

Engaging community members in the floodplain mapping process



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Executive Summary

A situational scan was undertaken to identify best practices, benefits and challenges surrounding engaging community members in the floodplain mapping process across Canada. This process typically involves flood hazard identification and priority setting, data collection and estimation of design flood and flood levels, floodplain mapping and data dissemination, and the development of a flood risk assessment that contributes to effective flood mitigation. The community can be engaged at all and any points in this floodplain mapping process, and their input can help shape data collection, hazard identification, priority setting, and eventual risk assessment.

Taking the time to engage community members in the floodplain mapping process is a highly worthwhile and beneficial investment. There is no single best way to engage communities, as each process and each community will be different. Based on accounts of what is currently being done to engage communities, and based on the lessons learned and key recommendations provided by experts in the field, a series of recommended best practices for engaging communities in floodplain mapping can be established:

1. **Listen to the needs and wants of each community, as each community is unique.** Experts agreed that every mapping process is unique, in terms of the characteristics of the watershed, the purpose of the exercise (to inform and build trust, or to improve the maps through local input), and the characteristics and needs of the community itself. As such, every community requires a different tool for engagement. Engagement methods that are effective in a big city with a large population may be of little interest or effectiveness in a small, remote community. To avoid barriers and waste of resources, project leaders should connect with communities early on to understand and establish specific community requests and sensitivities, to explain the purpose of the process and the maps to be generated, and to design an engagement process that best fits with these needs.
2. **Engagement tools are most effective when they are interactive.** Community residents are best engaged when they are involved in interactive processes and activities. Incorporating interactive components into engagement methods, such as interactive online maps, videos, animations, or hands-on activities, can increase the comprehension of subject matter and help to generate interest in the project.
3. **Utilize multiple tools and platforms to optimize engagement efforts.** Using multiple platforms to engage communities is essential for reaching and interacting with different groups of people and demographics. Not only does using multiple platforms reach wider audiences, it also helps to address accessibility issues by making project material available in different formats and through

different delivery channels. To increase cost efficiency, engagement material should be developed in a way that allows easy adjustment and applicability across various platforms. Methods of engagement currently being used in various projects include, but are not limited to, town hall and public meetings, information booths, website and social media updates, workshops and focus groups, and map calibration using local and traditional knowledge.

4. **Good facilitation is key for conducting effective community engagement.** Having a facilitator that specializes in consultation and communication is critical for carrying out meaningful engagement with communities in the floodplain mapping process. It was noted that engineers and technical staff may not be best suited for communicative roles. Having a facilitator as part of the project team that is comfortable and experienced in leading meetings, keeping everyone on track, communicating with people from a diverse range of backgrounds and professions, and dealing with angry or upset residents, was a key recommendation amongst experts. These facilitators can also work with engineers and technical staff to help structure technical and informational presentations in ways that can be understood by the average resident. Ensuring that the general public understands the information being presented is a crucial component in making sure that staff time and costs are not wasted during material preparation and delivery.
5. **Make project information, resources, and deliverables available to the public online.** Many current floodplain mapping projects upload relevant project information and documents to their respective websites, which can be accessed freely by the public. By making this information publicly available, it helps to keep the public informed throughout the process, sustains public interest throughout the process, and establishes accountability and transparency. In communities where online channels are not preferred, this information can be posted through traditional media.

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1. Introduction

The following subsections describe the background, purpose, and scope of this report.

1.1 Background

Floodplain mapping can be a critical tool in reducing the impacts of flooding in Canadian communities (Public Safety Canada, 2017). Floodplain maps are graphic depictions of the boundaries of historical and potential flood events (MVCA, 2015a; Henstra & Thistlethwaite, 2017). Floodplain maps assist in crucial decision-making regarding land use planning and restrictions, flood mitigation strategies, awareness and preparedness of the general public, and emergency management (Natural Resources Canada, 2017). However, in order for floodplain maps to be an effective tool for anticipating, preparing, and mitigating against flood damages, they must depict up-to-date information (Henstra & Thistlethwaite, 2017). A recent study revealed that the median age of floodplain maps in Canada is 18 years, with approximately half being produced before 1996 (MMM Group Limited, 2014). Due to urban development, river morphology, climate change, and frequently evolving technology and data availability, new and updated floodplain maps are necessary to increase the capacity of communities to predict and protect against flooding (Keller et al., 2014; Pal, 2002).

Effectively involving Canadian residents in the floodplain mapping process is a critical component in establishing community-level understanding of flood risk (White, Kingston, & Barber, 2010). Federal Minister for Public Safety and Emergency Preparedness, Ralph Goodale, stated at the National Roundtable for Flood Risk (November 16, 2017) that “Prevention can and should begin at the individual level”. As more responsibility for their own protection and recovery after flood events is shifted onto Canadians, residents should become more actively engaged in flood risk management (White, Kingston, & Barber, 2010). Participatory activity in the floodplain mapping process can enhance scientific learning and understanding of flood risks, and as such, can be used as a method of providing risk information in a localized way, in partnership with communities, to encourage preparedness and personal responsibility for managing flood risk (Maher, 2014).

1.2 Purpose

The purpose of this report is to gain a better understanding of how communities can be effectively engaged in the floodplain mapping process. The process, based on NRCan’s Floodplain Mapping Framework (Figure 1) starts with flood hazard identification and priority setting, continues through data collection and estimation of design flood and flood levels, through floodplain mapping and data dissemination, to development of a flood risk assessment that contributes to effective flood mitigation. The community can be engaged at all and any points in this floodplain mapping process, and their input can help shape data collection, hazard identification, priority setting, and eventual risk assessment.

opportunities for engagement

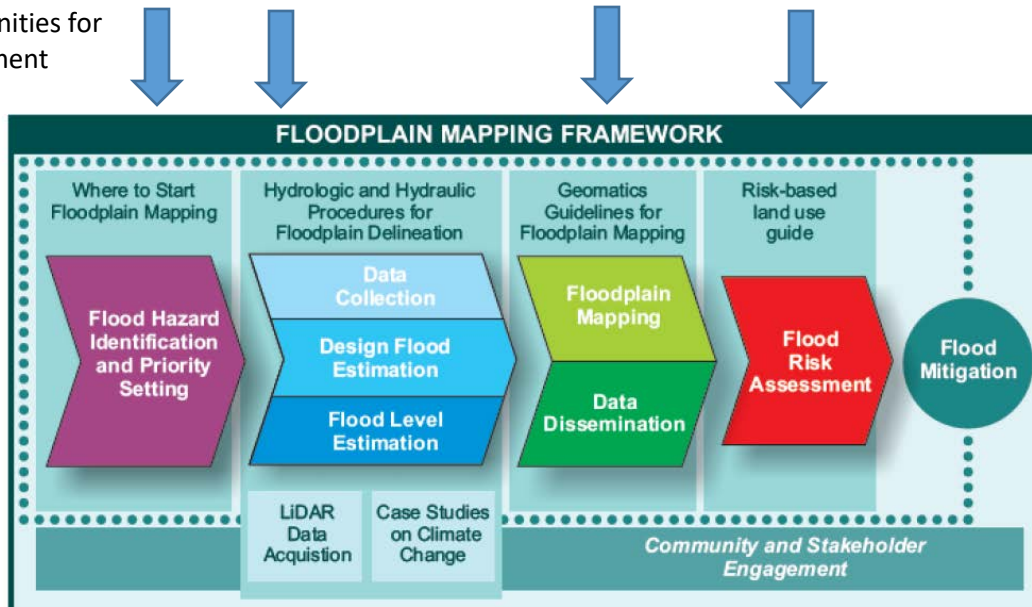


Figure 1. NRCan’s Floodplain Mapping Framework

While community engagement should be encouraged throughout the floodplain mapping process, the community can be most effectively involved at the following points in the Framework:

Floodplain Mapping Framework Phase	How can a community be involved?
Flood Hazard Identification and Priority Setting	<ul style="list-style-type: none"> • Learn about the project and the need for maps • Provide feedback on understanding of the need • Hazard identification and priority setting – what’s important to the community? • Identify concerns • Establish trust and transparency – build support and further participation
Data Collection	<ul style="list-style-type: none"> • Provide local and traditional knowledge (photographs of historical floods, flood-prone areas) • Identify particularly risky areas
Floodplain Mapping Data Dissemination <u>Draft public release</u>	<ul style="list-style-type: none"> • Provide feedback on preliminary maps and cartographic design, usability, relevance • Provide feedback on how to release data publicly (GIS files, paper maps) • Build support for use of maps for planning purposes
Floodplain Mapping Data Dissemination <u>Validation</u>	<ul style="list-style-type: none"> • Confirm local and traditional knowledge (photographs of historical floods, flood-prone areas) • Confirm relevance and usability of maps and distribution methods (GIS web portal, paper maps, online maps) • Build support for use of maps for planning purposes
Flood Risk Assessment	<ul style="list-style-type: none"> • Help prioritize where to focus attention to reduce risk to the community • Support for decision-making process and outcomes

The aim of this report is to examine what is currently being done to engage the general public and communities, and to identify potential benefits and drawbacks of such engagement. Recommendations will then be provided on how to best engage the general public and communities in the floodplain mapping process.

1.3 Scope

The focus of this report is on existing practices for involving communities in the floodplain mapping process in Canada; however, international case examples may be included where they are applicable and transferable to a Canadian context. In addition, interviews were conducted with individuals responsible for community engagement in the floodplain mapping process from the following organizations: AMEC Foster Wheeler (Ontario; Newfoundland and Labrador), City of Waterloo (Ontario), Department of Municipal Affairs and Environment – Government of Newfoundland and Labrador (Newfoundland and Labrador), Ebbwater Consulting (British Columbia), Fraser Basin Council (British Columbia), Grand River Conservation Authority (Ontario), Greenland Consulting (Ontario), Niagara Peninsula Conservation Authority (Ontario), and Six Nations of the Grand River (Ontario). Respondents were asked to detail their personal experiences, and are identified as Resource Person #X in this report to ensure confidentiality in their remarks.

While the findings from this report are intended for use by decision-makers in Canada, other countries with similar resources and abilities to engage with their communities may also benefit from the recommendations identified.

2. Existing Processes for Engaging Communities in the Floodplain Mapping Process

The following subsections detail what is currently being done to engage communities in the floodplain mapping process across Canada. Current methods of engagement include town hall and public meetings, information booths, website and social media updates, workshops and focus groups, and map calibration using local and traditional knowledge.

2.1 Town Hall and Public Meetings

Town hall and public meetings provide opportunities for local governments, organizations, and consultants to meet with community members to discuss topics of interest and upcoming projects. These meetings have the capability to facilitate well-informed citizen engagement and deliberation that is directly relevant to decision-makers and opportunities for action (Lukensmeyer & Brigham, 2002). Citizen deliberation can also have a real influence on regional planning and policy development (Lukensmeyer & Brigham, 2002). As such, these meetings can provide significant opportunities for discussion, feedback, and participation regarding flood risks and floodplain mapping projects.

Multiple jurisdictions have utilized town hall and public meetings as their method of community engagement in the floodplain mapping process. One example is the Niagara Peninsula Conservation Authority (NPCA), who undertook a floodplain mapping project for the Welland River, Ontario, in 2016 (Campbell, 2016a). To achieve as broad a public consultation as possible, the NPCA held multiple town hall meetings over the course of two rounds of public sessions, with a third round planned for 2018 (Campbell, 2016a; NPCA, 2016a; Resource Person #5, 2017). Each round of public sessions were comprised of town hall meetings in four different communities along the Welland River to make it as convenient as possible for residents to attend (Campbell, 2016a). To encourage residents to attend the meetings, a large publicity campaign was implemented utilizing newspaper ads, website postings, social media postings, and the direct mailing of postcards to over 5,000 households along the river (Campbell, 2016a).

Over 600 people attended the first round of meetings for the Welland River floodplain mapping project, designed to introduce the project, to hear concerns from residents, to answer questions, and to gather feedback (Campbell, 2016b; MMM Group Limited, 2016b). Over 260 people attended the second round of meetings, designed to explain the technical aspects of the process, and to answer additional questions (Campbell, 2016b, MMM Group Limited, 2016a). With both rounds of meetings seeing good public attendance (Figure 2), many community members had the opportunity to provide feedback through one-on-one discussions, verbal comments and questions, comment cards, and e-mails (Campbell, 2016a).

The third round of meetings, anticipated to be held in 2018, will be to introduce and explain the final map product and how it impacts residents, and to answer final questions (Resource Person #5, 2017).



Figure 2. First-Round Town Hall Meeting for the Welland River Floodplain Mapping Project (NPCA, 2016b)

Objectives of the public meetings include: appraising the public, gathering local knowledge of the watersheds, discussing concerns, providing understanding of previous and current hydraulic studies, and to present the final maps (NPCA, 2017a). All sign-in sheets, presentations, and submitted comments will be included in the final project reports (NPCA, 2017a). The NPCA is also undergoing a new floodplain mapping project for the Towns of Grimsby and Lincoln, Ontario (NPCA, 2017a). Three public meetings will be incorporated into this floodplain mapping process: at the initiation of the project, at the 60% completion stage, and at the completion of the project (NPCA, 2017a). NPCA has decided to implement three rounds of public information meetings for all floodplain mapping studies going forward (Resource Person #5, 2017).

In the Ottawa Region, three conservation authorities – Mississippi Valley (MVCA), Rideau Valley (RVCA), and South Nation (SNCA) are collaborating with the City of Ottawa on a five year project to update existing floodplain maps and to create new maps for several watercourses in the Ottawa area (CBC News, 2014; MVCA, 2015b). After the technical work and draft mapping for each watercourse area was complete for the RVCA, a public information session was held to collect public feedback (RVCA, 2017). Public input collected at these sessions are then used to further refine the mapped floodplain limits (RVCA, 2017). The SNCA also holds open houses to discuss their updated floodplain maps with residents and to educate residents on how to reduce their flood risk (Jackson, 2014).

The City of Waterloo, Ontario is also updating its floodplain maps for sections of Laurel Creek and Clair Creek, with assistance from Grand River Conservation Authority (GRCA) and Stantec Consulting Ltd. (The City of Waterloo, 2016b). To introduce the floodplain mapping project, a public information centre was held, where information panels were on display and a presentation was given (The City of Waterloo, 2016b). The purpose of the presentation was to inform and educate the public on the need for updated floodplain maps and how updated maps could impact what homeowners do on their property (The City of Waterloo, 2016a). An ad in the newspaper and the direct mailing of over 2,400 letters to property owners in the study area were the methods used to encourage residents to attend the public information centre and to stay informed on the project (Resource Person #6, 2017).

Six Nations of the Grand River, Ontario utilizes public meetings to engage its residents in current floodplain mapping work (Resource Person #7, 2017). In addition to larger community meetings, environmental technicians also meet with residents on their property, as it has been shown to be more effective in terms of project interest, input, and understanding (Resource Person #7, 2017). Because the reserve is spread out over a large area, community meetings near the end of the project are likely to be planned in multiple areas, to encourage more residents to attend (Resource Person #7, 2017).

Other jurisdictions have also utilized, or are planning to utilize, public meetings as a community engagement tool in the floodplain mapping process; however, limited details surrounding these meetings are available. After a 2017 flood event in West Montrose, Ontario, the GRCA held a debrief presentation, which indicated that the next step was to obtain input from a public meeting to update floodplain mapping and webpage for the community (Boyd, 2017). Truro, Nova Scotia also underwent a large flood risk study run by the county's Joint Flood Advisory Council and CBCL Limited (CBCL Limited, 2016). The study developed new floodplain maps and final reports indicate that a major stakeholder was the general public, who were consulted through public meetings at the beginning of the project (CBCL Limited, 2016).

Information presentations were also held in communities that were being mapped between 1975 and the early 2000's, as part of the federal government's Flood Damage Reduction Program (Sandink, Kovacs, Oulahen, & McGillvray, 2010). The information sessions were to ensure greater public awareness, as the public were identified as stakeholders (Sandink, Kovacs, Oulahen, & McGillvray, 2010). In addition, the City of Calgary and Province of Alberta currently have eleven multi-year studies underway to update floodplain maps (City of Calgary, 2017; Government of Alberta, 2017). The study updates indicate that the map finalization process will include engagement, specifically open houses to inform the public on the project and its resultant maps (Government of Alberta, 2017).

2.2 Information Booths

While town halls (typically presentation-style) and public meetings (typically walk-around style with display panels) play an important role in consulting the public, they are often under-attended, and can be restricted to those in the area under study (Meyer et. al., 2011). Authorities are turning to different methods to reach the broader community to engage and encourage people to find more information. Information booths and displays in the community are another popular form of public outreach for municipalities and organizations, regarding natural resource and environmental issues (Duffy, 2011; Cutts, Saltz, & Elser, 2008). This tool allows project teams to connect with the general public or specific groups of interest that may not have gone out of their way to learn about the project otherwise. This method of community engagement can provide the public with information on upcoming or current floodplain mapping projects, as well as information on upcoming meetings and how to get involved (Duffy, 2011). In turn, information booths can help to raise the public's awareness of flood risks and relevant projects in their community.

Grand Forks, British Columbia is an example of a jurisdiction that is set to use information booths to engage the public in an upcoming floodplain mapping project. The consulting firm Urban Systems prepared a proposed work plan for the project, to be completed in 2018, stating that “providing information and engagement opportunities, at the earliest stage of the project, will help to build awareness and support for this work and lead to better solutions that are supported by community members” (Urban Systems, 2017, p. 16). The project information will be presented to the public via staffed pop-up booths that will be set-up during community events and in busy community areas (i.e. parks) (Urban Systems, 2017). The display booths will allow the project team to connect with community members around the city and to raise the community's awareness and support for new floodplain maps beyond the boundaries of the newly confirmed floodplain area (Urban Systems, 2017).

Information booths and displays are also forms of public outreach that are recommended in community action plans for future mapping projects. Guidelines such as the BC Floodplain Maps Action Plan – “an action plan designed to advance progress to update existing floodplain maps” – suggest using public outreach, specifically posters, banners, and information displays in malls, to help strengthen political support for mapping projects (BC Real Estate Association, 2016).

2.3 Website and Social Media Updates

Providing information and interactive opportunities online and through social media platforms is another method of engaging the public in the floodplain mapping process. Not all community members have the time or means of transportation to access public meetings or information booths, and thus, online information can act as a more accessible method of public engagement (White, Kingston, & Barber, 2010). Being able to access project information at any time from any location is beneficial in today's busy society,

and being able to submit feedback online may increase participation from residents that are hesitant to express their concerns in public settings (White, Kingston, & Barber, 2010). Online updates provide opportunities to inform and educate the public on floodplain mapping, as well as gather feedback in a more anonymous way.

Ebbwater Consulting conducted a Flood Map Project for British Columbia, and made a call-out on their website for the public to submit ideas and feedback on how they wanted to see the data and maps presented (Ebbwater Consulting, 2016). This feedback was very valuable towards building maps for public education purposes, in particular. The contact information of the consulting firm was provided online, and the public was invited to offer feedback through email, over the phone, or in-person at their office (Ebbwater Consulting, 2016). Ebbwater is also currently using social media platforms, specifically Facebook, to engage small communities in Northern British Columbia in flood mapping projects (Resource Person #1, 2017).

Another example of engagement through an online channel is the International Joint Commission (IJC), who is working to develop floodplain maps for sections of Lake Champlain and Richelieu River that run through Quebec and parts of the United States (IJC, 2015). The IJC hosts a website to facilitate public outreach through project information and updates (IJC, 2017). The IJC also posted an invitation on their website for the public to submit comments and feedback on the project work plan (IJC, 2017). Project documents, updates, public comments, and public meeting dates are all uploaded on the website for community viewing (IJC, 2017).

Other floodplain mapping projects have also included online updates as a method of keeping the public informed and involved in the process. The City of Waterloo, Ontario provides online updates for its Laurel Creek and Clair Creek floodplain mapping project, and invites the public to sign-up for project updates via an e-mail subscription (The City of Waterloo, 2016a; Resource Person #6, 2017). The NPCA has created a website for its Welland River floodplain mapping project, which posts relevant documents and town hall meeting schedules, enables the public to sign-up for email updates, and encourages the public to provide feedback throughout the process (NPCA, 2017b). The RVCA encourages the public to sign-up for an e-mail subscription to receive updates on floodplain mapping studies and related community events (RVCA, 2017). Six Nations of the Grand River provides project updates via a newsletter that is emailed and posted on the Six Nations website, and via radio announcements (Resource Person #7, 2017).

Project updates and events are also commonly posted on organizations' social media pages, primarily Facebook and Twitter (Resource Person #1, 2017; Resource Person #5, 2017). One expert noted that social media is continuing to reach broader audiences than traditional print media, and that populations historically seen as less likely to use electronic platforms, such as the elderly and rural residents, are also more commonly using social media (Resource Person #5, 2017).

2.4 Workshops and Focus Groups

Workshops and focus groups are effective ways to consult and involve communities throughout floodplain mapping process (Duffy, 2011). It is important to recognize that communities are end-users of floodplain maps, and involving them in design and development can enhance the communicative power and overall effectiveness of the maps, particularly if these maps will be made public (Meyer, et al., 2012). Workshops and focus groups allow the public to participate in discussions and activities, and provide valuable feedback on floodplain maps before they are finalized and published.

The Government of New Brunswick has an objective of engaging its citizens in the floodplain mapping process, and suggests using working groups or workshops to facilitate this engagement, by giving the public opportunities to make comments on draft maps (Government of New Brunswick, 2014). Furthermore, the Government of New Brunswick aims at ensuring that its citizens are informed of the value of floodplain maps and are equipped with information on how to use them (Government of New Brunswick, 2014). A study conducted in the Tantramar Region of New Brunswick utilized focus groups to measure how individual risk perception was influenced by different visualizations, including floodplain maps, and to gather recommendations for the development of maps (Lieske, Wade, & Roness, 2014). The focus groups included a pre-focus and post-focus questionnaire, where participants could indicate what to improve on the floodplain maps, such as what they found difficult to understand and what could be added or changed to make the maps more useful (Lieske, Wade, & Roness, 2014).

First Nation communities in British Columbia have developed a set of strategies for increased public participation in community planning (Indian and Northern Affairs Canada, 2006). While not specific to a current floodplain mapping project, the strategies are applicable, as they suggest using focus groups to host mapping exercises and to overcome the barrier of communities feeling that their input may not be important (Indian and Northern Affairs Canada, 2006). Mapping exercises in these focus groups can include community members identifying areas on a map that they think are important because of historical flooding or drainage issues, or locations of community attributes of importance to them, including flood areas, water sources, watershed protection areas, and geological features, and then using this information to help develop land use designations (Indian and Northern Affairs Canada, 2006). One consulting firm has hired and trained local Indigenous residents to help with data collection for floodplain mapping projects, contributing to enhanced community understanding, capacity, and resiliency (Resource Person #2, 2017).

A European study examined five floodplain mapping case studies within Austria, England, Germany, and France, to understand how end-user participation in the mapping process can help to overcome barriers and enhance the effectiveness of maps (Meyer, et al., 2012). The study found that best practices for public participation in the floodplain mapping process included a set of workshops. Objectives of the workshops were: to engage the public in a dialogue about flood maps, to discuss and explore local

knowledge, to gather opinions on the aesthetics and usability of current and sample maps, and to identify recommendations for map improvement (Meyer, et al., 2012). The study found that incorporating public opinions and feedback into flood map design and development can increase the comprehensiveness and effectiveness of maps, since the public are an end-user of the final maps (Meyer, et al., 2012).

2.5 Map Calibration using Local and Traditional Knowledge

While floodplain maps are primarily produced using hydraulic modelling and remote sensing data, there are still opportunities for communities to engage in map production. Local and traditional knowledge on community flooding can play an important role in validating, augmenting, and challenging expert knowledge (McEwen & Jones, 2012; Resource Person #4, 2017; Resource Person #7, 2017; Resource Person #8, 2017). Many residents have personal experience with previous flooding events, or may be aware of local drainage issues that have not been reported to authorities (White, Kingston, & Barber, 2010; Resource Person #1, 2017; Resource Person #4, 2017; Resource Person #6, 2017). This information can be obtained through public participation in the floodplain mapping process, and can contribute to improved accuracy and quality of final maps, as well as improved trust in the process and the final product (Meyer, et al., 2012).

Partners for Action, the University of Waterloo, the City of Cambridge, and REEP Green Solutions recently collaborated on a design workshop that brought together community members and City staff to identify areas of localized flood events and opportunities for green stormwater infrastructure and property-level projects to reduce flood risk (REEP Green Solutions, the City of Cambridge, Partners for Action, & the University of Waterloo, 2017). A student interviewed and surveyed neighbourhood residents following a flood event, and these residents were then invited to participate in a design workshop using mapping to identify problem areas and potential solutions. Bringing together local knowledge helped target potential problem areas and contributed to support for the suggested options to reduce risk.

Consulting firm Amec Foster Wheeler recently conducted a flood mapping project for the town of Portugal Cove – St. Philips, Newfoundland and Labrador (Amec Foster Wheeler, 2015). As part of the map production process, the firm wanted to consider the experiences of the community. The town manager, who had intimate knowledge of the community and historical flooding, was consulted to review the inundation zones that were developed from hydraulic modeling (Amec Foster Wheeler, 2015). While most of the modelling results were found to be generally consistent with the town manager's flooding experiences, the areas that were identified as having potential discrepancies were reviewed and revised using model input (Amec Foster Wheeler, 2015). Thus, site-specific information gained from local knowledge contributed to the validation of new floodplain maps, but must also be considered with future climate and development and the previous flood experiences of others in the community to ensure all options are depicted.

A study conducted in Gloucestershire, United Kingdom, found that local knowledge is being harnessed to highlight gaps in expert knowledge and modelling for floodplain mapping (McEwen & Jones, 2012). Local knowledge and data, such as photographic records of previous flood events collected by citizens, are helping experts to calibrate and validate flood models (McEwen & Jones, 2012). One Gloucester City couple submitted photographs taken during previous floods to the Environment Agency to help flood models better depict what happens during floods in that community (McEwen & Jones, 2012). Ultimately, the study found that local knowledge can challenge expert knowledge and modelling and help validate updated floodplain maps (McEwen & Jones, 2012).

The RVCA encourages community members to contribute knowledge and information for use in validating floodplain maps for the Ottawa area (RVCA, 2017). Community residents that have photographs, news clippings, historical records, or memories of previous flood events are encouraged to share this information with RVCA's engineering team, to help confirm the validity of calculations and resultant floodplain maps (RVCA, 2017).

Six Nations of the Grand River also relies on traditional knowledge and anecdotal evidence from residents to corroborate new floodplain maps for the community. Historical data and records from previous flooding events, as well as stream gauges, are lacking for the community, so hearing flood stories from residents plays an important role in the development of floodplain maps (Resource Person #7, 2017). The information gathered from residents' memories and photographs (citizen science) helps to document past flooding events, provide information where scientific information is lacking, and validate new floodplain maps as they are generated (Resource Person #7, 2017).

3. Benefits and Challenges of Including the Public in the Floodplain Mapping Process

Involving the general public and communities in the floodplain mapping process has potential benefits and challenges, as discussed below.

3.1 Benefits of Including the Public in the Floodplain Mapping Process

Involving the public and communities in the floodplain mapping process can offer jurisdictions a range of benefits, including improved trust and transparency, improved accuracy and effectiveness of flood maps, and increased community understanding of risk.

3.1.1 Fosters Trust and Transparency

Engaging communities in the floodplain mapping process is an effective way to build trust and transparency between community members, leaders, and stakeholders (Mirza, Vodden, & Collins, 2012; National Research Council, 2012; Katz, 2017; Resource Person #2, 2017). Encouraging a dialogue between the public and authorities, such as the two-way communication that takes place during town hall and public meetings, helps to establish rapport and trust between actors (IIED, 2009; Wehn, Rusca, Evers, & Lanfranchi, 2015). Integrating local and traditional knowledge with scientific knowledge, such as what takes place when maps are calibrated using local information, also helps to establish a trusting relationship between actors (IIED, 2009). Because flood resiliency is largely dependent on trust, fostering these relationships is important (National Research Council, 2012). When the public and communities trust project leaders and stakeholders, they are more likely to be supportive of and responsive to the information that is published and distributed (National Research Council, 2012). Communities are more likely to support agencies' approaches to flood risk management, to take action to reduce their flood risk, and to adhere to flood evacuation protocols, when trust is established (Wehn, Rusca, Evers, & Lanfranchi, 2015; Meyer, et al., 2012; National Research Council, 2012).

To demonstrate the importance of trust between communities and authorities, the case of floodplain mapping for Welland, Ontario can be revisited. The NPCA originally approved new floodplain maps for Welland in 2010, but did so without formally informing or consulting the public in the process (Campbell, 2016a). Community residents discovered the new regulatory limits when applying for building permits, which led to feelings of shock, anger, and mistrust (Campbell, 2016a). Due to the public questioning the validity of the new boundaries and threatening legal action, the NPCA had to drop the project (Campbell, 2016b). The NPCA acknowledged that not consulting residents led to mistrust and resentment, and that going forward, their floodplain mapping projects would include public engagement and opportunities for resident participation and feedback (Campbell, 2016a). Thus, after reassessing their project approaches, the

NPCA chose to go forward with a full public participatory process for their 2016 floodplain mapping project for Welland, to build trust and transparency between the community and stakeholders (Campbell, 2016a).

3.1.2 Improves Accuracy and Effectiveness of Flood Maps

Obtaining and utilizing local and traditional knowledge can help to improve the accuracy and quality of floodplain maps (McEwen & Jones, 2012; Resource Person #4, 2017; Resource Person #6, 2017; Resource Person #7, 2017; Resource Person #8, 2017). Invested, empowered residents relying on maps they have helped create can also support flood risk management that impacts their communities, by informing decisions about what their governments can do about the risks identified by the mapping. While map production is often completed via technical knowledge and modelling, local and traditional knowledge can supplement this information, by identifying areas of discrepancy and encouraging the revision and calibration of certain map or model areas (McEwen & Jones, 2012). As seen in the Portugal Cove – St. Philip’s case study, a town manager helped the consulting firm Amec Foster Wheeler to identify areas of discrepancy and to verify the accuracy of new floodplain maps for the region in Newfoundland and Labrador (Amec Foster Wheeler, 2015). In addition, flood photographs from residents in Gloucester City, UK, helped the Environmental Agency to calibrate and validate their flood models for that community (McEwen & Jones, 2012).

Public participation and feedback can also increase the effectiveness of floodplain maps that are meant to educate the public about floods (White, Kingston, & Barber, 2010). Because the general public and community residents are end-users of floodplain maps, gathering and incorporating their feedback on the aesthetics and usability of the maps throughout the design process can improve the effectiveness of the final maps (Meyer, et al., 2012). Acquiring public opinions on sample or draft floodplain maps, such as during workshops and focus groups, allows authorities the opportunity to alter the final maps to better suit the end-user’s needs (Government of New Brunswick, 2014). This strategy was implemented in the Tantramar Region of New Brunswick, where recommendations on the visualization and comprehensiveness of floodplain maps were collected (Lieske, Wade, & Roness, 2014). One expert also noted that accessibility issues, such as an individual with colour-blindness being unable to view the specific colours on a flood map, can be addressed when public input is gathered before final publication (Resource Person #3, 2017). By incorporating public feedback into final map versions, maps can be more understandable and influential in communicating flood risks to communities (Meyer, et al., 2012).

3.1.3 Increases Community Understanding of Flood Risk

Engaging the public in the floodplain mapping process can also increase a community’s level of awareness and understanding of flood risk. Interviewed experts unanimously agreed that helping communities to become more aware of flood risk, the floodplain mapping process, and the resources

available to them, is one of the main benefits of engaging communities in the mapping process. By providing opportunities for the public to obtain information and explanations through public meetings, information booths, online postings, and workshops, jurisdictions can help communities to develop a better understanding of their flood risk and a greater understanding on the need for floodplain mapping and regulation of new and existing development in floodplains (Merz, Thielen, & Gocht, 2007). In addition, allowing the public to participate in the floodplain mapping process can increase their understanding on how to use flood maps, and how to better mitigate against flood damages (Merz, Thielen, & Gocht, 2007). Scientific learning can be enhanced through participatory activity, and thus, involving the public in floodplain mapping can increase community-level understanding of flood risk (Maher, 2014).

Once communities have a greater understanding and awareness of their flood risk, they are more likely to be motivated to take action to reduce their risk and to support floodplain mapping projects (White, Kingston, & Barber, 2010). That is why several mapping projects aim to engage the public to increase awareness and understanding. In the NPCA's proposal to update and create new floodplain mapping for the Towns of Grimsby and Lincoln, Ontario, one of the planned public meetings is specifically to increase the public's understanding of watershed hydrology and the hydraulic work that is being done in the project (NPCA, 2017a). In Urban Systems' work plan for new floodplain mapping in Grand Forks, BC, it is mentioned that display booths will be used as an engagement tool at the beginning of the project to build public awareness, to increase community support and better mitigation solutions (Urban Systems, 2017). And, the GRCA utilized information displays to increase the public's awareness of flood risk and the need for updated floodplain maps in Waterloo, Ontario (The City of Waterloo, 2016a).

3.2 Challenges of Including the Public in the Floodplain Mapping Process

Involving the public and communities in the floodplain mapping process also has its challenges, including public opposition to the project, and time and financial costs.

3.2.1 Opposition to the Project

Involving communities in projects that have the capability to impact their current and future homes, such as floodplain mapping projects, can create opposition and backlash from some residents (The Canadian Press, 2017a). Because updating floodplain lines can impact land use designations, building permits, home insurance costs, and home values, some residents may not support new floodplain mapping projects that they perceive will have negative impacts on their property (Cooke Insurance Group, 2017; Forrest, 2017; Resource Person #3, 2017; Resource Person #4, 2017; Resource Person #8, 2017). However, this backlash can be anticipated, and planned for, which may in turn result in a better engagement process, as the community is more involved throughout. As seen in the NPCA's 2010 attempt at updating floodplain lines

in Welland, Ontario, residents became angered after discovering they could no longer obtain building permits if they resided on a floodplain. Project opposition and political backlash ensued (Campbell, 2016b).

Public anger and backlash is what many local leaders fear in regards to involving communities in floodplain mapping, or making final floodplain maps available to the public (Stolte, 2016; Press, 2017). When the City of Edmonton, Alberta developed new floodplain mapping, they did not engage the public during the mapping process, and also questioned whether or not to make the final maps available to the public, out of concern regarding public anger and opposition (Stolte, 2016a). The maps were finally released to the public following a Request for Information submitted to the provincial government by a local newspaper (Stolte, 2016b). Vice-President of Federal Affairs for the Insurance Bureau of Canada, Craig Stewart, also acknowledges that local leaders are concerned about giving the public access to floodplain maps, due to fear that high-risk homeowners and residents will take out their anger at local officials (Press, 2017).

However, despite the resistance that floodplain mapping projects may face from pockets of residents, experts agree that the benefits of engaging communities in the floodplain mapping process still outweigh the challenges. The public have the right to be aware of their flood risk, and to be equipped with the knowledge and understanding to help them protect themselves, their families, and their properties, against flood damages (Press, 2017; Resource Person #1, 2017; Resource Person #8, 2017). The Federal Minister of Infrastructure and Communities, Amarjeet Sohl, recognizes that informing and engaging the public in floodplain mapping is critical for establishing flood risk awareness amongst residents, and for helping residents to make informed decisions on flood protection (The Canadian Press, 2017a). In addition, raising the public's awareness on flood risk can influence at least some members of the community to purchase optional home flood insurance, which can mitigate the costs of future damages (Cooke Insurance Group, 2017). Ebbwater Consulting also conducted a literature review and found that acknowledging floodplain maps most often only decreases real estate values marginally and temporarily, and sometimes not at all (Ebbwater Consulting, 2014). Ebbwater also found that these marginal and temporal decreases are far outweighed by the property values that can be saved in the future, through floodplain maps encouraging flood mitigation measures (Ebbwater Consulting, 2014).

3.2.2 Time and Financial Costs

It will require additional time and funding to incorporate community engagement and input into the floodplain mapping process (Wouters, Boys, & Wilson, 2011). Public participation and information methods can be quite time-consuming, and can extend a project's timeline (Wouters, Boys, & Wilson, 2011; Irvin & Stansbury, 2004). While certain community engagement methods may require more time than others, such as town hall meetings versus online updates, the delivery of information and gathering and processing of public input still requires staff time. In addition, public opposition and backlash to mapping

projects can delay a project's timeline even further (White, Kingston, & Barber, 2010), or result in reconsideration of engagement methodology, as in the NPCA case.

Community engagement can also be costly, and delegating a portion of project funding towards public engagement can lessen the budget for actual map production and implementation of project tasks (Irvin & Stansbury, 2004). It is also costly to train staff and build an organization's capacity to effectively facilitate public participation in the mapping process (Wouters, Boys, & Wilson, 2011; Irvin & Stansbury, 2004). Nonetheless, it can be cost-effective to spend money on engaging the public early in the floodplain mapping process, saving money in the long-run, as it contributes to community support for projects, and can result in community action to reduce flood risk and future flood damages (Resource Person #5, 2017; Cooke Insurance Group, 2017). Floodplain maps have been shown to have a return on investment of 2:1, and the costs of informing and involving the public during the mapping process has been shown to lessen the time and money spent on contesting maps later on (BC Real Estate Association, 2014; Campbell, 2016a; Resource Person #5, 2017).

4. Critical Steps in the Floodplain Mapping Process that Benefit from Public Input

Public engagement can benefit the floodplain mapping process at various stages, including at the onset of a project, throughout the map production phase, and before final map publication. Mapping projects can involve the public in one of these stages, in a combination of these stages, or in all of these stages.

4.1 At the Onset of a Project

Jurisdictions are encouraged to engage the public and communities from the very beginning of a project. Doing so is an integral tool for flushing out initial public concerns and for establishing trust and transparency (Meyer, et al., 2012). Engagement at the onset of a project typically has objectives of introducing the project to the public, answering preliminary questions, hearing concerns from residents, and gathering feedback (Campbell, 2016b). The feedback that the public provides at the beginning stage also has the capability to influence and shape the deliverables of the project (Resource Person #4, 2017). Providing opportunities for public information and engagement at the earliest stage of the project can also help to build support for the project, to motivate future participation in the project, and to ease public tensions (Urban Systems, 2017).

Many of the case studies mentioned in section 2.0 of this report embarked in public engagement at the onset of their floodplain mapping projects. The NPCA held town hall meetings at the beginning of their mapping projects for Welland, Grimsby, and Lincoln, Ontario (Campbell, 2016b; NPCA, 2017a). The Joint Advisory Council and CBCL Limited consulted the public through public meetings at the beginning of their mapping project for Truro, Nova Scotia (CBCL Limited, 2016). The GRCA held a public information centre at the beginning of their mapping project for Laurel Creek and Clair Creek, Ontario (The City of Waterloo, 2016b). And Urban Systems aims to inform the public via pop-up booths at the beginning of their project for Grand Forks, British Columbia (Urban Systems, 2017).

4.2 Throughout the Map Production Phase

Jurisdictions can choose to engage the public and communities in the middle stage of a project, or throughout the map production phase. Public engagement during this phase includes opportunities for community members to provide input on draft maps, to make recommendations on map design, and to contribute local and traditional knowledge for map calibration (McEwen & Jones, 2012; Lieske, Wade, & Roness, 2014; Amec Foster Wheeler, 2015). There are opportunities during this phase to educate the public on the importance and necessity of floodplain maps and the role maps play in land use planning (The City of Waterloo, 2016a; Merz, Thieken, & Gocht, 2007). There are also opportunities to educate the public on technical aspects of the project, to increase their understanding of hydrology and flood mapping (Campbell, 2016b; Resource Person #5, 2017). Participation should take place early on, when drafts are available for

comment, to allow adjustments to be made to final floodplain maps. This iterative process will enhance the maps' effectiveness in meeting end-user needs, and promote trust and credibility of the creators and the process, towards ultimate support of the maps themselves (Meyer et al., 2011; Meyer, et al., 2012).

Examples of engaging the public throughout the map production phase were highlighted in the second round of town hall meetings hosted by the NPCA, through website and email updates that were continuously posted by various project organizers, and through public sessions and focus groups that gathered public opinions on draft maps (Campbell, 2016b; IJC 2017; The City of Waterloo, 2016a; NPCA, 2017b; RVCA, 2017; Lieske, Wade, & Roness, 2014; Meyer, et al., 2012). Amec Foster Wheeler also consulted with public experiences to help calibrate their floodplain maps for Portugal Cove – St. Philip's, Newfoundland Labrador, throughout their map production stage (Amec Foster Wheeler, 2015).

4.3 Before Final Publication

Jurisdictions can also choose to engage the public and communities towards the end of a floodplain mapping project, before final maps are published and distributed. Before final publication, public outreach can address final questions and concerns, gather final comments on the aesthetics and usability of maps, and educate the public on project outcomes or how to use the maps (Merz, Thielen, & Gocht, 2007). Connecting with the public before final maps are published gives individuals the chance to have their opinions heard and to offer feedback that can lead to additional improvements to the maps (Meyer, et al., 2012). Connecting with the public before final map publication can also diminish tensions that could arise if individuals were to discover after-the-fact that their property is impacted by new floodplain lines (Campbell, 2016a). Engaging the public at the end stage of a mapping project is also an opportune time to provide information and education on how to use the maps and how to reduce flood risk (Merz, Thielen, & Gocht, 2007).

SNCA holds open houses near the end of their mapping projects to discuss resultant floodplain maps with residents and to educate residents on how to reduce their flood risk (Jackson, 2014). The floodplain study updates for the Province of Alberta indicate that their finalization process will include public engagement, specifically open houses near the end of the projects, to inform the public on project outcomes and updated maps (Government of Alberta, 2017). The NPCA is also planning to host a public meeting at the completion stage of their floodplain mapping project for Grimsby and Lincoln, Ontario (NPCA, 2017a).

5. Potential Benefits and Considerations of Using One Standardized Federal Guideline when Conducting Floodplain Mapping Consultation and Engagement

The following subsections explore the potential benefits and considerations of using one standardized guideline for engaging communities in the floodplain mapping process.

5.1 Benefits of Using One Standardized Federal Guideline

When engaging communities in the floodplain mapping process, a standardized federal guideline can help to ensure consistency and fair opportunities for public participation across the country. A guideline with best practices can provide project leaders, both new and experienced, with a baseline of tools and resources on how to effectively engage communities (Lee & Drubin, 2016). Instead of project leaders searching various sources or case studies for best practices, a standardized guideline can serve as a time-saving resource for providing recommendations on best practices. Experts agree that such a guideline may be particularly helpful for communities that have not done floodplain mapping projects before. A standardized guideline can help project leaders to avoid common mistakes made during previous mapping projects, and can improve consistency amongst future projects (Lee & Drubin, 2016). A standardized guideline can also build a sense of community amongst project leaders, by establishing common practices between organizations that may have previously had differing opinions and capacity for engagement processes (Lee & Drubin, 2016).

A standardized federal guideline can also encourage community engagement to take place in jurisdictions that may have otherwise not engaged the public in the mapping process. For example, municipal governments that hesitate to involve communities in floodplain mapping projects due to fear of political backlash can rely on the standardized guideline established by the federal government as a source of support and justification for their projects (The Canadian Press, 2017b). Because the directive for mapping projects can be passed to a higher level of government, municipal governments may feel more confident and secure in engaging their communities in the development of floodplain maps (The Canadian Press, 2017b).

5.2 Considerations of Using One Standardized Federal Guideline

It is important to recognize that each community has unique traits and demographics, and thus, one standardized guideline for community engagement might not meet the needs and wants of all communities. Demographics can influence how the public best receives information and can influence accessibility of engagement activities. For example, younger generations may prefer to receive updates and invites via the internet or social media, while older generations may prefer to receive updates and invites via direct mail-outs and newspaper ads (Helsper & Eynon, 2010). Older adults may be more likely to attend and participate

at town hall and public meetings in comparison to young adults (Milan, 2005; Resource Person #1, 2017). And, members of communities, such as the elderly, those with disabilities, and those who are mobility-impaired, may require more accessible forms of community engagement, such as online engagement (White, Kingston, & Barber, 2010). Linguistic and cultural diversity may also be a key attribute of some communities, and in these cases, community engagement sessions and information may need to be provided in multiple languages or in culturally appropriate ways (John, 2017). **Thus, experts agree that a guideline for community engagement should be somewhat general, with a degree of flexibility and options, so that engagement activities can be catered to unique community needs.** One expert also noted that the term “guideline” itself could be constraining to some communities if interpreted more so as requirements – the alternate term “best practices” was suggested. As the Federal Floodplain Mapping Guidelines are not prescriptive, rather are optional, we do not recommend changing terminology to “best practices”.

The presence or absence of recent flooding events in a community can also influence the attitudes and knowledge of community members, and can influence the level of community engagement required. For example, a community recently impacted by a flooding event may be extremely motivated to participate in a floodplain mapping project, versus a community that has not been impacted by a flooding event in their lifetime (Loucks, 2015; Resourcer Person #1, 2017; Resource Person #3, 2017). Some communities may require a lesser or greater degree of public outreach and engagement to raise awareness and support for floodplain mapping. **As a result, a standardized guideline should acknowledge the need for varying levels of community engagement, based on the desired outcomes, community knowledge, experience, and perceptions of flood risks.**

Having one standardized guideline for community engagement in the floodplain mapping process may also not address the various time, financial, and resource constraints found within different communities. Each community has its own project timelines, fiscal budgets, and staffing capabilities, and the depth of community engagement will change depending on these factors (Klein, Jackson, & Simpson, 2010). Jurisdictions with more resources can involve communities in deeper levels of engagement and participation versus jurisdictions that have less resources (Klein, Jackson, & Simpson, 2010). **As such, a standardized guideline should provide a spectrum of engagement opportunities for jurisdictions to choose from, depending on their available resources.** This spectrum can include informing, consulting, and involving the public, and how it coincides with the different methods of community engagement discussed in section 2.0 of this report is summarized in Figure 3 below (IAP2, 2017).

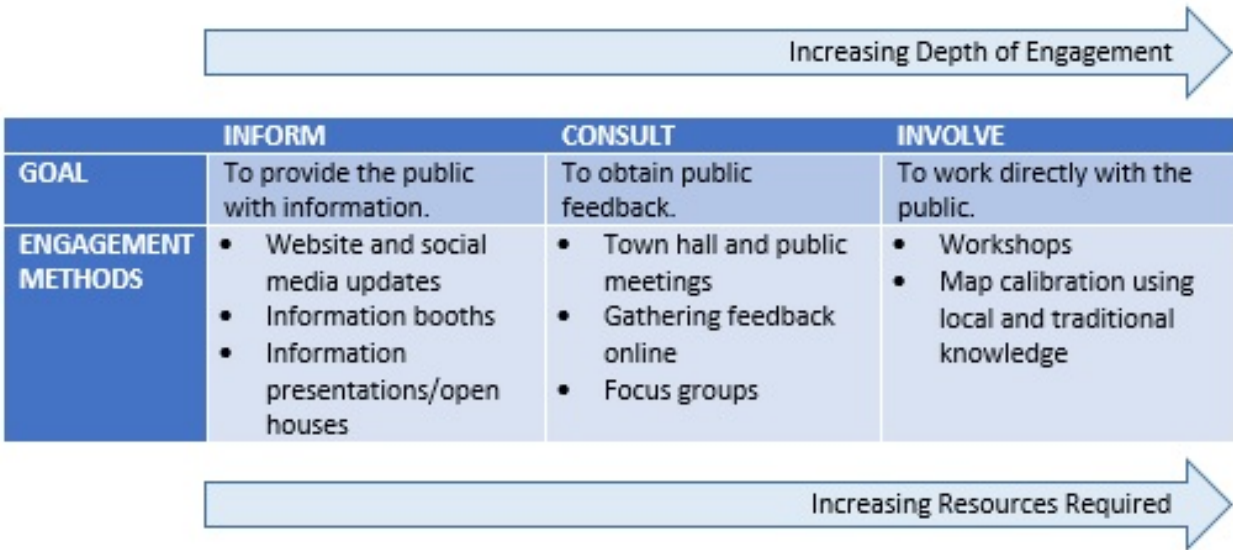


Figure 3. Community Engagement Spectrum (IAP2, 2017)

6. Lessons Learned and Recommendations for How to Best Engage Community Members in the Floodplain Mapping Process

Taking the time to engage community members in the floodplain mapping process is a highly worthwhile and beneficial investment. There is no single best way to engage communities, as each process and each community will be different. Based on accounts of what is currently being done to engage communities, and based on the lessons learned and key recommendations provided by experts in the field, a series of recommended best practices for engaging communities in floodplain mapping can be established:

1. **Listen to the needs and wants of each community, as each community is unique.** Experts agreed that every mapping process is unique, in terms of the characteristics of the watershed, the purpose of the exercise (to inform and build trust, or to improve the maps through local input), and the characteristics and needs of the community itself. As such, every community requires a different tool for engagement. Engagement methods that are effective in a big city with a large population may be of little interest or effectiveness in a small, remote community. To avoid barriers and waste of resources, project leaders should connect with communities early on to understand and establish specific community requests and sensitivities, to explain the purpose of the process and the maps to be generated, and to design an engagement process that best fits with these needs.
2. **Engagement tools are most effective when they are interactive.** Community residents are best engaged when they are involved in interactive processes and activities. Incorporating interactive components into engagement methods, such as interactive online maps, videos, animations, or hands-on activities, can increase the comprehension of subject matter and help to generate interest in the project.
3. **Utilize multiple tools and platforms to optimize engagement efforts.** Using multiple platforms to engage communities is essential for reaching and interacting with different groups of people and demographics. Not only does using multiple platforms reach wider audiences, it also helps to address accessibility issues by making project material available in different formats and through different delivery channels. To increase cost efficiency, engagement material should be developed in a way that allows easy adjustment and applicability across various platforms. Methods of engagement currently being used in various projects include, but are not limited to, town hall and public meetings, information booths, website and social media updates, workshops and focus groups, and map calibration using local and traditional knowledge.
4. **Good facilitation is key for conducting effective community engagement.** Having a facilitator that specializes in consultation and communication is critical for carrying out meaningful engagement with communities in the floodplain mapping process. It was noted that engineers and

technical staff may not be best suited for communicative roles. Having a facilitator as part of the project team that is comfortable and experienced in leading meetings, keeping everyone on track, communicating with people from a diverse range of backgrounds and professions, and dealing with angry or upset residents, was a key recommendation amongst experts. These facilitators can also work with engineers and technical staff to help structure technical and informational presentations in ways that can be understood by the average resident. Ensuring that the general public understands the information being presented is a crucial component in making sure that staff time and costs are not wasted during material preparation and delivery.

5. **Make project information, resources, and deliverables available to the public online.** Many current floodplain mapping projects upload relevant project information and documents to their respective websites, which can be accessed freely by the public. By making this information publicly available, it helps to keep the public informed throughout the process, sustains public interest throughout the process, and establishes accountability and transparency. In communities where online channels are not preferred, this information can be posted through traditional media.

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