EXECUTIVE SUMMARY:
REVIEW OF UTAH'S 319 NONPOINT SOURCE PROGRAM

Prepared for
Utah Division of Water Quality

Prepared by
PIs: Douglas Jackson-Smith, Nancy Mesner, David Stevens, Phaedra Budy
Core Staff: Lorien Belton, Nira Salant, William Hochstedler, and Marshall Baillie
Technical assistance: Brian Greene, James Milleson, Ann Armstrong, Amber Jones

Utah State University
Logan, UT 84322-5210
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Background

Nonpoint source (NPS) pollution remains a significant public policy concern throughout the nation. Utah's efforts to address NPS water pollution problems have been guided by the 1972 Federal Clean Water Act and its subsequent revisions. These efforts have been supported with federal funds under Section 319(h) of the Act, with funding allocated to states by the U.S. Environmental Protection Agency.

In Fall, 2010, our Utah State University research team was contracted by the Utah Department of Environmental Quality to carry out a "critical assessment of Utah's 319 program administration and activities, and to assess the impact, effectiveness and long-term maintenance of a scientifically valid and representative sample of 319-funded NPS BMPs in Utah." Although other funding sources have supported Utah's NPS program, USU's project was explicitly constrained to 319 funded projects.

The project had 3 objectives:

1. Evaluate the actual and perceived efficiency and effectiveness of Utah's NPS program.
2. Assess the water quality impact and effectiveness of representative 319-funded projects.
3. Assess the long-term maintenance and impact of representative 319-funded projects.

In this executive summary we highlight the core findings and recommendations for Utah's 319 Nonpoint Source Pollution program. Full summaries of supporting data and results of the study are presented in the reports main text (Part I and Part II) and Technical Appendices (available online by end of July 2013 at www.extension.usu.edu/waterquality.)

Methods

Part I of this report addresses Objective 1. We reviewed numerous program documents, reports and records and conducted structured interviews with 33 key individuals involved in different aspects of Utah's 319 program. This work was conducted from Fall 2010 through 2011 and was submitted in draft form to the Utah Division of Water Quality in February, 2012. Many of the recommendations made in this Part I draft have subsequently been incorporated by the DWQ.

Part II addresses Objectives 2 and 3. This work was conducted from summer 2011 through spring 2013[1]. We focused our efforts on six watersheds that had received significant 319 program funding (Figure 1). We randomly selected specific projects from within each watershed for more detailed assessment. Our analysis focused on five broad categories of BMPs: animal waste management and structures; irrigation infrastructure and management; grazing and other upland projects; rural stream restoration; and urban stream restoration. Our final sample included 66 BMP projects located on 49 properties across the five rural watersheds, and an additional 13 urban stream BMP projects in the Jordan River watershed.

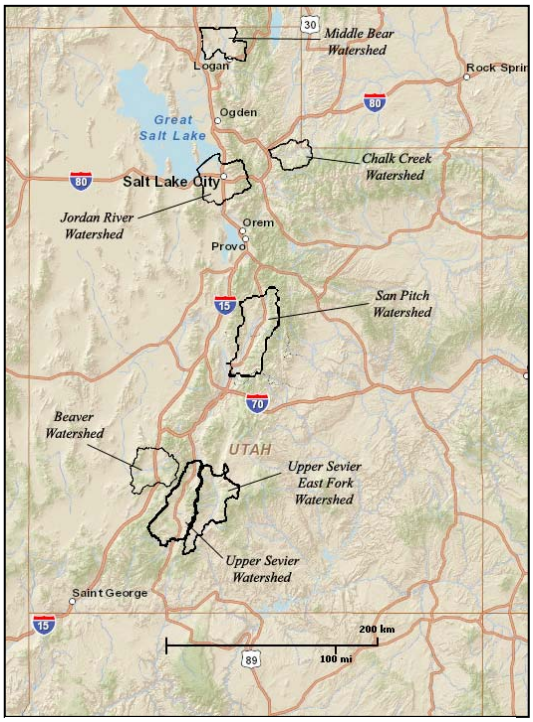

Figure 1: Location of study watersheds

In almost every case, we conducted site visits to the projects, interviewed the landowners or managers, and conducted a visual assessment of the condition of the BMPs. Availability of data and constraints in project budget and timing dictated which other analyses were conducted. We focused most intensely on riparian and in-stream projects, which allowed us to compare common assessment techniques. Full details of our methods are included in the body of the report and technical appendices.

The methods used are summarized in the table below.

	BMP Category				
	Animal Waste	**Irrigation**	**Upland**	**Rural Stream**	**Urban Stream**
Assessment Method					
Local File Review	●	●	●	●	●
Interviews	●	●	●	●	●
Field visual assessment	●	●	●	●	●
Repeat photo comparisons				●	●
Proper Functioning Condition				●	
Channel migration using historic aerial photography				●	
Fish habitat suitability analysis				●	
Watershed model – sensitivity analysis	●	●	●	●	

[1] It is worth noting that it took almost 1 year to negotiate a memorandum of understanding and receive permission from federal and state agencies to allow our research team to view the individual project files.

Results and Recommendations for Part I: Evaluation of Utah's 319 NPS Program Administration and Structure

Most respondents had a good basic understanding of the state's NPS program goals and the state's most significant pollutant concerns. Their perception of the general distribution of 319 funding fit well with the program's history from 2001 – 2010 (Figure 2.)

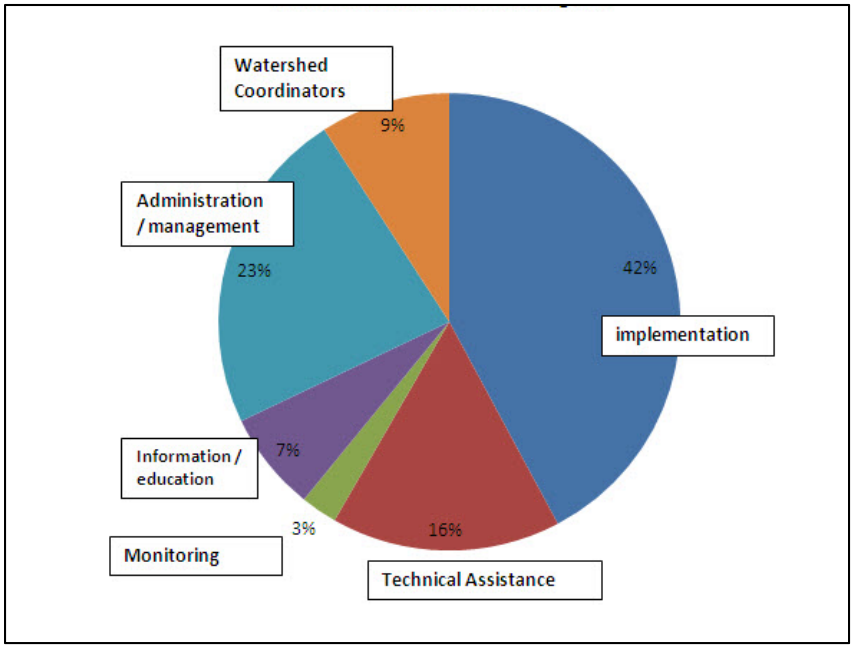

Figure 2. Allocation of 319 grant funds from 2001 through 2010.

The majority of those interviewed also felt that the state's NPS program had resulted in reduced pollution in Utah and had resulted in successes that should be acknowledged and celebrated.

Other program elements recognized as effective included:

- Strong local leadership, particularly through the work of local watershed coordinators, which allows flexibility to adapt to unique local problems and solutions.
- A focus on implementation of TMDLs within a broader watershed framework.
- Rotating funding cycles between major watersheds to better concentrate funding (a change that had just been implemented by UDWQ at the time of this study.)

Several respondents expressed concern that the allocation of 319 funding was too heavily tilted to staff support, rather than actual implementation of projects. Figure 3 summarizes EPA 319 funding to Utah through 2010, and the amount allocated to staff support and implementation of grants. While staff and support funding increased from 34% of the

annual 319 grant between 1990 and 2002 to 52% of the total grant from 2002 through 2010, this increase was due in large part to allocation of funding for watershed coordinators, a decision that was widely supported by all those interviewed.

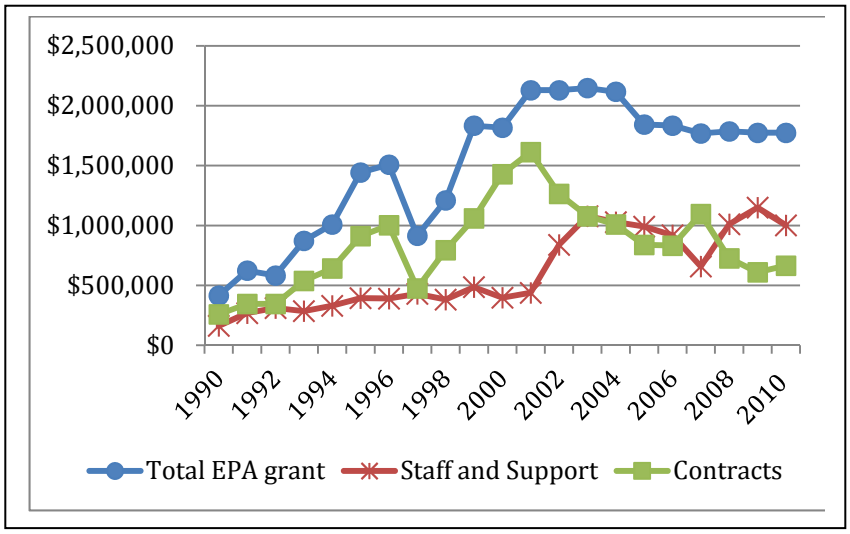

Figure 3. EPA 319 grants to Utah.

Other concerns expressed by those interviewed included:

- Poor coordination between the land management programs promoted by different state agencies, resulting in reduced overall effectiveness of all programs;
- Poor record keeping on project outcomes and impacts;
- A convoluted system of contract management;
- A perception that the program has focused too heavily on agricultural sources;
- Monitoring approaches that limited the ability to adequately document program impacts;
- A failure of the program to 'tell the 319 story' to Utah citizens and decision makers.

Suggestions [2] for improving program administration and support are summarized below.

Program Administration and Implementation:

- Develop more systematic record keeping systems to track implementation and outcomes of contracts, projects and individual BMPs.
- Develop efficient and consistent procedures in the state office to manage 319 contracts for local watersheds.

[2] The results of the overall program evaluation and preliminary recommendations were communicated with UDWQ staff in 2012. Since then, many of these topics have been addressed.

- Improve compensation (salary/benefits and technical) for and increase communication with local watershed coordinators to reduce turnover and take advantage of their local knowledge and contacts.
- Develop a project certification process to assure that project design is adequate and to reduce liability concerns for projects requiring engineering techniques.
- Increase technical assistance and follow up visits to ensure long-term utilization of BMPs that focus on management.
- Increase efforts to address urban runoff.

Partnerships

- Clarify the role of the UDAF as a partner in effective 319 program implementation
- Improve coordination of NPS related programs funded by partners, including Utah Division of Wildlife Resources, Natural Resources Conservation Service, US Fish and Wildlife Service, Forest Service, BLM and others.
- Increase opportunities for local input in development and implementation of TMDLs.
- Streamline permit application processes across agencies that supervise stream, wetland, and cultural work.

Monitoring and Reporting

- Assure that monitoring of NPS projects target stated project objectives and pollutants of concern.
- Require approved project monitoring plans prior to project implementation.
- Utilize monitoring approaches that allow detection of change at several scales, including individual BMPs, total project and aggregate watershed impacts.
- Take advantage of Utah's new citizen water quality monitoring program to track 319 project impacts.
- Develop a standardized reporting tool and train watershed coordinators in its use to increase coordination and continuity of reporting efforts.
- Include stand-alone "Impact Reports" in annual and final project reports.
- Share lessons from prior project successes/failures so future projects can benefit.

Communication and Outreach

- Ensure that all NPS documents are available to the public – ideally online – in an organized and accessible fashion.
- Develop strategic, clear and unambiguous local and statewide outreach messages that address diverse issues and target different audiences.
- Conduct regular needs assessments by the statewide outreach program to identify new and emerging concerns and unmet ongoing needs.
- Provide regular training on outreach and other issues to address turnover among watershed coordinators and other partners.

Results and Recommendations for Part II: Assessing 319 BMP Implementation, Maintenance, and Impacts on Water Quality

Overall, our study found that most 319-funded projects are still in place, still functional, and are appreciated by the landowner. Only a small minority of BMPs experienced implementation problems. Poor engineering design was the most cited reason for difficulties in implementing animal waste BMPs, and helped explain the least successful rural stream BMP projects.

Our qualitative assessment – based on interviews and field assessments -- suggests that

- Roughly 60 percent of BMPs likely or definitely produced positive impacts on water quality. Another 15 percent were in situations where it was difficult to clearly evaluate the net water quality impacts.
- About a quarter of all BMPs in rural watersheds were considered unlikely to have improved water quality. The lack of impact usually related to the placement of the BMPs in areas which were far from the targeted water body and/or designed mostly to accommodate other goals (such as improving irrigation efficiency).
- From the landowner point of view, the water quality impacts from BMP use are less evident (or important) than the beneficial impacts on labor, farm productivity, or recreation activities from the projects.

Evidence from watershed hydrologic models suggests that the full suite of 319-funded BMPs likely improved nutrient loadings and concentrations by very modest amounts (phosphorus dropped between 0.1% and 3%, while nitrogen declined 0.1-0.2%, over a 15 year period of simulations). The small change in total nutrient loadings were associated with two factors: (a) the relatively small proportion of the watershed that was affected by 319 BMP implementations, and (b) the high background levels of nutrient flows in the affected waterways. Water quality improvements were more significant at the subbasin scale – particularly in the winter and spring when hydrologic conditions generated higher total nutrient loads.

Taken as a whole, assessment of BMP impacts was constrained by poor record keeping, a lack of pre-project data, and the absence of systematic and ongoing monitoring of BMPs and water quality conditions. Improved monitoring efforts and data management for future BMP projects will be necessary to ensure program evaluations can provide more detailed, project-specific information on key parameters for NPS source reduction.

Specific results for individual types of BMPs are summarized below.

Animal Waste BMPs (16 projects in 4 watersheds)

- All animal waste BMPs had been implemented and were still in place and generally serving their intended purpose (improved storage & management of animal waste).
- A number of farmers reported problems in the engineering of BMPs that either over- or under-built the size and durability of animal waste projects. Farmers who had opportunities to work with engineers to adapt designs to their local situation felt that their projects were more effective and efficient.
- All animal waste projects improved the containment of manure, which is likely to reduce phosphorus loading to the targeted water bodies. Nitrogen impacts, in particular on groundwater, were generally not addressed. In a minority of cases, clear flow paths of animal wastes to targeted waterbodies were not readily apparent either before or after the project was implemented.
- While containment of manure was improved on all the farms we visited (often quite dramatically), many farmers did not report significant changes in the ways they made decisions about how much and where to spread manure on their fields. There was little evidence that a nutrient management plan or soil phosphorus test results guided their manure spreading decisions.

Irrigation projects (16 projects in 4 watersheds)

- Operators were overwhelmingly satisfied with the operational benefits of the irrigation projects, citing reduced labor and increased forage or crop production.
- Operators were often unaware that the funding for the irrigation projects was specifically intended to improve water quality.
- The estimated water quality improvements from irrigation work varied widely from project to project. Very little pre-project quantitative data (e.g. tail water flow volumes, application rates, etc.) were available, preventing quantitative assessments of potential impact. Projects that exhibited the most likely positive impact on water quality were in close proximity to receiving water bodies.

Upland grazing (14 projects in 5 watersheds)

- Upland projects varied widely in type and extent. Implementations of these types of projects were relatively straightforward.
- Generally, operators reported that these projects clearly improved their ability to manage their grazing operations, and they benefited from improved forage quality or availability.
- Grazing project files had little documentation of pre-project water quality problems, and water quality benefits were difficult to assess both during field visits and interviews. Only a third of producers indicated they had seen improvements in water quality as a result of the project.

- Projects that appeared to have greatest water quality benefits included those that: (a) improved grazing areas to relieve stress on other more sensitive areas near riparian zones, (b) installed sediment capture ponds that slow landscape-scale erosion; or (c) succeeded in increasing vegetative cover to reduce soil erosion. (However, in some cases increased grazing pressure as a result of these treatments may have mitigated benefits of improved plant cover.)
- Although improved grazing management or prescribed grazing were part of most grazing BMP contracts, few producers reported significant changes in grazing management specifically designed to meet water quality goals.

Rural stream projects (20 projects in 4 watersheds)

- Stream BMPs experienced few implementation problems and most were still in place and functioning as intended during our site visits. A minority of the streambank and instream structure projects had been negatively impacted by high runoff events or a failure of vegetative plantings to thrive.
- Very little pre or post-implementation monitoring and follow-up has been done on stream projects in these watersheds.
- Most operators were content with how well their stream projects turned out, and reported seeing improved water quality benefits. Unlike grazing and irrigation BMPs, stream projects appear to provide little direct operational benefit to agricultural producers other than potential prevention of land loss caused by erosion.
- Fencing to restrict livestock access to streambanks was seen by producers as a critical component of stream BMP projects.
- We conducted the most intensive assessments of individual rural stream BMP impacts using several complementary methods. The combined results suggest that most 319-funded stream BMPs have improved water quality conditions. However, in each watershed there were instances of BMPs that did not perform as well as expected, due to placement on the landscape or poor engineering design.
- PFC assessments were conducted in 3 rural watersheds. Results suggested that the majority of project areas are properly functioning or trending upward, and only 1 site was in nonfunctional condition. Older projects are in better condition than those projects where vegetation has not had as much time to establish.
- Comparisons of paired photographs were conducted in 3 rural watersheds. Results suggest that most stream BMPs have increased riparian area vegetation, and in some cases we could see improvements in the slope and shape of streambanks.
- Fish Habitat Suitability Analysis (HSA) was conducted on several BMP projects in 1 watershed. Results suggested that in-stream habitat conditions had improved in most projects, but that several limiting factors remained which constrain the suitability of these river reaches for native fish populations.
- Analysis of historic aerial photography was conducted in 3 rural watersheds. Results were inconsistent and suggest that not all stream project reaches demonstrated net improvements compared to untreated areas of the watershed. It is also evident that the scale of changes associated with individual stream BMP

projects are often overwhelmed by larger watershed processes (e.g., major flood events).

Urban stream projects (13 projects in 1 watershed)

- The urban stream projects in our study were successfully implemented and maintained.
- Reduced erosion and improved channel stability are likely to have improved water quality.
- Urban stream BMP projects face unique challenges associated with urban stormwater runoff, complex land ownership patterns, a more rigid built environment, recreational uses of stream areas, and complexities created by human-managed hydrologic flows.
- While the budget for water quality projects typically relies on external grant funds, urban cities and counties do have existing staff and equipment that can be utilized to help construct, maintain, and monitor the condition of stream BMPs over time.

<u>Other lessons from watershed studies for 319 program project administration</u>

- Qualification for receipt of 319 funds was not always based on clear and well documented information about the local water quality problem.
- Reports of engineering problems were common. NRCS requirements were perceived by cooperators as too specific, unnecessarily costly. At the same time, a lack of engineering expertise in some cases led to problems in implementation and performance of some BMPs (particularly for animal waste and stream restoration projects). Operators who worked closely with engineers to adapt plans to site conditions reported the highest level of satisfaction and success.
- Employee turnover and changes in watershed coordinators were problematic for some participating farmers.
  Producers suggested several changes in 319 program structure that would help make projects more sustainable and manageable. These included: (a) Creation of an errors and omissions fund to cover cost overruns associated with unforeseen engineering changes or errors; (b) budgeting for followup visits and project adjustments to fix small aspects of projects that might be failing in the first year; and (c) providing sufficient resources to implement projects throughout entire river reaches to ensure impacts at the watershed scale..
- Monitoring of projects at the local level is insufficient. Rarely was any type of data collected prior to project implementation, making quantitative water quality improvement assessment near impossible. Project evaluation in final reports seems to be based primarily on anecdotal evidence and model projections, not onsite monitoring.

General Conclusions & Recommendations

Conclusion #1: Post-implementation, qualitative reconstruction of pre-project data is fundamentally not an effective method of assessing water quality improvement from projects. Without adequate pre-project data, it is extremely difficult to make direct measurements that assess whether the implemented BMPs led to their intended improvements in water quality conditions.

Recommendation*:* Collection and preservation of pre-project condition data is critical to support any future project assessments. Minimal initial data to gather include labeled photopoints, written descriptions of site-specific conditions leading to water quality impairments and the intended process by which the project would be expected to improve conditions.

Conclusion #2: Lack of information on – or access to – previous monitoring efforts severely restricted our ability to replicate any data gathering post-project.

Recommendation: If technical data is gathered, records must be kept in the relevant project files. A separate section in both NRCS and UACD files dedicated to monitoring information would make post-project monitoring much more straightforward.

Conclusion #3: Most 319 project implementations appear likely to have positively impacted some aspects of water quality in the targeted water bodies. However, projects which had the greatest potential benefits were those that were thoughtfully designed to improve water quality, by teams of project managers and landowners who understood the problem and worked jointly to solve it.

Recommendation: Encourage watershed coordinators to engage landowners more proactively in project planning, not only to ensure benefit to the landowner or operation, but also to ensure they understand and contribute to solving the water quality goals. Landowners have unique understanding of their landscape that can help projects improve the design of BMPs to maximize both operational benefits and water quality outcomes. Communicate clearly with landowners to make sure that their water quality and other goals align with the project design. More successful projects can come from fully informed discussions where everyone's goals are clearly articulated.

Conclusion #4: All types of projects we examined (upland, irrigation, animal waste, and streambank stabilization) had examples of both high-value and low/no-value projects. BMPs that had little impact reflected poor implementation decisions (e.g. which projects to fund, where, and how they were designed) more than inherent problems with the practice type itself.

Recommendation: Require more detailed justification of how a specific BMP project will address a known water quality problem. Avoid funding BMPs just because they fit a certain category of approved practice, rather than having clear water quality improvement potential. Require specific statements about intended benefits to water quality, not just generalized statements about practices.

Conclusion #5: Post-project follow-up visits can provide important benefits to watershed conservation efforts. We found many instances where small additional investments could have corrected design flaws or mitigated impacts of extreme events. Field visit also provide insights into the strengths and weaknesses of different BMPs that can allow staff to adjust future funding to improve water quality benefits.

Recommendation: Do not rely on the landowner to report problems or situations where project components need follow-up. Watershed coordinators or others should follow-up to see if BMPs are still functioning as designed. Projects should allocate some resources to an 'errors and omissions' fund to allow for post-project corrections.

Conclusion #6: It is not clear that project staff always had a robust understanding of the assumptions and limitations of impact assessment models (such as UAFRRI or STEP-L) used in project reports

Recommendation: Ensure that watershed coordinators are trained to understand, assess and question, not simply input data to, models used for reporting results. To allow assessment of model estimates in the future, model input data and assumptions should be included in producer files, along with details about the ways input data were gathered. Auto-updating date fields in the UAFRRI model should be removed from the document to reduce confusion and allow for clearer documentation of model results.

Conclusion #7: File information quality varied widely across conservation district offices. Although funding information files were more carefully standardized, details beyond cost and specific practices funded were sometimes completely unavailable. The EPA Grants Reporting and Tracking System (GRTS) has not been used to its full potential to provide detailed and useful tracking of project implementation and outcomes.

Recommendation: The state should identify clear protocols for maintaining and storing information about individual BMP projects. The GRTS system should be used as a foundation for future tracking of individual projects and project outcomes. This should include

- Description of project locations, including maps with accurate georeference information,
- Description of both original BMP design and actual project details as implemented,
- Description of water quality concerns and understanding of how proposed BMPs would address these concerns,
- Pre-project water quality monitoring data,
- Data from ongoing monitoring activities,
- Pollutant-load-model input assumptions, and
- Copies of final project assessments (e.g. sections from final reports).

Summary

In summary, the BMPs evaluated in this research all have the potential to be effective in addressing NPS concerns – but only if well designed, properly implemented, and positioned in relevant places on the landscape. Because BMP adoption decisions are often shaped by considerations other than water quality, the most effective BMPs are those that both improve water quality and satisfy landowner objectives. At all levels of 319 program administration and implementation, successful reductions of NPS pollution problems will come from a focus on strategic project placement on the landscape, effective and relevant monitoring, and open communication with landowners and other partners.