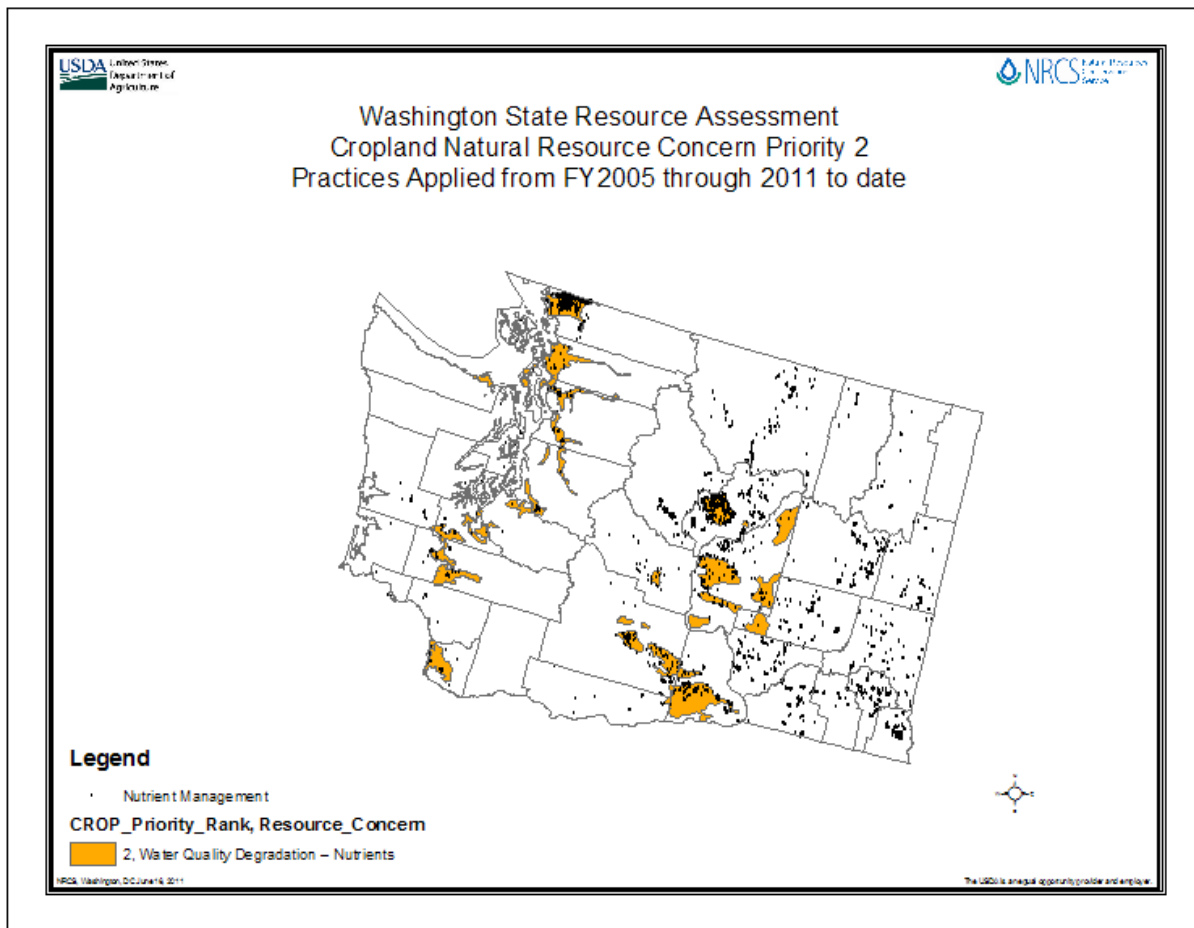


Figure 8. Illustrative Example of Analysis of Water Quality Degradation

This NRCS Map overlays nutrients with conservation efforts.



6. Recommendations for Developing Watershed Condition Assessment Framework

Regular assessments of the condition of our nation's water resources are critical to both determine changes in their status over time and to help prioritize future investments to those places and programs where it will be of most value. The Work Group thus recommends that USDA implement a Watershed Condition Assessment Framework as follows:

- The basic unit of analysis should be HUC 10-12 Watersheds, although some condition measures may be best conducted at larger scales. Although ultimately we would like to see assessments of all such Watersheds in the US, we recommend initially starting with a few priority regions. Since both condition data and the underlying conditions themselves generally change relatively slowly, these condition assessments only need to be made every few years. We recommend that condition assessments be made on a regular cycle, perhaps every 5 years as part of the more general Resource Condition Assessment (RCA).
- We recommend that a complete data quality and availability assessment be undertaken to determine if and how the data elements identified as High and Very High in Table 1 can be integrated into a condition assessment framework. This should include an assessment of

spatially-linked data that could be collated with HUC boundaries. Measurements of these indicators should mostly come from existing data sources that are analyzed and/or incorporated into appropriate models. For each indicator, we will also have to develop condition ratings using a 3-5 step evaluation scale that determines when the indicator is within the “acceptable range of variation.” Initial indicator measurements and condition ratings may in many cases be qualitative, categorical, and/or rely on inferences from modeling efforts; it is better to have a “good” systematic rating rather than hold out for the “perfect” rating that never gets completed. However, each rating should be accompanied by an assessment of the confidence level in the rating and we should seek to adaptively improve the precision of the framework over time.

- The existing US Forest Service “Watershed Condition Classification” portion of the Watershed Condition Framework and the NRCS Rapid Watershed Assessments and related efforts provide excellent starting points for this work, and our proposed ongoing work should build on this work, creating a common set of standards that can integrate information across different agencies.
- Completing and then implementing a common Condition Framework will require collaboration across USDA agencies as well as with other key partners in the Advisory Committee on Water Information (ACWI). We recommend formation of a cross-agency working group that is staffed at the national and regional/state level with individuals who have it in their job descriptions to do this work. This working group should be tasked with developing and pilot testing a first draft of this framework by the end of FY12.

III. Proposed Framework and Indicators to Assess HIT Practice Effectiveness

As described above, *effectiveness assessments* examine whether a given intervention has led to its desired impacts. They are analogous to the tests that a doctor will conduct to determine whether a recommend treatment is having its desired effect and thus needs to be continued, concluded, or modified. Effectiveness assessments generally focus on intermediate outcomes as opposed to the ultimate desired impacts (see Figure 1). They are the primary basis for adaptive management and for learning. In the context of water resources, they gauge the performance of specific water conservation practices. Specific examples of effectiveness assessment questions might include:

- Has a specific deployment of a particular practice worked?
- Should the practice in this instance be continued, modified, or abandoned?
- What is the effect of all similar practices in this watershed, country, etc?
- Under what conditions should we use this practice in the future?
- How can we improve this type of practice over time?
- What mix of practices provides the greatest benefit under what conditions?

Note that when asking “does a conservation practice work?” it is akin to “does a hammer work?” The answer is usually not “yes” or “no” but instead, breaks down into three sub-questions:

- What do you mean by “hammer?” A nail hammer is different from a tack hammer which is different from a sledge hammer which is different from a jack hammer.
- What do you mean by “work?” Pulling nails is different from hammering tacks which is different from breaking concrete which is different from baking a cake. Obviously a given type of hammer might be suited to one task and not others.
- Under what conditions are you working? A jack hammer may generally be more efficient at breaking concrete than a sledge hammer, but if you are in a remote location with no access to power, then you might prefer the sledge hammer anyway.

Following on the above analogy, the Work Group established a framework to consider the above questions for potential *High Impact Targeted (HIT) Practices*.

1. Units of Analysis, Sampling Frame, and Timing for Effectiveness Assessments

Units of Analysis

Effectiveness assessments can be conducted at several different scales including:

- *Individual HIT Practice* – A specific site-based implementation of a specific intervention, such as establishing a buffer strip or planting a cover crop on a field.
- *Roll-Up of HIT Practices* – A summary of similar interventions taken across a watershed, district, region, or other management unit.

HIT Practices take place in the context of broader management units and are often implemented together as suites of practices across management units:

- *Site* – A specific farm field, forested area, small watershed, or conservation or ranger district on which one or more HIT Practices is being implemented.
- *Managed HUC 10-12 Watershed* – A Watershed/Subwatershed that is being actively managed for water quality and/or quantity.

As a general rule, there will be multiple Sites within one Managed Watershed, but the inverse relationship may also occur, for example when a large forested area occurs over several Watersheds. A key task for the group implementing this framework will be to weigh the tradeoffs between managing watersheds at the HUC 10 versus HUC 12 levels. On one hand, the HUC12 Subwatershed level provides a large enough area to allow for integration of the effects of implemented conservation practices across the catchment to result in measurable changes in a reasonable period of time (say 2-5 water years). Furthermore, the HUC 12 level provides a small enough area that it is possible that all key conservation practices to be implemented with all willing landowners within a reasonable period of time (say 1-3 fiscal years). However, from a practical perspective, the sheer number of HUC 12 units (~160,00 units nationally) means it may make more sense use HUC10 Watersheds as the basic unit for implementation. A potential downside to use of this larger scale would be an extended lag time between initiation of implementation and completion with all willing owners within the catchment AND the increased lag time between completion and measurable changes. It may also be harder to distinguish the signal from the conservation actions from the noise of the rest of the hydrologic cycle, climate change, land use changes, etc.

Regardless of the choice of HUC Unit size for management, since we are ultimately interested in tracking the effectiveness of USDA's efforts in improving water quality and quantity, our framework needs to consider both individual actions and suites of actions and the management context in which they are taking place. We also need to be able to roll-up and report on individual and suites of actions and management areas at higher program scales. So we will need to consider all four of the above units of analysis as outlined in more detail below.

Sampling Frame

It is important to note that the set of all Managed HUC 10-12 Watersheds that are the basis for effectiveness assessments will be considerably smaller than the set of all HUC 10-12 Watersheds that are the basis for condition assessments as outlined in Section 2. This is because effectiveness assessments only take place in Watersheds that are being actively managed (or are at least prioritized for forthcoming management actions), whereas condition assessments should cover all watersheds. Selection of the *Priority Watersheds* for management should be based on both their condition as well as strategic (e.g., do we prioritize keeping healthy watersheds healthy, or restoring degraded watersheds) and political considerations. This prioritization may take place at higher scales (e.g., HUC 8 or HUC 4).

Timing

Unlike condition indicators which change slowly and only need to be assessed every few years, we have to track effectiveness on a more frequent basis. In an ideal world, we would want to monitor the

implementation of every action, both as it happens and then its impacts over time. This is possible to the extent that we can build data collection into routine business processes that are already occurring and can use models to link effectiveness measures to changes in condition (see below).

2. Approach for Effectiveness Assessments

There are literally hundreds of different resource conservation actions that have been identified as potential HIT Practices across forest and especially agricultural lands. A detailed website listing and providing guidance for a number of these actions is available at <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/alphabetical/ncps>.

The Work Group chose to examine in detail two sets of conservation actions that are commonly employed across both working lands and forested lands to protect and improve water resources:

- *Waterway Buffers* – Configurations designed to protect surface waters. They can be located either in/along fields, or along riparian areas. They are designed to intercept water so as to limit flashiness of runoff, filter nutrients and promote uptake.
- *Cover Crops* – Temporary vegetative cover designed to reduce bare soil / absorb nutrients, often part of a cropping rotation.

Following the *CMP Open Standards for the Practice of Conservation*, the Work Group developed a results chain for Waterway Buffers as shown in Figure 9. This results chain is intended to depict the “theory of change” behind the use of this practice. This results chain contains two different levels of work shown in Figures 9a and 9b. In these figures, the purple boxes represent the management of the overall sub-watershed management area of interest. The light blue boxes represent the results that are expected to occur for each site-specific Waterway Buffer established.

Figure 9a shows the results chain for the implementation of a single Waterway Buffer at a specific site within a Managed HUC 10-12 Watershed. For each suitable site that has been selected, relevant land owners and managers need to be identified, made aware of, and ultimately agree to implement the practice (SITE 1). The buffer then has to be built/implemented and has to become established and maintained (SITE 2). In the case of forested Waterway Buffers, there may a substantial lag time between the implementation of the practice and its ability to deliver the full anticipated benefits. Once the buffer has been established, it will then presumably deliver specific benefits to the site and the watershed, including less runoff flashiness which in turns leads to slower water release during low flow periods and reduced nutrient runoff (SITE 3). Finally, these results from all of the sites within the watershed will contribute to mitigation of stresses across the Managed Watershed (the WTRSHD 2 box). In addition to the blue and purple result boxes, the results chain also shows in yellow the specific activities that might be undertaken by USDA agencies as part of this action. For example, the agency might develop a management plan, identify suitable sites, identify the land/owners and managers, provide outreach and education, provide funding to implement the buffer, and assist with compliance monitoring.

Although the results chain in Figure 9 is for one specific practice, Waterway Buffers, the Work Group also developed a results chain for Cover Crops that was substantially similar. It is expected that results chains for other site-based interventions to improve water quality and quantity would not

look dramatically different. Furthermore, recent assessment of outcomes from conservation practices has shown that the use of a single conservation practice can lead to adverse unintended consequences. An approach that includes a suite of practices to address identified stresses will increase the positive ecosystem affects and avoid/minimize adverse unintended consequences.

The full results chain for this work in thus shown in Figure 9b. Here, the unit of analysis is the Managed HUC 10-12 Watershed. As shown in the WTRSHD 0 box on the far left-side of the figure, this process starts with a given Watershed being prioritized and then designated for management. Moving to the WTRSHD 1 box, the first set of results include an assumption that a condition assessment of the Watershed is completed, a management plan identifying which areas/sites need different interventions is completed, and that suitable sites for Waterway Buffers – *and for all other relevant HIT Practices* – are then selected based on the criteria identified in this plan. Moving to the right, for each site in the watershed, appropriate practices are implemented as described above, leading to Outcomes across the Managed Watershed (the WTRSHD 2 box), and ultimately adding up to change in the condition of the Watershed. A critical element is the effectiveness assessment, which as shown by the arrows across the bottom, both “completes the cycle” by allowing for ongoing adaptive management, and enable national roll-up reporting and improvements of the practice. Likewise, the condition assessment should over the long-term change the prioritizations for management action.

In general, the key results for any given practice are to 1) determine if implementation sites have been selected in reference to appropriate management plans/criteria, 2) get the land owner / manager to agree to implement the practice, 3) actually implement the practice, 4) assess the specific results that emerge from the practice, and finally 5) assess the impacts of this work on the water resources across the sub-watershed. Different practices will of course differ in the length of time that we might expect to see results as well as the specific types of stress mitigation that they will deliver. These details could be worked out, however, for each practice going forward.

3. Candidate Indicators to Assess HIT Practice Effectiveness

Using the Waterway Buffer results chain, our team first generated a list of potential indicators that could be used to assess the effectiveness of the Waterway Buffer intervention (the left-hand column in Table 3). Each candidate indicator is linked to one particular factor in the results chain as shown in the second column and then is described in more detail along with potential data collection methods in the third column.

The team then went through and rated each potential indicator for Waterway Buffers in terms of its importance and its current feasibility to collect and analyze data about the indicator as follows:

Relative Importance of Information		Feasibility to Collect/Analyze Information Today <i>(separate ratings for private and Forest Service lands)</i>	
1 = Low	Not useful to assess effectiveness	1 = Low	Not technically feasible
2 = Med	Some utility to assess effectiveness	2 = Med	Feasible only with great effort / expense
3 = High	Useful to assess effectiveness	3 = High	Reasonably feasible with some effort
4 = Very High	Very useful to assess effectiveness	4 = Very High	Readily feasible

Using these two criteria, the team rapidly assessed each indicator both in terms of how useful it might be to helping assess the effectiveness of the action and the feasibility of methods for collecting and analyzing data about that indicator under current circumstances. Note that feasibility included both whether data already existed and the amount of work it might take to take those data and analyze them for the purposes of determining e on a systematic basis. Finally, the team then considered both the importance and feasibility criteria to determine a final overall priority recommendation for each indicator as shown in the right-hand column of Table 3.

Figure 9a. Results Chain for Individual Waterway Buffer Practice

See text for description. Purple WTRSHD results are for Managed HUC 10-12 Watershed; Light Blue SITE results for each practice.

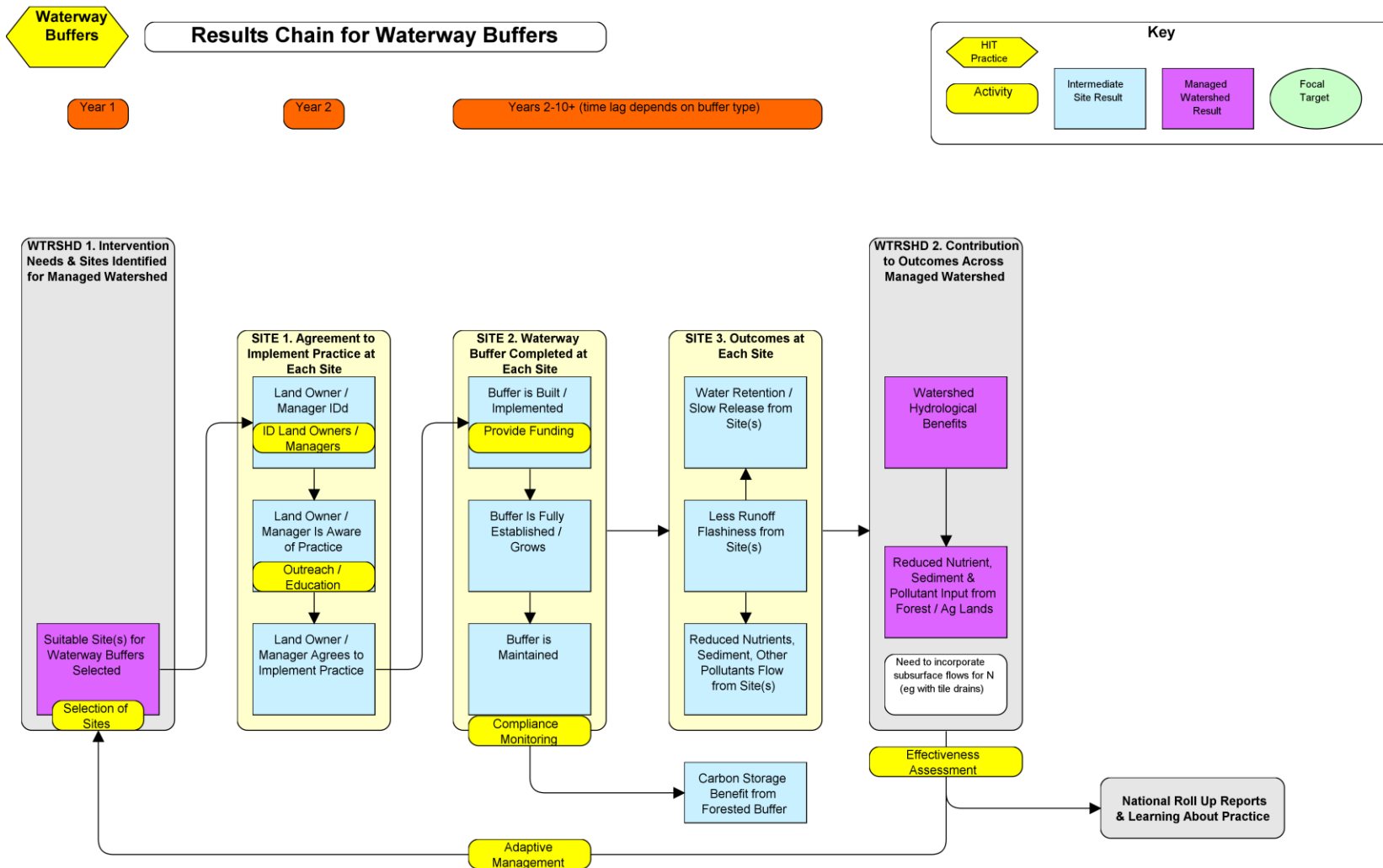


Figure 10b. Results Chain for Waterway Buffer Practice in Context of Management of Watershed

See text for description and Table 3 for indicator detail. Purple WTRSHD results are for Managed HUC 10-12 Watershed; Light Blue SITE results for each practice.

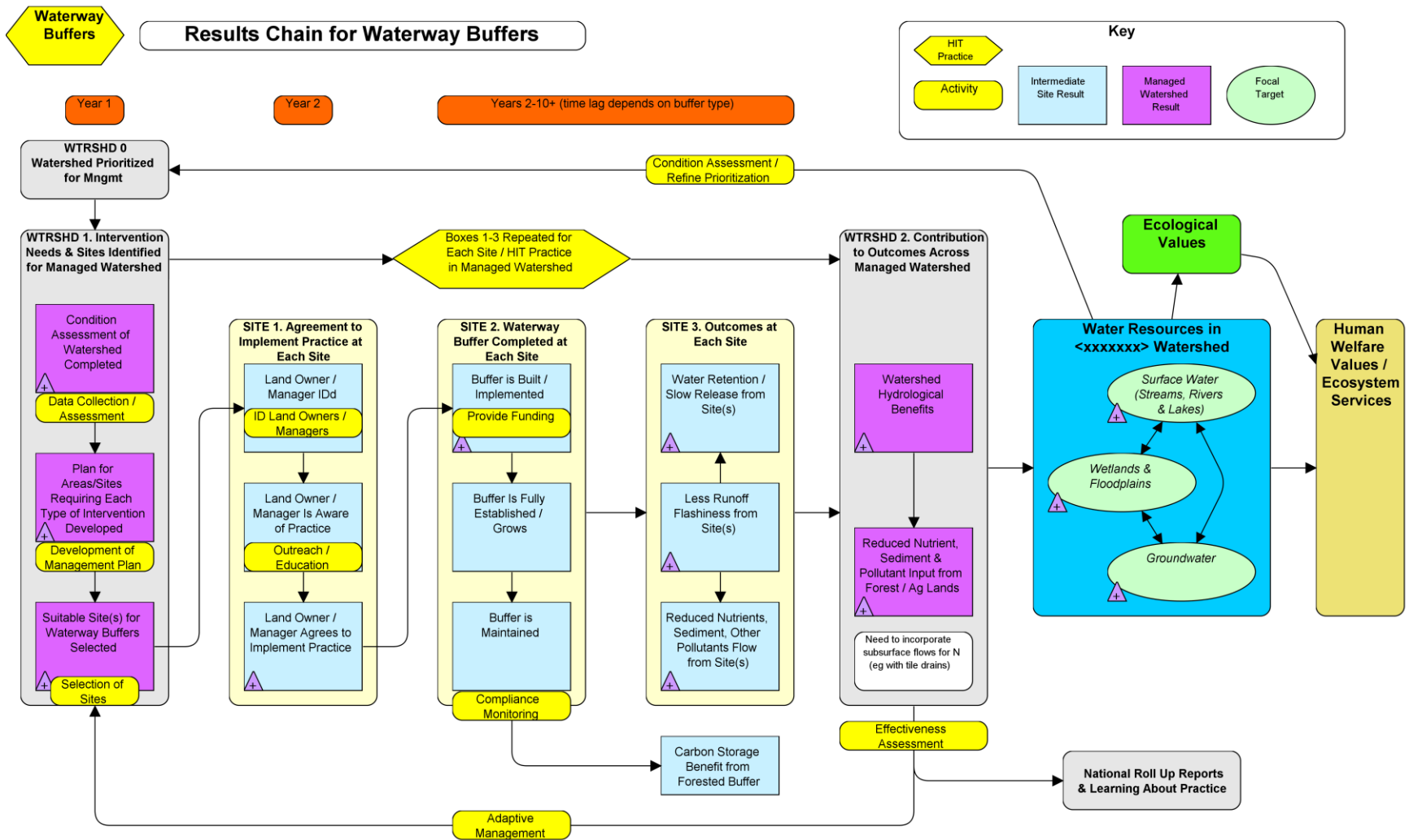









Table 3. Candidate Indicators for Waterway Buffer Effectiveness Assessment

Indicators correspond to Results Chain in Figure 9.

Candidate Indicator	Associated Factor	Details and Data Collection Methods	Importance Feasibility 1=Low, 2=Med, 3=High, 4=V High 1=Low, 2=Med, 3=High, 4=V High (Private & FS land feasibility rated separately)	Overall Priority
<p>▲ WTRSHD 1a. Status/Quality of Watershed Condition Assessment</p>	<p>Condition Assessment of Watershed Completed</p>	<p>Qualitative rating of degree to which a current watershed condition assessment has been completed:</p> <ol style="list-style-type: none"> 1. No current assessment 2. Current assessment underway 3. Current assessment sufficient to identify areas/sites requiring management 4. Assessment completed and revised/updated on regular basis <p>This rating could be self-reported by the relevant managers who could provide links to the assessment for audit purposes</p>	<p>4.0 This is basic to any effectiveness measures. 4.0 Private lands. 4.0 Forest Service lands.</p>	<p>Very High</p>
<p>▲ WTRSHD 1aR. % of Watersheds in Each Region Assessed</p>		<p>% of watersheds in a priority region that have acceptable assessments (score 3 or higher)</p>	<p>Requires a bit of extra work to do roll-up.</p>	
<p>▲ WTRSHD 1b. Status/Quality of Plan for Areas/Sites Requiring Intervention(s)</p>	<p>Plan for Areas/Sites Requiring Each Type of Intervention Developed</p>	<p>Qualitative rating of degree to which criteria have been developed and used to determine management plan for which general areas and/or specific sites in watershed require intervention:</p> <ol style="list-style-type: none"> 1. No current plan 2. Suitability criteria for identified for implementing practices (e.g., topography/relief, geology/soils, climate, cropping systems & land uses) 3. Current plan developed sufficient to identify which areas/sites require management practices based on criteria 4. Plan completed and revised/updated on regular basis <p>This rating could be self-reported by the relevant managers who could provide links to the plan for audit purposes</p>	<p>4.0 This is basic to any effectiveness measures. 4.0 Private lands. 4.0 Forest Service lands.</p>	<p>Very High</p>
<p>▲ WTRSHD1bR. % of Watersheds in Each Region with Plan</p>		<p>% of watersheds in region with acceptable plan (score 3 or higher)</p>	<p>Requires a bit of extra work to do roll-up.</p>	

Candidate Indicator	Associated Factor	Details and Data Collection Methods	Importance Feasibility 1=Low, 2=Med, 3=High, 4=V High (Private & FS land feasibility rated separately)	Overall Priority
<p>▲ WTRSHD 1c. Suitability of Sites Selected for Intervention</p>	Suitable Site(s) for Waterway Buffers Selected	<p>Qualitative rating of whether sites have been selected against criteria (e.g. APEX-SWAT vulnerability) / as part of mngmt plan:</p> <ol style="list-style-type: none"> Sites not yet selected or meet few/no criteria Sites meet some criteria Sites meet most criteria Sites meet all criteria <p>This rating could be self-reported by the relevant managers who must attest whether rating is expert opinion, map/plan-based, model-based (eg APEX-SWAT), or on-site assessment</p>	<p>4.0 This is the critical assessment to determine effectiveness of the intervention.</p> <p>3.0 Private non-forest lands through Streamlining Initiative.</p> <p>1.0 Forest Service lands where buffer zones are generally “left in place” rather than established.</p>	Very High
<p>▲ WTRSHD 1cR. % of Sites in Each Region Meeting Criteria</p>		% of candidate projects that have been satisfactorily assessed (score 3 or higher)	Requires a bit of extra work to do roll-up.	
<p>▲ SITE 1. Landowner Agreement to Implement Practice</p>	Land Owner / Manager Agrees to Implement Practice	<p>Qualitative rating of whether site landowner/manager has agreed to implement the practice:</p> <ol style="list-style-type: none"> No outreach to landowner yet -OR- Outreach has failed Outreach in process Landowner/manager agrees in principle Landowner/manager signs legal document <p>Total acres and/or stream miles of land for which landowners / managers agree to implement the practice</p>	<p>2.0 This is a key intermediate result for those practices that have like buffers that have long lag time before they deliver end results; less important for those practices that have more immediate impacts.</p> <p>4.0 Should be feasible for private lands by end of FY12.</p> <p>2.5 More difficult for Forest Service lands.</p>	Medium
<p>▲ SITE 1R. % of Targeted Landowners Agreeing to Implement Practice</p>		% of targeted land (by acres and/or stream miles) for which landowners agree to implement the practice	Ideally we want to look at the demand for the practice in relation to available \$\$ for this work.	
<p>▲ SITE 2a. Acres / Stream Miles of Buffers Built</p>	Buffer is Built / Implemented	<p>Qualitative rating of whether the practice has been implemented:</p> <ol style="list-style-type: none"> Implementation not started -OR- Implementation has failed Implementation in process Implementation completed, waiting for maturity Implementation fully completed <p>Total acres of land treated and/or stream miles of buffer built</p>	<p>4.0 This is the key output measure.</p> <p>3.5 Reasonably feasible for private lands with federal funding, harder for state-funded or voluntary actions.</p> <p>2.5 Will be difficult data call for Forest Service lands.</p>	Very High
<p>▲ SITE 2aR. % of Targeted Buffers Built</p>		% of targeted land (by acres and/or stream miles) for which buffers are actually built	Requires a bit of extra work to do roll-up	
<p>▲ SITE 2b. Actual Cost of</p>	Buffer is	Total cost of both technical and financial assistance per acre and	3.0 Critical to establish cost-effectiveness.	High

Candidate Indicator	Associated Factor	Details and Data Collection Methods	Importance Feasibility 1=Low, 2=Med, 3=High, 4=V High 1=Low, 2=Med, 3=High, 4=V High (Private & FS land feasibility rated separately)	Overall Priority
Implementation	Built / Implemented	total	3.5 Reasonably feasible for private lands with federal funding, harder for state-funded or voluntary action. 2.5 Will be difficult data call for Forest Service lands.	
 SITE 2bR. Total Cost of Implementation		Sum of all costs across the management unit		
 SITE 3a. % Reduction in Hydrograph Peaks from Site	Less Runoff Flashiness from Site(s)	Calculation of reduction of relevant stress reductions from implementation of practice Will generally be calculated by inference from CEAP and other modeling efforts based on experimental research and/or samples	3.0 This is the short-term impact measure. 2.5 This is what CEAP is designed to do. 1.5 Will require extending models to Forest Service lands.	High
 SITE 3b. % Increase in Base Flow from Site	Water Retention / Slow Release from Site(s)			
 SITE 3c. % Reduction in Key Pollutants from Site	Reduced Nutrients, Sediment, Other			
 SITE 3R. Avg % Improvements in Parameters at Sites Across Watershed	Pollutants Flow from Site(s)	The roll-up across the watershed; can be summation or inference from broader-scale models		
 WTRSHD 2a. Water Quantity / Timing Condition Indicators for Watershed	Watershed Hydrological Benefits	Assessments of relevant condition indicators and ratings for the watershed, collected as described in Table 1. Will require linking the scale at which watershed management occurs to the scale at which condition assessment occur.	4.0 This is the key ultimate impact measure. 2.0 Depends on how whether watershed scale of condition assessments equals watershed scale for management plans/efforts.	Very High
 WTRSHD 2b. Water Quality Condition Indicators for Watershed	Reduced Nutrient and Sediment Inputs from Forest / Ag Lands			

4. Crosswalk with Other Water-Related Effectiveness Assessment Frameworks

Here again, our work group is not the first entity to have attempted to assess the effectiveness of different water resource improvement interventions. Various USDA agencies have done extensive work to develop systems to assess effectiveness of different interventions across different spatial and management scales.

One relevant framework is the NRCS *Nine-Step Conservation Planning Framework* which is a method to work on private-lands with individual landowners, or across multiple partners in a watershed perspective (Area-wide Planning, and Rapid Watershed Assessment). As shown in the left-hand column of Table 4, this system involves a basic project design process. Another relevant framework is the US Forest Service’s *Six-Step Watershed Condition Framework Process* in which the Watershed Condition Assessment described in Section 2 takes place. As shown in the right-hand side of Table 4, this framework lines up with NRCS cycle.

Table 4. Comparing the NRCS Nine-Step Planning Process to the USFS Six-Step Watershed Condition Framework Process

NRCS Nine-Step Planning Process	USFS Six-Step Watershed Condition Process
1. Identify problems and opportunities	A. Classify watershed condition
2. Determine objectives	B. Prioritize watersheds for restoration
3. Inventory resource	
4. Analyze resource data	
5. Formulate alternatives	C. Develop Watershed Restoration Action Plans
6. Evaluate alternatives	
7. Make decisions	D. Implement integrated suites of projects in priority watersheds
8. Implement the plan	
9. Evaluate the plan	E. Track restoration accomplishments F. Verify accomplishment of project activities and monitor improvement of watershed and stream conditions

In addition to these planning frameworks, there are many efforts across USDA agencies and their partners that could contribute to the effectiveness measures system described above. Specific examples include:

- *Conservation Effects Assessment Project (CEAP)* – CEAP is a multi-agency effort to assess the condition of watersheds for the targeting of conservation practices to increase our effectiveness. In addition, it allows us to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. CEAP assessments are focused on national, regional, and watershed scales. Of particular relevance to this work are CEAP Cropland Assessments which use a sampling and modeling approach to estimate impacts of farm conservation practices on the environment, and CEAP’s Watershed Assessments which provide in-depth analysis and quantification of the measurable effects of conservation practices at the watershed scale. In addition, the watershed assessments and other research results are used to validate CEAP model results.

- *Landscape Initiative Process* – These initiatives are coordinated efforts to identify priority natural resource issues, find solutions, and effect change. They are accelerate the implementation of Financial and Technical Assistance, science based, partnership driven, build on existing locally led efforts, and measure outcomes.
- *State Resource Assessments* – State Resource Assessments (SRAs) provide a science-based, qualitative, and quantitative picture of the extent and geographic distribution of natural resource concerns (condition) within a State that should be credible and defensible. SRAs are based on the best available natural resource data and are enhanced by additional regional and State level geospatial data. The methodology is designed to support area-wide and watershed planning and financial assistance ranking, as appropriate. These SRAs assist national, regional, and State leadership, including State Technical Committees, to establish priorities and to help achieve natural resource objectives. The SRAs:
 - Assess the 31 natural resource concerns and are aggregated up to the nine major categories Use available National and State resource data
 - Focus on Priority Areas
 - Use input from partners, to prioritize their resource concerns, by landuse
 - Use Professional Judgment
- *Conservation Delivery Streamlining Initiative (CDSI)* –The Conservation Delivery Streamlining Initiative (CDSI) is to implement a more effective, efficient, and sustainable business model for delivering conservation assistance across the Nation. There are three objectives:
 - *Simplify Conservation Delivery* – Easier for customers and employees as they implement the NRCS 9-step conservation planning process.
 - *Streamline Business Processes* – Increased efficiency and integrated across business lines.
 - *Ensure Science-based Assistance* – Continued delivery of technically-sound products and services.

CDSI will allow conservation planners to assess the impacts of conservation practices on resources concerns as a part of that planning process. For water quality resource concerns (sediment, nutrients, pesticides) CDSI plans on leveraging data from existing CEAP models runs to allow the conservation planner to view a score card of the conservation benefits by resource concern.
- *Forest Service BMP Program Effectiveness Monitoring Framework* – The US Forest Service has developed a Best Management Practice (BMP) Process for projects on FS lands to ensure that water quality is protected. This process starts be establishing water quality goals and objectives as part of each Forest or Grassland Plan. As part of the authorization process for any project, a planning and environmental analysis process is conducted and specific BMP prescriptions are developed and put into implementation plans and then monitored as appropriate.

There seems to be considerable potential to build on this existing work to develop the next generation of effectiveness assessments across all of the USDA agencies and their partners.

5. Data Collection, Analysis and Communications

Similarly to the condition assessment framework, if we are to implement an effectiveness assessment framework along the lines outlined in the previous sections, it will require a substantial investment of time and other resources to finalize and operationalize the framework itself and then to collect and analyze the data on a periodic basis. Again, all data collected under this framework would be made available in a form that protects the privacy of private land owner information, in accordance with Section 1619 of the Farm Bill. In this case, it is pretty clear that it would have to be integrated into ongoing business processes and implemented by the following:

- One or more individuals in relevant USDA agency offices in Washington are assigned this work to finalize the overall framework and oversee implementation
- Appropriate individuals in relevant USDA agency offices will need to apply and extend CEAP and other relevant models to determine predicted stress reductions for each practice under different conditions
- Data collection and analysis is integrated into workplans for key individuals in each relevant regional office as part of routine business practices

In addition to the human resources required to do this work, it will also require IT support, including the ability to display geographic information at the site and sub-watershed management areas. The new *Conservation Delivery Streamlining Initiative* (CDSI) system currently being developed by NRCS for rollout in CY2012 (see Figure 11) seems like an ideal system in which to integrate the site level effectiveness measures described in our framework. To do so, we would have to build these indicators into these new IT tools being rolled out and then extend this tool across all relevant USDA agencies. It is not yet clear whether this initiative could be extended to track the planning needed at the sub-watershed management level.

One substantial benefit of the proposed effectiveness measures framework is that it lends itself to developing a high-level summary scorecard for both sub-watersheds within a priority region and then sites within each watershed. Figure 12 provides a partial mockup of what such as scorecard might look like. This scorecard provides practitioners a guide as to where additional action is needed – basically their job is to turn “red” and “yellow” cells to green. It also provides a high-level snapshot of the program for reviewers.

Figure 11. NRCS Conservation Delivery Streamlining Initiative
The following is an example of the new initiative.



Figure 12. Mockup of Scorecard Based on Effectiveness Indicators

This graphic shows a partial mockup of what a future scorecard could look like. Note that each scorecard entry would also have a corresponding notes column where justifications and details for the entry could be provided. It provides both a dashboard overview of effectiveness to date as well as a guide as to where management action is needed.

A1. Managed Watersheds - 2011

REGION Watershed	1. WTRSHD STRAT / PLAN CREATION			2. WTRSHD OUTCOMES	
	a. Wtrshd Assmt?	b. Wtrshd Plan?	c. % Sites Mtg Criteria?	a. Wtr Qty Condition	b. Wtr Qlty Condition
REGION A					
Watershed 1	3	3	3	F	G
Watershed 2	3	2	1	P	F
Watershed 3	2	1	1	F	F
REGION B					
Watershed 1	4	4	4	VG	G
Watershed 2	1	1	1	F	P

A2. Sites/Practices within Watersheds - 2011

WATERSHED Site	Targeted Site?	Total Acres	1. OWNER AGREE?		2. IMPLEMENTATION?			3. SITE IMPACTS		
			Owner Agree?	Total Acres=4	Buffer Built	Total Acres >2	Total Cost	% Decr Peak Flw	% Incr Base Flw	% Decr N
WATERSHED 1		550		47		47				
Site 1	4	40	4	40	3	40	60,000	8%	15%	25%
Site 2	3	10	4	7	3	7	25,000	11%	20%	5%
Site 3	2	500	1	0	1	0		0	0	0
WATERSHED 2		100		0		0				
Site 1	4	20	3	0	2	0		0	0	0
Site 2	3	80	2	0	2	0		0	0	0
Etc...										



B1. Managed Watersheds - 2015

REGION Watershed	1. WTRSHD STRAT / PLAN CREATION			2. WTRSHD OUTCOMES	
	a. Wtrshd Assmt?	b. Wtrshd Plan?	c. % Sites Mtg Criteria?	a. Wtr Qty Condition	b. Wtr Qlty Condition
REGION A					
Watershed 1	4	4	4	G	G
Watershed 2	4	4	4	F	F
Watershed 3	3	3	3	G	F
REGION B					
Watershed 1	4	4	4	VG	VG
Watershed 2	1	1	1	P	P

B2. Sites/Practices within Watersheds - 2015

WATERSHED Site	Targeted Site?	Total Acres	1. OWNER AGREE?		2. IMPLEMENTATION?			3. SITE IMPACTS		
			Owner Agree?	Total Acres=4	Buffer Built	Total Acres >2	Total Cost	% Decr Peak Flw	% Incr Base Flw	% Decr N
WATERSHED 1		550		50		50				
Site 1	4	40	4	40	4	40	60,000	22%	40%	50%
Site 2	3	10	4	10	4	10	25,000	16%	30%	50%
Site 3	2	500	1	0	1	0		0	0	0
WATERSHED 2		100		80		80				
Site 1	4	20	4	20	4	20	30,000	15%	15%	20%
Site 2	3	80	4	60	3	60	95,000	20%	30%	20%
Etc...										

Scorecards A1 & B1. These scorecards show the change in the Managed Watersheds using the indicators outlined in Table 3. Green colored cells show that the step has been completed; red and yellow cells show where work is still required. Moving from 2011 to 2015 shows changes in the situation over time.

Scorecards A2 & B2. These scorecards show the change in the implementation at sites in each Managed Watershed of Waterway Buffers (and could be extended to other HIT Practices) using the indicators outlined in Table 3. Again, green colored cells show that the step has been completed; red and yellow cells show where work is still required. Moving from 2011 to 2015 again shows changes in the situation.

6. Recommendations for Developing Effectiveness Assessment Framework

Systematic effectiveness assessments are critical to determine whether investments are having their desired impacts and to provide basis for learning and adaptive management. The Work Group thus recommends an Effectiveness Assessment Framework as follows:

- The basic unit of analysis should be both Managed HUC 10-12 Watersheds within priority landscapes and the specific interventions implemented at each site within these watersheds.
- We recommend that the framework ultimately include all Very High and High prioritized indicators in Table 3. Note that the specific measures will have to be adapted for each class of HIT Practices. Immediate short-term site impacts will necessarily need to largely be calculated through modeling exercises. Existing CEAP and other initiatives will be extremely good cores for this work, although they will need to be extended beyond crop lands. Longer term watershed impacts must be linked to the Condition Framework measures at appropriate scales.
- Site and watershed measures will need to be integrated into existing data collection efforts. In particular, these measures should be incorporated into regular business processes as part of the newly developing Conservation Delivery Streamlining Initiative.
- Completing and then implementing this Condition Framework will require collaboration across USDA agencies as well as with other key partners in the Advisory Committee on Water Information (ACWI). We recommend formation of a cross-agency working group that is staffed at the national and regional/state level with individuals who have it in their job descriptions to do this work.

IV. OVERALL RECOMMENDATION AND A FINAL WORD

The work of the USDA directly affects a large proportion of our nation's vital water resources. Furthermore, the USDA is uniquely positioned to bring together private and public land managers to help safeguard and improve these resources. To this end, it is of the utmost importance that USDA continually improve its performance in this area.

This report provides specific recommendations for both condition and effectiveness frameworks to assess USDA's Water Resources High Performance Priority Goal. We believe that these frameworks will enable USDA agencies and their partners to build performance measures into their programs and use the results to improve their work and guide future investments so as to more efficiently and effectively achieve this vital goal.

Although our Work Group has put considerable effort into developing the proposed frameworks, it will take substantial effort to operationalize and then implement the frameworks outlined in this report. We thus strongly recommend that USDA appoint a small, focused follow-on team to take these recommendations and develop a specific system for operationalizing them. This work, which should include pilot-testing of the specific indicators as well as the development of appropriate data collection and sharing mechanisms, should be completed by the end of FY 12. It will be essential that this implementation take place in an iterative and adaptive fashion and that it build on the substantial work already completed by USDA agencies and their partners. It is also imperative that this work be done collaboratively across relevant agencies and their partners.

APPENDIX

Action Plan Overview for Agency Priority Goal FY2012-2013 USDA Water Agency Priority Goal (APG) July 26, 2012

1. Impact and Priority Goal Statement

Our goal is to accelerate the protection of clean, abundant water resources by advancing USDA's capacity to measure the effectiveness of conservation investments in addressing water resource concerns. In FY12 and FY13 we will develop and implement an interagency water resource outcome metric in 2 pilot watersheds and quantify improvements in those watersheds. This work will allow USDA to test a measures framework designed to assess the work of agencies across USDA that can then be scaled up in other regions of the country. The Natural Resources Conservation Service (NRCS), Forest Service (FS), and Farm Service Agency (FSA) will collaborate on goal execution and will draw on the expertise of the Agriculture Research Service, the National Agricultural Statistical Survey and the National Institute of Food and Agriculture. USDA will continue to track a secondary goal: implementing high impact targeted (HIT) practices through USFS, NRCS, and FSA programs on 4 million acres within critical and/or impaired watersheds.

2. Problem / Opportunity Addressed

With 87 percent of America's surface supply of drinking water originating on land that USDA programs impact in some way, this Department has a key role to play in addressing the challenges facing this Nation's water resources. USDA has a nationwide technical presence and an array of authorities, tools and expertise with which to take action. Secretary Vilsack has identified protecting and enhancing water resources as one of his top conservation objectives in USDA's Strategic Plan.

While the agricultural and forestry communities have made good progress in reducing their impacts on water quality, challenges remain, and accelerating progress on reducing nonpoint source pollution is critical to meeting goals for safe drinking water, protected watersheds and habitat, clean lakes, streams and rivers. Progress in water conservation is even more challenging, with population growth and an uncertain climate adding complexity by escalating the already fierce competition for water to fuel agricultural, industrial and municipal demand.

By targeting the Department's resources in critical watersheds and bringing a unified approach to measuring results the Department is moving into a new era of results-based, landscape scale conservation investment that will protect the resource more efficiently and effectively. Measurable outcomes will encourage innovative partnerships that attract private capital and create non-regulatory incentives for a variety of stakeholders to invest in sustainable water resource management practices. Targeted, results-based conservation will encourage the development of ecosystem service markets such as payment for environmental services and trading markets, and State agricultural certainty programs that provide producers assurances that they are meeting a state's expectations for addressing water quality concerns.

3. Efficiencies

Results-based conservation will ensure that program dollars are invested in more effective and efficient conservation strategies. Not only will Federal investments go further, but the increased certainty that practices yield measurable results will help leverage non-governmental investments.

4. Relationship to Agency Strategic Goals and Objectives

The Water APG supports Secretary Vilsack's Departmental goal to protect natural resources including water quality and quantity. This priority is expressed in USDA's Strategic Goal 2: Ensure Our National Forests and Private Working Lands are Conserved, Restored, and Made More Resilient to Climate Change, While Enhancing Our Water Resources. Under this goal, the APG contributes to Strategic Objective 2.3: Protect and enhance America's water resources.

5. Contributing Programs Within the Agency

Ann Mills, Deputy Under Secretary of the Natural Resources and Environment Mission Area at USDA, is the goal leader for this program. NRCS, FS and FSA are partnering to implement this goal with key career staff from each agency directly involved. ARS, NIFA and NASS staff are involved in an advisory capacity. .

Agency staff members have been working together on this particular APG since 2009. These agencies each deliver programs, implement land management policies and conduct research designed to impact high priority watersheds, some of which are listed below.

NRCS:

- Environmental Quality Incentive Program (EQIP) (Direct Federal Program)
- Conservation Stewardship Program (CSP) (Direct Federal Program)
- Wetlands Reserve Program (Direct Federal Program)
- Emergency Watershed Protection Program (Direct Federal Program)
- Conservation Effects Assessment Project
- Conservation Streamlining Delivery Initiative

FS:

- Planning Rule for National Forest System Land Management
- USFS Watershed Condition Framework
- Development of National Best Management Practices for Water Quality Management
- Watershed Stewardship for a Changing Climate
- Forest-to-faucet web-based public education

FSA:

- Conservation Reserve Program (CRP) (Direct Federal Program)

ARS

- Water Availability & Watershed Management National Research Program (R&D Programs)

6. Contributing Programs Outside the Agency

USDA is working with the US Geological Survey and the Environmental Protection Agency (EPA) to develop water quality assessment protocols and we are partnering with a variety of state agencies, academic institutions and non-governmental organizations to collect and share data. These efforts directly and indirectly support the Water APG milestones. See implementation strategy below for greater detail.

7. Key Barriers / Challenges

The primary challenge to implementing the APG pilot watersheds is identifying locations where there is sufficient monitoring and modeling capability as well as conservation investment by multiple agencies. Barriers and challenges include:

- Monitoring locations – candidate pilot watersheds will have monitoring in place at a variety of locations including in-stream and edge-of-field for cropland agriculture. Significant funding is required for water quality monitoring. For example, typical costs of field monitoring stations are roughly \$30,000 for installation and approximately \$20,000 for maintenance over its working life;
- Adequate monitoring data – in general, because of weather variability, a minimum of 5 years of water quality data is required to identify significant changes. Weather events, such as extreme drought and flooding, may extend the needed time period for monitoring data;
- Water quality models – water quality models require significant time and expertise to set up for individual watersheds;
- Multiple agency participation – pilot watersheds must be selected where multiple agencies have conservation investments

Other challenges include selection of representative metrics that are appropriate to the scale of conservation being applied. For instance, conservation investments on cropland are made and understood on a field level basis, but conservation actions on forest or rangelands are made on more of a landscape basis. As is the case for many cross-agency efforts, maintaining institutional momentum for collaboration that adequately addresses separate agency missions will likely be a challenge.

Of important note: The APG aims to build on the work currently taking place within USDA agencies, with an emphasis on making continued gains in encouraging collaboration on investments in clean, abundant freshwater resources. Potential barriers to this collaboration

include cuts in funding for data collection, research including modeling and economic studies, discretionary funding for conservation agreements with partners; institutional resistance to cross agency collaboration; Several things are important to the success of this collaboration including continued funding for data collection and research, including modeling and economic studies; discretionary funding for conservation agreements with partners; and institutional acceptance of cross agency collaboration.

8. Implementation Strategy / Quarterly Milestones

As far back as 1990, the Government Accountability Office has weighed in on the need for better coordination between agencies regarding water quality and wetlands conservation results. Secretary Vilsack has directed USDA agencies to work in a more collaborative manner in order to achieve Department goals. The creation of the High Priority Performance Goal (HPPG) for Water – now the USDA Water APG – is one result of the Secretary’s charge – leading to new levels of collaboration between NRCS, USFS, FSA and ARS. This collaboration has facilitated additional projects including the development of a multi-tiered water quality monitoring and assessment framework for the Mississippi River Basin, as was recommended by the National Science Foundation. NRCS, USFS and ARS have been working with USGS and EPA to develop this framework, which will be one tool used to support the APG. The development of measures through the APG will also be supported by the ongoing work of the multi-agency Conservation Effects Analysis Project (CEAP).

By September 30, 2013, the agencies will quantify improvements in water quality by developing and implementing an interagency outcome metric in 2 pilot watersheds. This goal grew out of work the HPPG team did with *Foundations For Success* to develop recommendations for a performance measures framework to assess the condition of the resources and the effectiveness of our collective actions.

- Milestone: By June 15, 2012, formalize the formation of a cross-agency work group. In addition to working on the outcome metric for the 2 watersheds, the workgroup will integrate existing performance measure initiatives across agencies, work to establish common protocols, and make recommendations for FY14 data collection priorities and protocols.
- Milestone: Finalize selection criteria for pilot watersheds.
- Milestone: By June 30, 2012, finalize pilot interagency outcome metrics, with emphasis on building on agencies’ existing capacities and data; and select 2 pilot watersheds.
- Milestone: By September 30, 2012, begin implementation of pilot metric in watersheds.
- Milestone: By September 30, 2013, report on results of pilot implementation.
- Milestone: By September 30, 2013, report on outcome of USDA’s integrated performance framework and prioritization of data collection.

We will retain our interagency work group to carry out the APG. For the primary goal -- the watershed outcome metric -- NRCS is taking the lead on (1) working with the USFS and FSA to identify watersheds where at least two out of the three agencies have some influence over water quality and/or quantity through their land management practices/conservation programs, and in facilitating agreement on what indicators to track. We intend to couple edge-of-field and

in-stream monitoring; and (2) working with the US Geological Survey and the US Environmental Protection Agency, developing a multi-tiered water quality monitoring and assessment framework. No new monitoring capacity will be added as part of the APG pilots. The pilots will be carried out using data collected from stations funded and installed through existing efforts. One driver for watershed selection is capacity: robustness of the existing data in a watershed (from various sources including federal, private, NGO); the strength of local partnerships; producer interest level. Watershed selection will also be driven by a need to represent diverse landscapes and water regimes including both temperate and arid climates, cropland, rangeland, and forest ecosystems. Challenges and constraints to drawing a direct relationship between the results of conservation investments and measured water quality include legacy pollutants in water bodies and extraordinary weather events. This element of our APG is built on existing funding. Our implementation strategy for the secondary goal -- “acres treated” -- carries over from the FY10 and FY11 HPPG and serves as a contextual indicator.

Performance Indicators and Performance Update

The primary performance indicators for this APG are our interim and final milestones noted above. The secondary performance indicator for this APG is “Acres treated with High Impact Targeted (HIT) Practices. This measure was also used for the former HPPG. A significant proportion of the practices (over 85%) identified as HIT practices are on private land. These practices have rigorous technical specifications that identify water quality benefits if applied according to the practice standards. Agency staff are assigned to verify on the ground that these practices have been applied according to specifications, along with agency quality assurance processes for data and practices. Although there is overlap in the suite of practices used on public and private land, and with modeled estimates, some land may receive only one practice as that is the least-cost alternative to treat the resource concern. Some landscapes may need a larger suite of conservation practices either due to the land characteristics or the severity of the water quality impairments. Selection of the least-cost alternative to adequately treat the resource concern is part of the agency quality assurance process for technical planning of conservation work. The historic data for this indicator are below:

Acres Treated with High Impact Targeted (HIT) Practices		
Fiscal Year	Target	Actual
2010 Q1	100,000	547,000
2010 Q2	100,000	861,000
2010 Q3	450,000	2,034,000
2010 Q4	1,000,000	3,525,000
2011 Q1	1,240,000	3,963,000
2011 Q2	1,240,000	4,333,000
2011 Q3	5,000,000	5,263,000
2011 Q4	6,000,000	6,982,000

The current targets for the performance indicator and actuals to-date are set out below. Much of the Department’s accomplishments will come in Q3 and Q4 to correspond to the field season when much of the conservation work is done. FSA’s contributions are declining over last year’s levels, partially in response to crop prices and a reduction in CRP enrollment.

Acres Treated with High Impact Targeted (HIT) Practices		
Fiscal Year	Target	Actual
2012 Q1	300,000	67,802 ¹
2012 Q2	500,000	174,682 ²
2012 Q3	1,000,000	600,000
2012 Q4	2,000,000	
2013 Q1	2,250,000	
2013 Q2	2,500,000	
2013 Q3	3,000,000	
2013 Q4	4,000,000	

Milestone Update:

1. Milestone: By June 15, 2012, formalize the formation of a cross-agency work group. In addition to working on the outcome metric for the 2 watersheds, the workgroup will integrate existing performance measure initiatives across agencies, work to establish common protocols, and make recommendations for FY14 data collection priorities and protocols.

A project charter has been developed that formally establishes the membership and mission of the interagency team supporting development and execution of the USDA Water APG pilot watersheds. The charter has not yet been formally adopted by all involved agencies.

2. Milestone: Finalize selection criteria for pilot watersheds.

Completed.

Selection criteria include:

- *Conservation practices or activities within the watershed are documented and are of sufficient magnitude that they may be expected to have an effect on water quality.*
- *Monitoring at watershed scale and, as appropriate, at the edge of field is currently in place in the watershed and has existed for sufficiently long for conclusions to be drawn about the effectiveness of conservation measures taken in the watershed.*
- *Model(s) already set up set up in the watershed that can be used to characterize the outcomes expected for conservation practices.*
- *Forest land, grazing lands, and croplands in some combination will be represented in the set of selected watersheds.*

¹ Includes a negative value for CRP, due to reduced enrollments (-53,198 acres)

² Includes a negative value for CRP, due to reduced enrollments (estimated at -50,000 acres)

- *Representation of a variety of climate regimes including arid lands dominated by ephemeral streams.*

3. Milestone: By June 30, 2012, select 2 pilot watersheds.

Completed. Two pilot watersheds have been identified: the St. Joseph's watershed in Indiana and the La Cienega watershed in Arizona. Having identified the pilot watersheds, USDA is now working to develop project plans to produce outcome measures that draw from the proposed framework and indicators to assess practice effectiveness as presented in the Salafsky report.

4. Milestone: By September 30, 2012, complete project plans for producing the outcome measures, drawing upon the proposed framework and indicators presented in the Salafsky report.

5. Milestone: By September 30, 2012, begin implementation of pilot metric in watersheds.

USDA is on track to meet this milestone in Q3.

6. Milestone: By September 30, 2013, report on results of pilot implementation.

USDA is on track to meet this milestone in Q3.

7. Milestone: By September 30, 2013, report on outcome of USDA's integrated performance framework and prioritization of data collection.

ACKNOWLEDGEMENTS

This report was produced by a USDA interagency Work Group established in 2010 to implement the HPPG on Water. The team is lead by the Environment and Natural Resources Mission Area Deputy Under Secretary for Conservation and brings together staff from the NRCS, USFS, FSA, ARS and NIFA. Work Group members involved in developing this report include:

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