

Preventing Polluted Runoff From Parking Lots

Benefits, Barriers and Opportunities

AWARE Colorado Research Report

April 2009



Acknowledgements

AWARE Colorado (Addressing Water and Natural Resource Education) is a statewide program to help communities protect water quality through land use choices. Its purpose is to educate local decision makers about the impacts of land use on water quality.

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Contents

Overview of Findings.....	1
Study Background	5
Study Results.....	9
Parking Lots as a Water Protective Strategy	9
Importance of Parking Lot Design.....	9
Strategies to Reduce Parking Lot Pollutants.....	10
Barriers	12
Questionnaire Responses	12
Discussions and Interviews	15
Design, Construction, Maintenance Issues and Costs	15
Inertia and Reluctance.....	17
Other Barriers	19
Differences by Community	22
Ways to Overcome Barriers	23
Benefits	29
Questionnaire Responses	29
Discussions and Interviews	33
The Environment	33
Reduced Costs	34
More Developable Land	35
Aesthetics and Marketability	36
Other Benefits.....	37
Economic Value of Benefits.....	38
Ways to Bring About Benefits.....	39
Motivation, Opportunity and Ability	44
Ability and Authority.....	44
Motivation.....	47
Views of Other Stakeholder Groups.....	49
Recommendations and Final Thoughts of Stakeholders	51
Education.....	51
Advocacy	52
Collaboration.....	52
Design and Innovation	53
Broader Scope	53
Conclusion.....	55
Appendix A: Complete Set of Frequencies from Participant Questionnaires	56
Appendix B: Questionnaires, Focus Group and Interview Scripts	63

Overview of Findings

Background and Purpose

AWARE Colorado (Addressing Water and Natural Resource Education) is a statewide educational initiative, funded by the League of Women Voters of Colorado Education Fund, tasked with increasing awareness of local decision makers on the impacts of land use choices on water quality and providing strategies for protecting water resources.

AWARE conducted previous research to assess the relative effectiveness and implementation likelihood of various water protective approaches. This research showed that an important core of low-impact development (LID) strategies centered on parking lots, which provided a clear path for potential intervention and propelled AWARE toward conducting a qualitative research study using focus groups and key informant interviews.

National Research Center, Inc., (NRC) was hired by AWARE Colorado to carry out this qualitative research assessment to understand the barriers and benefits perceived by stakeholders on specific water quality protection strategies AWARE Colorado may pursue. A series of focus groups and key informant interviews was conducted with seven different stakeholder groups located in the South Platte River Basin: landscape contractors, landscape architects, engineers, planners, stormwater managers/engineers, developers and appointed and elected officials. Results of the research assessment will help guide AWARE's education and outreach efforts as it relates to low-impact development (LID) approaches to parking lot design and construction.

Methods

In collaboration with AWARE Colorado, NRC developed a script that was used for the focus groups and key informant interviews with the different target audience groups. The scripts shared many common themes with a few unique questions for the different groups.

AWARE used recommendations from its advisory committee and focus group subcommittee to identify key stakeholder groups with whom NRC could conduct focus groups and key informant interviews. AWARE also arranged the dates and locations for the discussions, and provided NRC with the names and contact information of individuals to recruit for the focus groups and key informant interviews.

NRC conducted four focus groups (38 total participants) and 21 key informant interviews with the identified stakeholder groups. The focus groups were scheduled for approximately 90 minutes each and each key informant interviews took approximately 30 minutes.

Key Findings

Key Players are Aware of the Importance of Stormwater Management in their Communities

All of the stakeholder groups acknowledged the importance of water quality in Colorado and reported strong support around topics of environmental stewardship. There was a common understanding that building “green” can have benefits – both long- and short-term.

Parking lot design and construction was important to most of the study participants; although a number felt parking lot design was too narrow of a focus to warrant much attention. (Note: Although, parking lots provided a manageable scope for this focus group/interview research, the results also will be used to address broader related community development activities.) Others assigning less importance to parking lot strategies often referred to a balance of environmental and economic trade-offs.

Many Benefits of Parking Lot Strategies are Recognized by Stakeholder Groups

The long-term benefits of low-impact parking lot techniques were generally accepted by stakeholders and included improved water quality, increased environmental health, improved public health, expedited recharge times and reduced flood risks. A number of these benefits translated into economic advantages for communities (e.g., reduced costs to capital improvement projects, reduced water treatment needs, etc.).

However, the more immediate economic benefit to developers (and consumers as costs are passed down) was more controversial.

- Many suggested that additional landscape could add aesthetic value, potentially increasing property values.
- The use of low-impact development (LID) paving materials is known to cost more at build, but the costs of maintenance were controversial. Some felt maintenance costs would be saved over time; others felt the materials would cost more to maintain.
- Some felt that building “green” was a selling point to many consumers, so the publicity of using LID techniques would raise sales prices and increase market demand of residential properties.
- A number proposed that new parking lot designs (or codes) would lead to more developable land and this would be a big incentive for developers.

Developers and elected officials, more than other stakeholder groups, were concerned with the return-on-investment of implementing LID parking lot strategies– although mention of the cost-benefit trade-offs of these LID techniques arose in every discussion.

Barriers Exist to Implementing LID Parking Lot Strategies in Colorado Communities

When asked the most common barriers to the implementation of parking lot strategies, stakeholders most often gave responses related to difficulties with design, construction and maintenance in

Colorado's climate; the cost of implementing new strategies; a general lack of technical information; and the inertia inherent in organizational and community processes.

Climate and Geology: Although a number of parking lot strategies have been used successfully in other areas of the country, many stakeholders were wary about the outcomes of the practices in Colorado. The use of pervious or porous materials was the strategy most commonly questioned due to the freeze-thaw nature of Colorado's climate, the expansive soils present in many communities and the need for snow removal or snow removal additives such as sand. The desire for information on when and where these various strategies would work locally was viewed as essential by all of the stakeholder groups.

Costs: Most stakeholder groups acknowledged the longer term economic benefits of these strategies to the public at large. Reduced costs spent on capital improvement projects, reduced water treatment costs, increased aesthetics, decreased probability of flood damages, were just a few of the perceived benefits mentioned.

However, a lack of knowledge on the more immediate costs and benefits for developers and consumers posed a serious obstacle for many. These unknowns and potential financial risks hindered action in many of the stakeholder groups.

Lack of Technical Information: Although many of the stakeholders participating in this study were familiar with stormwater strategies commonly used to mitigate water pollution, there was a general consensus that too little is known about how these strategies will play out in Colorado. Additional information would be required for stakeholders to pursue them, specifically:

- Good examples of which strategies work best in this climate (menu of options taking in consideration the many variables which might influence success)
- Costs of initial development and maintenance costs
- Return-on-investment for developers
- Designs that balance aesthetics with strong engineering (based on collaborations of various stakeholder groups – e.g., engineers with landscape architects)

Inertia and Reluctance to Change: Local government planning and development processes can be very complicated and cumbersome. However, the players know their roles and what to expect. Changing codes, policies or guidelines can add significant levels of additional work for government staff, longer review times, increased costs for developers, and political struggles for elected officials. A number of stakeholders reported they did not want to take on these pains unless they knew the science was correct and the parking lot strategies would work. Few local governments want to enforce policies which have not been proven as beneficial to the community. Change is always met with resistance unless benefits are known and immediate.

Stakeholders are Motivated but Vary in Their Ability to Increase Adoption of Water Protective Strategies

Nearly all of the stakeholders participating in this study felt motivated to promote water quality protection, mostly because “it is the right thing to do.” Further, most felt they could educate about and advocate for parking lot stormwater management, but for many, their ability to move their community into adoption of such strategies fell short. Elected officials reported the highest levels of

authority, although they were often less committed to the importance of implementing these stormwater strategies.

Stakeholder groups more committed to promoting these strategies – stormwater managers/engineers, landscape architects, planners, engineers, landscape contractors – generally expressed more support for the methods yet reported being too far down the process to implement or influence significant change. They frequently mentioned a need for policies or design guidelines to give them authority to make changes in the development process. Government staff wanted to be backed by their councils to advocate and enforce LID stormwater practices. Although many of the stakeholders felt developers had authority to bring about these changes, the developers themselves did not feel that they had authority but did agree that they had the ability to support and promote water protective strategies.

Needs and Motivators: Education, Collaboration, Advocacy, Innovation, Marketing and Regulation

Knowledge: The most pressing need coming from this study focused on the need for more knowledge – knowledge of best practices, recommended guidelines, anticipated return-on-investments (ROI) and ways to best overcome design obstacles. Many of the discussions centered around what is known, what is not known and how much more there is to know about parking lot strategies in Colorado.

Collaboration: Study participants commonly mentioned a need for partnership between the various stakeholders to impart knowledge, share values and use their area of expertise to innovate new designs, policies or programs. The best solutions will be ones based on input from all key stakeholder groups.

Advocacy: Many of the stakeholders recognized the work AWARE Colorado has been doing to increase awareness of water issues. Some felt additional advocacy at the state and national levels, or work with local governments and non-profits on the promotion of water quality protection is still needed. Educating the public was thought to be additional leverage to change development patterns.

Design and Innovation: Stakeholders felt strongly that many of the stormwater solutions used in other climates and regions may not work in Colorado. The need for local pilot projects and demonstrations is great to provide “proof” of the benefits as well as bring added publicity to environmental building and water quality issues. A number of study participants recommended providing incentives to promote pilot projects or asking governments to showcase the technologies before regulating others to do so.

Marketing: For many stakeholder groups involved in planning and implementation, increased education of local design features and costs were a strong motivator. If these data show that there is a ROI for developers, they too will be motivated. However, if the economic return to developers is less tangible or adverse, many argued that incentives might be useful or necessary.

Regulation: Many stakeholders suggested that jurisdictions will likely need to change policies, codes and regulations to force developers to use new LID parking lot designs. The usefulness and political appeal of such mandates was controversial, although a number of strategies were recommended to help gain acceptance and appeal.

Study Background

Purpose

AWARE Colorado (Addressing Water and Natural Resource Education) is a statewide educational initiative, funded by the League of Women Voters of Colorado Education Fund, tasked with increasing awareness of local decision makers about the impacts of land use choices on water quality and providing strategies for protecting water resources. The League of Women Voters of Colorado Education Fund receives money from the Colorado Department of Public Health and Environment through a grant from the U.S. Environmental Protection Agency.

Prior to this research effort, AWARE assessed the relative effectiveness and implementation likelihood of various water protective approaches through a stakeholder meeting and follow-up survey. This research showed that an important core of low-impact development (LID) strategies centered on parking lots, which provided a clearly focused target for intervention. LID is a planning, design and construction process, which seeks to mimic predevelopment runoff conditions. LID techniques emphasize absorbing small, frequent storms to reduce flood risk and pollutant loads to receiving waterways. In addition to promoting LID, AWARE also encourages other sustainable stormwater management approaches such as better site design, natural resource-based planning and green infrastructure.

Armed with the research on water protective strategies, AWARE undertook this qualitative research study using focus groups and key informant interviews. The goal of the study was to more effectively address how to prevent, or reduce, polluted runoff from parking lots – and by extension, other community development activities. AWARE will use the data gathered through this study to develop a community/stakeholder approach that encourages the adoption of water protective, LID strategies statewide.

The content of this focus group/interview research was based, in part, on *Breaking Down the Barriers to Low Impact Development in Colorado*, produced by Wright Water Engineers for the Keep it Clean Partnership.

National Research Center, Inc., (NRC) was hired by AWARE Colorado to conduct a qualitative research assessment to understand the barriers and benefits perceived by stakeholders on specific water quality protection strategies AWARE Colorado may pursue. NRC conducted a series of focus groups and key informant interviews with seven different stakeholder groups located in the South Platte River Basin: landscape contractors, landscape architects, engineers, planners, stormwater managers/engineers, developers and appointed and elected officials. Results of the research assessment will help guide AWARE's education and outreach efforts as it relates to low-impact development (LID) approaches to parking lot design and construction.

Methodology

Script Design

In collaboration with AWARE Colorado, NRC developed a script that was used for the focus groups and key informant interviews with the different target audience groups. The scripts shared

many common themes with a few unique questions and probes designed for each of the targeted populations, and focused on different types of strategies related to parking lot design and construction. Also explored were the perceived barriers and benefits to parking lot strategies related to water quality protection, and the ability, opportunity and motivation of the stakeholders to promote the water protective strategies. The scripts can be found in *Appendix B: Questionnaires, Focus Group and Interview Scripts*.

Participant Recruitment

AWARE used recommendations from its advisory committee and focus group subcommittee to identify key stakeholder groups with whom NRC could conduct focus groups and key informant interviews. AWARE also arranged the dates and locations for the discussions, and provided NRC with the names and contact information of individuals to recruit for the focus groups and key informant interviews.

To recruit focus group/key informant participants from diverse communities in the South Platte River Basin, AWARE researched data from the U.S. Census Bureau, Denver Regional Council of Governments, North Front Range Metropolitan Planning Organization, community Web sites and other sources. Based on that research, AWARE solicited participants from plains, foothills and mountain communities; in rural, urban and suburban settings; with small to large populations; and included areas where development is expected to occur at a faster pace.

NRC provided guidance and support to AWARE throughout focus group and key informant recruitment which included: answering questions and providing explanation for AWARE Colorado to use, if necessary, in talking with stakeholder groups and individuals; providing support and guidance for all logistics, including securing rooms, recruiting participants; scheduling key informant interviews; placing reminder calls to focus group participants and key informant interviewees; and purchasing refreshments and providing incentives for the focus groups.

Four focus groups (38 total participants) were conducted with stormwater managers/engineers, landscape architects, landscape contractors and planners (local government and consulting). A series of 21 key informant interviews were conducted by telephone with appointed and elected officials, landscape architects, engineers (local government, consulting and geotechnical) and developers.

Data Collection

Focus Groups

Each of the focus groups was held at donated facilities or before or, for convenience, after a standing meeting. Groups were lead by an NRC facilitator and all groups were audio recorded and later transcribed for analysis purposes. Focus group participants were asked to complete a brief questionnaire prior to the start of the discussion and, during the discussion, were asked to rate the importance of a list of barriers and benefits as they pertain to water protective strategies in land-use planning (see *Appendix B: Questionnaires, Focus Group and Interview Scripts*). Refreshments were provided to each group and a thank you gift was given to each participant.

Four focus groups were scheduled for approximately 90 minutes each and held on the following dates:

- Stormwater managers/engineers: October 22, 2008
- Landscape contractors: November 21, 2008
- Planners: November 21, 2008
- Landscape architects: December 15, 2008

The stormwater managers/engineers group had 11 participants, the landscape contractors group had nine participants, the planners group had 13 participants and the landscape architects group had five participants.

Key Informant Interviews

An NRC Research Associate conducted the phone interviews. All interview comments were entered into a Microsoft® Access database and were digitally audio-recorded for use in data analysis. Stakeholders were encouraged to provide honest feedback and received assurance that their responses would be completely confidential. Prior to the interview, key informants were asked to complete a brief questionnaire where they rated the importance of a list of barriers and benefits as they pertain to water protective strategies in land-use planning, identical to the questionnaire used at each focus group (see *Appendix B: Questionnaires, Focus Group and Interview Scripts*). During the interview, the Research Associate recorded the key informant's responses to the questionnaire on hard copy.

The 21 key informant interviews each took approximately 30 minutes and were conducted from mid-November 2008 through the end of January 2009. Interviews were conducted with four developers, six engineers, eight appointed or elected officials and three landscape architects.

Data Analysis

The focus group transcriptions and the comments from the key informant interviews were analyzed qualitatively. The NRC analyst first read through all responses to identify key statements and general themes. Using QSR N6, a qualitative software package, excerpts of each discussion were organized and coded so that recurrent themes could be further analyzed.

Results from the short focus group questionnaire and the questionnaire of the importance of barriers and benefits were analyzed using the Statistical Package for the Social Sciences (SPSS). The frequencies of responses are presented throughout the report body as well as in *Appendix A: Complete Set of Frequencies from Participant Questionnaires*.

Study Limitations

As with all focus group and key informant interviews, the small sample size and purposeful selection of participants may limit the generalization of these results. They do, however, suggest what specialists in similar fields of studies and occupations might feel and say, despite not being intended to be broadly representative. These focus groups and interviews lend insight into the opinions of key professionals about LID for parking lots.

Using the Report

Themes from the focus groups and interviews are described in the following sections. Participants' views about different parking lot design strategies related to water quality protection are discussed in the first section, followed by perceived barriers and benefits to adopting water protective strategies, and stakeholder's ability, motivation and opportunity to promote these strategies. The final section of the report details participants' messages to AWARE Colorado as they relate to parking lot design and construction as a water protective strategy.

When useful, direct quotes from focus group participants and key informants are included to highlight perspectives. These quotes are indented and italicized, on a blue background.

Study Results

Following are the analyses of the four focus group discussions and 21 interviews with key stakeholder groups. Statements in italics or quotation marks are verbatim quotes. Any words added to enhance reader understanding appear in square brackets. Each quote under a given topic is from a unique individual, unless otherwise specified. Sometimes larger portions of the conversation are excerpted to give the full flavor of the discussion, in which case each participant is numbered to suggest the sequence of comments in the conversation.

Parking Lots as a Water Protective Strategy

Importance of Parking Lot Design

In the first set of questions, participants were asked how important parking lot design and construction were as ways to protect water quality. Most stakeholder groups thought that parking lot design and construction was an important component of water quality protection. The pollutants from automobiles in parking lot runoff were commonly mentioned by study participants:

Developer: I would say very important. Because...the majority of pollutants that affect water quality are probably picked up through runoff off of parking lot surfaces. The land area in a particular development that's dedicated to parking is fairly extensive and is a big contributor to the pollution to water.

Elected/appointed official: Very, very important. Because our downtown area with its parking is exactly adjacent and sometimes above the river and it will runoff into the river and we don't want that. That's a really important part of protecting water resources.

Engineer: These areas are a place where a lot of pollutants are deposited. And if you convey all your runoff there then all these pollutants are going to move back into the water and subsequently offsite and into the receiving waters. I think the design of the parking lot is very important.

Planners: I think it's really important when you think about all the types of chemicals that get exposed or on the pavement, for example, oil dripping on it, gasoline, things coming off tires. Not a lot of people understand when you see a piece of blacktop, what's on that. It can be tremendously toxic... If you have a porous surface in the parking lot, why not just use the built environment to infiltrate all of that.

Differences Among Stakeholder Groups

Landscape architects, elected/appointed officials, engineers and stormwater managers/engineers placed a stronger importance on parking lot strategies as it relates to water quality protection than other groups. Stormwater managers/engineers were the most likely to feel that these strategies were crucial in protecting water quality. In contrast, developers more often felt that parking lot design and construction were not very important in water quality protection. Developers who felt these strategies to be less important often cited the importance of other factors in stormwater management (e.g., quality control measures downstream from parking lots) or felt that a regional approach to protecting water quality would be better.

While a majority of planners and landscape contractors felt that these parking lot strategies were important and might be helpful in protecting water quality, they were concerned about barriers they

would have to overcome in order for these techniques to work such as getting these strategies implemented and the costs associated with installation and maintenance.

Although many deemed parking lot design to be important, a number of participants from different stakeholder groups believed that AWARE's focus on parking lot design and construction was too narrow and that AWARE should focus on the bigger picture – all water protective strategies. (Note: Although, parking lots provided a manageable scope for this focus group/interview research, the results also will be used to address broader related community development activities.)

Landscape architect: All impervious surfaces are very important. I don't know what percentage of the urban environment is taken up by parking lots. They have taken a microcosm of a problem and focused on it. It's a small piece of the puzzle.

Developer: I don't think parking lot design is very important. The regional approach is a much better way of approaching it. I don't believe that pervious pavement functions as well in Colorado as it does in much warmer climates. The ground freezes and moisture freezes and doesn't allow the water to percolate.

Elected/appointed official: I don't know if parking lots are that much of a problem. I haven't heard that it's a problem. I can't remember parking lots ever coming up as a water quality issue... When you put [parking lots] under water quality, it just isn't that big of deal. If there's contaminants in the runoff, there's going to be contaminants in the runoff whether you put them through [a permeable surface] or direct it in a different direction. It doesn't make the contaminant go away. It might help with drainage, or stormwater drainage, it might help with the functionality of the parking lot and it might help with some attenuation but I'm not sure that overall it doesn't have much effect.

Strategies to Reduce Parking Lot Pollutants

To gauge awareness of and perceptions about parking lot design and construction in general, each focus group and interview began by providing participants with a list of four different strategies that could be used in parking lots. These included:

- Using porous/pervious paving materials
- Using landscaping designed to promote infiltration
- Planting trees
- Using landscaping that reduces need for irrigation, fertilizer & pesticides

Participants were asked to assess what, if anything, was missing from the list of parking lot strategies. While some participants felt that the list was comprehensive, a majority of participants added one or more concepts to the list. The most commonly mentioned strategies related to reduction of parking lots size (i.e., parking garages, underground parking, smaller parking lots and smaller parking spaces) and developing multi-use parking sites.

Stormwater manager: Shared parking lots. There are some that aren't used on the weekends, some that aren't used on the weekdays, and you can say those spaces that during the week are dedicated to the Wal-Mart and on the weekend they're dedicated to the church.

Elected/appointed official: Shared uses especially scheduling - a church doesn't need a parking lot if it has a business that's not open on Sunday.

Landscape contractor: Maybe parking structures would be missing. Instead of having a big shopping mall sized parking lot, have it go two, three, four levels as opposed to going out thirty, fifty acres.

Engineer: Often times I see parking lots that are designed a lot bigger than they need to be. Parking lots that are designed for the other 360 some odd days for the year with grass surfaces or some sort of alternative areas where people can park. Underground parking.

Other ideas, some of which could be rolled in to the four main strategies that were mentioned, included green roofs on the buildings at the site, bio-swales, detention or retention ponds, curbs, reusing rainwater and/or runoff for irrigation, filtering islands and gravel or grass parking lots.

Engineer: Rainwater harvesting. That means storing and collecting rain water which then can be used for irrigation or grey water in buildings. There's an issue with that currently in the state for water rights, which as I understand is trying to be overturned.

Landscape architect: I'm not sure how explicitly the list deals with running the water through swales where it might be as simple as grass that catches pollutants in a physical way or taking plants such as irises or cattails plants that absorbs heavy metals.

Elected/appointed official: Cut curbs within the construct of the landscaping. You have landscaping in island and you cut the curbs and make a hole so water runs off the parking lot into the landscaping.

Several participants noted problems that would arise with some of the four parking lot design and construction strategies presented to them.

Landscape architect: Porous pavements are untested and untried and unproven in Colorado and unlikely to work because of freeze thaw cycle.

Developer: Something we're looking at doing in several places are some filtering in islands and what not. We have a storm pipe at a lower position that filters the water that comes off the parking lot and takes water through a landscape area. Can be trees and shrubs but depends as where it is but we think that in Colorado trees and shrubs won't do well.

Landscape contractor 1: Well, with more pervious pavement or materials we have out there, it just increases the flow of the water and makes run out of the site quickly. So, I mean, we had more porous materials to work with our snow removal around here it could be something to look at. So, coming up with a solution is a big thing.

Facilitator: And why does that create more problems with snow removal?

Landscape contractor 1: It's bumpy, usually. Most of the porous stuff...a lot of them are a changing material and we have our blades down, it's not good. You can't plow it, so it causes some issues.

Landscape contractor 2: They are not plowable surfaces, generally.

Differences Among Stakeholder Groups

Most participants in each of the seven stakeholder groups offered ideas related to parking lot design and water protective strategies. Elected/appointed officials came up with the widest array of strategies and planners offered the fewest ideas. Using bioswales was mentioned most frequently by landscape architects.

Barriers

An important component of this study was to gauge the barriers to adopting LID parking lot design features. To augment the qualitative data from the focus groups and interviews, participants were given a questionnaire to assess the importance of 13 barriers to the adoption of water protective strategies. Stakeholders were asked to rate the importance of each barrier in keeping people from adopting these types of strategies in land-use planning. In the following discussions, participants were asked a series of open-ended, follow-up questions about the most important barriers to them and to their community, what they could do to overcome the barriers and if others needed to be involved in overcoming the barriers. The table below shows the percent and number of participants from each stakeholder group.

Table 1: Stakeholder Groups

Group	Percent of respondents	Count
Stormwater managers/engineers	19%	N = 11
Landscape contractors	15%	N = 9
Planners	22%	N = 13
Landscape architects	14%	N = 8
Developers	7%	N = 4
Engineers	10%	N = 6
Elected/appointed officials	14%	N = 8
Total	100%	N = 59

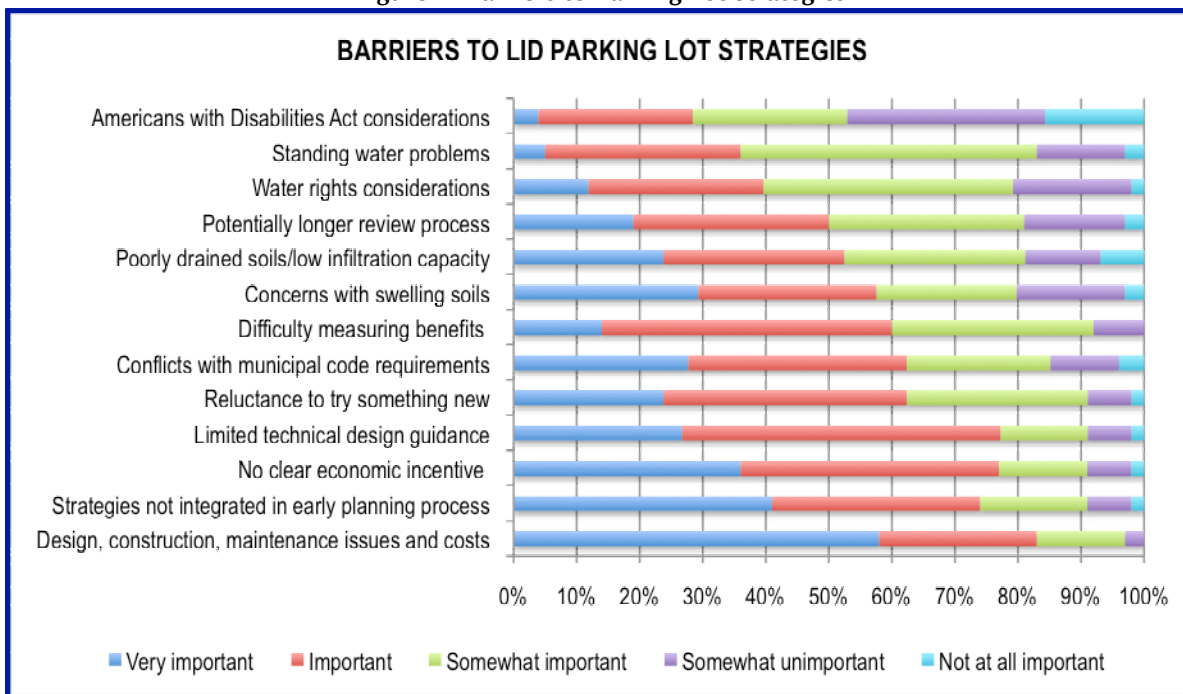
Questionnaire Responses

When responding to the questionnaire, a majority of stakeholders felt that most (11/13) barriers were important. The three most important barriers to participants were: 1) design, construction, maintenance issues and costs, 2) strategies not integrated early in the planning process and 3) no clear economic incentive. Barriers considered to be of less importance by stakeholders were standing water problems and Americans with Disabilities Act considerations. (See *Appendix A: Complete Set of Frequencies from Participant Questionnaires* for more information.)

Table 2: Barriers to Parking Lot Strategies

From your perspective, how important or unimportant are each of these barriers in keeping people from adopting water-protective strategies in land-use planning?	Very important	Important	Somewhat important	Somewhat unimportant	Not at all important	Total
Design, construction, maintenance issues and costs	58%	25%	14%	3%	0%	100%
Strategies not integrated in early planning process	41%	33%	17%	7%	2%	100%
No clear economic incentive	36%	41%	14%	7%	2%	100%
Concerns with swelling soils	29%	28%	22%	17%	3%	100%
Conflicts with municipal code requirements	28%	35%	23%	11%	4%	100%
Limited technical design guidance	27%	51%	14%	7%	2%	100%
Reluctance to try something new	24%	39%	29%	7%	2%	100%
Poorly drained soils/low infiltration capacity	24%	29%	29%	12%	7%	100%
Potentially longer review process	19%	31%	31%	16%	3%	100%
Difficulty measuring benefits	14%	46%	32%	8%	0%	100%
Water rights considerations	12%	28%	40%	19%	2%	100%
Standing water problems	5%	31%	47%	14%	3%	100%
Americans with Disabilities Act considerations	4%	25%	25%	32%	16%	100%

Figure 1: Barriers to Parking Lot Strategies



Differences Among Stakeholder Groups

Differences in ratings of the importance of the barriers by stakeholder group were examined (see the following table). Most groups thought that limited technical design guidance was an important barrier to implementing these strategies, except elected/appointed officials. Design, construction, maintenance issues and costs and strategies not integrated in the early planning process were in the top three or four barriers for a majority of stakeholder groups. Overall, fewer groups were concerned about Americans with Disabilities Act considerations, standing water problems and issues with soils. In addition, the following differences in opinion were reported:

- Stormwater managers/engineers felt that concerns with swelling soils and poorly drained soils were more important than did stakeholders overall.
- Landscape contractors reported that standing water problems and Americans with Disabilities Act considerations were more important than did stakeholders overall.
- Poorly drained soils/low infiltration capacity and water rights considerations were thought of as less important by planners than stakeholders overall.
- Landscape architects noted that water rights considerations and Americans with Disabilities Act considerations were more important than did stakeholders overall.
- Developers reported economic incentives or difficulty measuring benefits as less important when compared to stakeholders overall.
- When compared to stakeholders overall, all engineers felt that design, construction, maintenance issues and costs were important.
- In general, elected/appointed officials felt that each of the barriers was less important than did stakeholders overall.

Table 3: Barriers by Stakeholder Group

From your perspective, how important or unimportant are each of these barriers in keeping people from adopting water-protective strategies in land-use planning?	Stormwater managers/engineers	Landscapers/contractors	Planners	Landscapers/architects	Developers	Engineers	Elected/appointed officials	Stakeholder Groups Overall
Design, construction, maintenance issues and costs	82%	78%	100%	88%	100%	100%	38%	83%
Limited technical design guidance	91%	89%	77%	88%	75%	83%	38%	78%
No clear economic incentive	82%	78%	92%	88%	0%	80%	75%	77%
Strategies not integrated in early planning process	91%	89%	62%	50%	100%	80%	63%	74%
Reluctance to try something new	73%	89%	69%	50%	50%	67%	25%	63%
Conflicts with municipal code requirements	55%	78%	54%	88%	75%	80%	29%	63%
Difficulty measuring benefits	55%	78%	77%	63%	0%	83%	25%	60%
Concerns with swelling soils	91%	50%	46%	63%	50%	67%	25%	57%
Poorly drained soils/low infiltration capacity	82%	56%	38%	63%	50%	50%	25%	53%
Potentially longer review process	27%	56%	62%	38%	100%	60%	38%	50%
Water rights considerations	36%	44%	23%	88%	25%	20%	38%	40%
Standing water problems	45%	50%	31%	13%	25%	50%	38%	36%
Americans with Disabilities Act considerations	45%	56%	8%	43%	0%	20%	13%	29%

**Percent "very important" or "important"*

A few participants said they had difficulty rating the importance of the barriers as they believed they were not necessarily barriers or that most could easily be overcome.

Elected/appointed official: Most of the stuff that's in there is a question of design and engineering, and not necessarily more expensive, it's just changing the way we do it. That's why I don't think many of these are important because they're easily fixed.

Elected/appointed official: I couch this in my experience...but a lot of these things I feel they're issues that need to be addressed but there are engineering solutions that cause them to be less of a concern.

Discussions and Interviews

The biggest barriers mentioned by participants during the discussions coincided, for the most part, with their responses to the questionnaire of importance. These included design and construction issues, maintenance issues, costs and inertia.

Design, Construction, Maintenance Issues and Costs

When discussing the most important barriers, participants most frequently brought up the design, construction, maintenance issues and costs. These barriers were often attributed to an information void on local successful practices, a lack of specialists in low-impact development (LID) approaches to parking lot design and the lack of innovative strategies available to engineers, planners and builders.

Design and Construction Issues

Although most of the study participants were familiar with a number of the parking lot strategies, there was significant discussion about the successes of the various methods in Colorado. Issues of climate and geology often arose as reasons why design practices in other areas of the country were less compelling.

Stormwater manager/engineer: I would say the technical design guidance, instructions and maintenance issues, and soils issues.

Landscape architect: Well, I think limited technical guidance for me because I work by myself. It's kind of a new technology and I think you need to be part of team/group to figure all that stuff out. So, you know, I think that it's a great thing but, liability-wise, you just need a little more expertise to be able to do it.

Developer: Poorly drained soils/low infiltration capacity - if you have soils that poorly drain and have low infiltration capacity a lot of the low impact designs don't work very well and especially something in the Front Range you have to be careful of. And that kind of leads into the concerns with swelling soils. You have to make sure that soils are appropriate when you're doing infiltration.

Engineer: As a designer, poorly drained soils and concerns with swelling soils. Infiltration is excellent but if underlying soils can't handle it then it's not the solution for the site.

Elected/appointed official: I think Colorado in general has expansive soils so that often times enters into the debate.

Engineer 2: The two most important things on this whole topic are [poorly drained soils and swelling soils], and that's from our perspective. There are a lot of low permeability, expansive soils along the Front Range. And this becomes an issue for us, this promotion of infiltration, in the interest of improving water quality, when we see the approach being at odds with other geotechnical factors.

A number of stakeholders, particularly developers, mentioned that there are not enough consultants with a specialty in innovative stormwater management or parking lot strategies to provide the design and leadership to move these projects through the review process.

Developer: The design, construction, maintenance issues... There's a limited number of contractors that have done that, especially when you get in to porous pavement and other types of low impact development. So finding those contractors that are able to do that can be difficult and if you don't get right contractor you usually end up having maintenance issues and cost issues.

Developer: I think finding an engineer that's capable of doing the work and being up front with it; someone who knows what's going on. That's probably the largest barrier.

Maintenance Issues

Related to the data void, many participants focused on the potential maintenance issues of the LID strategies. While some argued maintenance would be simplified and less expensive than traditional methods of stormwater control, others argued that costs would be amplified. Discussions over the responsibility of maintenance arose in a number of groups.

Developer: It's important to us that we create something that, over the long-term, that's cost effective and have minimum maintenance requirements and that retains its high quality. So that's something that we're always looking at as we approach our projects; it's a very important feature to us.

Developer: The one thing that I guess, at the risk of getting specific, with this porous pavement option there are a couple concerns related to the freeze-thaw cycle and to the maintenance of those types of pavements. With water getting down inside the porous pavement and freezing and creating a maintenance issue and then with the way we use sand in the winter time with ice and that sand can get into the porous pavement and plug it up.

Planner: And long-term maintenance. How well it works. We have examples now. We have a new design, new ideas and then two years it's been scraped and old-fashioned design detention is constructed because it doesn't work.

Planner: So, the thing that I've also seen is that engineers might step out and require the private developers or allow the private developers to do some of these things. But, the quote I have is "They can do it on private property but we're not going to do it in the public right away." And the reason given was the maintenance concerns that the city will have long-term maintenance responsibilities for these things.

Stormwater manager/engineer: That's his big worry is long-term operation costs and whether that HOA (Homeowners Association) is going to be viable enough to do that themselves because when you think about it HOAs are not set up to be in the stormwater management business and if they default, it's ours. And what those costs are going to be to maintain those, we don't know yet. But I think it's not going to be cheap.

Costs

The costs of providing LID as it relates to parking lots was a central topic of conversation in all stakeholder groups. The costs upfront (e.g., increased landscaping, new materials and added review time) as well as the long-term maintenance costs were all felt to be important issues for developers, builders and whoever would be in charge of the long-term maintenance.

Elected/appointed official: There's a cost issue that always comes up and then it's hard to quantify what the benefits are. It's hard to put dollar signs to "if you do this then you generate this amount of benefit and this amount of revenue."

Elected/appointed official: From the developers standpoint they don't want to do anything that costs more money.

Elected/appointed official: No clear economic incentive. Developers don't want to make the added investment because the return doesn't go directly to them it goes to the larger community.

Engineer: For owners, cost is very important. If they can be convinced that they're actually saving money or there's no additional cost and it won't slow down their approval process, then they're more open to it, than if there's higher design costs, higher construction costs and a longer review period.

Planner: You've got design construction and maintenance issues and costs. I think if you cut everything up to costs and you'll be fine. Costs alone is not listed on the list, yet, it's probably the biggest barrier to doing something new, doing something innovative.

Landscape architect: I mean I think from a developer's standpoint the cost is probably the bottom line and that means anything they perceive as risky, they're not likely to go there. The more complicated it is, the more likely they are to say no and you go back to what they're comfortable with.

However, there was considerable discussion of potential cost reductions from the use of LID parking lot strategies. A sense of uncertainty about the costs of implementing LID methods was apparent in many of the stakeholder group discussions. As with the design and construction issues, a need for more information on project costs was mentioned frequently by study participants.

Inertia and Reluctance

Another important barrier emerging from discussions with stakeholders was the inherent inertia in the organizational processes and, thus, a reluctance to try something new. Government is not known for taking risks, and barriers such as the unknown costs of installation and long-term maintenance, lack of specialized design knowledge, conflicts with current code requirements, soil and infiltration concerns, as well as potential delays in review processes all increase the probability of inaction.

Reluctance to Try Something New

Reluctance to try something new was discussed in all stakeholder group discussions and thought to be a barrier to most local governments, engineers and planners.

Elected/appointed official: Primarily, the biggest barrier we see with any sustainability initiative is being that it's contrary to what we do and it's relatively new and it's hard to find data that supports it from an economic stand point.

Planner: And I think if you just have one project in your community that fails, you're dead in the water. You know, it's very easy to go back to the old tried and true.

Landscape architect: I think the reluctance to try something new. It's just hard for people to think outside the box. I mean [these strategies] are different from what they're used to doing.

Stormwater manager/engineer: We always have issues with people being reluctant to try something new.

A majority of the stakeholder groups said that reluctance was a huge barrier, particularly for developers, builders, engineers and elected/appointed officials. They noted that these groups tended to stick with what was proven and tested and did not want to be the “guinea pigs” for something new and untested in Colorado. Many participants believed there was a need for real-life examples.

Landscape contractor: It goes back to reluctance in trying something new and trying to get them to get into that and it's difficult to even measure the benefits. If you can't show developers something tangible, where it's worked, forget it.

Engineer: I would say reluctance to try something new is an issue with some of our department here because, when you deal with a bureaucracy, we have a tendency to do what's been tried and true for a long time. And cities, by nature, tend to be more conservative because they're dealing with public dollars. It's very hard for them to go out on limb because if something fails it'll make them look bad. And they don't want to look bad.

Planner: We act a little bit as a developer, not just a government, because we're out putting in parking lots ourselves in open space parks and one of the things that I'm finding is what a couple of you have said, there's not great examples out there. It's tough for us to put our neck out, no different than the developer...we are trying a couple of projects but it's very much scrutinized and if they fail it's going to be a big deal.

Developer: I think it's just locating or identifying other projects or other regions or other municipalities in the region or in the country where techniques are being used successfully. And having those available to show to other developers and municipalities to show them that it is working elsewhere or that it's been tried. Or a version has been tried and here's the results. They don't want to be the guinea pigs necessarily; they'll be reluctant. This is something similar where you're out in uncharted territory and your local governments and citizens will have reluctance and the more you can show other parts of the country where something has been used successfully the easier it will get it to be palatable to all the stakeholders locally.

Longer Review Process

This reluctance to try something was evident in the comments of developers who believed any change to the current development process would lead to longer review times. Anticipated delays in the review process were believed a significant economic disincentive to builders and developers.

Developer: We spend a lot of effort ensuring that we do everything we can to have an expedited review process with our projects. And that is, to a large extent, for economic development reasons. We need to be poised to move quickly when we have economic development opportunity. A key part of that is having a short expedited review and any items that can potentially prolong that review process are certainly a concern for us.

Developer: A longer review process is what happens when you start integrating something new or new technically and how does that affect the review process. My experience is that anything new will take much longer. And in many cases you need to move much quicker than I perceive a lot of governments to be moving right now.

Elected/appointed official: Potential longer review process - this costs developers money and anything that costs them money is a big concern.

Integration in Early Planning Process

Many of the stakeholders included in this study were involved later in the planning process for a number of projects. A theme that arose frequently among study participants was that these water protection strategies needed to be discussed early on in the planning process or else there would be little chance to implement them down the road. Some also felt that if these strategies were discussed and resolved early on, that some of the other barriers could be addressed at that discussion.

Developer: For my project, we've integrated those strategies early in process and that's helped us quite a bit. Because we've had conversation with the city early on, we've been able to work through a lot of the issues during the planning process so we're not trying to make our site fit into a good water quality development, we actually went through and designed it to be a good water quality development.

Elected/appointed official: Strategies not integrated early in planning process. If there isn't more comprehensive strategy for implementing these than each project that comes in individually becomes highly constrained in their options.

Engineer: Because sometimes what I find is that people that want to do these new techniques, they try to shoehorn them into the site at the end of the process rather than try to think of them early. If you don't think about these early in the process, down the road you don't have room set aside for it, and it would be hard to retro-fit it back in... It has to be early on in the process so they bring in the right technical expertise.

Engineer: It certainly is easier if we integrate these ideas early in our planning process. It's easier to have an open discussion and to address conflicts with municipal code and we may be able to overcome reluctance to try something new between the developer/designer. We'll have more time to address technical design guidance issues, construction, maintenance issues and costs, economic incentives.

Landscape contractor: Strategies not integrated into the early planning process because once it's in it's a heck of a lot harder to fix it than to try to implement something before you install.

Other Barriers

A number of participants mentioned other barriers such as a public lack of awareness of water quality importance, conflicts with municipal code requirements, water rights and lack of unique solutions.

Lack of Awareness

Although nearly all of the stakeholders in this study were aware of the stormwater mitigation issues, a number talked about ignorance or lack of knowledge as a barrier to the general public, citing that people were not informed of the issue of stormwater as it related to water quality.

Landscape architect: If people don't have the know how, they don't know how to do it. Ignorance is the biggest problem we face.

Landscape contractor: If I mentioned to the clients they have no idea what I'm talking about, regardless of cost. They're just not even aware that it's an issue or a problem. I'm talking about developers and builders. So, we're starting from ground zero when we start talking about it. They

don't have any idea if it's more expensive, not expensive, why they're required to do it. So, it's an education process.

Stormwater manager/engineer: Public acceptance. I'm talking about the common homeowner. I mean, we're talking about low impact development and possibly eliminating curb and gutter and having a pavement drain into a road side ditch or something like that. And that seems to be something that people like, is the curb and gutter, to get the water off of their site as soon as possible. They don't want standing water in a ditch; they don't want any mosquito areas and things like that. So, also a lot of people think it looks neater that way.

Conflicts with Municipal Code Requirements

Many participants, particularly landscape architects, felt that there were conflicts with municipal code requirements when trying to implement these design strategies. They noted that this was a struggle in nearly all jurisdictions and that, in order for engineers and planners to implement these strategies, codes and regulations had to change.

Landscape architect: Conflicts with municipal code requirements. They're the gatekeepers. That's the easiest place to insert a chip in the wheel by getting codes that allow different sorts of infiltration opportunities.

Landscape architect: Only because municipal code requirements, at least in this area, they tend to follow or frankly defer to the Urban Drainage [Urban Drainage & Flood Control District] and storm water standards. So with Urban Drainage, typically most municipalities don't want to take on burden of having to guarantee or take on the liability of doing something individually so they defer to those standards. It's really those standards, I think in stormwater, that are the primary barrier because that is the standard that people use so local municipal codes tend to defer to that. So yeah, without that not much else changes.

Landscape architect: That's back to conflicts with municipal code. In my view, the municipal code is just the container, if you will. Municipal codes are typically written and people refer to other professional standards. So for stormwater best practices, they're going to be driven by what's happening with Urban Drainage's standards. A lot of these barriers fit into the municipal code but there's a lot of things that shape municipal code that aren't in the control of the municipal government. They're having to adopt professional standards from other different other organizations. There are several different professional standards groups that come to bear on parking lots.

Planner: One that I focused on was conflicts with municipal code requirements... There's a conflict saying that "you can't do this, you can't do that," but there really isn't anything written, in our code at least, that says, "Hey, we'd like to explore these types of options." And I guess that other than our comp plan where it says kind of in flowery language, "Hey, we'd like to do this at some point." It hasn't made its way into the enforceable code and that really needs to come from above, there needs to be a mandate to make it happen to where we can look at the code and say, "Hey, you gotta do this."

Water Rights

Several stakeholders felt that perceived water rights considerations were a problem in thinking about these strategies. Landscape architects focused more on water rights than other stakeholder groups.

Developer: Water rights considerations. Colorado has lot of water rights issues that limit things we can do and there are questions out there about if some of this stuff violates water rights. It's a little bit difficult because every time we do something a little bit different, we end up talking to our water rights lawyers to make sure we're okay so that makes it a little bit more costly than doing a normal design.

Landscape architect: The term we run into a lot, I assume, is called beneficial use and if we show there's a beneficial use of our landscape design or of the development or of the property for that water and it's not collected and conducted downstream, then we are in violation of water rights, senior water rights typically. So, that comes right down to something as simple as planting a cottonwood swales as opposed to something that would be a little more drought tolerant and not use as much water. The argument can made that that tree is using a lot more water than it should be and therefore those water rights are not passing through to the intended user. So, it's interesting.

Landscape architect: Some of the water harvesting you're talking about needs to be a collaborative effort between a number of property owners, maybe a number of jurisdictions. Really I think having somebody pushing it at the statewide level to promote more planning for the way these communities are going to grow and deal with storm water management because as it stands right now we're just looking at it on an individual basis. I mean there's a real opportunity to create basins where all this water can run into.

Lack of Unique Solutions

Some participants felt that there was not a “one size fits all” approach and that, because the geology and climate of Colorado is different across the state and than other areas of the country, there is not one answer or solution that will fit all sites.

Engineer: Too much of people looking for a silver bullet and too little of appropriate watershed scale planning. Parking lot design is very important but it has to be in the context. You're not going to come up with the perfect parking lot design in every situation.

Engineer: I've worked with a number of states where they're trying to mandate infiltration across the state and it doesn't work on every site. They need to have a bunch of tools in the toolbox that people can choose from and not just mandate one solution.

Planner: It's not a one size fits all. What works in one site isn't going to work in another. So, soil conditions, I mean everything. Just the right regulations for it, isn't quite as simple as building heights or anything else.

Stormwater manager/engineer: You can't make everybody happy all the time. People have different tastes, different needs and wants and it's a whole diversification. So, LID isn't for everybody.

Differences Among Stakeholder Groups

All stakeholder groups believed that design and construction; maintenance issues; costs and strategies integrated in the early planning process were important barriers, which was mirrored in the questionnaire results. Reluctance to try something new was thought of as an important barrier to

implementing water protective strategies by most stakeholder groups. As shown in the questionnaire results, developers were less likely to think of reluctance as an issue and more likely to feel that a longer review process was a barrier. Landscape architects and engineers mentioned concerns with soils were a barrier more so than the other stakeholder groups. Landscape architects tended to focus more on water rights considerations as a barrier than other groups, which ties back into the questionnaire results.

Differences by Community

Study participants were asked if there were any barriers that were a special concern to their community. Although there were not many differences between communities when discussing barriers, two themes were revealed: issues with soil types and the politics of the local jurisdictions. Most of the communities participants served have various types of soil that play a large role in whether or not these types of parking lot strategies will be effective.

Developer: The last two [on the list - poorly drained soils/low infiltration capacity and concerns with swelling soils] as well because of our soil profiles up here in our region.

Engineer: In Colorado in general the swelling soils are a concern.

Planner: Most of the soils... are clay shifting soils. So, there's certain parts of the city where they have that nice sandy soil. But, we've run into a lot of problems with some of our developments where infrastructure, roads crack, there's heaving, there's not a lot of fly ash or lime treatment so they're done. But when you get into this pervious type solution it's becomes difficult when you've got those clay soils. And so I think that's one of our biggest barriers.

Stormwater manager/engineer: I think the poorly grade soil and the infiltration capacity is a big issue for us.

One participant reflected that he would have an easier time overcoming the soil issues:

Planner: Well, in terms of the soils. We've got great free-draining soils. So, that should be an advantage for us. I don't think that there is anything unique to our location and environment that would make it more difficult and in fact, maybe it would be easier to do.

Other stakeholders noted the politics of the local jurisdiction (i.e., reluctance, code requirements, the review process, personal preferences) determine if these strategies can be implemented.

Landscape architect: Some of the financial, design, construction, maintenance issues and costs; those are important but those are driven by if [these strategies are] approved [in] codes or [are common] practice.

Developer: The biggest barrier is the review process and how long it takes. The community we're building in now we have good relationship with the agencies from the technical stand point it's just getting it reviewed and processed. Having to wait several years from the start to the end is too long and that is typical.

Engineer: A lot of people in municipal jobs they don't want to lose their jobs and they don't want to try something new and whatever's been done before is tried and true and is the safe route to take. So whenever you try to push them outside of that safe envelope they're uncomfortable...they're not willing to fail. They don't see that you learn from failure.

Landscape architect: It depends on who's running show and the political views and ideas.

Stormwater manager/engineer: I think the biggest one for us is a reluctance to try something [from] our Planning Department and our engineers. They kind of get stuck in the "well, let somebody else try it first" deal. And they don't seem to [communicate with each other] either.

Ways to Overcome Barriers

Study participants were asked, in their role, what they could do to overcome the barriers mentioned. Most participants felt that more education was needed about the different barriers that show ways to overcome them. Some stakeholders said that instating regulations or changing codes would be a way to overcome some of the barriers that were discussed. Some participants felt incentives were a good idea and offered suggestions on types of incentives, but others did not know what the incentives would look like.

Education

Overall, education was mentioned most often as a way to overcome these barriers. Educating all stakeholder groups was felt to be very important in getting these strategies implemented. Stakeholder groups most often mentioned as needing education were elected/appointed officials and local jurisdictions, the general public, design professionals, engineers and developers.

Landscape architect: I give talks to the Green Building Council in rethinking water as the element of life. The key to that is having people understand and fall in love with what water is, the role it plays, so that they're more willing to protect it and spend more money on it. See its significance in the larger picture of things. The more we know about something the more likely we are to appreciate it and take care of it. Educating people not just to the technologies but the meaning and purpose of standing up for and advocating for water...education is huge.

Developer: Education I think would probably be the most important and that could be pretty broad reaching. Design professionals and people actually engaged in the design and construction of water quality features but also the public so they could be made more aware of the things that they do that impact water quality.

Elected/appointed official: There's a lot of dialogue and that comes in the education. Business owners, developers, town board. We just need to educate our citizenry.

Elected/appointed official: We could do [education] but I'm not sure how impactful that is. When it comes down to developers, they're really looking at what the bottom line is and they're going to design it the way their clients want them to. They're really not too responsive to being educated by the government. Maybe trade might be better, home builders associations, would have more impact than a governmental agency would.

Engineer: I think the best thing I can do is education to bring in the right experts. And the other thing I can do is to I can try them out in a safe environment that even if they fail it's not catastrophic and we can demonstrate the effectiveness.

Engineer: We can help educate the other engineers as to what type of site conditions are receptive to these kinds of water quality approaches. Sometimes it's a foregone conclusion that they're going to implement a strategy regarding infiltration before they know what they subsurface conditions are. Education in what kinds of conditions are good candidate sites.

Stormwater manager/engineer: It's not just educating, it's educating everybody. It's not just the engineers and the planners on the Land Development side...the developers and the design engineers that work for those developers.

A number of participants said that they could be an advocate of these LID parking lot strategies. They felt they could push the importance of these strategies to their peers and clients but that advocating was not enough to get these strategies implemented.

Landscape architect: I think what we can do, I'm not a direct practitioner, is work with AWARE and variety of other non-profits to solidify the place for change. And by change I mean being able to articulate what some of these other barriers in code and put together an initiative to revisit some of those.

Planner: I think one thing planners do well is they are able to have the public policy discussions at the front end [of the] process or some other form of public involvement where you can begin to get public support for some of the green technologies and the more you get the support for it then you can begin building them into your codes.

Engineer: I think we can help owners select BMPs (best management practices) or practices that make sense for their site. We've had experience implementing and we've seen some of the real challenges involved with some of the techniques. As long as we were convinced that they make sense or if we thought they match owners objectives for the site then we'd promote them. We would make them aware of pitfalls from other projects.

Education through successful, real-life examples was also mentioned by most stakeholders. They considered most people to be reluctant to try these strategies because they had not been tested in Colorado. Participants were interested in successful examples where all stakeholders could go and physically see how these parking lot strategies work and that have data showing their environmental and financial benefits.

Elected/appointed official: Primarily, the biggest barrier we see with any sustainability initiative is being that it's contrary to what we do and it's relatively new and it's hard to find data that supports it from an economic stand point

Planner: I would like to add that data is the real barrier to this. We had some proven examples, proven data that people could turn to and say, "This is how it will work and we know this going to happen." I think people, including engineers, will feel more comfortable signing off on something like this.

Developer: Education is good, especially if presented with real projects that have been successfully completed in the local area. It's hard to take techniques that have been adopted in warmer climates.

Planner: I think the other thing we could do, this was an educational piece that was brought up earlier, all of us have public facilities. We're all developers, maybe the planners aren't but the public works are, the road and bridge, your parks department. So, we could all be putting in parking lots in areas that make sense, doing the site specific additions and allow ourselves to be a pilot project. We can partner with Urban Drainage. I mean there's lots of ways that we can minimize our risks to do that.

Stormwater manager/engineer: There's no confidence in the technology and the techniques... To some extent if it's not documented. But, especially in the engineering side because it doesn't have a proven track record and then we'll end building both systems, side by side, one as a backup for when the water quality system fails.

A couple of participants noted that education should start with the schooling of engineering students and include curriculum on stormwater management practices.

Landscape architect: Engineers follow standards and when colleges begin to teach a different form of water runoff then engineers begin to listen.

Stormwater manager/engineer: We have a lot of engineering schools out here...up there at CSU (Colorado State University). We're hiring interns there from them and they have very little knowledge of stormwater. They know how to do bridges. They know how to do the structural part of it and we hire these stormwater people and they know about hydraulics, in terms of water coming through maybe the river and dams... But, when it comes to stormwater quality there's very little thought involve... So, to me, if that was emphasized more in our schools or something available to them then they would learn that very early on and then move on from there. But, they're taught the same ol', same ol' right from the beginning... And if you start throwing curve balls to them, it just throws them completely off. I think that's part of the problem as well.

Regulations

A number of study participants suggested that changing regulations, legislation and municipal codes so that it would be easier to implement these types of designs is something that should be considered. Some noted developing a best practices manual, which other participants pointed out is currently being created by Urban Drainage and Flood Control District called Volume III. Elected/appointed officials and planners were more supportive of regulations, overall.

Landscape architect: [As an architect] there's very little I can do because the way that current construction and design that puts you at the very end of the realm. As a land planner there's much more that I can accomplish. As a land planner, I can reduce pavement. Work to reduce or eliminate curb and gutter and underground piping. Work legislatively to do away with over lot grading.

Developer: Regulations would help quite a bit. If there's some regulations in place that you have to meet that's going to help with municipalities.

Developer: On the regulation side, the government agency adopting regulations need to work with the development community when researching so they get a buy in rather than adopting without discussing with development community.

Elected/appointed official: Look at it from a regulatory stand point and a design stand point...our land use codes is probably the biggest thing. Depends on the issue, whether it's changing the codes or enforcing them more. There really isn't one answer that would solve all these.

Elected/appointed official: Encourage adoption of municipal codes and regulations to require integrating these strategies into project designs. And second reviewing projects for compliance.

Elected/appointed official: Well, you can put it into best practices so that the city and staff can say here's our best practices manual for your design criteria for this development, for this parking lot.

Landscape contractor: There's a requirement. You have to have x percent pervious pavement. Period. Boom. That's how things get changed.

Planner: The communities have to really clearly define their process and review procedure and make sure the developers know right from the beginning what those requirements are and can show them examples of how to meet that requirement is what it takes to do that because otherwise they're kind of at a loss.

Planner 1: I think my experience is that we [need to] have more flexibility in our code. What kind of flexibility? It's a clear requirement for the developer but flexibility in our municipality to manage what is exactly important, how we can have it. But, right now what I see are these requirements that we cannot overcome because it's in our code... So, having a more flexible code will be helpful.

Planner 2: So sort of a menu of options to be applied depending on the context.

Planner 1: Maybe just something the director may kind of override, give flexibility to local municipalities, to have that ability to change.

While a majority of stakeholders felt that regulations were a good idea, some believed developing regulations around water protective strategies could be counterproductive and limiting.

Developer: I'm always a little leery of [regulations/changing codes or standards] because once they develop a code it becomes less flexible and not always is the code ever written to accommodate every situation. For me a code would be almost more like a goal to find ways and work together to find ways to increase water quality that is beneficial to all parties concerned...you may not be doing the best thing but just complying with code and I think that's always a mistake.

Engineer: I don't know if regulations are a good approach unless they were to require evaluation by appropriate engineers on a case by case basis.

Incentives

Some stakeholders felt the use of incentives would be critical to encourage developers or those putting up the money for these types of projects.

Developer: Incentives is kind of a tough one. It would definitely help, especially if there was potential to incentivize test cases where you could have a project go out there and build a project that was a little different. And maybe the incentive doesn't come in so much of a cash to the developer but maybe the incentive comes from having money set aside for Urban Drainage or someone else go out there and monitor what's been done so it can actually create an opportunity for education and other things. But I think it would help but I think it's the least important of the three.

Elected/appointed official: I prefer incentives to regulation. I'm a small business owner and I believed that if people are encouraged to head in the right direction and you encourage folks' sense of ethics and morals to take hold, that regulation become less necessary. That being said, I think there's a tendency for people to hang onto the way they've been doing business for the last 20 years because they know how to do it and they know it works. At some level, some amount of mandate or government regulation forces folks or helps them to get over that hurdle.

Elected/appointed official: Incentives are always good because it gets people to do things if they think there's something in it for them. And I've not really seen incentives used much to get

developers to do things. More you see regulations being used to get them to do things. Regulation requires it.

Landscape architect: Financial incentives. And if you have a client who's trying to get a LEED (Leadership in Energy and Environmental Design) certified building, this is one way you can get some points with that client.

Engineer: Incentives can help or at least assurances that say a local jurisdiction is open and encourages these things and it won't slow down the review process are important to give some confidence to owners that want to try these things.

Planner: I also like what you said earlier about incentives. I think we could really look at a lot of incentives...all you have to do is give an incentive and it could be an individual homeowner, it could be an apartment complex, it could be anything - grow it from there.

Greater Collaboration

Most participants believed that other stakeholders needed to be involved and that getting these strategies implemented had to be a collaborative effort among all groups. Some also mentioned the need for finding people who know how to design, install and maintain these strategies and who are familiar with the techniques.

Landscape architect: There is a loop that consists of engineers, public works directors, developers, planners and each of those are dependent on a system that exists and until public works directors say you can use new strategies in their city, nothing will change.

Developer: One of the things we do with our company is we look for consultants that are innovative and kind of leading edge. And so by doing that we are going to hopefully find the best and brightest. Find those consultants naturally that will be able to come up with those solutions that achieve the goal. The thing we can't think we're a large development company and we can throw a lot of money at it because we have to stay competitive with our peers locally and beyond and part of being competitive is being wise with the use of your money and funds.

Developer: Consultants in the design process. We also need to have municipalities that are flexible with their design standards because there are clearly going to need to be some design standards gets at the conflict with municipal code requirements. We need municipalities that are willing to step outside the box and consider deviations from their standards and often times what we have is we have our consultants needing to work closely with municipality to convince them that this is not going to be a harmful situation to them if they allow this new and innovative idea to occur.

Elected/appointed official: You start with the community and your planning and development staff of the municipalities. And everybody has to have a stormwater permit so the stormwater person for the local government entity has to be on board. And then there has to be education for developers.

Elected/appointed official: It's definitely a team effort. You need to have the design community that's aware of the problems and solutions. You have to have jurisdiction staff - engineering, planning, building - who needs to be aware. And the owners of the property and developers need to understand what the ideas are. People all need to come to table with a sense of cooperation. We're all trying to work together to creatively solve a problem and allow everybody to win. I think the community needs to be involved too.

Differences Among Stakeholder Groups

Nearly all stakeholder groups agreed that education in one form or another for all stakeholders needs to happen to overcome these barriers. A majority of the groups felt that using proven examples as a tool for education and for creating a change in mindset about these strategies is extremely important. They believed that showing that the benefits actually exist would be helpful in overcoming the barriers. Most groups also mentioned changing codes or regulations as a way to overcome barriers. Making codes more flexible and knowing that each site is different was important. Incentives were less commonly thought of as a way to overcome barriers, although they were mentioned by at least one participant in most groups. A number of participants felt that developers or builders would have the most to benefit from incentives.

In general, landscape contractors and landscape architects noted that there was very little they could do to overcome the barriers to implementing water protective strategies other than advocating to their clients. They noted that they are not involved until the end of the process and that, by the time they are at the table, the plans are set and they are expected to implement them.

Benefits

As with the list of 13 barriers, each study participant was given a list of 11 benefits to adopting water protective strategies and asked to rate the importance of each in encouraging people to adopt these types of strategies. Participants were then asked a series of open-ended, follow-up questions about the most important benefits to them and to their community, what they could do to bringing about the benefits, if others needed to be involved and the best ways to communicate the benefits to others. (Please refer to *Table 1: Stakeholder Groups* on page 12 for the number of participants in each stakeholder group.)

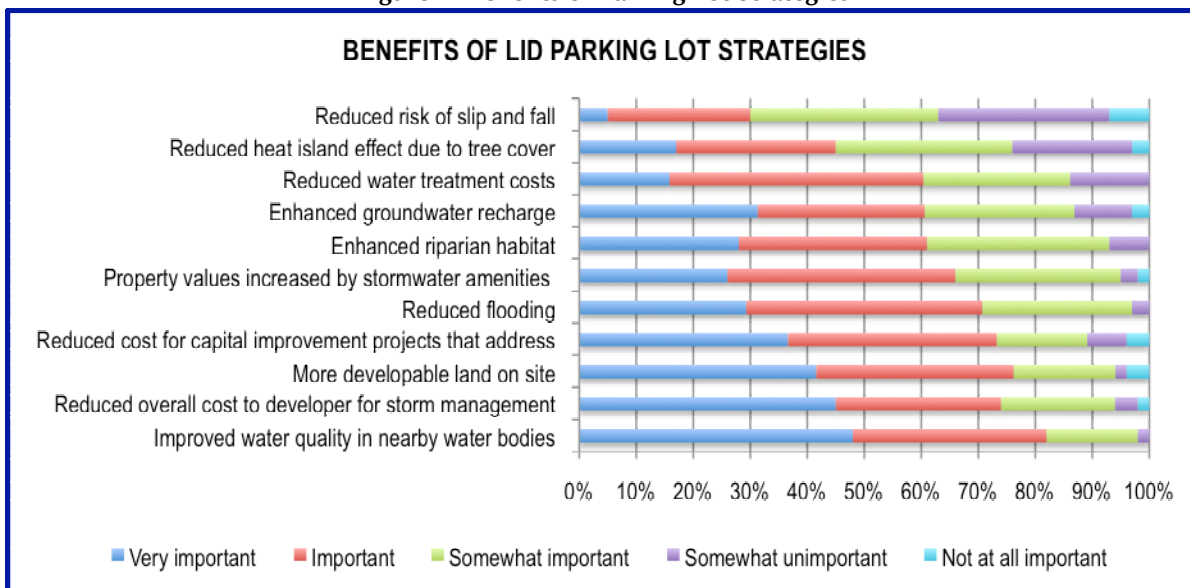
Questionnaire Responses

Improved water quality in nearby water bodies, reduced overall cost to the developer for storm management infrastructure, more developable land on site and reduced cost for capital improvement projects that address stream damage were mentioned by stakeholders as the most important. Reduced heat island effect due to tree cover, reduced water treatment costs and reduced risk of slip and fall were viewed as less important when thinking about benefits that would encourage implementing these strategies. (See *Appendix A: Complete Set of Frequencies from Participant Questionnaires* for more information.)

Table 4: Benefits of Parking Lot Strategies

From your perspective, how important or unimportant are each of these benefits in encouraging people to adopt water-protective strategies in land-use planning?	Very important	Important	Somewhat important	Somewhat unimportant	Not at all important	Total
Improved water quality in nearby water bodies	48%	34%	16%	2%	0%	100%
Reduced overall cost to developer for storm management infrastructure	45%	29%	20%	4%	2%	100%
More developable land on site	42%	35%	18%	2%	4%	100%
Reduced cost for capital improvement projects that address stream damage	37%	37%	16%	7%	4%	100%
Enhanced groundwater recharge	31%	29%	26%	10%	3%	100%
Reduced flooding	29%	41%	26%	3%	0%	100%
Enhanced riparian habitat	28%	33%	32%	7%	0%	100%
Property values increased by stormwater amenities	26%	40%	29%	3%	2%	100%
Reduced heat island effect due to tree cover	17%	28%	31%	21%	3%	100%
Reduced water treatment costs	16%	45%	26%	14%	0%	100%
Reduced risk of slip and fall	5%	25%	33%	30%	7%	100%

Figure 2: Benefits of Parking Lot Strategies



Differences Among Stakeholder Groups

The benefits that were most important to each stakeholder group were relatively similar when looking at the importance across all groups (see the table on the following page). Improved water quality in nearby water bodies, more developable land on site, reduced cost for capital improvement projects that address stream damage and reduced overall cost to developer for storm management infrastructure were listed as the most important to the majority of stakeholders.

Developers and engineers were slightly less likely to mention improved water quality in nearby water bodies and reduced cost for capital improvement projects that address stream damage as being important benefits. As would be expected, developers were more likely than the other groups to think that reduced costs for storm management infrastructure and more developable land were important than the other groups. Overall, elected/appointed officials were least likely to feel that these benefits were of greater importance. In addition, there following differences in opinion were reported:

- Stormwater managers/engineers noted that enhanced groundwater recharge and reduced heat island effect due to tree cover were less important benefits than did stakeholders overall.
- For the most part, landscape contractors rated the importance of the benefits similarly to stakeholders overall.
- Improved water quality in nearby water bodies, more developable land on site and reduced heat island effect due to tree cover were viewed as more important by planners than stakeholders overall.
- More developable land on site was seen as less important to landscape architects than stakeholders overall.
- As would be expected, developers felt that more developable land on site and reduced overall cost to developer for storm management infrastructure were important benefits when compared to stakeholders overall.

- When compared to stakeholders overall, engineers felt that reduced cost for capital improvement projects that address stream damage, reduced flooding and improved water quality in nearby water bodies were less important benefits.
- In general, elected/appointed officials often believed that each of the benefits was less important than did stakeholders overall.

Table 5: Benefits by Stakeholder Group

From your perspective, how important or unimportant are each of these benefits in encouraging people to adopt water-protective strategies in land-use planning?	Stormwater managers/engineers	Landscape contractors	Planners	Landscape architects	Developers	Engineers	Elected/appointed officials	Stakeholder Groups Overall
Improved water quality in nearby water bodies	82%	89%	100%	88%	75%	60%	63%	82%
More developable land on site	64%	89%	92%	57%	100%	80%	63%	77%
Reduced cost for capital improvement projects that address stream damage	60%	89%	77%	88%	75%	40%	75%	74%
Reduced overall cost to developer for storm management infrastructure	60%	78%	85%	88%	100%	50%	57%	74%
Reduced flooding	82%	78%	77%	63%	75%	40%	63%	70%
Property values increased by stormwater amenities	64%	78%	62%	75%	75%	60%	50%	66%
Reduced water treatment costs	64%	67%	62%	75%	25%	40%	63%	61%
Enhanced riparian habitat	50%	67%	69%	63%	50%	100%	38%	61%
Enhanced groundwater recharge	45%	67%	69%	75%	50%	40%	63%	60%
Reduced heat island effect due to tree cover	18%	56%	62%	63%	50%	40%	25%	45%
Reduced risk of slip and fall	20%	22%	31%	38%	75%	20%	25%	30%

**Percent "very important" or "important"*

In the conversations following the questionnaires, more stakeholders had difficulty rating or took issue with the benefits than they did with the barriers. Participants mentioned that they did not believe that some of the benefits listed were actually benefits because of a lack of evidence or proof.

Landscape architect: Some of these benefits look like stop the bleeding but that doesn't necessarily the actual healing that needs to happen.

Engineer: The question is how important is any one of these benefits. Obviously any one of these is a benefit, only if what you're trying to accomplish actually occurs. Anyone would agree that improved water quality in water bodies is a benefit. In a sense, it's a trick question because I think any one of these is important to very important if the desired result actually occurs. There are some sites that just by implementing a water quality strategy isn't necessarily going to realize that benefit. The degree to which these are a benefit, as to if something works, isn't something I can comment on.

Engineer: I have issues with a few of them. Property values increased by stormwater amenities - I think in certain instances, like residential, that's a very meaningful point but not in commercial/retail can it be sold as an amenity. That item is very land use dependent. Reduce slip and fall - only applies to pervious pavement and as long as it's been maintained and functioning well, that is a benefit of it. But what we're also finding is that the snow melts faster on it and they push the snow to that entire area and that clogs it.

Engineer: There's a lot of economic benefits claimed by the LID designers and LID people; people who are pushing LID. That may be the case when they're no longer new and people are really comfortable with eliminating other types of stormwater infrastructure. But until that's the case, claiming the economic benefit when LIDs don't really come in that way is also damaging the credibility of those proponent, in my opinion. What I'm saying is these are some leading questions that people who are proposing a particular management technique are trying to convince people of it, where to the average person they are not yet seen as benefits. So it depends on what amenity you mean. A healthy environment is definitely an amenity. But claiming that every one of these on site practices is an amenity, is simply not true at this point.

Landscape architect: I was going to challenge that the benefit is more developable land because I think typically it takes more land to do a lot of this as opposed to detention. Detention you can go very deep and you reduce the footprint and if we're doing infiltration, bioswales, we have to dedicate a lot more open space land to it. The benefit usually comes back in higher property values if it's a development. But, if it's not a development those property values aren't an argument.

Landscape contractor 1: I think cost, we all agree, it isn't there.

Facilitator: Reducing overall costs?

Landscape contractor 1: Yeah.

Landscape contractor 2: But if was there it'd be okay. If that was a benefit.

Landscape contractor 1: But it's not. This assumes it's a benefit. It's not. More developed land. I don't know, you know, it'd be nice if you could actually do that but I don't know how you'd do that because we've all already kind of agreed that impervious pavement's not really going to work well here. So, therefore you're not going to end up with more developable land so that's a hard sell.

Discussions and Interviews

Overall, the benefits that were most frequently discussed by study participants as being most important fell into five categories: the environment, reduced costs, more developable land, and aesthetics and marketability. Many of the 11 benefits listed could be grouped into these three topic areas which are discussed below. Comments on benefits that could not be categorized under these five themes, as well as any other benefits noted by participants, can be found in the section labeled “Other Benefits.”

The Environment

For the majority of participants, improved water quality in nearby water bodies topped their list of the most important benefits. Other participants talked about overall environmental protection, reduced flooding, enhanced riparian habitat and enhanced groundwater recharge as benefits that were important in encouraging adoption of these strategies. Some felt that there was an economic value attached to the environmental benefits and that if developers or jurisdictions can save money by reducing costs for clean up, they can put that money back into the development or site in the form of additional amenities.

Landscape architect: The heat island, riparian habitat and improved water quality in nearby water bodies. Those are all part of reduced costs because that actually frees up dollars to enhance water quality and enhance riparian habitat.

Landscape architect: Improved water quality. It doesn't matter where it is, the water bodies are what people see so their kids can go swimming and play and not get sick. You impact the whole ecology of things. Groundwater recharge and riparian habitat are tied for number one. From an economic point of view, we're going to run out of it, and from ecological point of view.

Developer: Improved water quality, for obvious reasons, that would be very important. Reduced flooding is very important to basically anywhere if you can reduce the runoff and the potential for flooding that's going to help your overall project and everything downstream. Enhanced riparian habitat goes back to improved water quality. The nicer you can make the riparian areas and increase the habitat the more of an amenity it's going to be in general to everybody.

Elected/appointed official: Improved water quality - as a Front Range community we all take our drinking water from the same water bodies. So it's important that when we return water into those water bodies that it is of the highest quality we can make it. And the same with reduced flooding we don't want to increase flooding potential to existing development resulting from new development.

Elected/appointed official: I think improved water quality, reduced overall cost to developer for storm management infrastructure and more developable land on site; those are awfully important. Right now the buzz word is to enhance density to get back to being able to reduce parking requirements. So from that stand point, if you look at it and start incorporating some of these design strategies you not only improve the water quality but you do start to generate additional value in your property. Because your property starts to become an engine for making the environment better rather than a detriment to the environment. It starts to change the impression of the developer as the destroyer of natural habitat and turn that around and say now the construction industry is helping to improve the environment.

Engineer: As a lay person, I would rank improved water quality as very important. It's my sense that that's the primary objective to these strategies. I see most of these others as secondary benefits.

Engineer: Improved water quality. That to me is the main one. I think these techniques will hopefully prevent our streams from being filled with what comes off of our land and is directly shoved into our streams without treatment. It has a whole chain effect down the whole ecosystem.

Engineer: Improved water quality and groundwater recharge. Our traditional methods of treatment I don't think work very well. We just dilute the pollutants but we still put pollutants into our water bodies. Whereas if you can force through infiltration then it's been proven over time that those pollutants don't make it into the water bodies. That, also with our shortage of water, particularly in surrounding states we give water to, is very important.

Landscape architect: Just being overall responsible for the environment. I think that that's becoming more and more a green thing, that people like that and they want to feel like they're helping. And I think if you can really plug into that mentality of people that maybe things might start changing because they feel like they're doing something good.

Planner: If you could in fact enhance repairing a habitat that would be a pretty big deal because of the wildlife values that go with that and the aesthetic values and since we're a resort community that's an economic payback.

Reduced Costs

Costs played an important role for nearly all stakeholders when thinking about ways to encourage adopting water protective strategies. Most felt that reducing costs overall was important for developers including costs for capital improvement projects addressing stream damage, costs for storm management infrastructure and water treatment costs. Some participants believed that if there was a reduced cost to the developer, the developer would put that money back into the community or site by way of additional amenities.

Landscape architect: Reduced overall cost to developer for stormwater management infrastructure, I think that there's a reduced overall cost to the broader stormwater system. The developer kind of implies a project basis and I think that the scale of these changes matters considerably. I think that while it's helpful to have a reduced overall cost to the developer, that's what's going to get their attention, that's only going to happen if it also reduces cost on an overall scale.

Developer: Well of course the ones I identified are somewhat self-serving but are reduced overall cost and more developable land, which increase profits, so those are ones that are most important to us as a developer. If we can decrease our costs and increase our developable land both of those things really flow to the bottom line in terms of profitability. I will say that in regards to reducing overall cost part of what we would do with those cost savings is we would redirect those cost savings into other enhancements within the development - buy more trees and enhance landscaping beef up the architectural enhancements within the development.

Developer: They speak for themselves. Reduced costs and more developable land allows developers to introduce more improvements to the development. Landscaping, bike trails, walk ways. In a larger community could be substantial and could be available community-wide facilities.

Elected/appointed official: Reduced cost for capital improvement projects that address stream damage, reduced flooding, reduced overall cost to developer, more developable land, property values increased and enhanced groundwater recharge. Those are all very important. I look at it also from the consumer's aspect and that's something that the government has a tendency not to

do. I know that the developer just can't pass on all the costs all the time. So, we have to protect the consumer. I think that's important.

Elected/appointed official: Reduced cost for capital improvement projects. That's important from a community perspective. [Communities] don't want to shift the costs unnecessarily from the developer to the community. Reduced water treatment costs. We don't want to diminish the water quality in nearby water bodies that results in higher treatment cost for the entire community.

Elected/appointed official: As I said in the barriers, if there are cost reductions for developers that's always a winner. If they believe they can save money somewhere, if using these methods can save them money, they'll jump all over it.

Elected/appointed official: The greatest for getting these things accomplished is minimizing excessive cost during development. Especially if there's things have to be done one way at one stage and then redone for the permit. They can see it's going to be costly at face value but in the long run it's effective because you only have to do it once and it takes care of the costs. Try to figure out the means to design something that has a greater permanency, a longer longevity.

Landscape contractor: Certainly from a municipal stand point, reducing capital costs from stream damage and reducing flooding are high on the list from a municipal stand point.

Stormwater manager/engineer 1: Improved water quality and reduced costs for capital improvement projects are most important to me but the question is "What's most important in encouraging to adopt..." so then in that case, to me it becomes reduce the overall cost to the developer. If you're proposing an alternative that's less cost, that's most important in getting a developer to do it. But, in terms of what I want to see, it's the top two.

Stormwater manager/engineer 2: That's a good point.

Stormwater manager/engineer 3: For the developer, it's giving them more land.

Stormwater manager/engineer 1: And that is reduced cost, in essence. Yeah, you're right. That was tied to it, thank you.

Planner: I think for other people to adapt, out of these strategies, economic kind of has to move towards the front. As a planner, I tend to think about improving water quality, the reduction the heat island, things like that. But I think for the general populous to kind of move this way, there does need to be some economic incentives as well.

More Developable Land

Some believed that more developable land would encourage developers, in particular, to adopt these types of parking lot designs.

Developer: More developable land - it somewhat depends on the location if you're developing in an infill site where land is more valuable that becomes more important as opposed to a green fill site where land isn't as expensive but I think that's an important selling point, especially to the development community, that part of the benefit of using low impact development design that you have more developable land to sell on the site so that's part of the cost trade off.

Engineer: In terms of a discussion with a developer or owner they're really more concerned with the economics of the project than what's immediately happening on their project site... They're more interested in knowing that they'll have more developable land or invest less money or lower

construction costs... Depending on who you're audience is it changes the answer. There are different stakeholder groups and each one has a different idea of what's important to them.

Aesthetics and Marketability

Although aesthetics and marketability were not listed as a benefit on the questionnaire, a number of stakeholders suggested that the potential aesthetics of LID parking lot design could increase sales for developers and property values of consumers. Many stakeholders felt, if added appropriately into development, stormwater features could increase customer bases and therefore increase marketability.

Elected/appointed official: Aesthetics for us. People come to see our elk and our hawks and eagles and we have fishing. I would say tourist appeal would begin as our economic base. We want to look good. Just so that people will continue to come here and spend money here and keep us going. We want to appeal and what is more appealing than a beautiful stream or a beautiful lake.

Elected/appointed official: Improved aesthetics of the development. It's kind of implied in some of the others.

Elected/appointed official: Properly designed they can appear to be open space parks. That always is a positive to a newcomer to a new person interested moving to the city. Well designed stormwater management can go beyond taking care of water and recharge which is very important... It's an aesthetic benefit and can actually be significant where it appears to be a park but it's not. It's designed well and in an event it's effective... A grassed area that's fenced in doesn't look good but some of the elements that are prominent to stormwater management allows for the perception of more beneficial type of appearance.

Engineer: I would say that a benefit is that it could create a theme for the site which would help with marketing like a green theme or good steward of the environment. We've been associated with single family residential developments where the stormwater management approach, the greenness of it, was a major marketing theme of the whole community.

Planner: It's a potential marketing advantage for a new project, that I could see and we've already seen it with some of the well water use communities where they've put in Xeriscaping and all this kind of stuff. If we use this as a marketing tool to help sell the house I imagine the same thing could be done with this. We've done all these things and it helps to get people interested at least in looking at the homes and possibly being buyers. Given this market you need every edge you can get.

Planner: Aesthetically it's better looking, I think, than having a parking lot with no vegetation.

Landscape contractor: I want to say beautification, being able to use that from our beautification approach, like we've been talking about.

Other Benefits

Stakeholders listed a number of other benefits that they believed could be used or promoted to encourage others to adopt water protective strategies. These included:

- Natural watering of plants/irrigation/reuse of water
- Reduced velocity of flood water
- Increased infiltration
- Do well by doing right
- Functionality/multi-use

Elected/appointed official: I guess I would look at legislation where we could reuse that water on locale to water trees and grass rather than just letting it evaporate.

Elected/appointed official: I think being in Colorado, and we have quirky water rights and legal scenarios that should be more on the barrier side. If you can help folks get over that barrier and help them realize that rainwater and stormwater is a resource. It really becomes resource management. That could turn into a benefit because you could take a semi-arid climate and turn it into a place more rich in natural resources.

Engineer: Reduced irrigation costs, reduced use of water for irrigation. If you can use the water coming off the land to water plants. You can also reduce the use of salts on streets because that might reduce a lot of salts used on parking lots which will improve water quality.

Planner: There's one I didn't see on there, it was water rights. Those communities use intermountain water because we're bringing that water across. We can keep reusing it for a certain number of times up there.

Planner: I think somehow looking at it as sort of a multiple purpose surface rather than having a parking lot.

Differences Among Stakeholder Groups

Most stakeholder groups noted improved water quality as one of the most important benefits to these strategies. Reduced costs for capital improvement projects that address stream damage, reduced overall costs to developer for infrastructure and more developable land also came to the forefront in the majority of stakeholder groups when discussing benefits to adopting water protective strategies, if they these benefits could be supported by evidence. Reducing costs in some way was believed to be a great benefit by nearly all stakeholder groups if that could actually be achieved.

Not surprisingly, developers more frequently mentioned reduced costs for storm management infrastructure and more developable land on site as a benefit to adopting water protective strategies than those in the other stakeholder groups.

Economic Value of Benefits

When asked about the economic value of the list of 11 benefits, a number of participants felt that there was value to some of them. They felt economic value was implied in some of the benefits, such as lower maintenance and treatment costs and increased property values by stormwater amenities.

Landscape architect: One is that there's a reallocation. Rather than most development money going to hardware and infrastructure and then send money over to systems and riparian habitat. So that's the benefit it actually frees up some dollars to do some, not just stop the bleeding things but some enhancement and some restoration work.

Developer: If there's a decrease in maintenance requirements then, that would be another economic benefit. Kind of in the lines of some of the benefits reduced overall cost.

Developer: I would say it's more of a long-term investment. That by improving the way we do water quality right now and improving water quality, in the long-term, the maintenance costs, especially when this stuff ends up being a little more mainstream, costs are going to go down. Being able to have more land and do more compact development and not having to dedicate large tracks to detention water quality is going to be big economic impact in especially in areas where land is a little more expensive.

Elected/appointed official: The cost of drinking water, and even irrigation water, could be reduced because you wouldn't have to take it and do so much treatment.

Engineer: The most important one is hopefully that if they can last longer, you don't have to put in long-term capital to replace it and if you can minimize the amount of maintenance requirements so you could save on costs of maintaining it over the long run and replace cost.

Others mentioned different kinds of economic benefits such as aesthetics, the health and welfare of the community and survival, in general.

Landscape architect: It's survival. That's the biggest economic benefit. We don't recharge our groundwater. We don't think in really big picture, thinking entire cities are going to shrivel up and die. It's not a question of whether it's polluted it's a question of being really dumb as to how we use it.

Elected/appointed official: [Economic benefits] mostly resulting from having improved water quality and the decreased costs of water treatment. But also improved health and therefore lower health costs for individuals.

Stormwater manager/engineer: I think there's another economic benefit that we haven't quantified. For example, a lot of water protective strategies or LID type things really tend to be considered aesthetic and what is the economic benefit of a sense of place?

Ways to Bring About Benefits

Stakeholders' thoughts about different ways to bring about the benefits to water protective strategies were similar to their ideas about the barriers. Education about the benefits, particularly through examples and data, and being advocates on the subject to their peers and clients were most commonly mentioned by most participants. Changing codes or regulations also were discussed as a way to bring about these benefits.

Education

Education of all stakeholders was considered to be key in bring about the benefits to water protective strategies. Simply educating on what the benefits are as well as showing what the benefits are through concrete examples of these designs and strategies were key.

Landscape architect: Identifying the state of where research and practice is at. Pilot projects and demonstration projects that have shown that the technologies work and that the economics did follow from those. And then that's part of the outreach on a project level as well as a policy level.

Developer: We may not understand the problem that we have here, we may not recognize it, and if there's a way to show how another location or another example where they had a problem and that they implemented some of these measures and here's the improvement, again, providing examples, real life examples. And doing that you might be able to show that this community in some other part of the country and that looks familiar and that might be something we seem to be tracking towards.

Elected/appointed official: I think there's the education piece. Whenever these sorts of things come up, part of what I try to do is direct my comments and ruling is to help inform the applicant, staff and the public. I think you can be somewhat of a spokesman or advocate to push an issue. That's probably the best way to do it.

Engineer: I can offer to be a part of an educational process where we get more dialogue going among the various engineering disciplines and develop criteria that target sites that are going to benefit from implementing these kinds of strategies.

Landscape architect: But something that we try to do is put that out to the profession and show success stories, show through awards what we as a profession are doing and what we deem to be you know, award worthy and hopefully that is something that we then we all continue to follow and implement, put the right foot forward.

Landscape contractor: Educate people about what Colorado is, which is semi area desert, not a rain forest. And let them know that the reason our grass is so green is because we're using all these chemicals to make it green. So, just educate them that a nice looking landscape can be achieved by more than just a football field of grass and some shrubs around it.

Planner: The other is, I think we need projects that people can go see and touch and feel and they worked, not all of the horrible poster child examples of where they didn't work. We've got a few of those. And it doesn't have to be in this state but it has to be snowy climates, it has to be in varying soils because we're, you know, we're not consistent among the state patterns. So, I think there's some out there. I don't think anyone's done a good job collecting them all.

Stormwater manager/engineer: I think successful examples. I think that you know, show them a project like Shea Homes there. Show them what benefits you're deriving from doing what they've

done there. But, or even on a smaller scale, depending on what you're talking about. But, if you can show folks that some of these concepts are valid and that they do work and you can put it in right and they do enhance the property, then I think you have a better chance of selling it to the developers.

Advocate

Some participants also noted that they could advocate for these strategies to their peers and to their clients. They could relay the benefits of implementation and hopefully persuade people to change or at least begin thinking of these types of designs.

Developer: We have pushed our consultants and the municipalities to get a lot of these types of water quality enhancements constructed and designed out at our site and I think that's our biggest role is pushing our consultants as well as the municipalities to make sure that we get everything out there that we can and making sure what we're doing is making the water quality as good as it was when the rain hit the ground.

Engineer: We have been counseling our clients. Most of our clients are solely concerned with costs and reluctance to try something new. We've been counseling on what the benefits are and trying to get them to do this versus the traditional design.

Landscape architect: Being an advocate to your clients essentially and you can educate them.

Regulations

Some stakeholders mentioned regulations, changing codes or best practices as ways to bring about the benefits, as a good place to start.

Elected/appointed official: Encourage the development of standards and regulations. And then review projects for compliance. Also provide leadership in terms of advocating the use of these concepts and technologies.

Elected/appointed official: We can take and recommend best practices, we can change the code, we can use the bully pulpit - get people to change because you talk about it all the time. You say something long enough people believe it. I can be an advocate as a citizen, and then also in my day job as a public health professional I can be advocating for the importance of water quality regardless of what kind of water it is.

Engineer: My most important role is to make these practices part of the way we do business and not make them so foreign to people. Right now I have a challenge to make them acceptable, state-of-the-art practice and most important role is to make them adopted by the city as a way of doing business. So something that makes them not out of the ordinary but as a way we do business. I want them to be normal operating procedures

Planner: Short of changing the code, you can take advantage of grey areas in the code to, you know, make a case for doing something.

Stormwater manager/engineer: You gotta revise all the planning codes, site development codes, your ordinances, everything that conflicts with what you're trying to do.

Greater Collaboration

As with the barriers, study participants felt that other stakeholder groups needed to be involved and that it needed to be a shared effort between all groups who are involved.

Developer: One group, the irrigation companies that we have here in northern Colorado, they would be a stakeholder in this based on water quality to their facilities. And it seems like they should be included in this process particularly in benefits side. They will stand to benefit from the implementation of any water quality measures.

Elected/appointed official: The other respective parties. Environmental groups, our health department, design engineers, landscape architects, interested citizens. Run it through our health board and our advisory board and planning commission. We have a water review board, it'd probably go through that.

Elected/appointed official: Yeah and we kind of talked about that. You go through all levels and you got everybody from professionals who work in public health and environmental, and you've got citizens, and you've got elected officials that have to make decisions on stuff and appointed officials like me who have to make decisions. Then you've got the planners and then you've got the developers.

Elected/appointed official: The same thing, I think it needs to be across the board. All those folks that were involved in trying to get over the barriers needs to be involved in the benefits. There really needs to be that spirit of cooperation. This thing doesn't work if you go into a negotiation with desire to have city win on every account and beating up the developer to get that. I think you need to go in and say that everybody needs to be creative but everybody needs to walk out of here taking something in as a victory.

Engineer: It's probably the 3 professional disciplines I mentioned before would be the water engineers, drainage engineers, civil design engineers and geotechnical engineers. I think that to address some of the concerns I have would take dialogue among those groups of professionals. I suppose there should be some policy making type of people involved.

Stormwater manager/engineer 1: I think planners are a critical piece but I think also engineering is a critical piece and I think designers coming in with private developments is a critical piece.

Stormwater manager/engineer 2: I don't think it's just one entity. I think it's several entities on board at the same time. I don't think you can just say, "We're going to start with the planners and then we're going to go to the engineers."

Differences Among Stakeholder Groups

Overall, most groups agreed that education and real-life examples of successful design strategies were needed to show the benefits. Elected officials frequently mentioned education of stakeholders and that they could advocate for these strategies in their respective communities. Examples and changes in code were believed to be important as ways to bring about the benefits by planners and stormwater managers/engineers. The other groups held a variety of opinions about ways to produce these benefits.

Best Ways to Communicate

Stakeholders believed the best ways to communicate these benefits of water protective strategies were through education of stakeholders through specific professional groups or publications, and by having successful examples available that show the benefits of these designs.

Landscape architect: I think outreach efforts and that could be materials that have case studies with technical information about certain kind of a BMP. I think a more holistic way to present these case studies, not just from a water quality standpoint but anything that articulates as many of these benefits listed here with real numbers behind them and connecting to people who tried that so that others can learn from the mistakes and successes of others.

Developer: Case studies, newsletters, the written format - on the internet. Definitely through local trade magazines and communications.

Developer: You need to communicate all of them [economic, social, environmental]. You can't do just one because you come across as having a preplanned agenda and you need to look at all the variables when discussing this. You need to give the full picture and it increases the credibility to your audience.

Elected/appointed official: Newspapers, citizen groups, speaking at citizen groups. Those would be the two. Again, education is the key. Educating your citizenry.

Elected/appointed official: The best way is going through the folks that can have an impact which would be developers, landscape architects and engineers. Through continuing education or trade associations. They're the ones that are going to be doing the design and putting them together. They're the ones that need to understand the concepts and the theories.

Elected/appointed official: Mostly to talk about the environmental and social benefits. I think it's very hard to quantify from an economic perspective so kind of articulating the environmental and social perspectives are good. I think people react well to that.

Elected/appointed official: I think it takes the full gamut of tools and education. The basic brochure and pamphlet that shows the resources that are available to communities in Colorado. Examples of those cases of implementation in neighboring communities so they can be seen. And building the communication where a person-to-person workshop or presentation could be realized. The best thing is some version of a demonstration, whether initiated by the city or a non-profit, to show how new innovations can be adapted into the development... Analyze all this effort and where has it brought you and what needs have been unmet to further encourage implementation.

Engineer: It depends on the audience. For owners and the people shelling out the money definitely it's the economic benefit. For municipalities and design world it's the environmental qualities. The communication part needs to be in a lot of these forums like publications from these professional organizations; even more mainstream magazines.

Landscape architect: I'm wondering if they did...an advertising campaign on TV... So, if we started educating our public when they are little and really gearing in on a lot of these conservation environmental issues that they will grow up to be more responsible and really maybe become leaders in helping.

Planner: I think with today's technology webinars are great, you know, instead of getting people from all four corners of the state to drive somewhere you can set up something where you can do things online. It's a great tool.

Planner: I was also thinking, I wrote down like a handout for both homeowners and for developers. It's just like sustainability principals for land use development, just something that's real basic... I think would be helpful.

Motivation, Opportunity and Ability

The final set of questions asked study participants about their ability and authority to promote water protective strategies, their motivation for promoting them and how other stakeholder groups view these strategies.

Ability and Authority

Most stakeholders felt that they had the ability to promote and support water protective strategies through educating and advocating to their peers and clients. Some noted that they could select team members and consultants who are familiar with these strategies and who have experience installing and implementing them. They believed that simply having the knowledge about different water protective strategies gave them the ability to promote these ideas.

Landscape architect: I think I see the big picture and I have a compelling discussion about why we should be changing our strategies for drainage, water use and water protection.

Developer: Probably the ability we have, the most beneficial, would be to share some of our experiences with the development community and to encourage our consultants to do the same and get the word out there that this is something that isn't impossible to do and that there are benefits. It's not something that's going to be cost prohibitive to do and if you do it right and get if you get everyone on board you can go through and do these types of water quality enhancements... Also we have the ability to provide support to other groups that may be out there doing research whether it's providing access to our site and some of our designs.

Elected/appointed official: A great deal. Usually we either recommend to the town board if the property is in the town or to the county commissioners if the property is in the county. They usually listen to us and this planning commission really does its research and an excellent planning staff that we rely on. I feel I have quite a bit of influence and I'm not shy or quiet.

Elected/appointed official: We've got some pretty good authority. We're the agency that has the health department and we can enforce that direction and the water quality standards through our water quality people. We can also, through our land use code and design standards, can affect it pretty considerably. In development review when it comes through storm drainage, we go through our hydrologist and approve you on those. On new projects, we have quite a bit of influence.

Engineer: We're usually not in a position where we're asked to provide input or expected to provide input to developing water protective strategies. Other than if someone's already decided on an approach and that designer wants some design criteria. That's when we get involved is to help with the details.

Engineer: I have several roles. I have a role as an educator to educate people on what these strategies are and I go to conferences and I bring them locally to our engineers or other people. And my role also is like an advocate within my organization to try these new sustainable practices. So my role as technical person, I review them to make sure they work correctly.

Planner: I think as planners, especially if you're AICP (American Institute of Certified Planners), it's one of your ethical responsibilities, is look out for the public and the environment as well. So, you need to make sure that those policies are brought to everyone's attention in one format or another.

Stormwater manager/engineer: I can sure as heck promote them to death and our stormwater group listens, our develop and review engineering group listens and some of our planners do.

Nonetheless, very few participants felt that they had authority to mandate or bring to fruition the implementation of these strategies in their communities. As one might expect, elected/appointed officials more often believed that they had the authority to promote these designs.

Elected/appointed official: Our ability is to basically encourage the development of regulations. And we can enforce them by reviewing projects to make sure they're designed consistent with the regulations. We have authority to disapprove projects. Our only authority in terms of the development of regulations is to make recommendations to city council.

Elected/appointed official: It's probably somewhat limited. You can always go through and simply vote no on a submittal. To me, I don't think that's necessarily fair to do. I always try to approach things that come in front of the commission from the standpoint of lets offer adequate feedback to the pros and the cons of the submittal. We're rarely put in the position where we're issuing the final vote on something.

Most of the other stakeholder groups said they had little authority because they were at the end of the line and were expected to carry out, not create, design plans.

Landscape architect: As part of our profession, I think I have a tremendous ability on outreach on the larger scale education and policy forming. As an individual working on a project team, you have a much more limited impact. Most of that outside structure is already set by the time you start a project. There are existing codes you have to work with so unless you want to put your project on hold and try to change those codes, it's going to be hard to impact that change. So there's two scales of operation. Most professionals operate within the latter, they're more tied to a specific project which is hard to make substantial change.

Landscape architect: Ability is to make the suggestion to the owner. The authority is not there.

Landscape architect: For us to urge our clients to spend money to do things that may or may not work, we know that we can plant trees around the parking lot and that seems to work. But, we do not know that porous pavement works and if we're put in a position that we recommend to our clients that they spend the extra money to do this and it doesn't work we look like fools. So it's hard to say we have any authority at all.

Developer: Speaking for myself and our company we have a lot of ability, I wouldn't call it authority because we like to lead by example. We do a lot of things that are innovative and we get out on the leading edge and our peers and competitors will take note of that and often times they'll copy something we're doing. Our company definitely has the ability to model a technique and people pay attention to what we do because we've had a lot of success.

Engineer: I don't know that I have authority but I have an ability to direct the design. I can understand the municipality and what their interests are and what they'd allow and I can understand my client and what their interests and try to marry those two together and create a project that incorporates these ideas to some degree.

Landscape contractor 1: I don't have any authority.

Landscape contractor 2: Right, we don't.

Landscape contractor 1: We don't have authority.

Landscape contractor 3: You can promote it all you want.

Landscape contractor 2: Right.

Landscape contractor 4: The ability, you said? Ability or authority? We have the ability.

Landscape contractor 1: We don't have the authority to affect the change though.

Facilitator: And what ability do you have?

Landscape contractor 4: To educate, to communicate what the folks we are working with.

Stormwater manager/engineer: I was going to say, that's my biggest heartburn in my job is not having enough authority to stand and say this is something we need to be doing.

Increasing Stakeholders' Ability

Study participants offered several ideas about ways to increase their ability to promote these strategies ranging from education and changing regulations to getting other stakeholder groups on board and discussing the issues.

Landscape architect: Engineers, it's really another group of people. And in something like parking lots where our interests really come together, there hasn't been a lot of connections, and that's where I think some non-profits or third parties can be helpful to bring people together who normally don't interact to tackle issues and look at solutions from a holistic policy standpoint outside of a specific project.

Elected/appointed official: Because we sit on the board, we can get that to our planners and to the engineers and make that a part of the process. Then when we see that on there then we approve those quickly.

Elected/appointed official: Again, developing regulations and enforce them on developers.

Elected/appointed official: Every time you open your mouth in a commission meeting you have an opportunity to support strategies you think are important. That's why I think it's important for commissioners to be informed in planning and development. And our job is not to stop development from happening, our job is to take development that wants to happen and channel it and help form it so it's responsible and beneficial.

Engineer: Promoting directly to clients. We give many talks and presentations at local conferences and we try to highlight things that work and things are more like lessons learned and things to be cautious about.

Opportunities to Promote Strategies

A number of stakeholders felt that there were limited opportunities for them to promote these types of strategies but did identify things such as education and providing input during the planning process.

Landscape architect: Of course. I have the opportunity every time I do work. Do the municipalities and government agencies and engineers support it, usually not. The correct question is are there opportunities for success, and the answer is very little. Are there opportunities to give it a shot, sure, every day. Most people give up because it's just not worth beating your head against a wall.

Landscape architect: There are some but they've been limited. There are occasionally, in the scope of project, you can say we ought to change from x to y. And very occasionally, there's a chance to comment on code changes that might be proposed by an organization like a county government or Urban Drainage.

Developer: There are and it's somewhat unique to our situation. We have an environmental set aside area within this development and we have educational programs associated with that, environmental/open space program. And we do have a great opportunity to promote through that particular and somewhat unique affiliation that we have.

Differences Among Stakeholder Groups

There were some differences among stakeholder groups about the ability and authority they have to promote water protective strategies. Overall, most groups believed they had the ability to support and promote these strategies but that having ability may not do much if there is no authority associated with it. Very few groups felt that they had any authority to promote these strategies. Landscape architects, landscape contractors and stormwater managers/engineers reported having no authority in the matter, and most elected/appointed officials considered themselves to have authority.

Motivation

A majority of stakeholders noted that their motivation was simply to “do the right thing” for society and the environment. They talked about personal responsibility and invested interests in their communities.

Landscape architect: Makes my personal environment much nicer and I believe it does for everybody else.

Developer: It's our company's philosophy, I think personally it's my philosophy. I don't think it's anything where you would go back and say it's going to help us out or it's going to be a big windfall financially. It's the right thing to do.

Elected/appointed official: Because I'm spending the rest of my life in this community and I want it to be beautiful. I want the riparian habitat protected. I want my lakes to look beautiful. I have a personal stake here. I'm very proud of this community and I think it needs to be protected.

Elected/appointed official: Mostly just to provide a healthy environment to the community.

Engineer: I think just a sense to do the right thing for society. I suppose, almost a secondary benefit, or any kind of advantage it would provide for our clients.

Engineer: I'm motivated professionally, big part of my professional life, and personally because I'm a fly fisherman and a consumer of water.

Engineer: As a designer I understand what the impact is by the traditional methods. I understand what we're doing to the environment whereas the average person doesn't and the people building that are building the projects probably don't.

Planner: We wouldn't be planners if we weren't motivated to a great a degree.

Planner: Our fiduciary responsibility is for the health, safety, welfare of the population and we continue to try to do that and that's being innovative. I mean that's what kept us alive as long as we have.

Stormwater manager/engineer: It's a good feeling that I'm doing the right thing.

Some participants mentioned other motivators such as publicity, costs and their return on investment.

Developer: Doing the right thing for the environment and the other one is certainly positive publicity.

Elected/appointed official: It's a combination of things. There has to be a balance for each on the economic factor to the environmental factor. Everybody wants the best but sometimes that's not affordable.

Elected/appointed official: The return on investment not necessarily in dollars but there has to be some impact... What's the cost-benefit analysis?

Increasing Stakeholders' Motivation

While some participants believed they were motivated enough to promote these designs and ideas, other mentioned providing examples of where these strategies have worked and educating about the benefits would increase their motivation.

Landscape architect: Part of it is the success stories. When you start from the people who have tried things that have worked, that's the motivation... I think the motivation is trying to produce a more high quality long-term sustainable environment for people and the critters that live around here.

Elected/appointed official: If there was data that showed this is a high priority and that parking lots have a high impact on water quality as opposed to some of the other strategies, then it would change its priority.

Engineer: I already support them but I think for others it would be more case studies of examples that have worked.

Landscape architect 1: Proof in the pudding. And I'm really speaking about the pavement side. I think we can, I'm comfortable with suggesting to an owner that additional landscaping around the parking lot is good. It's not going to cost that much money and doing bioswales and things like that are good. But I think that the issue of pervious pavement is still unresolved, to say whether it's good or it's not good.

Landscape architect 2: I would agree completely, especially on parking lots, especially when you think about the impact to that parking lot and the long-term maintenance. And if we have heavy vehicles turning in those parking lots, I don't know if they hold up as well.

Stormwater manager/engineer: Yeah, I think the strategy goes back to my point. When I start seeing some things that work, it's a lot easier to promote.

Stormwater manager/engineer: We have to be able to speak with confidence about something because scientists and regulators tend to be a pretty conservative group and go on fact-based, evidence-based recommendations and that's what we do. So, we're always, we tend to be more

cautious which puts us almost inherently behind the curve because we don't want to be wrong or steer someone down the wrong path...those connections are still a little fuzzy.

A few stakeholders thought that cost savings, more opportunities to promote strategies and governmental support also were motivators.

Developer: Cost savings, whatever that looks like but again if there's a cost reduction somehow overall that would be considered a plus.

Developer: I think I'm motivated enough. Like I said, I think if there were opportunities out there. It may be a little bit of us not looking hard enough because we're so busy but trying to get more engaged and look for opportunities to share our experiences as well as learn from others experiences.

Landscape architect: I think the government has to be the main driver in something like that in terms of carrots and sticks and just providing the framework for the developers to then want to go out and do that. You know, as a designer we can't really push it.

Planner: I think you need to have a clear policy locally on reimbursements between developers. So, the next project is going to have to pay those costs and you shouldn't have to negotiate them for months on end to get 'em. So, anyway, that's kind of it...time, money, the kinds of things we've been talking about.

Planner: The almighty dollar is very important. Regulated and having no choices is very important. The idea of having a marketing tool is very important... I think the money is probably the most important single thing as far as, you know, the land developer trying to put a project in and the time. The time is extremely important.

Differences Among Stakeholder Groups

All stakeholder groups said that they were motivated to do the right thing and all groups believed that proven and tested examples of these strategies would help motivate them to promote these designs. Developers, more so than any other group, mentioned costs as a motivating factor to promote these strategies. Planners, stormwater managers/engineers and engineers wanted more support from the local officials and felt that would motivate them.

Views of Other Stakeholder Groups

Each study participant was asked how he or she thought other stakeholder groups viewed water protective strategies. For the most part, stakeholders believed that everyone involved was aware of the issues, supported these strategies and felt that they were important. Most thought that developers were the most resistant and that time, money and design guidance played a role in their implementation of these strategies. Engineers were thought to be conservative by most other stakeholders – but for good reasons – they have to be responsible and follow codes.

Landscape architect: Developers are compliance people. Give them a rule they'll figure out how to minimally meet it in the most cost effective way they can. Landscape architects love the idea of creating a more environmentally sound world. That's how they're trained and love to do. Public works directors are of a conservative crowd, meaning engineers, they're the most conservative and they're the least likely to allow any changes or they'll be the slowest to allow changes in status quo. Engineers are conservative, as they should be, and would love to engineer, use all their skills and abilities to do the best job in the safest manner. They can't fall outside the realm

of the criteria that are developed in the schools and the rules given by municipalities, county or state governments. So they have the abilities but are shackled by the rules. Planners are, for the most part, would love to see a more human urban environment but are very much at the call of developers. They do what they're told, for the most part.

Developer: I think municipalities definitely realize it's very important. There can be somewhat of a limited view that all stakeholders have. I think a lot of people think it's a good idea but I don't know how to follow through with it but in the grand scheme how important it is and that's why I think education is paramount in getting these things to be more of a standard than the exception.

Developer: They're a good idea but a pain in the butt. I think a majority that feel that way but not everyone. I'd say developers and contractors would feel [more like it's a hassle], after that engineers and then planners. Most of the planners around here are wanting to implement green strategies.

Elected/appointed official: I think everybody's in favor of it if it doesn't burdensome.

Elected/appointed official: I think that everybody is interested in protecting water quality, especially in Colorado. Again, thinking of the strategies, there has to be some true benefits in the investment that there is some reality to it and there's not just a perception. If it doesn't make a difference but it looks like it does but they're spending a lot of money, it's not going to be well supported. But if there are design strategies that can be used that will protect the water quality of surrounding streams and water bodies, I think it would be very receptive. I think people need to know why they're doing something and if there's a good reason, there are very few that will push back. I think when people push back, is when they see them having new expenses with no benefit to them or to the community. Regulatory red tape - that's when people push back.

Elected/appointed official: I think locally there's already a lot of support by all those constituencies. With developers and landscape contractors and the designers it's just communicating the community's expectations very explicitly so that they can design around those expectations. But to be honest I've never seen any developer come to our commission saying we don't want to do this because I think most of them realize the community benefits

Engineer: I think developers are generally going to try to do the right thing if it doesn't cost them much more. They'll try to avoid incurring additional costs. I haven't put a lot of thought into it. I think [other groups] probably view it as I do.

Engineer: I think these groups like talking about it but I don't see many people who are really invested in it, really passionate about it. Willing to try and come together and realize their role in creating a successful project. I think these projects are going to be more successful if each group, engineers, landscape architects, ecologists, all their minds come together and realize they all play an important role and put their selfish interests aside.

Planner: Another headache, another like "Oh my God, with all the other things we gotta do now gotta talk about something else?" and it's going to cost more money no matter what. I think getting the data and the research that shows that it could not only maybe cost less but at least if it cost more in the short than in the long run, it has a cost-savings.

Stormwater manager/engineer 1: Developers, you're looking at cost and money. Consultants, designers and architects, you view them as making some money.

Stormwater manager/engineer 2: It comes down to feasibility and profit.

Recommendations and Final Thoughts of Stakeholders

The last question in the scripts asked participants what one message they would like to relay to AWARE Colorado as it relates to the topics that were discussed. The themes that arose were education, examples, advocacy, collaboration among all groups and design guidance.

Education

Most stakeholders considered education and examples to be the most important message for AWARE Colorado.

Developer: I think there's a lack of opportunity to promote and educate stakeholders, especially in a regional context, and that there should be an emphasis put on by AWARE or someone else, or a program put together, that I think could really change people's ideas and perceptions.

Elected/appointed official: I would say you go guys! We've got to protect our water resources, they are so precious, and I think we take them for granted in a lot of communities... Whatever can be done to educate Coloradoans on how important our water resources are, I'm all for it, and again careful responsible development really ties hand and glove into that.

Elected/appointed official: Ramp it up. There's such a significant need in this area and I think possibly their strength is having informed citizens as much as decision makers. If citizens are informed and asking reasonable questions and request to the city that's probably what's going to get things done. That's you're greatest means of influence. And that's going to be tough because they don't fully realize. There's a lot of universal design and LID and I think would be a huge plus to put into any type of community. The full implementation of those type of things as a means of a demonstration and show everybody.

Engineer: I think AWARE's job is to educate the citizenry so they will pressure the municipal officials. Think about how they can influence on a larger scale and use their education efforts to impact the citizens in general. Unless we have the political realm, and that will come from the public's demand for action, that will not happen because politicians want to get elected and if they don't feel like it's a popular thing they won't do it.

Engineer: They need to increase the education of every citizen in the state as to what the current impacts of traditional stormwater treatment methods are and how those can be mitigated with low impact design. I think goes back to not enough people that understand the ramifications. You've got to get out to more than the professional organizations. It goes back to every person needs to understand.

Landscape architect: I would encourage them through this process to actually come up with some real concrete ideas as opposed to "pie in the sky"... They may even consider trying to fund and lead a project that would be a demonstration project and see what type of resistance and barriers they get through that since we're identifying some. Go ahead and put together a pilot project they would drive and show how the benefits are more than just proposed and that they are real. The reality is the proof is in the pudding... But, that would be interesting to see them actually lead a project and help it through these barriers that have been identified by all their focus groups.

Planner: Cindy Peterson provides a great education programs in PowerPoint and her role is to go anywhere and take that message out there. And I think AWARE Colorado needs to keep doing

that and maybe be a little more aggressive about who they talk to and when they talk to them. I think more with the elected officials would be a really good thing.

Stormwater manager/engineer: Develop a stormwater education for municipal officials.

Stormwater manager/engineer 2: Examples of what could be done on this site to provide somebody a decision matrix of soft landscape, bioswales, permeable pavers, green roof, whatever would appease the needs based on different site qualities.

Stormwater manager/engineer 3: Right, it's proven research but it's newer technologies for the lay person elected official. The only thing they know that works is the thing they see when they drive by every day. So, it's showing them examples of the other things that do work. So, they can at least understand that when you're proposing something different that it's not completely new that you're not the first one to dream this up.

Stormwater manager/engineer 4: Plus, I think you should be able to show the benefit to the community.

Advocacy

As with realizing the benefits and barriers, some people thought that advocating and promoting these designs and ideas were important messages to relay to AWARE.

Elected/appointed official: Advocate for change of water regulatory guidance at the federal and state level to create a balance, a moderation balance, and how do we protect our environment, protect our people and protect our nation. AWARE can advocate toward public health organizations, towards city/CML (Colorado Municipal League), CCI (Colorado Counties Inc.), and through the League of Women Voters. Think of all these stakeholders and AWARE Colorado can come out with what they've learned, best management practices, etc. and be the advocate and try to push for change and for realistic, moderate, balanced guidance and regulations.

Elected/appointed official: The message is that it's an important development issue for the Front Range. And there needs to be continued leadership in promoting it.

Landscape architect: To continue to promote the concept that improving water quality is good. Water quality and water protection are good.

Collaboration

Other study participants felt that there needed to be collaboration between all parties and balanced approaches and discussions.

Landscape architect: It is time to come up with a group or agency with enough authority to begin to look at big picture of drainage and how it affects recreation, open space, air quality wildlife and the humanity of our urban areas.

Landscape architect: Keep up the good work and I think there's an overwhelming need for third party groups to be the holder of the story, the long-term mission and potential for change. And by be the holder, I mean something that holds the mission and the motivation that keeps people plugging back in without the pressures of an individual project. I think AWARE is the kind of group that can really help.

Developer: That it's a multilateral process that involves not only AWARE Colorado but also local the community and the development community working together in a cooperative spirit. You can't

push a rope uphill so if everybody is working together and understands where everybody is trying coming from. There's always a middle ground. Not everyone can get 100% of what they want. It's a long process and we all have to work together.

Elected/appointed official: I think the biggest thing that needs to be maintained in these discussions is a sense of balance and fairness. And really understanding that everybody is proceeding with an amount of passion of their small spectrum of whatever's going on.

Engineer: Keep doing what they're doing which is promoting good practices and making the community aware of pitfalls to avoid so all practices that are implemented are successful and the practices aren't given bad name by overzealousness or improper application. Favor a balanced approach.

Planner: I was going to say whether issue is specific to parking lot design and whether it's a broader water quality issue, one thing I've seen AWARE Colorado do is bring people together for a dialog. And I would suggest, you've kind of heard this, we need to have not just planners on the table, but engineers perhaps. We need to have landscape architects, the lending community, the development community. So, your focus group is very diverse in terms of the points of view you're going to get on either a specific issue or broader issues so you can get to those best practices and those techniques to get things integrated into the system.

Design and Innovation

A few stakeholders felt that there ought to be better design guidance and recommendation for implementing these strategies.

Engineer: To recognize there are limitations to these strategies and to properly evaluate the applicability to any given strategy to a given site.

Elected/appointed official: I guess solution-oriented design with balance.

Landscape contractor: The whole process sounds like it lacks innovation and lacks creativity, that the entire process just stifles that, doesn't give anybody the opportunity to go out and try new things because there's a long stack of rules and regulations that have to be followed. And there were an opportunity to provide a company the experience to try some new things, sounds to me like that's part of the whole problem.

Stormwater manager/engineer 1: They need a team, probably an engineering consulting company that gets down into the design recommendations. That's probably where they're at.

Stormwater manager/engineer 2: And have that list of recommendations for all the different soil types whether it's a database of examples or whatever, to try when they throw the tight soils, you have an answer for that or if there's a different condition, you have an answer for that.

Broader Scope

Some participants noted that, while parking lots are important in water quality protection, AWARE needed to broaden its focus to look at the big picture of water quality and not just parking lots.

(Note: Although, parking lots provided a manageable scope for this focus group/interview research, the results also will be used to address broader related community development activities.)

Elected/appointed official: I would say broaden your perspectives beyond parking lots. I think that is so narrow that it waters down the message. I think there are so many important issues in

development that affect water quality. If you're really interested in water quality, you need to address water quality. It's kind of like addressing car safety if you're only going to address the right front brake. I think it's a little narrow.

Engineer: I think it would better for AWARE to be focusing on broader issues than parking lot design. Protection of water bodies, making sure that municipality are seeing if they have an overall stormwater plan and moving forward in coordinated manner on protecting water bodies. Bigger picture policy things rather than getting into the design details of a parking lot. It would be much more valuable there because hopefully they would be dealing with policy makers.

Planner: I guess my concern is, you know, we spent, like I said, the last hour and a half, we've been talking about parking lots. Well, I think it needs to be broader than parking lots. I think we really need to start looking at every way we can create better water quality, be it either through the type of grasses that we use in our front lawns to the type of parking we use to the type of - you name it. I just think it's too limiting at this point in time because the one thing we didn't talk about when it came to parking lots was the issue of TODs (Transit Oriented Developments) where you have what I consider to be a real fraction.

Planner: I just want to second what was [said] earlier. I don't know why AWARE is focusing on just parking lots. I mean I think it ought to be much broader. In fact, you'd have a different dynamic if you didn't just focus on parking lots because there's a lot of these other water quality issues, at least that's my experience in a mountain environment, where...a little bit of site planning early on could save of a ton of site disturbance and all of the sudden you're not battling this economic battle, you're actually talking about how people can save money and do something good in terms of water quality and the environment, more broadly. So, I would say it's all bigger than that.

Conclusion

In summary, this assessment captured the perspectives of many key players in stormwater management in the South Platte River Valley, demonstrating widespread agreement that water quality is important and that parking lot design plays an important role in water quality protection.

AWARE Colorado (Addressing Water and Natural Resource Education) provides useful information to these stakeholders, but limitations to the program's continued success need to be addressed before communities can fully embrace low-impact development (LID) parking lot strategies.

Most importantly, information on benchmarks and best management practices (BMPs) are needed to demonstrate that water-protective LID strategies will be successful in Colorado. The economic costs and benefits of such methods must also be quantified and communicated to all relevant stakeholders. Government planners need to feel confident they are recommending sound design advice. Many called for greater collaboration among key stakeholders to innovate designs and programs, and to pilot new projects that provide BMPs data.

Many stakeholders participating in this study thought they could support LID parking lot design options, but few felt powerful enough to bring about significant community change because they were involved late in the development process or believed they had little authority. Alternatively, elected officials were more confident in their ability to bring about change, especially with regulations.

Although the longer-term environmental and economical benefits of water quality protective strategies to the public at large was well agreed upon in the discussions, most believed that more immediate benefits for developers and consumers were necessary to change current development patterns. Numerous ideas for incentives and regulations were offered by study participants – all with the goal of encouraging water-protective strategies in Colorado communities.

These findings, and the entire report, will be available to others conducting similar education and outreach efforts. To help those who might plan related research, AWARE has documented the process of developing and conducting this research initiative.

AWARE plans to use results from this research in its ongoing community-based social marketing efforts. This study will lead to specific community outreach strategies that aim to effectively deliver information to Colorado communities and maximize changes in behavior to protect water resources. AWARE will enhance its program by incorporating approaches that address barriers and benefits discussed in the research analysis. In its future program planning, AWARE will also consider findings that deal with stakeholders' motivation, ability and opportunity.

Appendix A: Complete Set of Frequencies from Participant Questionnaires

This section contains the complete frequency of responses to the questions asked of focus group participants and interviewees, and the number of participants responding to each question. The first set of tables are responses from the pre-focus group questionnaire, which was given to stormwater managers/engineers, planners, landscape contractors and most landscape architects (five participants). The second set of tables contains responses to the barriers and benefits questionnaire from all study participants.

Focus Group Questionnaire

Stakeholder Group		
Group	Percent of respondents	Count
Stormwater managers/engineers	29%	N = 11
Landscape contractors	24%	N = 9
Planners	34%	N = 13
Landscape architects	13%	N = 5
Total	100%	N = 38

Q1		
How many years have you been in your profession? Is it...	Percent of respondents	Count
Less than 2 years	0%	N = 0
2-5 years	8%	N = 3
6-10 years	16%	N = 6
11-20 years	30%	N = 11
More than 20 years	46%	N = 17
Don't know	0%	N = 0
Total	100%	N = 37

Q2										
Please mark the circle that most closely matches your opinion on each of the following statements.	Extremely		Very		Somewhat		Not at all		Total	
	In your current position, how important is water quality protection?	46%	N = 17	38%	N = 14	16%	N = 6	0%	N = 0	100%
In general, how important would you say water quality protection is to your profession?	57%	N = 21	41%	N = 15	3%	N = 1	0%	N = 0	100%	N = 37

Q3		
In your current position, what percentage of your time is devoted to water quality protection?	Percent of respondents	Count
5% or less	29%	N = 8
6% to 20%	39%	N = 11
21% to 99%	18%	N = 5
100%	14%	N = 4
Total	100%	N = 28
<i>Average percent of time</i>		35%

Q4		
How would you describe the area in which you work?	Percent of respondents*	Count
Rural	41%	N = 15
Urban	68%	N = 25
Suburban	73%	N = 27
Foothills	49%	N = 18
Mountains	35%	N = 13
Plains	35%	N = 13
Other	5%	N = 2

**Total may exceed 100% as respondents could select more than one option.*

The tables below show breakdowns of the questionnaire results by stakeholder group.

Q2 by group				
Percent "extremely" or "very" important	Stormwater managers/engineers N = 10	Landscape contractors N = 9	Planners N = 13	Landscape architects N = 5
In your current position, how important is water quality protection?	100%	89%	62%	100%
In general, how important would you say water quality protection is to your profession?	100%	100%	92%	100%

Q3 by Group				
Average percent of time	Stormwater managers/engineers N = 8	Landscape contractors N = 7	Planners N = 9	Landscape architects N = 4
In your current position, what percentage of your time is devoted to water quality protection?	83%	21%	11%	15%

Barriers/Benefits Questionnaire

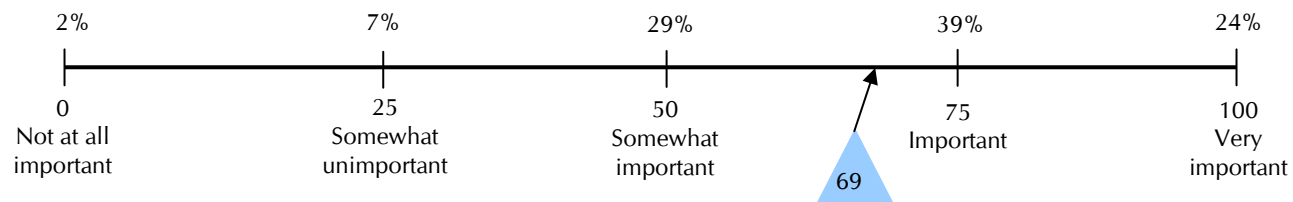
The following tables contain the frequency of responses and the number of respondents to each question. Some of the tables also display an average rating for each question, which is described in more detail below.

Putting Evaluations onto a 100-point Scale

Responses to the questions were made on a 5-point scale. To make comparisons easier, the results are reported on a common scale where 0 is the worst possible rating and 100 is the best possible rating.

The 100-point scale is not a percent. It is a conversion of responses to an average rating. Each response option is assigned a value that is used in calculating the average score. For example, “very important”=100, “important”=75, “somewhat important”=50, “somewhat unimportant”=25 and “not at all important”=0. If everyone reported “very important,” then the average rating would be 100 on the 100-point scale. Likewise, if all respondents said “not at all important”, the result would be 0 on the 100-point scale. If half the respondents gave a score of “very important” and half gave a score of “not at all important,” the average would be in the middle of the scale (like the center post of a teeter totter) or “somewhat important.” An example of how to convert survey frequencies into an average rating appears below.

Reluctance to try something new?				
Response option	Total	Step 2: Assign scale values	Step 3: Multiply the percent by the scale value	Step 4: Sum to calculate the average rating
Very important	24%	100	= 24% x 100 =	24
Important	39%	75	= 39% x 75 =	29
Somewhat important	29%	50	= 29% x 50 =	14
Somewhat unimportant	7%	25	= 7% x 25 =	2
Not at all important	2%	0	= 2% x 0 =	0
Total	100%			69



Stakeholder Groups		
Group	Percent of respondents	Count
Stormwater managers/engineers	19%	N = 11
Landscape contractors	15%	N = 9
Planners	22%	N = 13
Landscape architects	14%	N = 8
Developers	7%	N = 4
Engineers	10%	N = 6
Elected/appointed officials	14%	N = 8
Total	100%	N = 59

Q1: Barriers							
From your perspective, how important or unimportant are each of these barriers in keeping people from adopting water-protective strategies in land-use planning?	Very important	Important	Somewhat important	Somewhat unimportant	Not at all important	Total	Average rating on 100-point scale (100 = very important, 0 = not at all important)
Design, construction, maintenance issues and costs	58%	25%	14%	3%	0%	100% N = 59	84
Strategies not integrated in early planning process	41%	33%	17%	7%	2%	100% N = 58	76
No clear economic incentive	36%	41%	14%	7%	2%	100% N = 58	75
Limited technical design guidance	27%	51%	14%	7%	2%	100% N = 59	73
Reluctance to try something new	24%	39%	29%	7%	2%	100% N = 59	69
Conflicts with municipal code requirements	28%	35%	23%	11%	4%	100% N = 57	68
Difficulty measuring benefits	14%	46%	32%	8%	0%	100% N = 59	66
Concerns with swelling soils	29%	28%	22%	17%	3%	100% N = 58	65
Poorly drained soils/low infiltration capacity	24%	29%	29%	12%	7%	100% N = 59	62
Potentially longer review process	19%	31%	31%	16%	3%	100% N = 58	61
Water rights considerations	12%	28%	40%	19%	2%	100% N = 58	57
Standing water problems	5%	31%	47%	14%	3%	100% N = 58	55
Americans with Disabilities Act considerations	4%	25%	25%	32%	16%	100% N = 57	42

Q2: Benefits								
From your perspective, how important or unimportant are each of these benefits in encouraging people to adopt water-protective strategies in land-use planning?	Very important	Important	Somewhat important	Somewhat unimportant	Not at all important	Total		Average rating on 100-point scale (100 = very important, 0 = not at all important)
Improved water quality in nearby water bodies	48%	34%	16%	2%	0%	100%	N = 58	82
Reduced overall cost to developer for storm management infrastructure	45%	29%	20%	4%	2%	100%	N = 55	78
More developable land on site	42%	35%	18%	2%	4%	100%	N = 57	77
Reduced cost for capital improvement projects that address stream damage	37%	37%	16%	7%	4%	100%	N = 57	74
Reduced flooding	29%	41%	26%	3%	0%	100%	N = 58	74
Property values increased by stormwater amenities	26%	40%	29%	3%	2%	100%	N = 58	71
Enhanced riparian habitat	28%	33%	32%	7%	0%	100%	N = 57	70
Enhanced groundwater recharge	31%	29%	26%	10%	3%	100%	N = 58	68
Reduced water treatment costs	16%	45%	26%	14%	0%	100%	N = 58	65
Reduced heat island effect due to tree cover	17%	28%	31%	21%	3%	100%	N = 58	58
Reduced risk of slip and fall	5%	25%	33%	30%	7%	100%	N = 57	48

The tables below show breakdowns of the questionnaire results by stakeholder group.

Q1: Barriers by Stakeholder Group																
From your perspective, how important or unimportant are each of these barriers in keeping people from adopting water-protective strategies in land-use planning?	Stormwater managers/engineers		Landscape contractors		Planners		Landscape architects		Developers		Engineers		Elected/appointed officials		Stakeholder groups overall	
Reluctance to try something new	73%	N = 11	89%	N = 9	69%	N = 13	50%	N = 8	50%	N = 4	67%	N = 6	25%	N = 8	63%	N = 59
Limited technical design guidance	91%	N = 11	89%	N = 9	77%	N = 13	88%	N = 8	75%	N = 4	83%	N = 6	38%	N = 8	78%	N = 59
Design, construction, maintenance issues and costs	82%	N = 11	78%	N = 9	100%	N = 13	88%	N = 8	100%	N = 4	100%	N = 6	38%	N = 8	83%	N = 59
Strategies not integrated in early planning process	91%	N = 11	89%	N = 9	62%	N = 13	50%	N = 8	100%	N = 4	80%	N = 5	63%	N = 8	74%	N = 58
Water rights considerations	36%	N = 11	44%	N = 9	23%	N = 13	88%	N = 8	25%	N = 4	20%	N = 5	38%	N = 8	40%	N = 58
No clear economic incentive	82%	N = 11	78%	N = 9	92%	N = 13	88%	N = 8	0%	N = 4	80%	N = 5	75%	N = 8	78%	N = 58
Difficulty measuring benefits	55%	N = 11	78%	N = 9	77%	N = 13	63%	N = 8	0%	N = 4	83%	N = 6	25%	N = 8	59%	N = 59
Standing water problems	45%	N = 11	50%	N = 8	31%	N = 13	13%	N = 8	25%	N = 4	50%	N = 6	38%	N = 8	36%	N = 58
Potentially longer review process	27%	N = 11	56%	N = 9	62%	N = 13	38%	N = 8	100%	N = 4	60%	N = 5	38%	N = 8	50%	N = 58
Conflicts with municipal code requirements	55%	N = 11	78%	N = 9	54%	N = 13	88%	N = 8	75%	N = 4	80%	N = 5	29%	N = 7	63%	N = 57
Americans with Disabilities Act considerations	45%	N = 11	56%	N = 9	8%	N = 13	43%	N = 7	0%	N = 4	20%	N = 5	13%	N = 8	28%	N = 57
Poorly drained soils/low infiltration capacity	82%	N = 11	56%	N = 9	38%	N = 13	63%	N = 8	50%	N = 4	50%	N = 6	25%	N = 8	53%	N = 59
Concerns with swelling soils	91%	N = 11	50%	N = 8	46%	N = 13	63%	N = 8	50%	N = 4	67%	N = 6	25%	N = 8	57%	N = 58

Percent "very important" or "important"

Q2: Benefits by Stakeholder Group

From your perspective, how important or unimportant are each of these barriers in keeping people from adopting water-protective strategies in land-use planning?	Stormwater managers/ engineers		Landscape contractors		Planners		Landscape architects		Developers		Engineers		Elected/ appointed officials		Stakeholder groups overall	
	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N
Improved water quality in nearby water bodies	82%	N=11	89%	N=9	100%	N=13	88%	N=8	75%	N=4	60%	N=5	63%	N=8	83%	N=58
Reduced cost for capital improvement projects that address stream damage	60%	N=10	89%	N=9	77%	N=13	88%	N=8	75%	N=4	40%	N=5	75%	N=8	74%	N=57
Reduced flooding	82%	N=11	78%	N=9	77%	N=13	63%	N=8	75%	N=4	40%	N=5	63%	N=8	71%	N=58
Reduced overall cost to developer for storm management infrastructure	60%	N=10	78%	N=9	85%	N=13	88%	N=8	100%	N=4	50%	N=4	57%	N=7	75%	N=55
More developable land on site	64%	N=11	89%	N=9	92%	N=13	57%	N=7	100%	N=4	80%	N=5	63%	N=8	77%	N=57
Property values increased by stormwater amenities	64%	N=11	78%	N=9	62%	N=13	75%	N=8	75%	N=4	60%	N=5	50%	N=8	66%	N=58
Reduced risk of slip and fall	20%	N=10	22%	N=9	31%	N=13	38%	N=8	75%	N=4	20%	N=5	25%	N=8	30%	N=57
Reduced water treatment costs	64%	N=11	67%	N=9	62%	N=13	75%	N=8	25%	N=4	40%	N=5	63%	N=8	60%	N=58
Reduced heat island effect due to tree cover	18%	N=11	56%	N=9	62%	N=13	63%	N=8	50%	N=4	40%	N=5	25%	N=8	45%	N=58
Enhanced riparian habitat	50%	N=10	67%	N=9	69%	N=13	63%	N=8	50%	N=4	100%	N=5	38%	N=8	61%	N=57
Enhanced groundwater recharge	45%	N=11	67%	N=9	69%	N=13	75%	N=8	50%	N=4	40%	N=5	63%	N=8	60%	N=58

Percent "very important" or "important"

Appendix B: Questionnaires, Focus Group and Interview Scripts

The following pages contain the two questionnaires and the scripts used in the focus groups and interviews for the AWARE Colorado study.

Focus Group Quick Questionnaire

We have a short series of questions to ask you just to give us a better idea of who participated in the focus groups when we later analyze the data. Please do not put your name on this sheet, as all responses will be kept confidential and not linked to any individuals.

1. How many years have you been in your profession? Is it...

- Less than 2 years
- 2-5 years
- 6-10 years
- 11-20 years
- More than 20 years
- Don't know

2. Please mark the circle that most closely matches your opinion on each of the following statements. In this context, "water quality protection" means protecting water resources (such as lakes, rivers, streams, wetlands and reservoirs) from polluted runoff or stormwater-generated pollutants.

	Extremely	Very	Somewhat	Not at all
In your current position, how important is water quality protection?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, how important would you say water quality protection is to your profession?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. In your current position, what percentage of your time is devoted to water quality protection?

4. How would you describe the area in which you work? (Please check all that apply)

- Rural
- Urban
- Suburban
- Foothills
- Mountains
- Plains
- Other _____

Thank you very much for your time!

Barriers

From your perspective, how important or unimportant are each of these barriers in keeping people from adopting water-protective strategies in land-use planning?

	Very important	Important	Somewhat important	Somewhat unimportant	Not at all important
Reluctance to try something new	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Limited technical design guidance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design, construction, maintenance issues and costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strategies not integrated in early planning process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water rights considerations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No clear economic incentive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficulty measuring benefits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Standing water problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Potentially longer review process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conflicts with municipal code requirements ¹	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Americans with Disabilities Act considerations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poorly drained soils/low infiltration capacity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concerns with swelling soils	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¹ i.e. curb and gutter required

Benefits

From your perspective, how important or unimportant are each of these benefits in encouraging people to adopt water-protective strategies in land-use planning?

	Very important	Important	Somewhat important	Somewhat unimportant	Not at all important
Improved water quality in nearby water bodies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced cost for capital improvement projects that address stream damage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced overall cost to developer for storm management infrastructure ²	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More developable land on site ³	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property values increased by stormwater amenities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced risk of slip and fall ⁴	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced water treatment costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced heat island effect due to tree cover	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enhanced riparian habitat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enhanced groundwater recharge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

² no curbs and gutters, smaller detention/retention facilities

³ less land used for stormwater management infrastructure

⁴ since ice doesn't form as easily on porous paving surfaces

Moderator Discussion Guide

Welcome and Ground Rules (6 minutes)

Hello. Thank you all for coming and participating in this focus group discussion. My name is _____ and I work for an independent research group called National Research Center.

AWARE Colorado, an initiative of the League of Women Voters, is sponsoring this focus group discussion so it can learn about your perspective on water quality protection strategies, which we will discuss. You were invited to join this discussion because, in your profession, you and your (stormwater/planning/architect/developer) colleagues deal with water quality protection either directly or indirectly in the work that you do.

How many of you have participated in a focus group before? In case you have not been in a focus group before, a focus group is a structured discussion where we'll ask you a series of questions to encourage sharing of ideas and opinions. We really want you to express yourself openly and honestly. There are no right or wrong answers. We just want to know what you think.

We are going to tape record this session to ensure our report accurately reflects your comments. However, your responses will not be linked with your name in any way. Everything you say will be kept strictly confidential. Because we are taping, I may need to remind you occasionally to speak up or talk one at a time so that we can hear you clearly when we review the session audio tapes

I am your guide, but I want the conversation to be among all of you. Each time I ask a question, we don't need to go around the table to let everyone respond in turn. But every so often I may check in and make sure that we get a chance to hear from different people because it is important that we understand different perspectives. There are only _____ of you, so each one of your perspectives is important to hear. If you would like to add to an idea, or if you have an idea that is different from other people's ideas, that's the time to jump into the conversation. Bear in mind, we're not looking for consensus here; we're looking to hear a variety of opinions and experiences.

[Mention food protocol, gift at end of group, no bathroom break].

Introductions (10 minutes)

1. Let's begin by pronouncing your name for me and telling the group how many years you have been in your current position. I'll start – My name is _____. I'm a Research Associate, and I've been in my position ___ years .

Today we're going to talk about water quality protection. What we mean by that is "protecting water resources (such as lakes, rivers, streams, wetlands and reservoirs) from polluted runoff or stormwater-generated pollutants." Land use planning has been found to be important in water quality protection, and one area that's recently emerged as a potentially positive area of focus is parking lot design and construction.

Parking Lots (10-15 minutes)

Here are some of the strategies that can be used in parking lots.

- Using porous/pervious paving materials¹
 - Using landscaping designed to promote infiltration²
 - Planting trees³
 - Using landscaping that reduces need for irrigation, fertilizer & pesticides
2. What's missing from this list of parking lot strategies?
 3. How important are parking lot design and construction as ways to protect water quality?

Barriers (25-30 minutes)

Here are some barriers to the adoption of water-protective strategies that have been generated by prior research. Please review the list, add any you feel are missing, then rate their relative importance for you.

[HAND OUT BARRIERS – ALLOW 5 MINS FOR COMPLETION, THEN DISCUSS]

Now, let's discuss your responses.

4. What are the most important barriers for you? Let's talk about that.
[PROBE: barriers of special concern to your community? Are there other significant barriers related to parking lot design, construction or maintenance?]

5. In your role as _____, what can you do to overcome these barriers? Do others need to be involved? If yes, who?
[PROBE: Ask specifically about education, incentives, regulation]

Benefits (20-25 minutes)

Now, let's talk about some benefits to some of the water quality protection strategies we've been discussing. Here is a list of benefits that other professionals in fields related to yours have mentioned when discussing water quality protection. Please review the list, add any you feel are missing, then rate their relative importance for you.

¹ Porous asphalt or concrete, Permeable pavers, Gravel, Reinforce grass

² Landscaped sumps vs traditional islands; Filter strips between parking lots and sidewalks; Vegetated swales; Porous landscape detention

³ to reduce runoff volume

[HAND OUT BENEFITS – ALLOW 5 MINS FOR COMPLETION, THEN DISCUSS]

Now, let's discuss your responses.

6. Were there benefits you added to the list? Let's hear them.
7. What are the most important benefits for you? In what ways are these important?
[PROBE: Ask specifically about economic value. Do these benefits accrue to your organization or another party? Any benefits of special concern to your community?]
8. In your role as _____, what steps can you take to bring about these benefits? Do others need to be involved? Who?

[PROBE: What are the best ways to communicate the value of these benefits to others? Ask about economic, environmental, social benefits]

Opportunity, Ability and Motivation (20 minutes)

9. In your role as _____, what ability/authority do you have to support/promote the water protective strategies we have been discussing? What could be done to increase your ability to support/promote these strategies?
[PROBE: Are there opportunities for you to do so? What are these opportunities? Training or education?]
10. In your role as _____, what would motivate you (or what *does* motivate you) to support the water protective strategies we have been discussing?
[PROBE: What would increase your motivation to support these strategies? What would prompt you to *promote* such strategies?]
11. How do you think other stakeholder groups view the strategies we have discussed?
[PROBE: Developers, engineers, planners, landscape architects, landscape contractors, etc.]

Final Opinions (5 minutes)

Let's stop for a moment and consider everything we have discussed in this group, and all the ideas it made you think about.

12. Given all you have said and heard, what is the one most important message you would want to relay to AWARE CO?

Conclusion (1 minute)

That concludes our discussion. I've enjoyed talking with all of you. Thank you again for your time. AWARE Colorado will be using the results of this and other focus groups to help communities in Colorado better protect water resources.

[On your way out, _____ will give you your thank you gift.]

Interviewer Guide

Welcome and Ground Rules (1 minute)

Hello. Thank you for agreeing to participate in this interview. My name is _____ and I work for an independent research group called National Research Center.

AWARE Colorado, an initiative of the League of Women Voters, is sponsoring focus groups and a series of individual interviews to learn about different perspectives on water quality protection strategies. We want to talk with you because, in your profession, you and your (stormwater/planning/architect/developer) colleagues deal with water quality protection either directly or indirectly in the work that you do.

I am going to ask you a series of questions. We really want you to express yourself openly and honestly. There are no right or wrong answers. We just want to hear what you think.

I am going to tape record this interview to ensure our report accurately reflects your comments. However, your responses will not be linked with your name in any way. Everything you say will be kept strictly confidential.

This will take about 30-35 minutes. Do you have any questions before we begin?

So, _____ [name], how many years have you been in your current position?

OK, great. In this interview, we're going to be talking about water quality protection. What we mean by that is "protecting water resources (such as lakes, rivers, streams, wetlands and reservoirs) from polluted runoff or stormwater-generated pollutants." Land use planning has been found to be important in water quality protection. One particular area that's recently emerged as a potentially positive area of focus is parking lot design and construction.

Parking Lots (3 minutes)

I am going to list for you some of the strategies that can be used in parking lots.

- Using porous/pervious paving materials¹
- Using landscaping designed to promote infiltration²
- Planting trees³
- Using landscaping that reduces need for irrigation, fertilizer & pesticides

1. What's missing, if anything, from this list of parking lot strategies?
2. How important do you think parking lot design and construction are as ways to protect water quality?

¹ Porous asphalt or concrete, Permeable pavers, Gravel, Reinforce grass

² Landscaped sumps vs traditional islands; Filter strips between parking lots and sidewalks; Vegetated swales; Porous landscape detention

³ to reduce runoff volume

Barriers (8 minutes)

Via email, we sent you some barriers to the adoption of water-protective strategies that have been generated by prior research. Can you get out that list and review it, please? Go ahead and complete the relative importance rankings, if you haven't already done so, then tell me any that you feel are missing.

[ALLOW 1 MIN FOR COMPLETION, THEN DISCUSS]

Now, let's go through each one, and tell me how you ranked it in importance first, then we'll discuss your responses. [RECORD ALL SURVEY RESPONSES]

3. What are the most important barriers for you?

[PROBE: barriers of special concern to your community? Are there other significant barriers related to parking lot design, construction or maintenance?]

4. In your role as _____, what can you do to overcome these barriers? Do others need to be involved? If yes, who?

[PROBE: Ask specifically about education, incentives, regulation]

Benefits (8 minutes)

Now, let's talk about the flip-side – benefits, which we also emailed you earlier. Please get out the list of benefits. These are benefits that other professionals in fields related to yours have mentioned when discussing water quality protection. Go ahead and complete the relative importance rankings, if you haven't already done so, then tell me any that you feel are missing.

[ALLOW 1 MIN FOR COMPLETION, THEN DISCUSS]

Now, let's go through each one, and tell me how you ranked it in importance first, then we'll discuss your perspective. [RECORD ALL SURVEY RESPONSES]

5. Were there benefits you added to the list? Let's hear them.

6. What are the most important benefits for you? In what ways are these important?

[PROBE: **What economic benefits do you see?** Do these benefits accrue to your organization or another party? Any benefits of special concern to your community?]

7. In your role as _____, what steps can you take to bring about these benefits? Do others need to be involved? Who?

[PROBE: What are the best ways to communicate the value of these benefits to others? Ask about **economic**, environmental, social benefits]

Opportunity, Ability and Motivation (8 minutes)

8. In your role as _____, what ability/authority do you have to support/promote any water-protective strategies? What could be done to increase your ability to support/promote these strategies?

[PROBE: Are there opportunities for you to do so? What are these opportunities? Training or education?]

9. In your role as _____, what would motivate you (or what does motivate you) to support water-protective strategies?
[PROBE: What would increase your motivation to support these strategies? What would prompt you to promote such strategies?]
10. How do you think other stakeholder groups view water-protective strategies?
[PROBE: Developers, engineers, planners, landscape architects, landscape contractors, etc.]

Final Opinions (3 minutes)

Let's stop for a moment and consider everything we have discussed in this interview, and all the ideas it made you think about.

11. Now, what is the one most important message you would want to relay to AWARE CO?

Conclusion (1 minute)

That is the end of my interview questions. I've enjoyed talking with you. Thank you again for your time. AWARE Colorado will be using the results of this interview and other interviews and focus groups to help communities in Colorado better protect water resources.

If you have any further comments or questions, please don't hesitate to call NRC or AWARE CO. Would you like my email address?

Thanks!