AGENDA

Public Safety, Courts and Civil Service Policy Committee

November 9, 2021, 1:00 pm

Council Member Dave Gruber, Chair
Council Member Marsha Berzins, Vice Chair
Council Member Curtis Gardner, Member

Public Participant Dialing Instructions
Dial Access Number 408.418.9388
Event Number 2491 059 0977

Council Goal: Assure a safe community for people

4.f. **Hazard Mitigation Plan Update** 40
Matt Chapman, Battalion Chief / Angela Garcia, Senior Assistant City Attorney (15 Minutes)

4.g. **Fleet Replacement Schedule** 391
Rodney Weber, Deputy Fire Chief / Angela Garcia, Senior Assistant City Attorney (10 Minutes)

4.h. **2021 Public Safety, Courts and Civil Service Agenda Item Review** 401
Jason Batchelor, Deputy City Manager (5 Minutes)

5. **Miscellaneous Matters for Consideration**

6. **Confirm Next Meeting**
2022 meetings to be determined by the new Council.

7. **Adjournment**

Public Safety, Courts and Civil Service Committee

October 14, 2021

Members Present: Dave Gruber, Chair; Marsha Berzins, Vice Chair; Curtis Gardner, Member

Others Present: D. Carrel, A. Dickens, W. Nicholson, J. Haien, J. Schneebeck, A. Robnett, M. Platt, A. Garcia, D. Parker, J. Bergeron, M. Nelson, M. Hays, M. Hildebrand, R. Weber, F. Gray, M. Longshore, S. Day, J. Batchelor, M. Wasserburger, M. Chapman, M. Ridder, T. Buneta, J. Heckman, M. Cain, T. Brown, S. Stowell, D. Wilson, J. Twombly, C. Juul, Y. Kennedy, J. Moon, R. Jackson, S. Wright, C. Hills, R. Lantz, M. Smith, R. Pena, C. Amparan, B. Wesner, P. Schulte, Z. DeBoyes, V. Wilson, I. Evans, J. Bajorek, D. Stafford

---

1. Call to Order

Meeting called to order at 11am.

2. Approval of Minutes

September 16, 2021 minutes approved.

3. Consent Items

3.a Aurora Fire Rescue International Fire Code 2021 Adoption

Deputy Fire Chief Caine Hills gave a brief overview of this item. The process of adoption started with the Business Advisory Board in January 2020. The Building Department is critical in collaboration because they adopt the International Building Code (IBC) simultaneously with the adoption of the International Fire Code (IFC) being proposed. Both codes mirror and complement each other. Tax and Licensing has added a provision in the new code related to food trucks. Latent vapors utilization must have commercial codes in them and AFR has established a process of identifying those food trucks when they request a license. A new version of the code is to come out every three years. The last code was adopted in 2015 because 2018 was skipped. In addition to multiple amendments, four chapters were added to this version; Energy Systems, Higher Education Laboratories, Process and Extraction Facilities, and Storage of Distilled Spirits and Wines.

Outcome

Approved to move forward to Study Session.

Follow-up Action

Provide meeting minutes from the Business Advisory Board when this item goes to Study Session.

3.b Regional Fire Code Board of Appeals IGA

Deputy Fire Chief Caine Hills gave a brief overview of this item. There is a provision within the Fire Code that allows business owners to appeal an interpretation of the fire code if a violation is issued. They have never had an appeal process requested. The initial IGA was developed and initiated in 2006. AFR is requesting to terminate the previous 2006 agreement and move the presented IGA forward for full council consideration. This Board would include participants from other jurisdictions such as South Metro, City of Sheridan, West Douglas Fire Protection District, Jackson, and Aurora Fire. After research and discussion, staff concluded that having an outside appeal process would be most appropriate. Otherwise the appeal process would be the same as the Building Department's process. The board will include representatives with experience in design, fire protection, engineering, industrial safety, general contracting, a general industry business.

Outcome

Approved to move forward to Study Session.

Follow-up Action

None.

4. General Business

4.a September 2021 Crime and Police Attrition Data

Deputy Police Chief Darin Parker provided the update on crime to the committee. A review of the 4-week comparisons from last year indicates a slight decrease. However, an overall increase is expected for 2021.

Business Services Manager John Schneebeck presented the attrition data to the committee. There were 12 additional losses in September which tallies up to 101 losses year-to-date. Comparatively, total losses for 2020 was 87 and total losses for 2019 was 58. The turnover percentage is 13.6% The cumulative slope continues in the upward trend. Five classes comprised of 1 lateral and 4 basic entry classes have started resulting in 75 total additions. This results in a net loss of 26. Organizationally, there were 733 sworn employees at the end of the month, which is 11 less than the 744 authorized sworn strength. This breaks down to 38 losses in patrol as well as 15 trainees working in patrol side-by-side with the trainers. If all the current classes go as planned, there will be 65 additional FTEs added by June of 2022. The next academy is scheduled to start on October 25, 2021 with 20 basic recruits.

CM Gruber: The numbers are still disturbing. We're not seeing the drops in crime that I was hoping to see but I understand the challenges. In regard to the attrition, this is the most frustrating information to see crime going up and police going down. The basics of management is to measure and modify based on the measurements in order to correct. So, we've got the measurements going on, and I appreciate the job the police department has done and bringing these numbers to council. The frustrating part is that we lack the knobs to turn that would, both,

reduce crime and increase retention. And that's incredibly frustrating to me. I know it's frustrating to city management, the chief of police, and leadership within the police department. I think it's important that these numbers continue to come to council. I'll be gone in another two months, but it's important these come to council so that we can at least see the results of our efforts or our ability or lack of ability to change these.

CM Berzins: I agree with you 100%. It is very frustrating. I know we have good recruiters. The lateral classes have just about dried up and we've always gotten recruits from that. We've always gotten people moving over. This is totally different than I've ever seen and it's a shame. I hate to see this. Unfortunately, it's going to take us a while to dig out of here.

CM Gruber: We've got the Attorney General's report and the impact of that. I pray for the city and I congratulate and support the police department and I wish you the best in protecting the citizens and residents of Aurora.

CM Berzins: I would like to say, keep you heads up. You were painted with a broad brush and never should have happened. We have wonderful staff and police, everyone involved and please don't let all this get you down. You're there to help and you do help and I'm just so sorry that you got painted with that negative brush, because you don't deserve that.

Outcome

Information Only.

Follow-up Action

None.

4.b September 2021 Aurora Fire Rescue Attrition Data

Assistant Director of Fire Management Services, Mathew Wasserburger, presented this item to the committee. AFR has had 15 separations year-to-date which is an attrition rate of 3.5%. The department has done a pretty good job over the last couple years planning for attrition and making sure academy classes are big enough to meet that. The three-year planning average is 6.8%. AFR may get there but planning decisions were made to cover that.

CM Gruber: This is encouraging information.

Outcome

Information Only

Follow-up Action

None.

4.c 2021 Judicial Performance Commission

Dr. Zelda DeBoyes explained that part of her role with the city was to act as the staff liaison for the Judicial Performance Commission. She introduced the commission members to the committee; Interim Court Administrator Mike Ridder, Chair John Haien, Vice Chair Debbie Stafford, Secretary Wesley Nicholson, Yasmeen Kennedy, and Attorney Kelly Malcolm. Their purpose is to maintain

quality of judge's performance based on input from citizens, jurors, attorneys, administrative staff. The report is prepared with a full and confidential evaluation of each judge and is forwarded to City Council and the judges. Every two years the commission makes recommendations to council to appoint, do not reappoint, or no opinion along with explanations of the evaluations. The commission performs court evaluations and private executive sessions where they discuss the evaluations before presentation. The commission is comprised of three attorneys and 4 non-attorneys appointed by council and serve a three-year renewable term. There are currently two vacant attorney positions. The data package for 2021 is not yet complete but is expected to be by the end of the year. Judge Day provided his perspective of the process. He explained it is part of the city code and provides an annual opportunity to evaluate each other and see where they stand. The feedback, even critical comments, are viewed positively by the judges and provide a benchmark for additional training and areas of improvement. The commission and Judge Day meet annually to stay informed of his perspective to build that into the interview process of the judges to ensure its usefulness. The Commission's role is not to discipline the judges but rather to ensure the judges have what they need for self-evaluation and provide refined, objective feedback about the judges.

CM Gruber: I spend a lot of time with these reports when I receive them. I don't have a judicial background, so it's very informative and helpful to understand from a community perspective as to how the judges are doing.

Outcome

Information Only

Follow-up Action

None.

4.d Aurora Fire Rescue Auto/Mutual Aid Procedure

Deputy Fire Chief Allen Robnett presented this item to the committee. Automatic aid agreements are the exchange of services between two agencies dispatched to scenes as part of response force and does not require approval. Mutual aid is a requested response based on agreements between AFR and other agencies. It requires approval from a battalion chief, at minimum. The mutual aid agreement is negotiated so participating agencies know exactly what their participation entails. It is typically clearly outlined what each agency will provide. There is some maintenance required for the automatic aid agreements such as sharing of radio channels and cross-training, so they know how to function on-scene. AFR currently has mutual aid agreements with Douglas County, Metro Chiefs, and Buckley Airbase. These agreements are determined by ease of access to specific geographical areas. For example, on 225 going north, Denver will respond and on 225 going south, AFR will respond. This provides citizens a much quicker response. AFR has automatic aid agreements with Denver Fire and South Metro Fire. Every metro department sending a crew outside the city to perform suppression operations will also send a battalion chief to operate as their safety officer. AFR anticipates establishing an agreement in the future with Bennett/Watkins Fire District and the Colorado Air and Space Port areas.

CM Gruber: I thought we had agreements put in place with Watkins and Bennett over some of the oil wells that are going into Aurora on the far east side. Do those operate under mutual aid or some other type of agreement?

Robnett: Those are mutual aid and we've had interaction training together on those. We're conducting active negotiations with them but those are covered by mutual aid, we don't automatically respond. There is a confusing part to that, I should clarify; a lot along Watkins are dual jurisdiction areas. Those are areas that are annexed into the city, but they pay into the Watkins Fire District so both agencies have an obligation to respond.

CM Gardner: Last year I had opened a council request asking about some statistics on how often we're calling for aid from other agencies. I think our software at the time didn't allow us the ability to track that as well as we would have liked. Now that we have some of that new software in place, is that something we're tracking and if needed in the future, could get the data on?

Robnett: That's correct, Sir. We are grateful for the upgrade and software. It is capable of tracking that. It has a tremendous amount of flexibility and how we track it, and we're still drilling down into the best way to track it, but we do have that data.

Outcome

Information Only.

Follow-up Action

None.

4.e APD Mutual Aid Process and Procedures

Deputy Police Chief Darin Parker presented this item to the committee. The original request for this item was from Councilmember Berzins and her questions about how police stay safe when either assisting in other jurisdictions or when other jurisdictions assist APD. There are two types of mutual aid; those established by an Intergovernmental Agreement (IGA) or Memorandum of Understanding (MOU) that are prepared with the assistance of legal advisors, and more short-term agreements that come in through Dispatch and must be approved by a patrol lieutenant or higher. When APD receives requests for planned operations, a determination on available resources is made. The requests are normally for SWAT or resources such as those. Leadership determines what the role of APD will be, the equipment needed such as vehicles, and specifically what the ask from the other agency is. The expectation is that, while operating with another agency, that APD will operate according to APD training and policies or procedures with the equipment that APD officers are trained to use. APD does not typically integrate personnel with other jurisdictions as far as unit operations so communication, tactics and procedures can be followed. All of these things would be outlined in an operation plan to include what APD's role would be, objective, rules of engagement, and command and control. The metro area has radio channels that are shared amongst the jurisdictions and they make sure to identify which of those will be used. When APD requests mutual aid, the process is similar but in reverse. A need is identified and a decision is made to reach out to another agency that can help provide any needed resource. The request goes through the chain of command

and is ultimately approved by the chief. The request is generally made chief to chief or sheriff. An example of how the requests work is related to the request from Denver. When they were placed under restrictions by a Denver judge as far as what their tactics could be and what weapons could be used, from that point on APD was unable to assist from that point on crowd control operations because the restrictions didn't allow for the equipment, training, or tactics used for operation.

CM Berzins: That was very helpful. I did not realize that once the judge did that in Denver, then that turned you away. That's good to know.

CM Gardner: I'm glad to hear that we're not compromising our tools or tactics or training or anything to help other agencies. So, if it doesn't meet kind of our minimum standards, then it's not going to work for us. So that I'm glad to hear that.

CM Gruber: I'm equally supportive of that decision. If we train our people one way if they're in a situation where the training does not match what the situation requires, essentially, then our people would be untrained and that's never a good situation. So, I think that was a good decision as well.

Outcome

Information Only

Follow-up Action

None.

5. Miscellaneous Matters for Consideration

M. Ridder: I'd like to make a request. We're doing E-Discovery and we're under some guidelines that the PD Commission would like to have implemented real quick. I'd like to make an additional request for two FTE's for the Court IT Division. We're a staff of four people, and we have two programmer analysts on board that we would like to devote one totally to the project. We have to have an online bonding project completed by December 31st this year to comply with the Senate bill for this year. The two FTE positions would help us push these projects forward and accommodate the timelines that we are pushed with.

CM Gruber: Council has done the funding review. Pretty much now all development or all software is working through software as a service. Do you make or do you buy the software applications used by the court system?

M. Ridder: No, we develop all our software. We tailor make all our software we believe doing business here at the court we want to do the business, the way the city wants to do the business, and not try and run into a situation with a vendor. We take into account that usually most software packages you're at the mercy of them going into their upgrade and usually that's where you have to have a business analyst that is tasked with having to do those upgrades and at the mercy of what a vendor wants you to do on an upgrade and that usually affects numerous systems when you do that. The beauty of us is that we integrate into multiple systems and we have the talent to do that. Where we get tied along is when we get into the house bills that has just been, the last couple of years, just been unbelievable how many house bills has come across. There is no timing on them and there is no planning on them. So, we basically are at the mercy of whatever is being passed that we have to comply with. I don't know how software packages and the cost of those would even be affordable for the city at the present time. That's been our practice for the last 20-25 years

is developing. I think we've done quite a good job of keeping up with everything that needs to be done.

D. Wilson: This came about as a result of our meeting with my commission and Judge Day, Julie Heckman and Mike Ridder as a result of the assessment. The number one thing we talked about was how we could get electronic discovery implemented. It's been a project that started well before I was appointed. The conclusion was that if Mike can get this done by Spring, which is the project that we've been trying to get figured out for about six years. But, it's going to take some relief in his officer because it's going to take some staff to get this completed. We know it's late in the process, but all of us over here support this request because he will embed a person in Julie's wing of the City Attorney's office to get it done. It will save so much time and money if we can get that done.

CM Gardner: I'm certainly supportive of the concept of moving to electronic discovery. My concern is developing our own versus buying third-party. From a support standpoint, you lose the people who are around development and you don't have that institutional knowledge then also adding two FTEs. Are there not third-party software available?

M. Ridder: We looked at Xerox Solution a couple years back. And even with Xerox there was a couple year wait for them to even do a programming for the municipal court level. It had a million dollar cost at that time and no guarantee. We weren't too happy with the way their product was and what they would support. We have really embedded a lot of time in this, and we also have most of the stuff ready to go right now.

D. Wilson: I was involved in the building out of the state. If my office alone, the state public defender's office alone, had to give up $1.2 million to get it done and that was just my share. It was an extremely expensive process and Mike's office is, in essence, three to four months away.

CM Gardner: Scott Newman probably isn't on this call. I'd be curious, from his perspective and what he does for the city, what his thoughts would be on building this out ourselves versus something off the shelf. I don't know where we're at in this process and I hate to throw up a roadblock. I'd be curious to hear from his perspective what his thoughts were because I think he's pretty in tune to a lot of the cyber security and that type of thing.

S. Day: You have really good points. There's been other courts that have gone with third-party vendors for their process. In speaking with those other courts, there was a lot of challenge as it related to those 3rd party vendors. In talking with the presiding judges, one issue that came up is that some of the third-party vendors, when they agreed to join your particular court, they then become the owner of their own data. As you know, we're getting into an era with criminal justice reform and the State is really interested and involved with the collection of data it relates to the law enforcement concerns. That's finding its way into the courts as well. Negotiating and dealing with the issues of who owns the data is a huge issue. For us to do it ourselves to keep it kind of in house, we don't have to deal with all those other issues. There may be advantages to what you're referring to as to support of that system ongoing. We've had our own court administrative system for my entire time here, it's been in house and we've administered that system for 30 plus years. I think we could do so with the E-discovery as well.

CM Gruber: My experience is that home-build applications become very costly in the long-term given the expertise needed to maintain them. I know that there are other applications where E-Discovery is built into it. I've also heard complaints over the last few years about the paper copies necessary to execute court proceedings and the inherent risk of sharing

links to data that may be stored on a server without a secure front end. I would like to see at our November meeting is a make-or-buy analysis. I would like to have the Chief Information Officer for the City do that analysis. Based on the outcome, we either fund the FTEs or we take that money to buy a system off the shelf and work with other municipalities to ensure that system is meeting what the legislature put into statute.

6. Confirm Next Meeting

Next meeting moved from November 18 to November 9, 2021 at 1pm via WebEx due to the upcoming election and committee members no longer involved in council thereby not having a quorum.

7. Adjournment

Meeting adjourned at 12:35pm

APPROVED: _____

Dave Gruber, Chair

8

CITY OF AURORA
Council Agenda Commentary

Item Title: October 2021 Crime and Police Attrition Data
Item Initiator: Danelle Carrel, Committee Liaison
Staff Source/Legal Source: Darin Parker, Deputy Chief of Police / Megan Platt, Assistant City Attorney
Outside Speaker: N/A
Council Goal: 2012: 1.0--Assure a safe community for people

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☐ Approve Item as proposed at Study Session

☒ Information Only

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☐ Approve Item with Waiver of Reconsideration

Why is a waiver needed?Click or tap here to enter text.

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: N/A

Policy Committee Date: N/A

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval

☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation

☐ Recommendation Report Attached

☐ Minutes Attached

☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

N/A

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

Monthly Crime statistics and sworn personnel attrition data.

QUESTIONS FOR COUNCIL

N/A

LEGAL COMMENTS

The City Manager shall be responsible to the City Council for the proper administration of all affairs of the City placed in his charge and, to that end, he shall have the power and duty to make written or verbal reports at any time concerning the affairs of the City under his supervision. City Charter § 7-4(e). (Platt)

PUBLIC FINANCIAL IMPACT

☐ YES ☒ NO

If yes, explain: N/A

PRIVATE FISCAL IMPACT

☐ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A

Aurora Police Department - UCR Statistics — District: ALL

*UCR crimes are measured by a count of **victims and/or incidents** reported during data period*	4 Week Last Year	4 Week Current Year	4 Week Difference	4 Week % Chg	Y-T-D Last Year	Y-T-D Current Year	Y-T-D Difference	Y-T-D % Chg - or - % of Total
Current Wk 44: 10/25/21 - 10/31/21	09/27 - 10/24		+ or -	% chg	01/01 - 10/24		+ or -	% chg
Major Crimes	09/28/20 - 10/25/20							
Murder Victims	0	7	+7	--	32	30	-2	(6.3%)
Sex Assault Victims	23	18	-5	(21.7%)	267	267	--	0.0%
Spouse / Dating	5	2	-3	(60.0%)	84	49	-35	18%
Familial	2	6	+4	200.0%	24	34	+10	13%
Otherwise Known	12	6	-6	(50.0%)	72	84	+12	31%
Sex Assault DV Victims	5	2	-3	(60.0%)	77	43	-34	16%
Agg Assault Victims	170	213	+43	25.3%	1,867	2,243	+376	20.1%
Spouse / Dating	18	41	+23	127.8%	338	419	+81	19%
Familial	11	28	+17	154.5%	169	188	+19	8%
Otherwise Known	36	40	+4	11.1%	421	470	+49	21%
Agg Assault DV Victims	24	36	+12	50.0%	370	420	+50	19%
Robbery	55	60	+5	9.1%	634	629	-5	(0.8%)
Major Violent Crimes Reported	***248***	***298***	***+50***	***20.2%***	***2,800***	***3,169***	***+369***	***13.2%***
Burglary	159	114	-45	(28.3%)	1,363	1,423	+60	4.4%
MVT	399	420	+21	5.3%	2,977	4,436	+1,459	49.0%
Larceny	593	472	-121	(20.4%)	5,932	6,381	+449	7.6%
Major Property Crimes Reported	***1,151***	***1,006***	***-145***	***(12.6%)***	***10,272***	***12,240***	***+1,968***	***19.2%***
Major Index Crimes Reported	***1,399***	***1,304***	***-95***	***(6.8%)***	***13,072***	***15,409***	***+2,337***	***17.9%***
Criminal Arrests								
Physical Arrests	333	322	-11	(3.3%)	4,238	3,925	-313	(7.4%)
Criminal Summonses	336	310	-26	(7.7%)	3,765	3,516	-249	(6.6%)
DUI/DUID (Detox Summons)	46	34	-12	(26.1%)	538	496	-42	(7.8%)
Total Arrests	***669***	***632***	***-37***	***(5.5%)***	***8,003***	***7,441***	***-562***	***(7.0%)***
Traffic Enforcement								
Traffic Tickets Muni	1,068	542	-526	(49.3%)	14,386	14,166	-220	(1.5%)
Traffic Tickets in GO's Muni	284	146	-138	(48.6%)	2,909	2,470	-439	(15.1%)
Total MET Tickets Muni	1,172	474	**-698**	**(59.6%)**	11,592	11,990	**+398**	**3.4%**
Total Traffic Tickets Muni	**1,352**	**688**	**-664**	**(49.1%)**	**17,295**	**16,636**	**-659**	**(3.8%)**
Total Traffic Tickets State	**53**	**44**	**-9**	**(17.0%)**	**1,339**	**1,127**	**-212**	**(15.8%)**
Total Traffic Tickets	***1,405***	***732***	***-673***	***(47.9%)***	***18,634***	***17,763***	***-871***	***(4.7%)***
Traffic Accidents								
Fatal	2	4	+2	100.0%	29	28	-1	(3.4%)
Injury	75	0	-75	(100.0%)	566	99	-467	(82.5%)
Non-Injury	775	3	-772	(99.6%)	8,054	2,204	-5,850	(72.6%)
Total Accidents	***852***	***7***	***-845***	***(99.2%)***	***8,649***	***2,331***	***-6,318***	***(73.0%)***

Ran: 11/3/2021 1:15:03 PM *by Crime Analyst R. Eisner*

Aurora Police Department - UCR Statistics — District: 1

*UCR crimes are measured by a count of **victims and/or incidents** reported during data period*	4 Week Last Year	4 Week Current Year	4 Week Difference	4 Week % Chg	Y-T-D Last Year	Y-T-D Current Year	Y-T-D Difference	Y-T-D % Chg - or - % of Total
Current Wk 44: 10/25/21 - 10/31/21	09/27 - 10/24		+ or -	% chg	01/01 - 10/24		+ or -	% chg
Major Crimes	09/28/20 - 10/25/20							
Murder Victims	0	5	+5	--	22	16	-6	(27.3%)
Sex Assault Victims	4	7	+3	75.0%	109	126	+17	15.6%
Spouse / Dating	0	0	--	--	35	24	-11	19%
Familial	0	3	+3	--	6	18	+12	14%
Otherwise Known	3	1	-2	(66.7%)	22	33	+11	26%
Sex Assault DV Victims	0	0	--	--	34	23	-11	18%
Agg Assault Victims	91	119	+28	30.8%	953	1,113	+160	16.8%
Spouse / Dating	9	20	+11	122.2%	171	188	+17	17%
Familial	6	9	+3	50.0%	76	82	+6	7%
Otherwise Known	23	22	-1	(4.3%)	211	246	+35	22%
Agg Assault DV Victims	13	19	+6	46.2%	186	196	+10	18%
Robbery	31	31	--	0.0%	387	354	-33	(8.5%)
Major Violent Crimes Reported	***126***	***162***	***+36***	***28.6%***	***1,471***	***1,609***	***+138***	***9.4%***
Burglary	71	53	-18	(25.4%)	630	639	+9	1.4%
MVT	195	182	-13	(6.7%)	1,346	1,882	+536	39.8%
Larceny	220	173	-47	(21.4%)	2,402	2,394	-8	(0.3%)
Major Property Crimes Reported	***486***	***408***	***-78***	***(16.0%)***	***4,378***	***4,915***	***+537***	***12.3%***
Major Index Crimes Reported	***612***	***570***	***-42***	***(6.9%)***	***5,849***	***6,524***	***+675***	***11.5%***
Criminal Arrests								
Physical Arrests	141	138	-3	(2.1%)	1,826	1,633	-193	(10.6%)
Criminal Summonses	163	130	-33	(20.2%)	1,751	1,494	-257	(14.7%)
DUI/DUID (Detox Summons)	19	14	-5	(26.3%)	199	208	+9	4.5%
Total Arrests	***304***	***268***	***-36***	***(11.8%)***	***3,577***	***3,127***	***-450***	***(12.6%)***
Traffic Enforcement								
Traffic Tickets Muni	214	96	-118	(55.1%)	3,427	2,161	-1,266	(36.9%)
Traffic Tickets in GO's Muni	85	64	-21	(24.7%)	1,105	908	-197	(17.8%)
Total MET Tickets Muni	255	85	**-170**	**(66.7%)**	2,431	1,717	**-714**	**(29.4%)**
Total Traffic Tickets Muni	**299**	**160**	**-139**	**(46.5%)**	**4,532**	**3,069**	**-1,463**	**(32.3%)**
Total Traffic Tickets State	**20**	**21**	**+1**	**5.0%**	**561**	**365**	**-196**	**(34.9%)**
Total Traffic Tickets	***319***	***181***	***-138***	***(43.3%)***	***5,093***	***3,434***	***-1,659***	***(32.6%)***
Traffic Accidents								
Fatal	0	1	+1	--	12	12	--	0.0%
Injury	25	0	-25	(100.0%)	239	43	-196	(82.0%)
Non-Injury	308	1	-307	(99.7%)	3,154	874	-2,280	(72.3%)
Total Accidents	***333***	***2***	***-331***	***(99.4%)***	***3,405***	***929***	***-2,476***	***(72.7%)***

Ran: 11/3/2021 1:15:03 PM *by Crime Analyst R. Lesner*

Aurora Police Department - UCR Statistics — District: 2

*UCR crimes are measured by a count of **victims and/or incidents** reported during data period*	4 Week Last Year	4 Week Current Year	4 Week Difference	4 Week % Chg	Y-T-D Last Year	Y-T-D Current Year	Y-T-D Difference	Y-T-D % Chg - or - % of Total
Current Wk 44: 10/25/21 - 10/31/21	09/27 - 10/24		+ or -	% chg	01/01 - 10/24		+ or -	% chg
Major Crimes	09/28/20 - 10/25/20							
Murder Victims	0	2	+2	--	6	13	+7	116.7%
Sex Assault Victims	12	8	-4	(33.3%)	83	88	+5	6.0%
Spouse / Dating	5	1	-4	(80.0%)	27	16	-11	18%
Familial	1	3	+2	200.0%	10	9	-1	10%
Otherwise Known	4	3	-1	(25.0%)	27	31	+4	35%
Sex Assault DV Victims	5	1	-4	(80.0%)	25	12	-13	14%
Agg Assault Victims	50	58	+8	16.0%	619	742	+123	19.9%
Spouse / Dating	6	15	+9	150.0%	103	154	+51	21%
Familial	3	7	+4	133.3%	55	56	+1	8%
Otherwise Known	10	9	-1	(10.0%)	136	146	+10	20%
Agg Assault DV Victims	8	13	+5	62.5%	111	151	+40	20%
Robbery	19	21	+2	10.5%	165	193	+28	17.0%
Major Violent Crimes Reported	***81***	***89***	***+8***	***9.9%***	***873***	***1,036***	***+163***	***18.7%***
Burglary	46	33	-13	(28.3%)	421	459	+38	9.0%
MVT	130	149	+19	14.6%	1,035	1,676	+641	61.9%
Larceny	207	173	-34	(16.4%)	1,970	2,306	+336	17.1%
Major Property Crimes Reported	***383***	***355***	***-28***	***(7.3%)***	***3,426***	***4,441***	***+1,015***	***29.6%***
Major Index Crimes Reported	***464***	***444***	***-20***	***(4.3%)***	***4,299***	***5,477***	***+1,178***	***27.4%***
Criminal Arrests								
Physical Arrests	108	104	-4	(3.7%)	1,445	1,377	-68	(4.7%)
Criminal Summonses	109	106	-3	(2.8%)	1,258	1,316	+58	4.6%
DUI/DUID (Detox Summons)	13	14	+1	7.7%	185	159	-26	(14.1%)
Total Arrests	***217***	***210***	***-7***	***(3.2%)***	***2,703***	***2,693***	***-10***	***(0.4%)***
Traffic Enforcement								
Traffic Tickets Muni	511	284	-227	(44.4%)	6,339	6,871	+532	8.4%
Traffic Tickets in GO's Muni	94	46	-48	(51.1%)	925	778	-147	(15.9%)
Total MET Tickets Muni	522	261	**-261**	**(50.0%)**	5,430	6,255	**+825**	**15.2%**
Total Traffic Tickets Muni	**605**	**330**	**-275**	**(45.5%)**	**7,264**	**7,649**	**+385**	**5.3%**
Total Traffic Tickets State	**12**	**10**	**-2**	**(16.7%)**	**409**	**469**	**+60**	**14.7%**
Total Traffic Tickets	***617***	***340***	***-277***	***(44.9%)***	***7,673***	***8,118***	***+445***	***5.8%***
Traffic Accidents								
Fatal	1	2	+1	100.0%	7	7	--	0.0%
Injury	35	0	-35	(100.0%)	205	33	-172	(83.9%)
Non-Injury	246	0	-246	(100.0%)	2,564	696	-1,868	(72.9%)
Total Accidents	***282***	***2***	***-280***	***(99.3%)***	***2,776***	***736***	***-2,040***	***(73.5%)***

Ran: 11/3/2021 1:15:03 PM *by Crime Analyst R. Lesner*

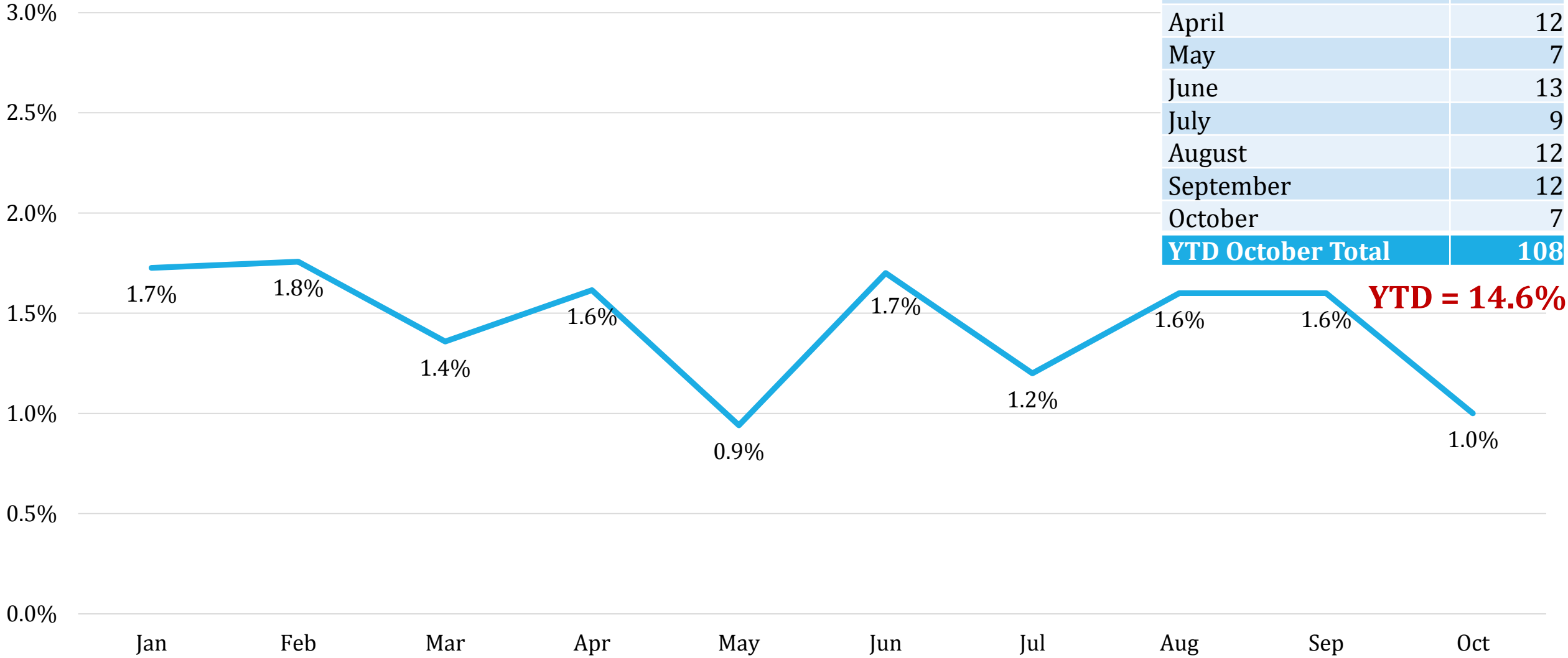
Aurora Police Department - UCR Statistics — District: 3

*UCR crimes are measured by a count of **victims and/or incidents** reported during data period*	4 Week Last Year	4 Week Current Year	4 Week Difference	4 Week % Chg	Y-T-D Last Year	Y-T-D Current Year	Y-T-D Difference	Y-T-D % Chg - or - % of Total
Current Wk 44: 10/25/21 - 10/31/21	09/27 - 10/24		+ or -	% chg	01/01 - 10/24		+ or -	% chg
Major Crimes	09/28/20 - 10/25/20							
Murder Victims	0	0	--	--	4	1	-3	(75.0%)
Sex Assault Victims	7	3	-4	(57.1%)	71	51	-20	(28.2%)
Spouse / Dating	0	1	+1	--	21	8	-13	16%
Familial	1	0	-1	(100.0%)	8	7	-1	14%
Otherwise Known	5	2	-3	(60.0%)	22	20	-2	39%
Sex Assault DV Victims	0	1	+1	--	16	8	-8	16%
Agg Assault Victims	29	34	+5	17.2%	288	378	+90	31.3%
Spouse / Dating	3	5	+2	66.7%	64	76	+12	20%
Familial	2	12	+10	500.0%	36	48	+12	13%
Otherwise Known	3	9	+6	200.0%	71	78	+7	21%
Agg Assault DV Victims	3	3	--	0.0%	71	72	+1	19%
Robbery	5	7	+2	40.0%	82	80	-2	(2.4%)
Major Violent Crimes Reported	***41***	***44***	***+3***	***7.3%***	***445***	***510***	***+65***	***14.6%***
Burglary	41	28	-13	(31.7%)	305	315	+10	3.3%
MVT	74	87	+13	17.6%	589	865	+276	46.9%
Larceny	158	126	-32	(20.3%)	1,506	1,629	+123	8.2%
Major Property Crimes Reported	***273***	***241***	***-32***	***(11.7%)***	***2,400***	***2,809***	***+409***	***17.0%***
Major Index Crimes Reported	***314***	***285***	***-29***	***(9.2%)***	***2,845***	***3,319***	***+474***	***16.7%***
Criminal Arrests								
Physical Arrests	58	53	-5	(8.6%)	674	612	-62	(9.2%)
Criminal Summonses	63	72	+9	14.3%	734	674	-60	(8.2%)
DUI/DUID (Detox Summons)	13	6	-7	(53.8%)	148	119	-29	(19.6%)
Total Arrests	***121***	***125***	***+4***	***3.3%***	***1,408***	***1,286***	***-122***	***(8.7%)***
Traffic Enforcement								
Traffic Tickets Muni	342	131	-211	(61.7%)	4,287	4,764	+477	11.1%
Traffic Tickets in GO's Muni	100	33	-67	(67.0%)	840	733	-107	(12.7%)
Total MET Tickets Muni	393	99	**-294**	**(74.8%)**	3,556	3,685	**+129**	**3.6%**
Total Traffic Tickets Muni	**442**	**164**	**-278**	**(62.9%)**	**5,127**	**5,497**	**+370**	**7.2%**
Total Traffic Tickets State	**19**	**12**	**-7**	**(36.8%)**	**332**	**241**	**-91**	**(27.4%)**
Total Traffic Tickets	***461***	***176***	***-285***	***(61.8%)***	***5,459***	***5,738***	***+279***	***5.1%***
Traffic Accidents								
Fatal	1	1	--	0.0%	10	7	-3	(30.0%)
Injury	15	0	-15	(100.0%)	112	22	-90	(80.4%)
Non-Injury	198	2	-196	(99.0%)	2,123	584	-1,539	(72.5%)
Total Accidents	***214***	***3***	***-211***	***(98.6%)***	***2,245***	***613***	***-1,632***	***(72.7%)***

Ran: 11/3/2021 1:15:03 PM *by Crime Analyst R. Leaner*

Police Turnover Percent

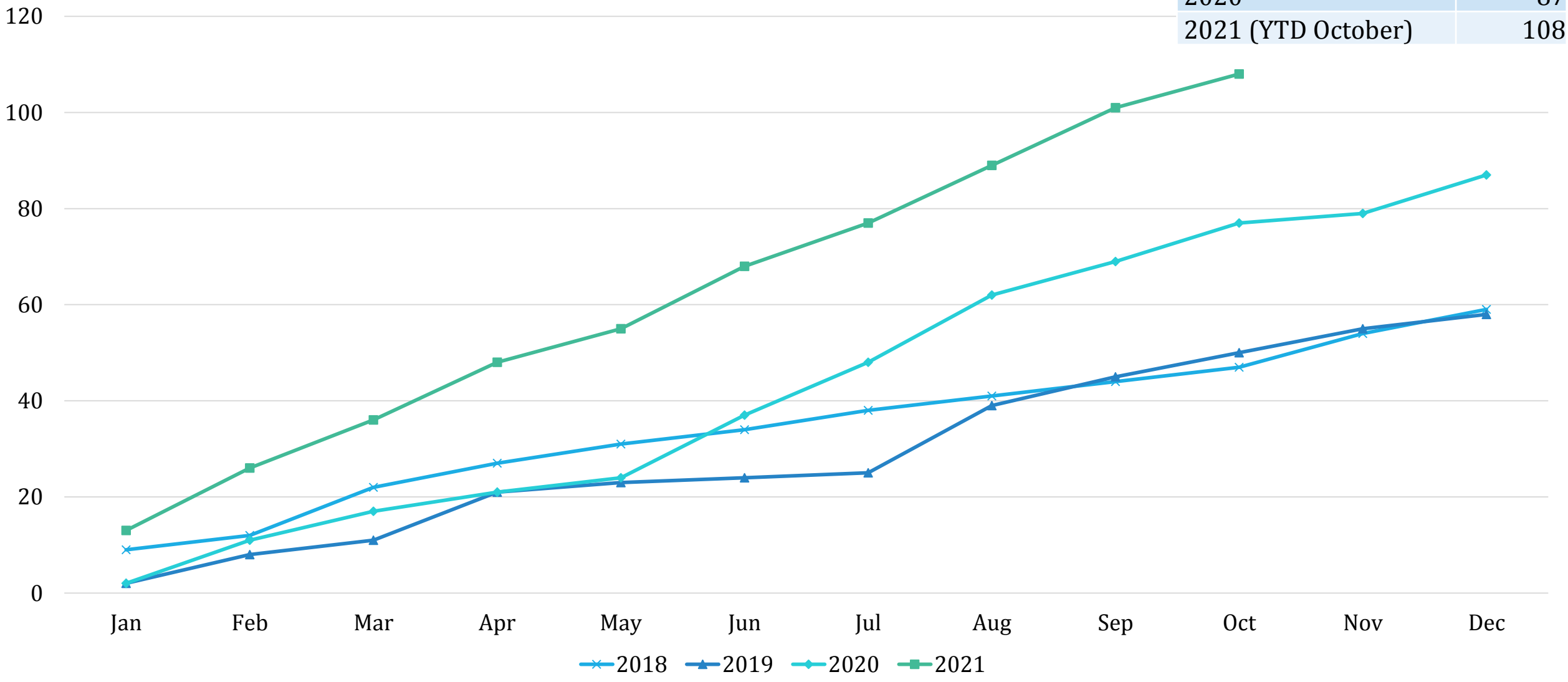
Month	Total
Jan	13
Feb	13
Mar	10
April	12
May	7
June	13
July	9
August	12
September	12
October	7
YTD October Total	108



YTD = 14.6%

Attrition Review

Year	Total
2018	59
2019	58
2020	87
2021 (YTD October)	108



2021 Sworn Staffing

Additions:

80 Basics (16 in 2021-1B, 17 in 2021-2B, 19 in 2021-3B, 20 in 2021-4B, 8 in 2021-5B)
3 Laterals (3 in 2021-1L)
83 Total Adds

Losses as of 10/31/21:

53 Resignations (35 commissioned, 9 FTEP, 9 recruits)
39 Retirements
6 Med. Retirements
5 Terminations (3 commissioned, 2 recruits)
4 Transfer to Career Service (1 commissioned, 3 FTEP)
1 Death (1 commissioned)
108 Total Losses

25 Net Losses

October Sworn Separations Detail

3 Retirements
3 Transfer to Career Service (1 commissioned, 2 FTEP)
1 Resignation
7 Total Losses

Reason	Count
Retirement	3
Another Job	3
Another Law Enforcement Job	1
Total	**7**

Assignment	Count
Patrol	2
Recruit FTEP	2
Academy (staff)	1
PAR	1
Vehicle Impound	1
Total	**7**

October Sworn Staffing Detail

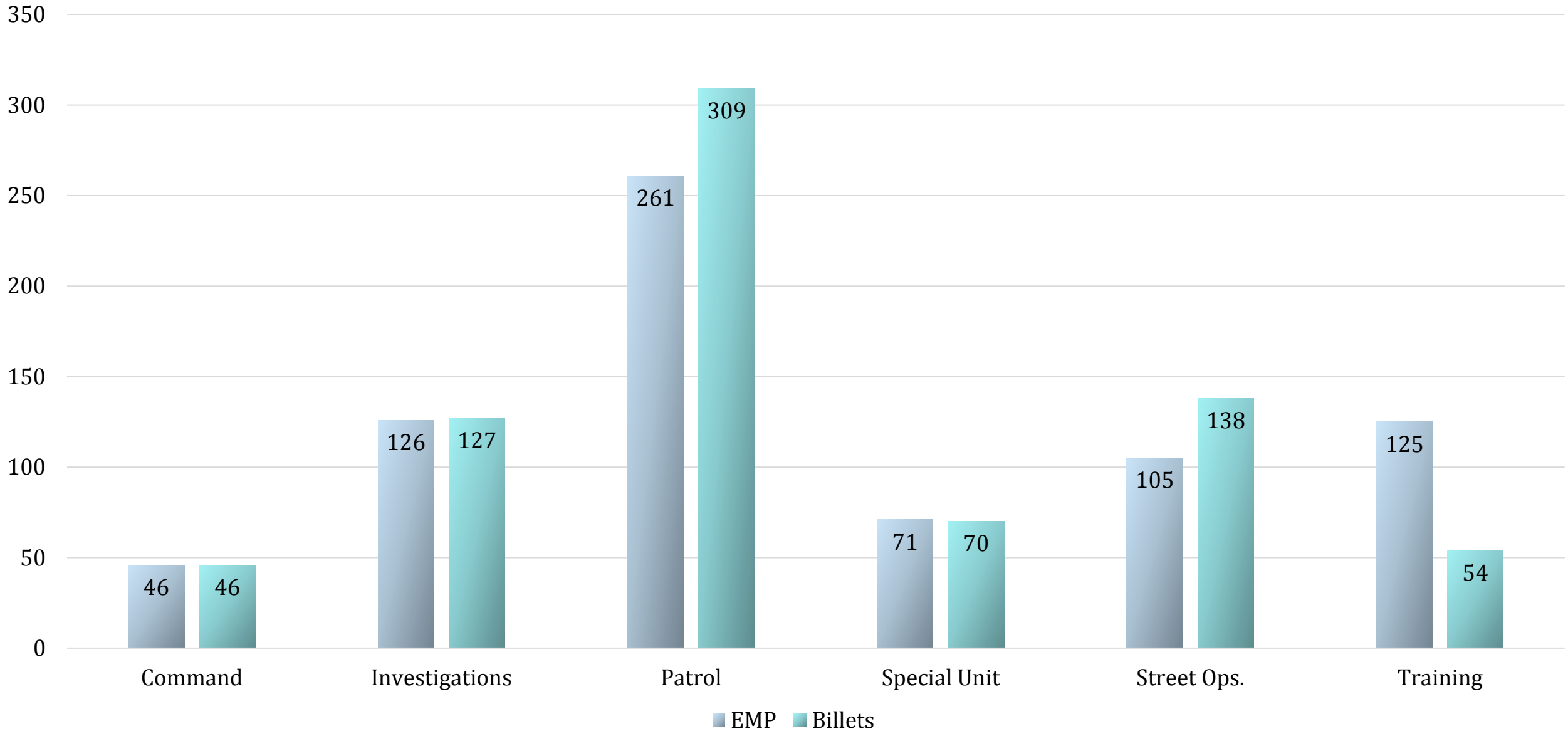
Function	EMP	Billets	Variance	Actual	Design
Command	46	46	0	6%	6%
Investigations	126	127	(1)	17%	17%
Patrol	261*	309	(48)	36%	42%
Special Unit	71	70	1	10%	9%
Street Ops.	105	138	(33)	14%	19%
Training	125*	54	71	17%	7%
Grand Total	**734**	**744**	**(11)**		

*Includes Field Training Officers (FTOs) training 26 FTEP recruits

*Includes 26 recruits in FTEP

Class	Count	FTEP Completion
2021-1B (3/1/21) FTEP	12	12/17/21
2021-2B (4/26/21) FTEP	14	2/11/22
2021-3B (6/21/21)	16	4/8/22
2021-4B (8/30/21)	20	6/17/22
2021-5B (10/25/22)	8	8/12/22
Total	**70**	

Organizational Functional Categories



APD Resource Deployment

APD has an authorized strength of 744 sworn
Chief and Executive Staff design the placement of positions to achieve the Mission & Vision of the organization

Mission: Partnering with our community to make Aurora safer every day

Vision: APD will continually evolve as an innovative agency

The position placement is called 'Billet' by rank and assignment
Continuous evaluation is done to align and adjust to changes throughout the year
Chief may temporarily move staff to accomplish initiatives or fill vacancies as needed
In the following slide, we have summarized the organization reflecting the distribution of Billets by functional categories

Functional Category Breakdown

Command	Investigations	Training	Special Unit	Patrol	Street Ops.
Lieutenants and Above	District Detective Units	Academy	Employee Support	District Patrol Units	District PAR Units
	Crimes Against Children	Range	Media Relations	Field Training Officers	SROs
	Domestic Violence Unit	Recruit Classroom	Recruiting		Crisis Response Team
	Economic Crimes	Recruit FTEP	Aurora for Youth		Gang Intervention
	Forensic Services	Military Leave	Equipment & Facilities		K9
	Intelligence	Not Available for Duty	Property & Evidence		SWAT
	Internet Crimes Against Children		Vehicle Impound		Traffic
	Gang & Robbery Invest. Team		Community Relations		
	Major Crime/Homicide		Front Desk		
	Sex Crimes		Dispatch		
	Special Victims		Electronic Support		
	Joint Terrorism TF		Internal Affairs		
	Safe Streets TF		CMATT		
			FAST		
			Narcotics		
			RAVEN		
			Backgrounds		
			Force Investigations		
			Professional Standards		
			Emergency Mgmt.		
			ATF TF		
			Front Range TF		
			Fugitive TF		

CITY OF AURORA
Council Agenda Commentary

Item Title: Aurora911 Staffing and Attrition Update
Item Initiator: Danelle Carrel, Committee Liaison
Staff Source/Legal Source: Tina Buneta, Director of Aurora911 / Angela Garcia, Senior Assistant City Attorney
Outside Speaker: N/A
Council Goal: 2012: 1.0--Assure a safe community for people

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

ITEM DETAILS:

Aurora911 Staffing and Attrition Update

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☐ Approve Item and Move Forward to Study Session

☐ Approve Item as proposed at Study Session

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☒ Information Only

☐ Approve Item with Waiver of Reconsideration
Reason for waiver is described in the Item Details field.

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: Public Safety, Courts & Civil Service

Policy Committee Date: 11/9/2021

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval

☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation

☐ Recommendation Report Attached

☐ Minutes Attached ☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

N/A

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

Staffing and attrition update on Aurora911.

QUESTIONS FOR COUNCIL

N/A

LEGAL COMMENTS

This item is informational only. There is no formal council action necessary.
The City Manager shall be responsible to the Council for the proper administration of all affairs of the city placed in his charge and, to that end, shall have the power and duty to make written or verbal reports at any time concerning the affairs of the City. (City Charter, Art. 7-4(e)) (Garcia)

PUBLIC FINANCIAL IMPACT

☐ YES ☒ NO

If yes, explain: N/A

PRIVATE FISCAL IMPACT

☒ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A

AURORA911

PSCSS Staffing Update

November 9, 2021

Recruiting and Retention

Authorized FTE: 90

Current FTE: 65 (25 Vacancies)

Staffing Percentage: 72% Staffed

We're Hiring!

Vacancy Detail

Entry Level Positions: 23

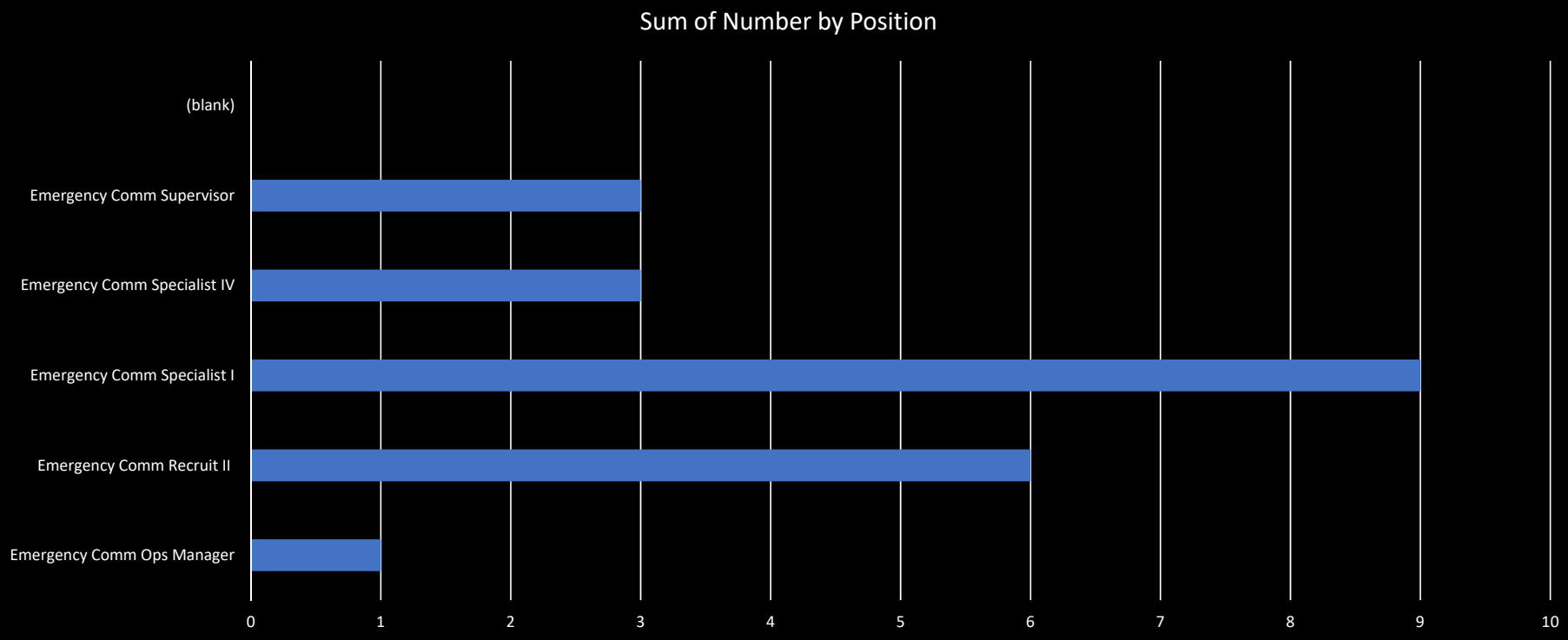
Records and Reporting Specialist: 1 (External Recruitment)

Records and Reporting Supervisor: 1 (External Recruitment)

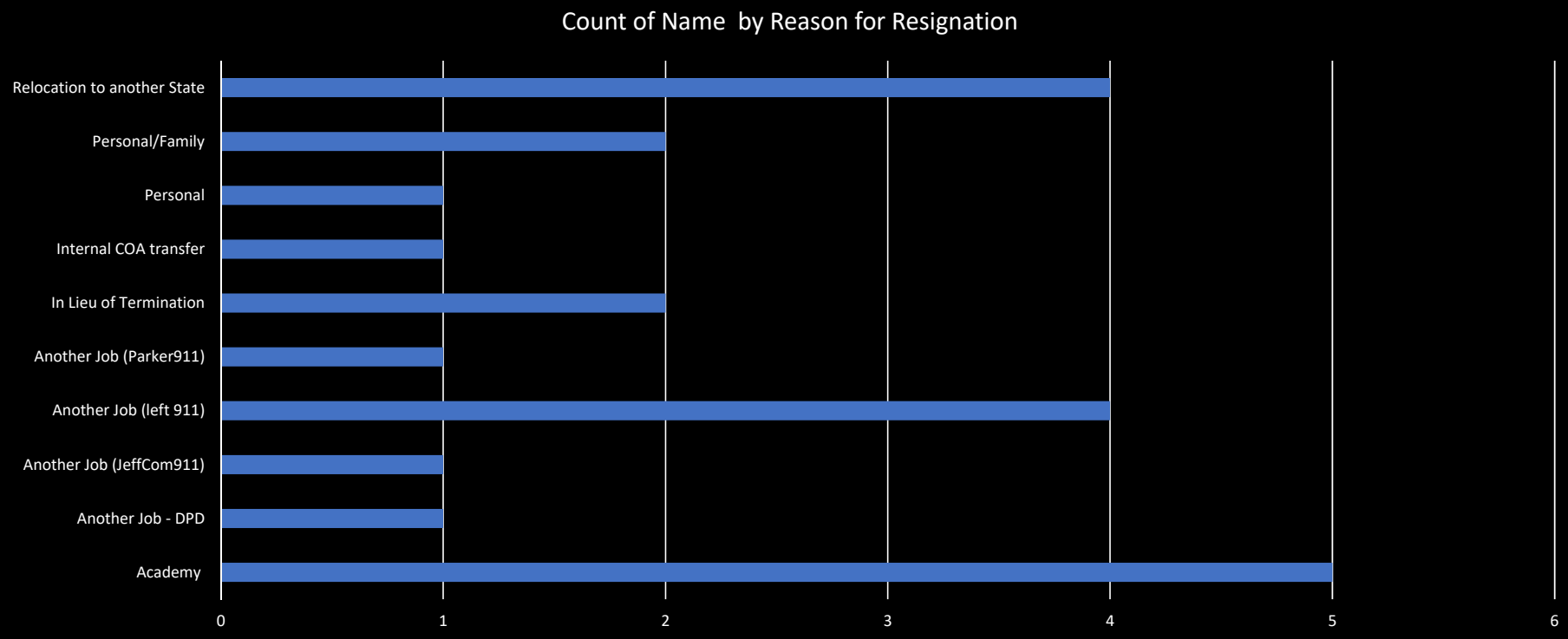
Attrition Data

02/12/21	Emergency Comm Specialist I	Personal/Family
03/31/21	Emergency Comm Recruit II	Academy
04/06/21	Emergency Comm Recruit II	Academy
04/14/21	Emergency Comm Recruit II	Academy
04/15/21	Emergency Comm Specialist IV	In Lieu of Termination
04/18/21	Emergency Comm Recruit II	Academy
05/25/21	Emergency Comm Specialist I	Relocation to another State
05/27/21	Emergency Comm Supervisor	Personal/Family
06/06/21	Emergency Comm Specialist I	Another Job - DPD
06/18/21	Emergency Comm Ops Manager	Another Job (left 911)
07/07/21	Emergency Comm Recruit II	Academy
07/16/21	Emergency Comm Specialist IV	Another Job (Left 911)
07/20/21	Emergency Comm Supervisor	In Lieu of Termination
08/06/21	Emergency Comm Supervisor	Another Job (left 911)
08/27/21	Emergency Comm Specialist IV	Internal COA transfer
09/16/21	Emergency Comm Specialist I	Relocation to another State
09/17/21	Emergency Comm Recruit II	Another Job (Parker911)
09/25/21	Emergency Comm Specialist I	Another Job (left 911)
10/07/21	Emergency Comm Specialist I	Relocation to another State
10/09/21	Emergency Comm Specialist I	Personal
10/29/21	Emergency Comm Specialist I	Another Job (JeffCom911)
11/17/21	Emergency Comm Specialist I	Relocation to another State

Attrition Data



Attrition Data



Strategies

- Compensation – better aligning salary to responsibilities, and addressing competitiveness in the metro area.
- Career Progression – Creation of a six step career progression program to provide employees with continued growth
- Staffing Model – Balancing service need with employee wellness
- Public Education – 911 use, Access Aurora, Mobile App, Online Reporting in order to reduce call volume on non-emergency line
- Recruitment – partnering with APD and City Comm to enhance recruitment efforts more strategically

AURORA911

THANK YOU!

Questions?
Clarifications?

CITY OF AURORA
Council Agenda Commentary

Item Title: October 2021 Aurora Fire Rescue Attrition Data
Item Initiator: Fernando Gray, Fire Chief
Staff Source/Legal Source: Mathew Wasserburger, Assistant Director Fire Management Services; Angela Garcia, Senior Assistant City Attorney
Outside Speaker: N/A
Council Goal: 2012: 1.0--Assure a safe community for people

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☐ Approve Item as proposed at Study Session

☒ Information Only

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☐ Approve Item with Waiver of Reconsideration
Why is a waiver needed?

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: N/A

Policy Committee Date: N/A

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval

☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation

☐ Recommendation Report Attached

☐ Minutes Attached

☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

N/A

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

Aurora Fire Rescue monthly turnover and attrition rate for sworn personnel.

QUESTIONS FOR COUNCIL

N/A

LEGAL COMMENTS

This item is informational only. There is no formal council action necessary.
The City Manager shall be responsible to the Council for the proper administration of all affairs of the city placed in his charge and, to that end, shall have the power and duty to make written or verbal reports at any time concerning the affairs of the City. (City Charter, Art. 7-4(e)) (Garcia)

PUBLIC FINANCIAL IMPACT

☐ YES ☒ NO

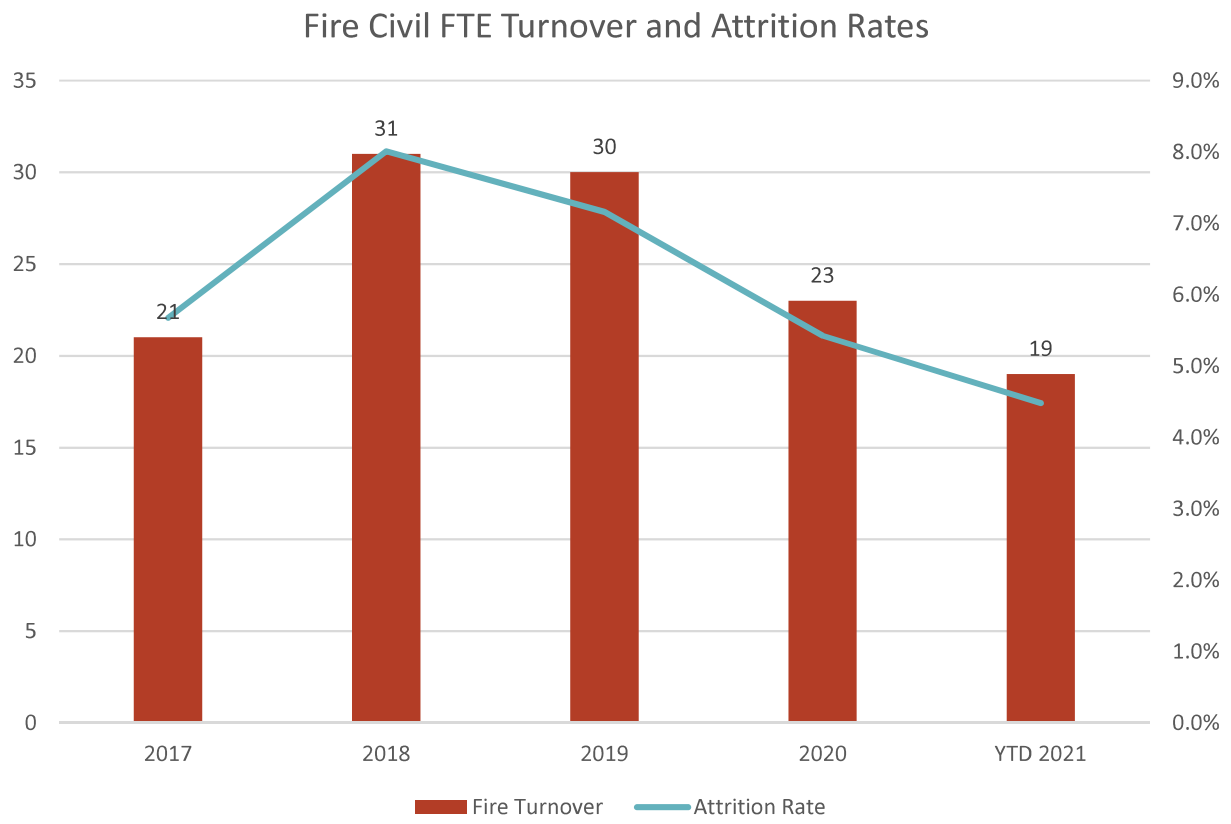
If yes, explain: N/A

PRIVATE FISCAL IMPACT

☒ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A

Aurora Fire Rescue
Civil FTE Attrition – Oct 31, 2021



- YTD 2021 Attrition Rate = 4.4%
- 3-Year Average Attrition Rate = 6.8%

CITY OF AURORA
Council Agenda Commentary

Item Title: Office of the Independent Monitor Update
Item Initiator: Danelle Carrel, Committee Liaison
Staff Source/Legal Source: Roberto Venegas, Deputy City Manager/Jack Bajorek, Deputy City Attorney
Outside Speaker: N/A
Council Goal: 2012: 1.0--Assure a safe community for people

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

ITEM DETAILS:

Office of the Independent Monitor update.

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☐ Approve Item and Move Forward to Study Session

☐ Approve Item as proposed at Study Session

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☒ Information Only

☐ Approve Item with Waiver of Reconsideration
Reason for waiver is described in the Item Details field.

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: N/A

Policy Committee Date: N/A

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval

☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation

☐ Recommendation Report Attached

☐ Minutes Attached ☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

N/A

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

The 2022 Budget included staffing and funding for the Office of the Independent Monitor. Staff have been working to research best practices and the key questions that need to be addressed to establish the Office. Staff will provide an overview of the powers and duties, access to records and information, access during Police processes including discipline and Internal Affairs, public reporting and recommendations of the Office, and Council actions in creating the Office.

QUESTIONS FOR COUNCIL

Does the Committee have any questions regarding the Office of the Indepedendent Monitor?

LEGAL COMMENTS

The City Manager shall be responsible to the Council for the proper administration of all affairs of the city placed in his charge and, to that end, shall have the power and duty to make written or verbal reports at any time concerning the affairs of the City. City Charter § 7-4(e). J. Bajorek

PUBLIC FINANCIAL IMPACT

☐ YES ☒ NO

If yes, explain: N/A

PRIVATE FISCAL IMPACT

☒ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A

CITY OF AURORA
Council Agenda Commentary

Item Title: Technology Analysis for E-Discovery
Item Initiator: Mike Ridder / Doug Wilson / Scott Newman
Staff Source/Legal Source: Mike Ridder / Doug Wilson / Scott Newman
Outside Speaker: N/A
Council Goal: 2012: 6.1--Ensure the delivery of high quality services to residents in an efficient and cost effective manner

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

ITEM DETAILS:

In the October 14th, 2021 Public Safety, Courts, Civil Service committee meeting, Mike Ridder from Courts Administration requested 2 additional FTE positions within Courts IT for the 2022 fiscal year. The intent behind the request is to provide the support and skills necessary to finalize the in-house development of an E-Discovery software tool that can be used by the City Attorney's and Public Defender's offices. At the close of the presentation, the Committee directed that this request be brought forward at the November 9th meeting with additional detail around the request, including what options may exist to utilize a commercial product instead, and the potential benefits / consequences of each approach.

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☐ Approve Item and Move Forward to Study Session

☐ Approve Item as proposed at Study Session

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☒ Information Only

☐ Approve Item with Waiver of Reconsideration
Reason for waiver is described in the Item Details field.

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: Public Safety, Courts & Civil Service

Policy Committee Date: 10/14/2021

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval ☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation ☐ Recommendation Report Attached

☐ Minutes Attached ☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

This topic was first addressed in the October 14th, 2021 meeting of the Public Safety, Courts and Civil Service committee.

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

In the October 14th, 2021 Public Safety, Courts, Civil Service committee meeting, Mike Ridder from Courts Administration requested 2 additional FTE positions within Courts IT for the 2022 fiscal year. The intent behind the request is to provide the support and skills necessary to finalize the in-house development of an E-Discovery software tool that can be used by the City Attorney's and Public Defender's offices. At the close of the presentation, the Committee directed that this request be brought forward at the November 9th meeting with additional detail around the request, including what options may exist to utilize a commercial product instead, and the potential benefits / consequences of each approach.

QUESTIONS FOR COUNCIL

Does Council require additional details, or would Council like to move the FTE request forward to Study Session for further consideration?

LEGAL COMMENTS

The corporate authority and all legislative authority of the city shall be vested in the council, as the governing body of the city. The council shall have and shall exercise the powers, privileges and duties granted and conferred by the state constitution, statute or city Charter. (Section 2-32 of the City Code). (Platt)

PUBLIC FINANCIAL IMPACT

☒ YES ☐ NO

If yes, explain: If the original request is approved, it would result in 2 additional FTE positions within Courts IT in the 2022 fiscal year.

PRIVATE FISCAL IMPACT

☒ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A

CITY OF AURORA
Council Agenda Commentary

Item Title: Hazard Mitigation Plan Update
Item Initiator: Battalion Chief Matt Chapman, Aurora Fire Rescue
Staff Source/Legal Source: Battalion Chief Matt Chapman/Angela Garcia, Senior Assistant City Attorney
Outside Speaker: N/A
Council Goal: 2012: 1.0--Assure a safe community for people

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

ITEM DETAILS:

A Resolution expressing the support of City Coucil and adoption of the updated Hazard Mitigation Plan.

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☒ Approve Item and Move Forward to Study Session

☐ Approve Item as proposed at Study Session

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☐ Information Only

☐ Approve Item with Waiver of Reconsideration
Reason for waiver is described in the Item Details field.

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: Public Safety, Courts & Civil Service

Policy Committee Date: 11/9/2021

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval

☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation

☐ Recommendation Report Attached

☐ Minutes Attached

☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

N/A

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

The City of Aurora is required by FEMA and the State of Colorado to maintain an updated Hazard Mitigation Plan in order to be eligible for mitigation related grants and programs. This plan is intended to be updated every five years and develops a current analysis of natural hazards that may create risk to the city. The planning process allows city staff from all departments to develop comprehensive mitigation projects and goals for the entire city.

QUESTIONS FOR COUNCIL

Does Council approve and support moving the 2021 Hazard Mitigation Plan forward to Study Session?

LEGAL COMMENTS

City Council has the authority to provide for the safety, preserve the health, promote the prosperity, and improve the morals, order, comfort and convenience of the city and its inhabitants. (City Code, Sec. 2-32). Council shall act only by ordinance, resolution or motion. (City Charter, Art. 5-1). (Garcia)

PUBLIC FINANCIAL IMPACT

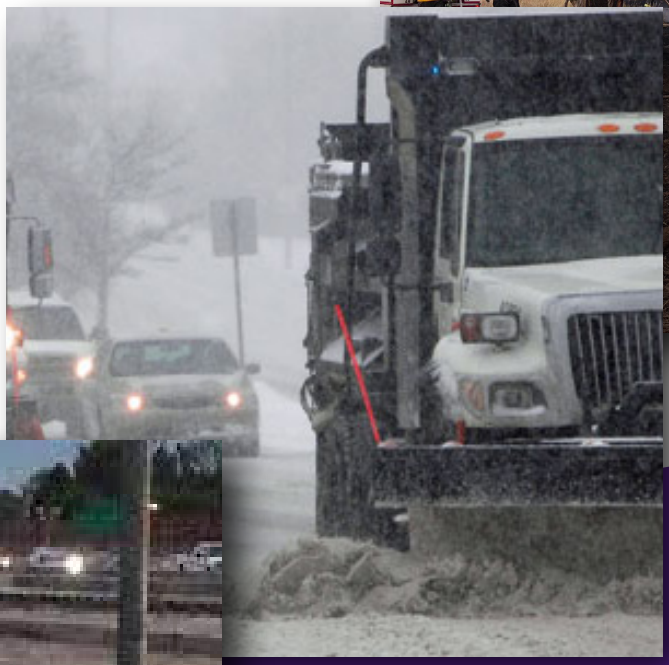
☐ YES ☒ NO

If yes, explain: N/A

PRIVATE FISCAL IMPACT

☒ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A



CITY OF AURORA

Hazard Mitigation Plan Update
State Review Draft
August 2021

Table of Contents

Appendices

1 Introduction

1.1 Executive Summary

Hazard mitigation is the use of long- and short-term strategies to reduce or alleviate loss of life, injuries, and property damage that can result from a disaster. Studies have found that hazard mitigation is extremely cost-effective, with every dollar spent on mitigation saving an average of $6 in avoided future losses.

This Plan will serve as a blueprint for coordinating and implementing hazard mitigation policies, programs, and projects in the City of Aurora. It provides a list of mitigation goals and related actions to assist the City in reducing risk and preventing loss from future hazard events. The impacts of hazards can often be lessened, or even avoided, if appropriate actions are taken before events occur. By reducing exposure to known hazard risks, the City will save lives and property and minimize the social, economic, and environmental disruptions that commonly follow hazard events.

The 2021 City of Aurora Hazard Mitigation Plan (HMP) is the latest update in a series of mitigation plans City of Aurora has participated in going back to 2005. All sections of the 2016 Aurora Hazard Mitigation Plan were reviewed and updated to address natural hazards for the purpose of saving lives and reducing losses from future disasters or hazard events.

This Plan was also developed to maintain the City's eligibility for federal disaster assistance, specifically the Federal Emergency Management Agency's (FEMA), Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and Building Resilient Infrastructure and Communities (BRIC) grant program, as well as the Rehabilitation of High Hazard Potential Dams (HHPD) grant program. The Federal Emergency Management Agency (FEMA) requires that hazard mitigation plans be updated every five years for the jurisdiction to be eligible for federal mitigation assistance.

Section 1 Introduction contains this Executive Summary, and outlines the background, purpose, and scope of the Plan.

Section 2 Planning Process describes the process followed to update the Plan. A broad range of public and private stakeholders, including agencies, local businesses, nonprofits, and other interested parties, were invited to participate. Public input was sought throughout the planning process including online surveys and public review of the draft Plan.

Section 3 Community Profile describes the planning area, consisting of the City of Aurora, with updated information on demographics, social vulnerability, and changes in development. It includes an assessment of programs and policies currently in place to reduce hazard impacts or that could be used to implement hazard mitigation activities and identifies opportunities to enhance those capabilities.

Section 4 Hazard Identification and Risk Assessment identifies the natural hazards of greatest concern to the City and describes the risk from those hazards. The information generated through the risk assessment helps to prioritize and focus efforts on those hazards of greatest concern and those assets or areas facing the greatest risk(s). The best available information on the impacts of changing weather conditions were taken into account for each hazard. The hazards profiled in the 2021 Plan and their assessed significance are shown in the following table, in order of overall significance.

Table 1-1 Hazards Identification Summary

Hazard	Location/Extent	Probability of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Hail	Significant	Highly Likely	Critical	High
Winter Storm	Extensive	Highly Likely	Limited	High
Drought	Extensive	Likely	Critical	Medium
Extreme Heat	Significant	Likely	Critical	Medium
Flood	Significant	Likely	Limited	Medium
Lightning	Limited	Highly Likely	Limited	Medium
Severe Wind	Significant	Highly Likely	Limited	Medium
Tornado	Limited	Likely	Limited	Medium
Dam/Levee Failure or Incident	Limited	Unlikely	Critical	Low
Earthquake	Significant	Occasional	Limited	Low
Erosion and Deposition	Significant	Likely	Critical	Low
Expansive Soil	Extensive	Likely	Limited	Low
Subsidence	Limited	Occasional	Limited	Low
Landslides, Mud/Debris Flow, Rockfalls	Limited	Likely	Negligible	Low
Wildfire	Limited	Likely	Limited	Low

Section 5 Mitigation Strategy describes what the City will do to reduce vulnerability to the hazards identified in Section 4. It presents the goals and objectives of the mitigation program and details a broad range of targeted mitigation actions to reduce losses from hazard events.

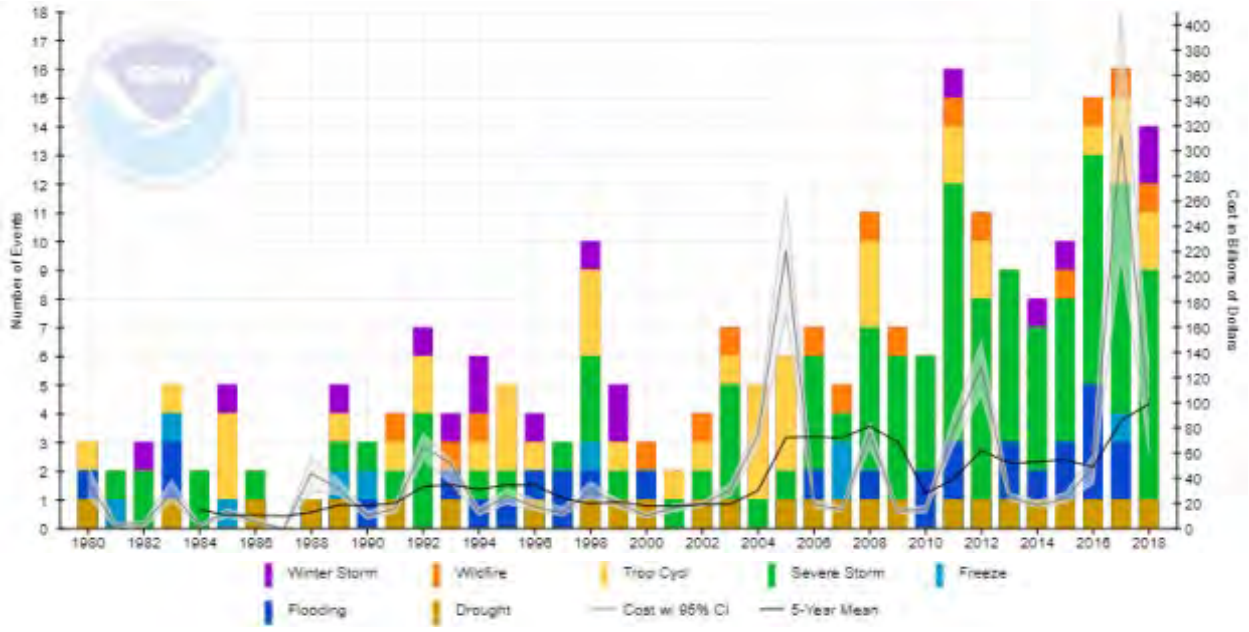
Section 6 Plan Implementation and Maintenance details how the Plan will be implemented, monitored, evaluated, and updated, as well as how the mitigation program will be integrated into other planning mechanisms.

It is important that local decision-makers stay involved in mitigation planning to provide new ideas and insight for future updates to the Aurora Hazard Mitigation Plan. As a long-term goal, the Hazard Mitigation Plan and the mitigation strategies identified within will be fully integrated into daily decisions and routines of City government. This will continue to require dedication and hard work, and to this end, this Plan update continues efforts to further strengthen the City of Aurora's resiliency.

1.2 Background

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. Additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars, making the costs of disasters several times higher than calculated amounts. Figure 1-1 shows the number and type of natural disasters in the US that have caused more than one billion dollars in damage, showing how the frequency and cost of major disasters have risen over the past several decades.

Figure 1-1 Billion-Dollar Disasters in the US, 1980-2018

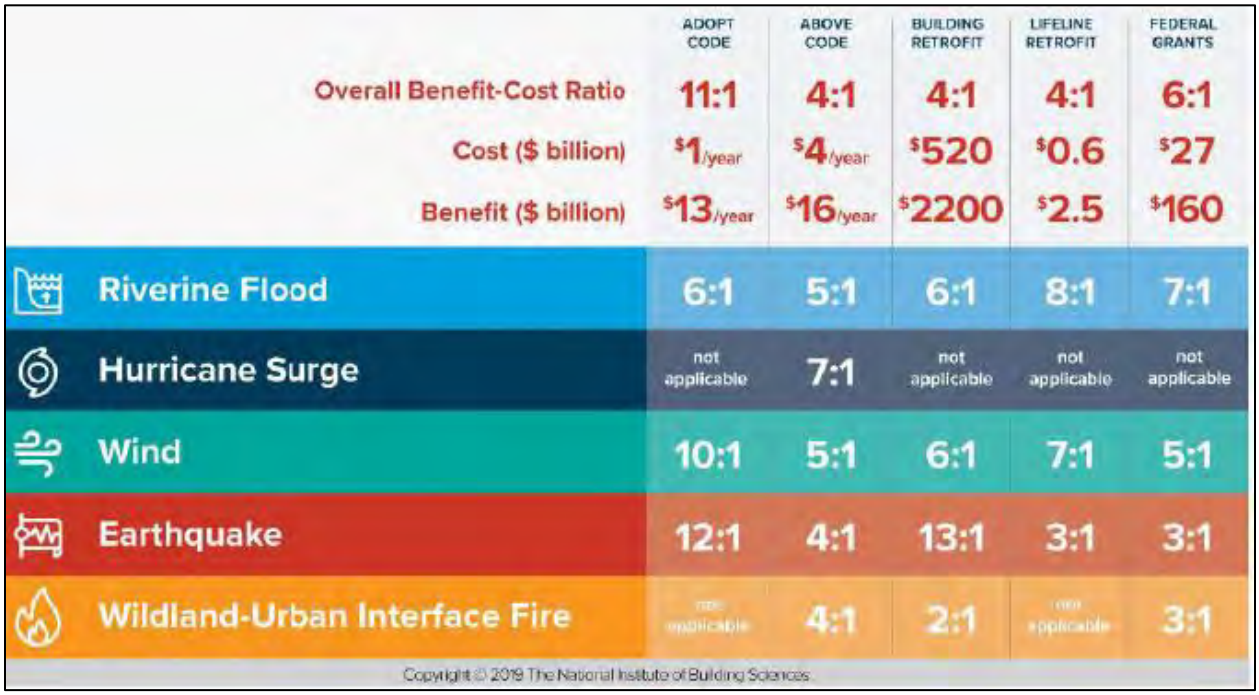


Source: NOAA

However, some types of hazards are predictable, and much of the damage caused by these events can be mitigated through the use of various zoning, construction and permitting vehicles and other preventative actions. Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $6 in avoided future losses in addition to saving lives and preventing injuries, as illustrated in Figure 1-2.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007. Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act or DMA. While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

Figure 1-2 Financial Benefits of Hazard Mitigation



Source: National Institute of Building Sciences, Natural Hazard Mitigation Saves: 2019 Report

This plan builds on more than fifteen years of deliberate mitigation planning in the City of Aurora, starting with participation in the 2005 Denver Regional Council of Governments (DRCOG) Hazard Mitigation Plan. The City developed its first stand-alone HMP in 2016.

This Plan is a comprehensive update to the 2016 plan. Information in this Plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The City of Aurora is committed to reducing the impacts of future disasters.

1.3 Purpose and Scope

The purpose and guiding principle for the City of Aurora Hazard Mitigation Plan is:

Develop and maintain a disaster-resistant City of Aurora that is more resilient to the physical devastation and resulting economic impacts associated with all natural hazard events.

This HMP identifies resources, information, and strategies for reducing risk from natural hazards. The planning team discussed adding human-caused hazards to the plan, but elected to retain the plan's focus on natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet the needs of the planning partners and their citizens. This plan will help guide and coordinate mitigation activities throughout the City.

All citizens and businesses of Aurora are the ultimate beneficiaries of this HMP update. The plan reduces risk for those who live in, work in, and visit the City. It provides a viable planning framework for all foreseeable natural hazards that may impact Aurora. Participation in development of the plan by key stakeholders in the City helped ensure that outcomes will be mutually beneficial. The resources and

background information in the plan are applicable throughout the City, and the plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

The City of Aurora remains dedicated to implementing the actions and strategies outlined in this updated Hazard Mitigation Plan. This Plan will be maintained regularly to address changes in hazards or vulnerabilities and will be updated within the next five years.

2 Planning Process

DMA Requirements §201.6(b) and §201.6(c)(1):
An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: *An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and* *Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.* *[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

2.1 Background on Mitigation Planning in the City of Aurora

The City of Aurora participated in previous regional HMPs as part of the Denver Regional Council of Governments (DRCOG) in 2005 and 2011. In 2015, the City of Aurora decided to develop a different plan to focus on the hazards and risks specific to this jurisdiction and to better develop mitigation actions to address them. To achieve this, the City developed this Hazard Mitigation Plan (HMP) in 2015-2016. The plan underwent a comprehensive update in 2020-2021 to comply with the five-year update cycle required by the DMA 2000. The planning process and update of this plan was originally initiated in mid-2020 under the coordination of the City of Aurora Emergency Manager. This plan update was developed to focus on the goals and objectives and the natural hazards pertaining only to the City of Aurora.

The updated HMP complies with Federal Emergency Management Agency (FEMA) guidance for Local Hazard Mitigation Plans. The update followed the requirements in the Disaster Mitigation Act (DMA) of 2000 and FEMA's 2013 Local Hazard Mitigation Planning Handbook.

2.1.1 What's New in the 2021 Plan

This HMP update involved a comprehensive review and update of each section of the 2016 plan and includes an assessment of the progress in evaluating, monitoring, and implementing the mitigation strategy outlined in the previous plan. The planning process provided an opportunity to review priorities related to hazard significance and mitigation actions, and revisions were made where applicable to the plan. Only the information and data still valid from the 2016 plan was carried forward as applicable into this HMP update.

2.1.2 2016 Plan Section Review and Analysis

During the 2020-2021 update process, the Hazard Mitigation Planning Committee (HMPC) updated each section of the previously approved plan to include new information and improve the organization and formatting of the plan's contents. The HMPC analyzed each section using FEMA's local plan update guidance to ensure that the plan met the latest requirements. Upon review the HMPC determined that nearly every section of the plan would need some updates to align with the latest FEMA planning guidance and requirements. The overall format and structure of the plan changed to align the plan with modern hazard mitigation planning practices. The Risk Assessment in Section 4 was substantially revised to incorporate recent events and reflect recent development trends with an updated GIS-based risk

assessment. Information within has been updated throughout the plan where appropriate. The mitigation strategy in Section 5 has been updated to reflect current priorities and mitigation actions moving forward from the 2016 plan.

2.2 2021 Planning Process

A consultant, Wood Environment and Infrastructure Solutions, Inc. (Wood), was contracted to assist with the update. The City of Aurora and Wood worked together to establish the planning process for the City's plan update using the DMA planning requirements and FEMA's associated guidance. The original FEMA planning guidance is structured around a four-phase process:

1. Organize Resources
2. Assess Risks
3. Develop the Mitigation Plan
4. Implement the Plan and Monitor Progress

FEMA's March 2013 Local Mitigation Planning Handbook recommends a nine-step process within the original four phase process. Into this four-phase process, Wood integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the modified 10-step process used for this plan meets the funding eligibility requirements of the Hazard Mitigation Assistance grants (including the Hazard Mitigation Grant Program, the Building Resilient Infrastructure and Communities grant, the High Hazard Potential Dams grant, and the Flood Mitigation Assistance grant), the Community Rating System, and the flood control projects authorized by the U.S. Army Corps of Engineers (USACE). Table 2-1 summarizes the four-phase DMA process, the detailed CRS planning steps and work plan used to develop the plan and the nine handbook planning tasks from FEMA's 2013 Local Mitigation Planning Handbook. The sections that follow describe each planning step in more detail.

Table 2-1 Mitigation Planning Process Used to Update the Plan

FEMA's 4-Phase DMA Process	Modified 10-Step CRS Process	FEMA Local Mitigation Planning Handbook Tasks
1) Organize Resources		
201.6(c)(1)	1) Organize the Planning Effort	1: Determine the planning area and resources
201.6(b)(1)	2) Involve the Public	2: Build the planning team - 44 CFR 201.6 (C)(1)
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies	3: Create an outreach strategy - 44 CFR 201.6(b)(1)
		4: Review community capabilities - 44 CFR 201.6 (b)(2)&(3)
2) Assess Risks		
201.6(c)(2)(i)	4) Identify the Hazards	5: Conduct a risk assessment - 44 CFR 201.6 (C)(2)(i) 44 CFR 201.6(C)(2)(ii)&(iii)
201.6(c)(2)(ii)	5) Assess the Risks	
3) Develop the Mitigation Plan		
201.6(c)(3)(i)	6) Set Goals	

FEMA's 4-Phase DMA Process	Modified 10-Step CRS Process	FEMA Local Mitigation Planning Handbook Tasks
201.6(c)(3)(ii)	7) Review Possible Activities	6: Develop a mitigation strategy - 44 CFR 201.6(c)(3)(i); 44 CFR 201(c)(3)(ii) and 44 CFR 201.6(c)(3)(iii)
201.6(c)(3)(iii)	8) Draft an Action Plan	
4) Implement the Plan and Monitor Progress		
201.6(c)(5)	9) Adopt the Plan	7: Review and adopt the plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan	8: Keep the plan current
		9: Create a safe and resilient community - 44 CFR 201.6(c)(4)

Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

This section describes the planning process used during the 2020-2021 update. The original planning process effort is well documented and can be referenced in the 2016 plan. The City of Aurora Emergency Manager took the lead on coordinating and reconvening the HMPC, identifying the key municipal and other local government and initial stakeholder representatives. An email invitation was sent to them with a request to participate as a member of the HMPC and to attend a kickoff meeting. Representatives from a wide range of City departments participated on the HMPC and the update of the plan. This included local and regional agencies involved in hazard mitigation activities, agencies that regulate development, and for neighboring communities. Other local, state, federal, and private stakeholders invited to participate in the HMPC are discussed under Planning Step 3. A list of HMPC representatives and participating stakeholders can be found in Appendix B.

During the plan update process, the HMPC communicated via a combination of online webinars, phone interviews, and email correspondence. Three planning meetings with the HMPC were held during the plan's development between December 2020 and March 2021. The meeting schedule and topics are listed in the following table. The meetings were held as virtual webinars due to the global COVID-19 pandemic that required social distancing. Agendas, attendance rosters, and meeting summaries for each of the meetings are included in Appendix C.

Table 2-2 Schedule of Meetings

HMPC Meeting	Meeting Topic	Meeting Date
1	Kickoff Meeting: Introduction to DMA Planning and overview of Update Process	December 9, 2020
2	Risk Assessment Summary/Goals Development	February 17, 2021
3	Mitigation Strategy Development	March 18, 2021

HMPC Meeting #1 – Kickoff Webinar

During the kickoff webinar on December 9, 2020, Wood presented information on the scope and purpose of the plan update, participation requirements of HMPC, and the proposed project work plan and schedule. Twenty-three participants attended the kickoff meeting. Plans for public involvement (Step 2) and coordination with other agencies and departments (Step 3) were discussed. Wood also introduced the hazard identification requirements and data. The HMPC discussed past events and impacts and future probability for each of the hazards required by FEMA for consideration in a local hazard mitigation plan.

Each jurisdiction provided updates through a data collection workbook created by Wood and mitigation action trackers or provided information directly to Wood for incorporation into the plan update.

HMPC Meeting #2 – Risk Assessment Update

On February 17, 2021, the HMPC convened virtually to review and discuss the results of the risk and vulnerability assessment update. Twenty-three members of the HMPC and stakeholders were present for the discussion. Wood presented preliminary risk assessment results for natural and human-caused hazards. The group went through each hazard together and discussed the results as well as shared any local insight to inform the HIRA update. The HMPC discussed the possibility of adding human-caused hazards to the Hazard Mitigation Plan but elected to keep the plan focused on natural hazards. A survey was developed by Wood and shared with the HMPC after the meeting, that asked the members to rank each hazard and asked to rank the human-caused hazards that should be included in the plan update. The survey also asked the HMPC to review the 2016 mitigation goals and determine if they were still valid, comprehensive, and reflect current priorities and updated risk assessments. Refer to the meeting summary in Appendix C for notes related to each hazard discussed and results from the post meeting survey.

HMPC Meeting #3 – Mitigation Strategy

The HMPC convened virtually on March 18, 2021 with twenty people participating to discuss updating the mitigation action plan from 2016 and finalize the goals and objectives for this planning process. The group reviewed the public survey results and noted the differences between the HMPC's hazard ratings and the public's perception of risks to the various hazards. The human-caused hazards discussed in the second meeting were revisited and the group reached a consensus on which human-caused hazards to include in the 2021 plan update. The group discussed the criteria for mitigation action selection and prioritization using a worksheet provided by Wood (refer to Appendix C). The meeting ended with a review of the next steps and planning process schedule. Wood provided the HMPC with a link to an online form to submit new mitigation actions. During the HMPC review of the full plan, each member was provided a handout on prioritizing new mitigation actions and asked to focus on prioritizing each new mitigation action proposed.

Planning Step 2: Involve the Public

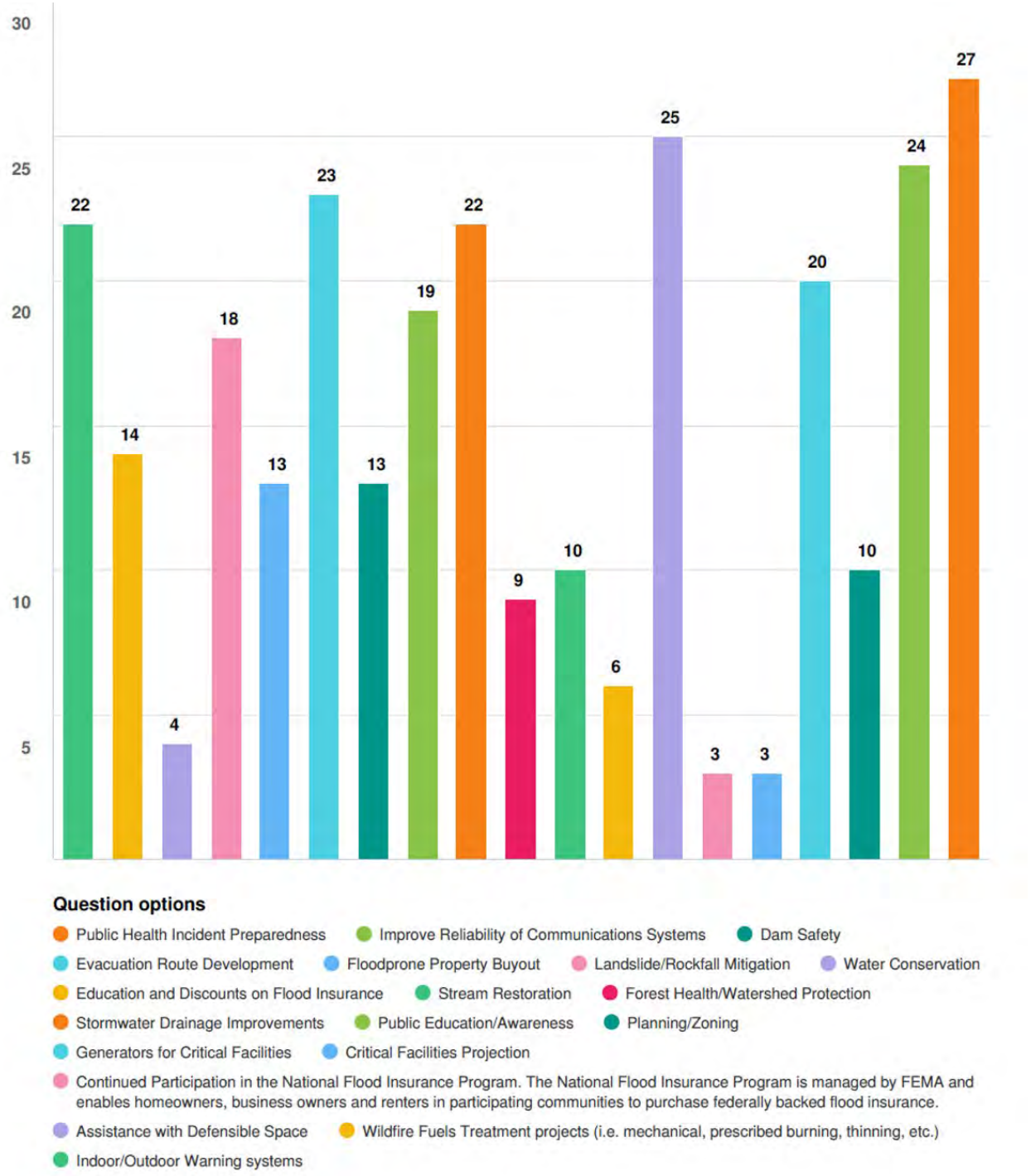
At the kickoff meeting, the HMPC discussed options for soliciting public input on the mitigation plan and developed an outreach strategy by consensus. The fact that the process was conducted during the COVID-19 pandemic, with attendant restrictions on public gatherings, made it difficult to use many traditional outreach methods such as in-person public gatherings or discussion at other forums. The HMPC adapted by leveraging virtual meetings and other online messaging, which in many cases resulted in greater public attendance and involvement than more traditional face-to-face meetings. The City developed and advertised a public survey through their public outreach platform, Engage Aurora. An announcement of the plan update process is shown in Figure 2-1.

Figure 2-1 City of Aurora Hazard Mitigation Plan Update Public Outreach Homepage

The survey provided an opportunity for public input during the planning process, prior to finalization of the plan update. The public survey received responses from 38 individuals. Responses reflect the public perception that the most significant hazards to be hailstorm, followed by pandemic/public health incident, drought, and cyber-attack.

Figure 2-2 below displays the results from Question 4, which asked respondents to consider potential mitigation actions and to indicate which types of actions should have the highest priority in the updated Mitigation Strategy. These results were considered during the planning process and in the development of new mitigation actions. Complete results of the public survey are provided in Appendix D.

Figure 2-2 City of Aurora Public Survey Results, Question 4



The public was given an opportunity to review and comment on the draft plan in August 2021. The City made copies of the plan available through Engage Aurora, along with a public comment form. The plan was advertised through Engage Aurora as well as the City's Facebook and Twitter accounts. The public was given a two-week period to review and provide comments. In total one individual submitted comment, which is included in Appendix C. The Planning Team reviewed the comment and determined no revisions were needed based on public review.

Record of public advertisements, public input, and sign-in sheets can be found in Appendix C.

Planning Step 3: Coordinate with Other Departments and Agencies

There are numerous organizations whose goals and interests' interface with hazard mitigation in the City of Aurora. Coordination with these organizations and other community planning efforts is vital to the success of this plan update. The Aurora Office of Emergency Management invited other local, state, and federal agencies to the kickoff meeting to learn about and participate in the hazard mitigation planning initiative. Many of the agencies participated throughout the planning process in meetings described in Step 1: Organize the Planning Effort. In addition, the HMPC developed a list of neighboring communities and local and regional agencies involved in hazard mitigation activities, as well as other interested parties to keep informed on the plan update process.

Stakeholders included local and regional agencies involved in hazard mitigation activities or those beyond the City and local government that have the authority to regulate development. Stakeholders could participate in various ways, either by contributing input at HMPC meetings, being aware of planning activities through an email group, providing information to support the effort, or reviewing and commenting on the draft plan. Representatives from the following agencies and organizations were invited to participate as stakeholders in the process; an asterisk indicates they attended HMPC meetings.

State and Federal Agencies

- Colorado Division of Fire Prevention & Control
- Colorado Division of Homeland Security and Emergency Management*
- Colorado Department of Local Affairs
- Colorado Department of Transportation
- Colorado Division of Water Resources*
- Colorado Parks and Wildlife
- Colorado State Patrol
- Colorado State Forest Service
- Colorado State University Extension Office
- National Weather Service*

Neighboring Jurisdictions

- Adams County*
- Arapahoe County
- City & County of Denver
- Douglas County

Integration with Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this plan. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability from natural hazards. The City of Aurora uses a variety of comprehensive planning mechanisms, such as master plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. Table 2-3 below provides a summary of the key existing plans, studies, and reports that were reviewed during the update process. Information on how they informed the update are noted where applicable.

Table 2-3 Summary of Key Plans, Studies, and Reports

Plan, Study, Report Name	How Plan, Study or Report Informed the HMPC
2018 Aurora Places Comprehensive Plan	Informed the Community Profile and capability assessments.
City of Aurora Comprehensive Management Plan (CEMP) and Disaster Recovery Plan	Provided information on disaster response and recovery procedures and how mitigation is integrated.
Colorado State Hazard Mitigation Plan (2018 Update)	Reviewed information on past hazard events and hazard risk information to inform the risk assessment Reviewed State goals and objectives
Colorado Drought Mitigation and Response Plan (2018 Update)	Reviewed information on pasts droughts and their impacts on the planning area. Incorporated information into the risk assessment
Colorado Flood Mitigation Plan (2018 Update)	Reviewed information on past flood events and risk analysis for the planning area to inform the risk assessment
Colorado State Demographer Community Demographic Profiles (ACS 5-Year Estimates 2015-2019)	Provide demographic data and trends for the City of Aurora.
FEMA Flood Insurance Study for the City of Aurora. (2020)	Provided flood risk data for specific hazard areas located within the City.
The Aurora Sentinel	The local newspaper located in the City of Aurora provided background information on past hazard events.

Phase 2: Assess Risks

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

Chapter 4, Risk Assessment is the result of a comprehensive effort to identify and document all the hazards that have, or could, impact the planning area. This section was updated to reflect recent hazard events and current assets within the City. Where data permitted, Geographic Information Systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. The HMPC conducted a capability assessment update to review and document the planning area's current capabilities to mitigate risk and vulnerability from natural hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process and the results are included in Chapter 4. The capability assessment is included in Chapter 3 Community Profile.

Phase 3: Develop the Mitigation Plan

Planning Step 6 and 7: Set Goals and Review Possible Activities

Wood facilitated a brainstorming and discussion session with the HMPC during their second webinar to update the goals and objectives from the 2016 plan. During the third HMPC webinar/meeting Wood facilitated a discussion session with the HMPC around a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This included a review of progress on each action identified in the 2016 plan. Several new mitigation actions resulted from this process that were added to the plan in 2020-2021. This process and its results are described in greater detail in Chapter 5.

Planning Step 8: Draft an Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, Wood produced a complete first draft of the plan. This complete draft was shared electronically for HMPC review and comment. Other agencies were invited to comment on this draft as well. HMPC and agency comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. Wood integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the Colorado Division of Homeland Security and Emergency Management (DHSEM) and FEMA Region VIII to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction.

Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

To secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction on the dates included in the adoption resolutions in Appendix A.

Planning Step 10: Implement, Evaluate, and Revise the Plan

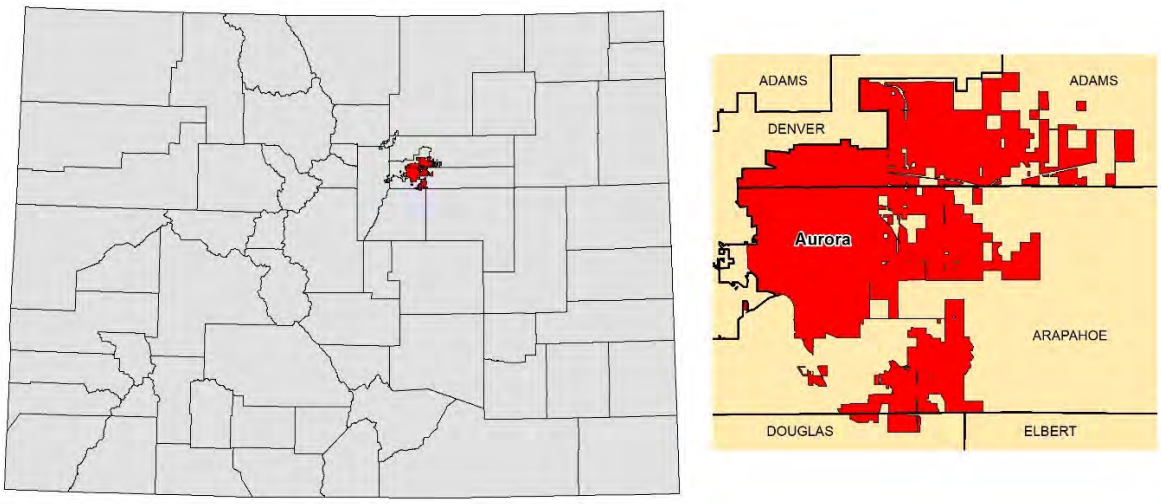
The HMPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time. A discussion on the progress with implementation is included in Chapter 5. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. An overall implementation strategy is described in Chapter 6.

Finally, there are numerous organizations within the City of Aurora planning area whose goals and interests' interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and mitigation in the City of Aurora and is addressed further in Chapter 6. An updated overall implementation strategy and maintenance and a strategy for continued public involvement are also included in Chapter 6.

3 City of Aurora Profile

The City of Aurora covers approximately 154.3 square miles in central Colorado (Figure 3-1). The City of Aurora is a Home Rule Municipality in Colorado, spanning Arapahoe and Adams Counties, with the extreme southeastern portion of the city extending into Douglas County. Aurora is one of the principal cities of the Denver-Aurora-Lakewood Metropolitan Statistical Area (Metro Denver). The City of Aurora manages more than 100 parks, more than 6,000 acres of open space and natural areas, and six award-winning municipal golf courses. The City of Aurora operates under a council/manager form of government, where the city manager runs the city's day-to-day operations with general guidance from the City Council. The Aurora City Council is composed of a mayor and ten council members. Aurora is protected by the Aurora Police Department (one of only 10 law enforcement agencies in Colorado to be accredited by the Commission on Accreditation for Law Enforcement Agencies), the Aurora Fire Department (which is accredited by the Commission on Fire Accreditation International), and a Public Safety Communications dispatch call center. The City is the 3rd most populous of Colorado's cities and the 54th most populous city in the United States.

Figure 3-1 Location of Aurora Within the State of Colorado



3.1 History

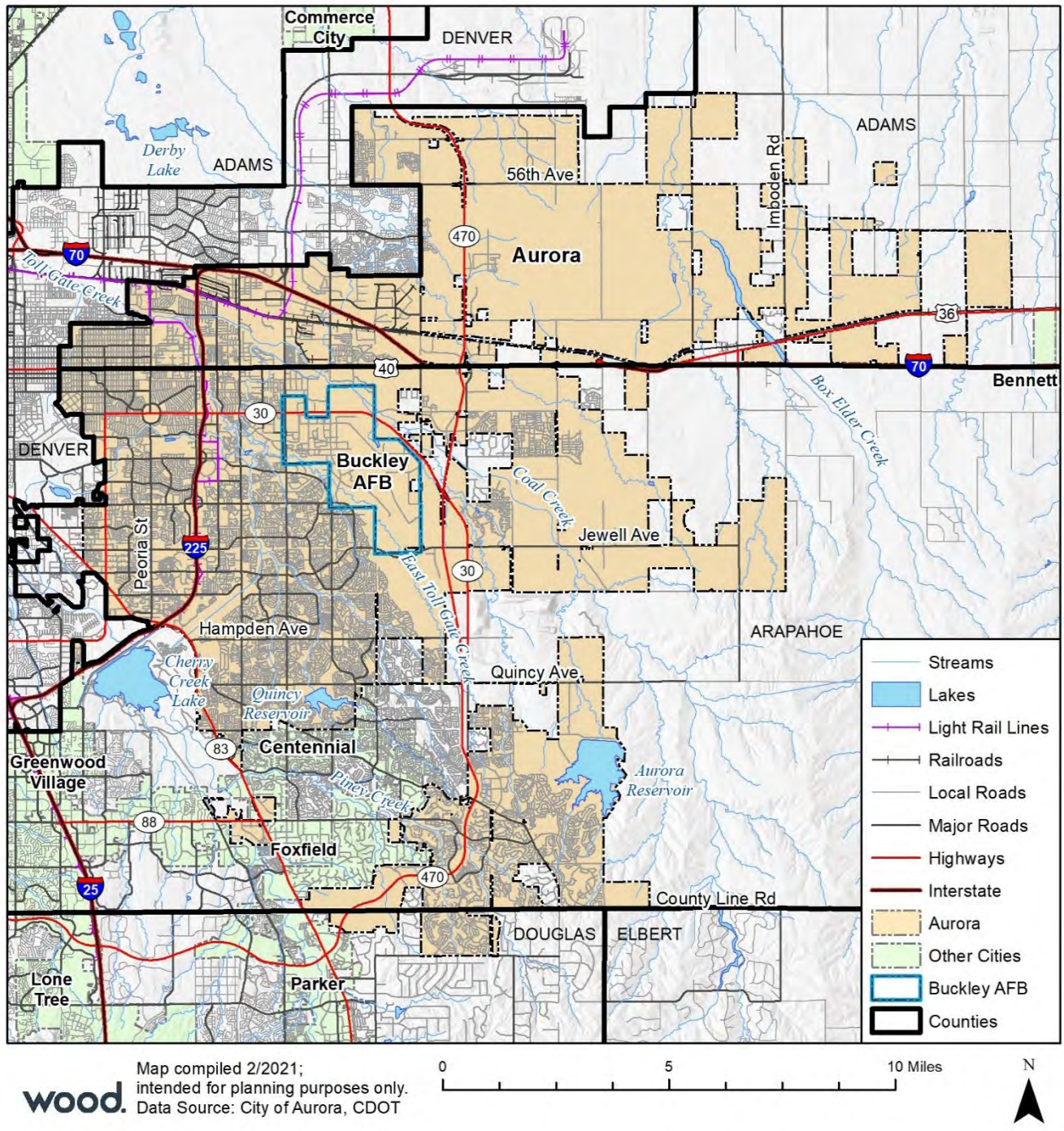
According to the 2018 Who is Aurora? Report, Aurora was incorporated as the Town of Fletcher on April 30, 1891. The Town of Fletcher, one of the new crop of suburbs sprouting up around Denver, was four square miles of prairie reaching from Yosemite Street to Peoria Street, and from 6th Avenue north to 26th Avenue. Named after one of the developers, Donald Fletcher, the town boasted 39 citizens, the beginnings of a water system, and 14 new brick homes designed with indoor plumbing. The high hopes of the new residents and the developers were short lived. A drought soon put an end to the water system and the Silver Panic of 1893 caused a severe drop in property values.

The Town of Fletcher became the Town of Aurora in 1907. No reasons for the name change were recorded in the town minutes but one of the original developers, Francis Perry, raised his family in the first new house built in Fletcher and was town clerk, recorder, and treasurer in the town for many years. His family home was originally in Aurora, Illinois.

The year 1918 marked the beginning of Aurora's first building boom with the opening of Army General Hospital #21 (later re-named Fitzsimons Army Hospital) east of town. Housing servicemen and their families stretched the little town's capacities. The City of Aurora reached official "city" status of 2,000

people in 1928; the year before Denver opened Stapleton Airport along the northern border of the city. Ten years later, in 1938, Lowry Air Force Base was opened to the southwest of the original town. Rather than closing Fitzsimons, the United States government expanded and upgraded the hospital facilities in 1941 just in time to care for the wounded servicemen of World War II. In 1942, Lowry expanded to a site 15 miles to the east that eventually became Buckley Air National Guard Base, now Buckley Space Force Base. In 1942, the War Department spent $62.4 million to purchase land northeast of town for the Rocky Mountain Arsenal. More job opportunities equaled more residents for the City of Aurora.

Figure 3-2 The City of Aurora



The City's population, which had grown to 3,000 residents in 1940, grew to 10,000 in 1950 with the return of servicemen to the area looking for the "American Dream." Hoffman Heights, the first suburb of Aurora outside its original city limits was annexed in 1954. New subdivisions are annexed on a regular basis. The 1990's census accredited Aurora with 222,000 residents and the July 1st, 2019 US Census Bureau estimate placed the population at 379,289.

Lowry Air Force Base closed in 1994 but was redeveloped into the Higher Education and Advanced Technological Center, a cooperative effort between private industry and 12 of Colorado's most progressive institutions of higher education.

Fitzsimons Army Hospital was decommissioned in 1996, and the University of Colorado has taken advantage of the buildings and potential for growth in the area to create the CU Anschutz Medical Campus, the largest academic health center in the Rocky Mountain region with an estimated 17,000 employees.

Aurora has been characterized by rapid growth and expansion over the past several decades. Aurora's first million-dollar homes have been built around E-470 and Smoky Hill Road which has since seen rapid growth. The northeastern plains of Aurora have become the focus of growth and expansion in recent years, with several new master planned communities anticipated to house an additional 60,000 residents in the coming years.

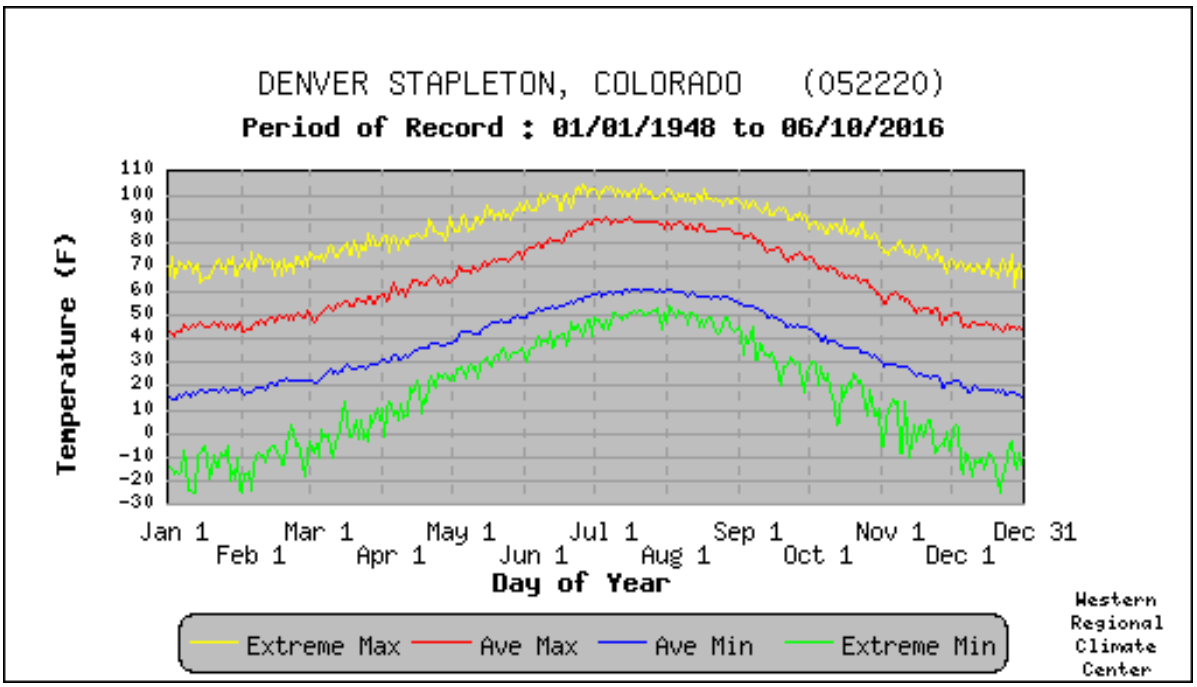
3.2 Geography and Climate

The City of Aurora has a semi-arid climate with four distinct seasons and modest precipitation year-round. Summers range from mild to hot, with generally low humidity and frequent afternoon thunderstorms. Aurora also averages about one dozen tornado warnings throughout the tornado season, which runs from April through July. Winters range from mild to occasional bitter cold, with periods of sunshine alternating with periods of snow, high winds, and very low temperatures. The Western Regional Climate Center reports data from the Stapleton Weather Station. Table 3-1 contains temperature summaries for the station. Figure 3-3 graphs the daily temperature averages and extremes.

Table 3-1 City of Aurora Temperature Summaries

Period of record	1948 – 2016
Winter Average Minimum Temperature	18.5ºF
Winter Mean Temperature	31.8ºF
Summer Average Maximum Temperature	85.3ºF
Summer Mean Temperature	70.9ºF
Maximum Temperature	104ºF; June 26, 1994
Minimum Temperature	-25ºF; February 1, 1951
Average Annual Number of Days >90ºF	35.4
Average Annual Number of Days <32ºF	155.5
Note - Winter: December, January, February; Summer: June, July, August Source: Western Regional Climate Center, www.wrcc.dri.edu/	

Figure 3-3 Stapleton Station Monthly Temperature Data (1948 – /2016)



Source: Western Regional Climate Center, www.wrcc.dri.edu/ (2016 is most recent available data)

The average first snowfall in the Aurora area occurs in late October and the average final snowfall occurs in late April, although snow has fallen as early as September 4 and as late as June 1. While precipitation is normally highest in the months of May and July, in certain years the summer months can be very dry. Early fall tends to be temperate and dry. Total annual precipitation is 18 inches coming mostly in spring and summer.

The geology of Aurora is consistent with the surrounding plains of Colorado. According to the CGS, the plains are characterized predominantly by sedimentary rocks. The City of Aurora is geographically located on the Colorado Piedmont between the high eastern plains and the foothills to the west. There are five major streams: Cherry Creek, Tollgate Creek, Unnamed Creek, Columbia Creek, and Sand Creek that all originate from springs on the eastern plains and ultimately flow into the South Platte River. Two reservoirs are managed by the City of Aurora, the Aurora and Quincy Reservoirs.

3.3 Demographics

According to the US Census Bureau ACS 2015-2019 5-year estimates, the 2019 population of Aurora is estimated at 369,111. This represents a 6.7% increase since 2015. The following tables break down key demographic, economic, and social characteristics based on data from the U.S. Census Bureau. Table 3-2 through Table 3-5, as well as Figure 3-4 and Figure 3-5, summarize various demographic, economic, and social characteristics of the City of Aurora over time with data from the US Census Bureau American Community Survey. As shown in Table 3-3, there are some categories in which Aurora differs significantly from the rest of Colorado and the Nation. Aurora's population is notably younger than the state and national median age. Additionally, Aurora's rate of residents who are not fluent in English is more than twice that of Colorado as a whole, and significantly higher than the rest of the US. This is one potential indicator for social vulnerability to hazards.

Table 3-2 City of Aurora Demographic and Social Characteristics, 2015-2019

City of Aurora	2015	2019	% Change
Population	345,867	369,111	6.72%
Median Age	33.6	34.3	2.1%
Total Housing Units	130,995	135,559	3.5%
Housing Occupancy Rate	94.7%	95.9%	1.3%
% of Housing Units with no Vehicles Available	6.9%	6.1%	-11.6%
Median Home Value	$189,100	$290,000	53.4%
Unemployment Rate	6.1%	3.3%	-45.9%
Mean Travel Time to Work (minutes)	29.1	29.5	1.4%
Median Household Income	$53,011	$65,100	22.8%
Per Capita Income	$25,115	$30,504	21.5%
% of Individuals Below Poverty Level	15.3%	10.7%	-30.1%
% Without Health Insurance	18.2%	11.4%	-37.4%
# of Households	124,031	130,054	4.9%
Average Household Size	2.8	2.8	1.8%
% of Population Over 25 with High School Diploma or Higher	86.5%	87.7%	1.4%
% of Population Over 25 with bachelor's degree or Higher	27.9%	29.7%	6.5%
% with Disability	10.2%	9.8%	-3.9%
% Speak English less than "Very Well"	14.8%	14.2%	-4.1%

Source: U.S. Census Bureau, American Community Survey

Table 3-3 Demographic and Social Characteristics Compared to the State and the Nation

Demographic & Social Characteristics (as of 2019)	City	Colorado	U.S.
Median Age	34.3	36.7	38.1
Housing Occupancy Rate	95.9%	90.0%	87.9%
% of Housing Units with no Vehicles Available	6.1%	5.1%	8.6%
Median Home Value	$290,000	$343,300	$217,500
Unemployment	3.3%	4.3%	5.3%
Mean Travel Time to Work (minutes)	29.5	25.8	26.9
Median Household Income	$65,100	$72,331	$62,843
Per Capita Income	$30,504	$38,226	$34,103
% of Individuals Below Poverty Level	10.7%	10.3%	13.4%
% Without Health Insurance	11.4%	7.6%	5.1%
Average Household Size	2.82	2.56	2.62
% of Population Over 25 with High School Diploma or Higher	87.7%	91.7%	88.0%

Demographic & Social Characteristics (as of 2019)	City	Colorado	U.S.
% of Population Over 25 with bachelor's degree or Higher	29.7%	40.9%	32.1%
% with Disability	9.8%	10.6%	12.6%
% Speak English less than "Very Well"	14.2%	5.8%	8.4%

Source: U.S. Census Bureau, American Community Survey

Table 3-4 Demographics by Race and Sex

City of Aurora	Population	%
Total Population	369,111	
Male	182,938	49.6%
Female	186,173	50.4%
White, not Hispanic	117,346	31.8%
Hispanic or Latino	105,531	28.6%
Black	60,909	16.5%
Asian	23,917	6.5%
American Indian and Alaska Native	3,203	0.9%
Native Hawaiian and Other Pacific Islander	1,296	0.4%
Some other race	37,539	10.2%
Two or more races	19,370	5.2%

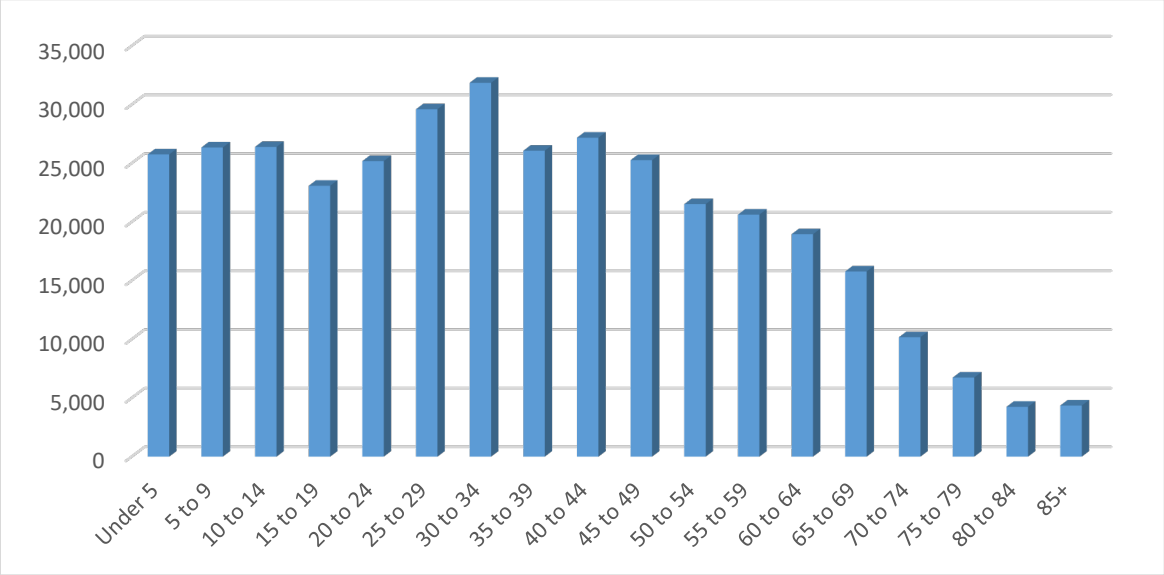
Source: U.S. Census Bureau, American Community Survey

Table 3-5 Types and Total Amounts of Housing Units in the City of Aurora

Type of housing units	Total	%
Total housing units	135,559	
1-unit detached	70,211	51.8%
1-unit attached	16,432	12.1%
2 units	1,348	1.0%
3 or 4 units	4,352	3.2%
5 to 9 units	9,056	6.7%
10 to 19 units	13,862	10.2%
20 or more units	17,737	13.1%
Mobile home	2,487	1.8%
Boat, RV, van, etc.	74	0.05%

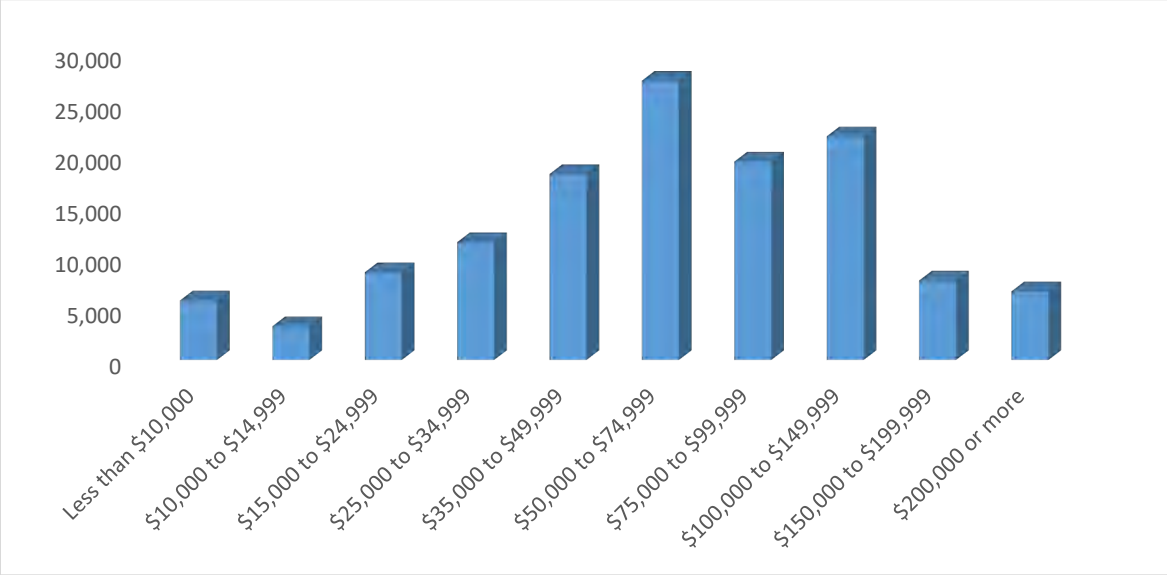
Source: U.S. Census Bureau, American Community Survey

Figure 3-4 City of Aurora Demographic Breakdown by Age



Source: U.S. Census Bureau, American Community Survey

Figure 3-5 City of Aurora Demographic Breakdown by Income



Source: U.S. Census Bureau, American Community Survey

3.4 Social Vulnerability

Local vulnerability to disasters depends on more than the relationship between a place and its exposure to hazards. Social vulnerability to disasters refers to the characteristics and situation of a person or group that influence their capacity to anticipate, cope with, resist, or recover from the impact of a hazard. It is determined by a number of pre-existing social and economic characteristics. Very often, the impacts of hazards fall disproportionately on the most underserved or marginalized people in a community – people with low income, children, people who are aging, people with disabilities, and minorities. During emergencies, for example, self-evacuation can be nearly impossible for individuals who are disabled or institutionalized. Additionally, the willingness of an individual/family to invest in residential mitigation

actions is often limited if their home is a rental and they are averse to investing money in long-term mitigation activity. Not only do conditions like this limit the ability of some communities to get out of harm's way, they also decrease the ability of communities to recover from and thrive in the aftermath of a disaster event.

The term vulnerability should be used to describe the communities more vulnerable to a risk or hazard, such as high vulnerability due to wildfires or floods based upon geography, topography, hydrology or weather. Referencing people themselves directly with the term vulnerability causes individual community members to be seen with a deficit lens, leaving the impression that the vulnerability is a result of the lack of responsibility and/or adequate planning of the individual. Instead, vulnerability only occurs when the system that the individual is part of fails to provide equitable accessibility to resources or services, known as access and functional needs, for the individual to survive, respond to, and recover from an event. Barriers that may be exacerbated by certain social and economic factors – including race, age, income, renter status, or institutionalized living – directly affect a community's ability to prepare for, respond to, and recover from hazards and disasters. The concept of social vulnerability helps explain why communities often experience a hazard event differently, even when they experience the same amount of physical impacts or property loss.

The 2016 Plan discussed disabled populations and racial/ethnic differences that can increase the vulnerabilities of some groups. The 2021 Plan takes a broader look at social vulnerability, including lessons learned from the ongoing COVID-19 pandemic. The social vulnerability assessment is designed to improve local decision making, hazard prioritization, and emergency management activities. By incorporating social vulnerability into the risk assessments of individual hazards, local communities are able to identify more vulnerable areas and tailor their mitigation actions to accommodate all members of their community, including the most sensitive groups.

The Centers for Disease Control and Prevention (CDC) has developed a social vulnerability index (SoVI) as a way to measure the resilience of communities when confronted by external stresses such as natural or human-caused disasters or disease outbreaks. The SoVI is broken down to the census tract level and provides insight into particularly vulnerable populations to assist emergency planners and public health officials identify communities more likely to require additional support before, during, and after a hazardous event. The SoVI index combines four main themes of vulnerability, which are in turn broken down into subcategories for a total of 15 vulnerability factors. Table 3-6 displays those 15 factors and shows how the City of Aurora compares to the rest of the Nation. The rankings show the percentage of census blocks nationally that Aurora is more vulnerable than, i.e. – high numbers reflect greater vulnerability.

Table 3-6 City of Aurora Social Vulnerability

Theme	Variable	Ranking Compared to US	Vulnerability
Socioeconomic status		**55%**	**Above Average**
	Below poverty	48%	Average
	Unemployment	51%	Average
	Income	58%	Below Average
	No high school diploma	59%	Below Average
Household composition & disability		**50%**	**Average**
	Age 65 or older	32%	Below Average
	Age 17 or younger	64%	Above Average
	Disability	40%	Below Average
	Single-parent households	64%	Above Average

Theme	Variable	Ranking Compared to US	Vulnerability
Minority status and language		**77%**	**High**
	Minority	76%	High
	Speaking English "less than well"	74%	Above Average
Housing and transportation		**49%**	**Average**
	Multiunit structures	57%	Above Average
	Mobile homes	24%	Low
	Crowding	60%	Above Average
	No vehicle	51%	Average
	Group quarters	26%	Below Average
Overall Social Vulnerability		**58%**	**Above Average**

Source: U.S. Centers for Disease Control and Prevention, https://svi.cdc.gov

The data shows that Aurora's social vulnerability is above average compared to both the State and the Nation. In particular, the City ranks high or above average in the following areas:

- Percentage of racial minorities, who historically are hardest hit by disasters.
- Percentage of people who speak English "less than well," complicating disaster communications.
- Multi-unit housing (defined as more than 10 units per structure), and crowded housing (defined as housing units with more occupants than rooms), which are more difficult to evacuate during emergencies.
- Single-parents' households and children age 17 or younger, who generally have fewer resources to respond to disasters and may need more assistance.

It should be noted that even though the City may have relatively fewer people in a SoVI category compared to other counties, there are still people in that category who may be disproportionately impacted by disasters. For example, the City scores relatively low in number of mobile homes, but the mobile homes the City does have are still more vulnerable to many hazards compared to non-manufactured homes.

Figure 3-6 through Figure 3-10 display the SoVI data for the City of Aurora broken down by census tract. Based on this data, the areas with the highest level of social vulnerability are primarily located in the northwestern part of the City west of Airport Blvd/South Buckley Rd and north of Hampden Ave. The maps also show above average vulnerability in the northeast and southeast portions of the City, however the population density in that area is significantly lower than the rest of the City, which may inflate the risk percentages.

During the risk assessment and mitigation strategy development phases of the 2021 planning process, the HMPC reviewed the results of the social vulnerability analysis in conjunction with the multi-hazard risk assessment results. The social vulnerability information helped staff uncover unseen risks and better prioritize mitigation actions.

Additional information on the CDC's Social Vulnerability Index can be found at https://svi.cdc.gov.

Figure 3-6 City of Aurora Overall Social Vulnerability

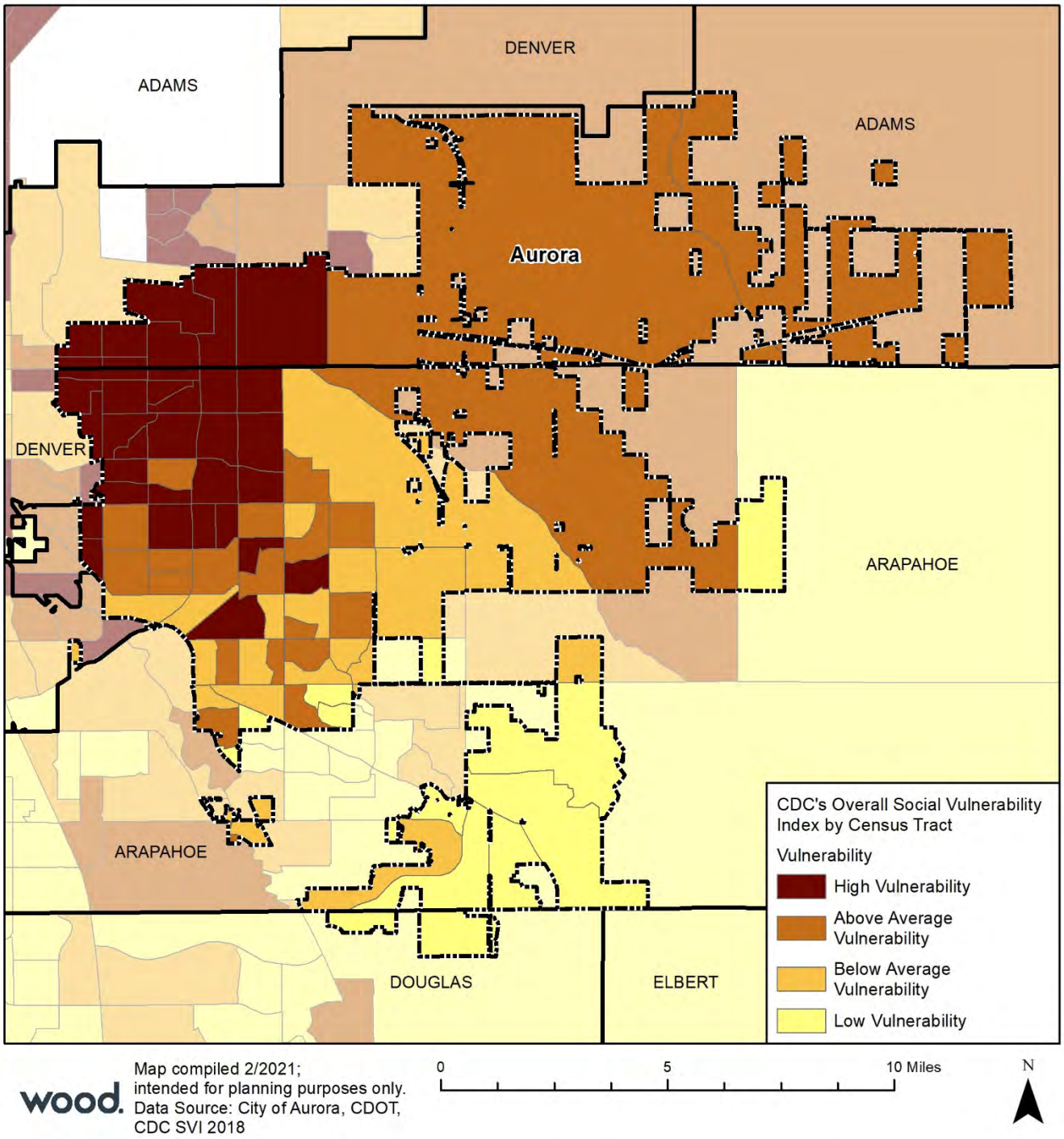


Figure 3-7 City of Aurora Socioeconomic Vulnerability

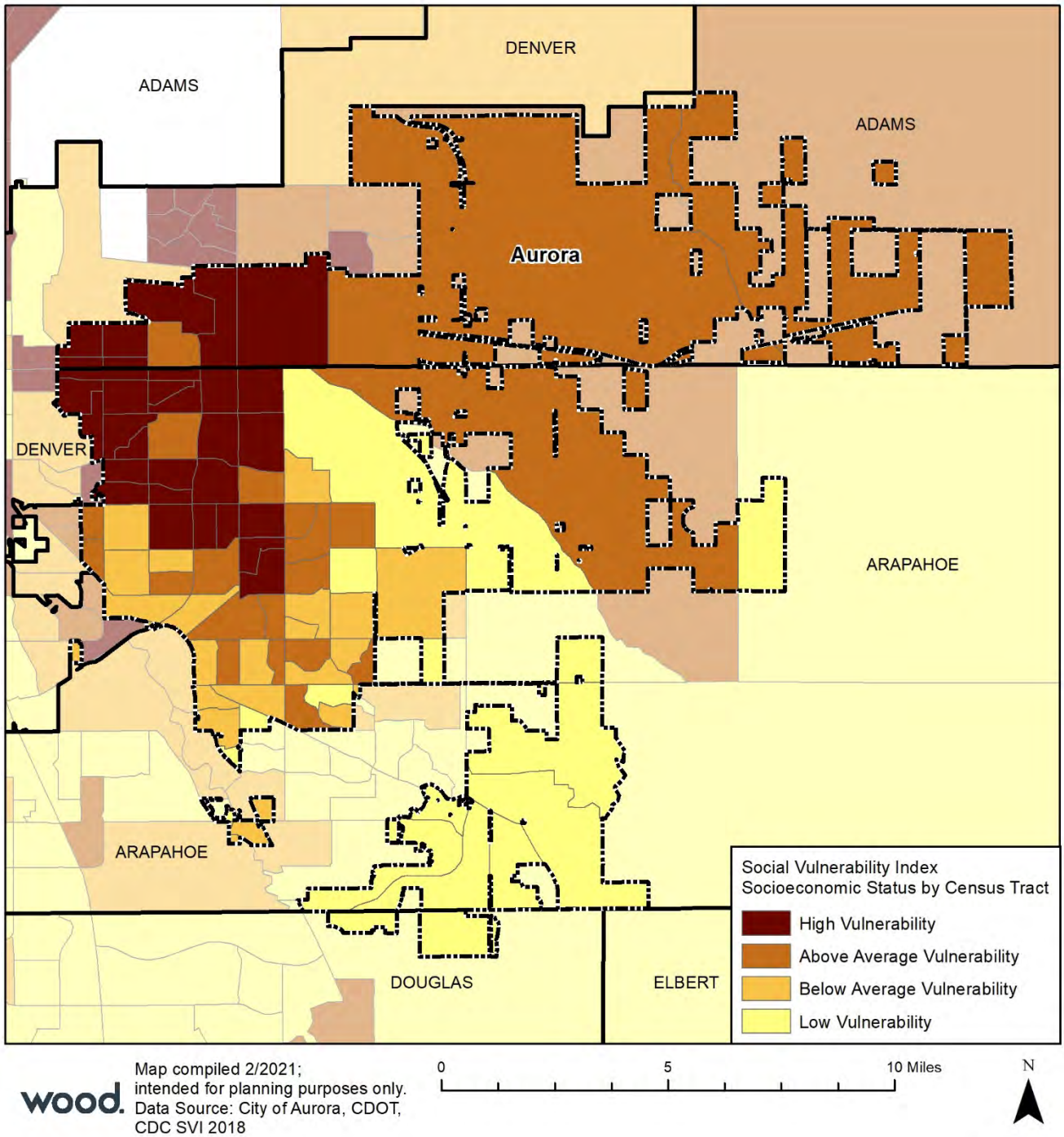


Figure 3-8 City of Aurora Household Composition and Disability Vulnerability

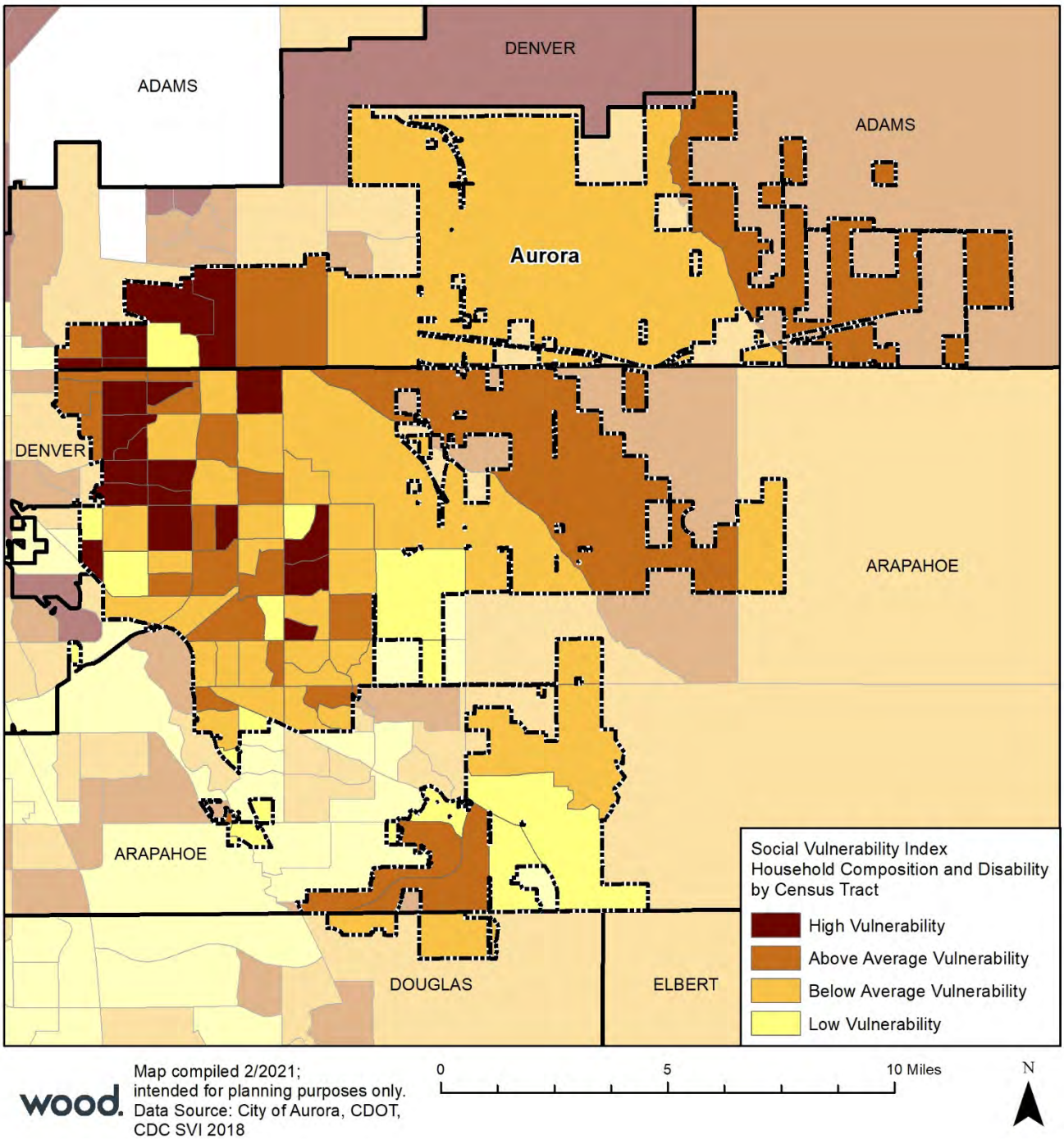


Figure 3-9 City of Aurora Minority Status and Language Vulnerability

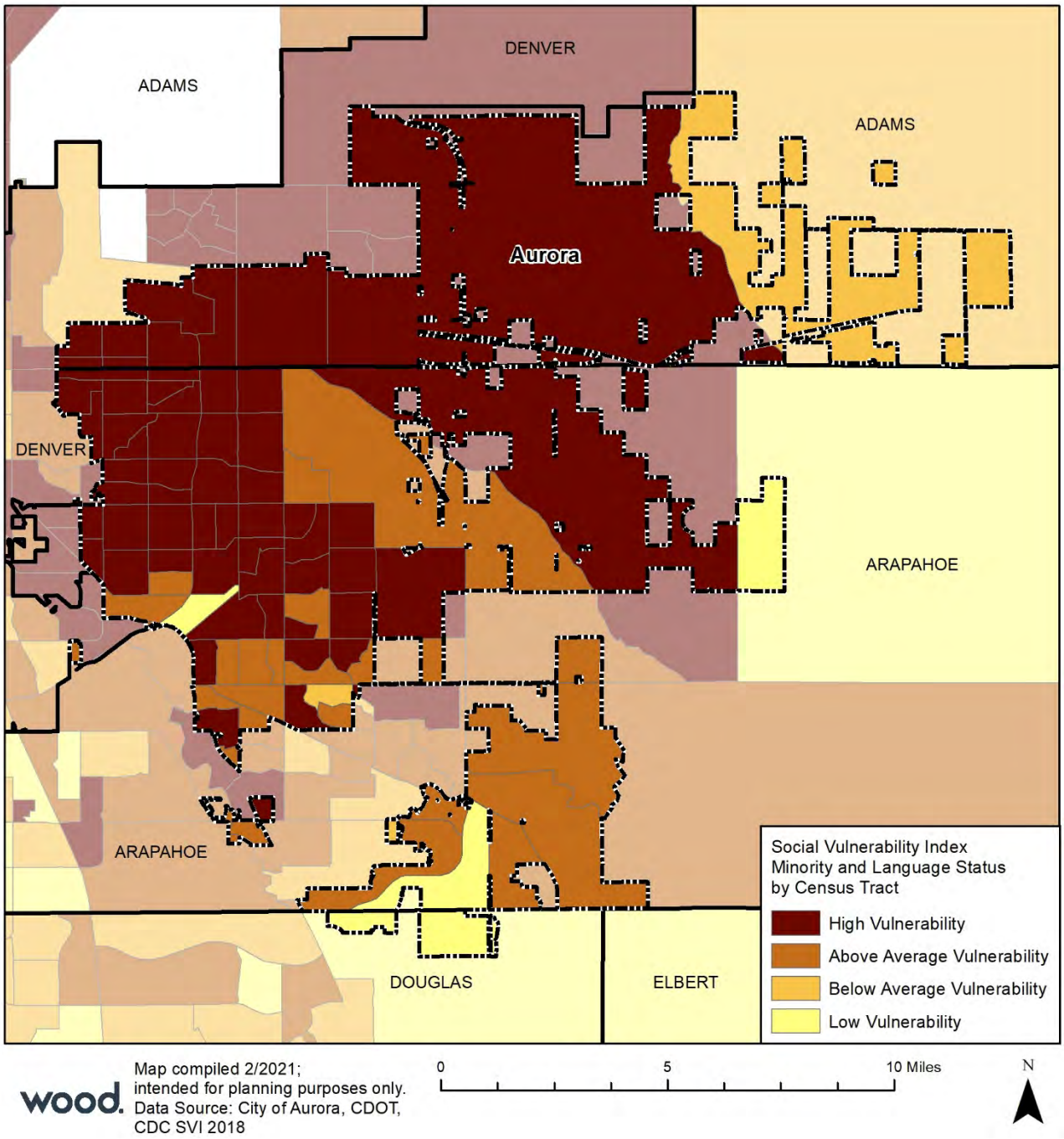
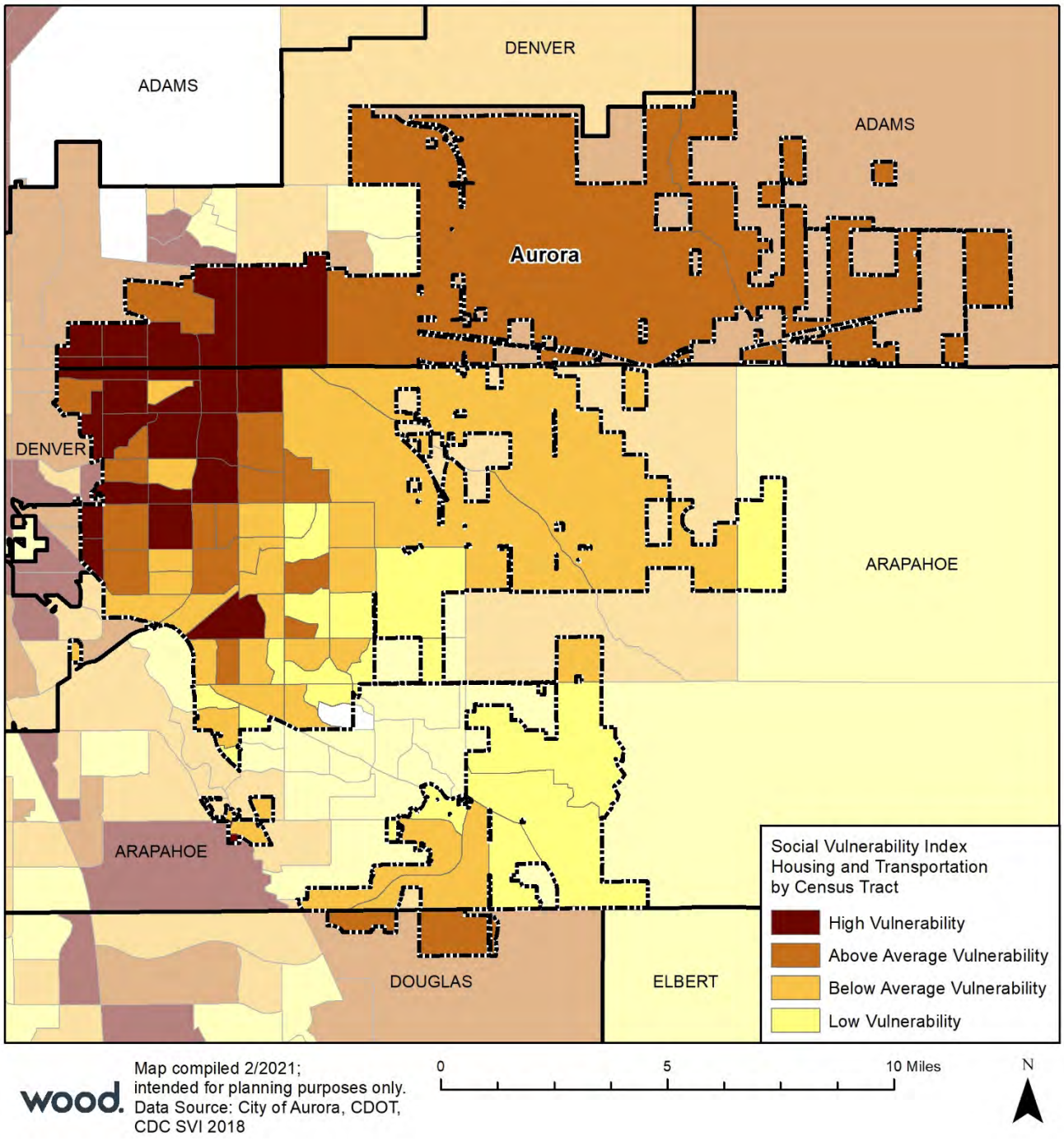


Figure 3-10 City of Aurora Housing and Transportation Vulnerability



3.5 Economy

Select 2019 economic characteristics estimated for the City of Aurora by the American Community Survey are shown in Table 3-7.

Table 3-7 City of Aurora Economic Characteristics

% of Families below poverty level	7.9
% of Individuals below poverty level	10.7
Median home value	$290,000
Median household income	$65,100
Per capita income	$30,504
% of Population >16 in Labor Force	71.9
% of Population Employed	68.0

Source: American Community Survey, 2014-2019 5 Year Estimates

3.5.1 Income

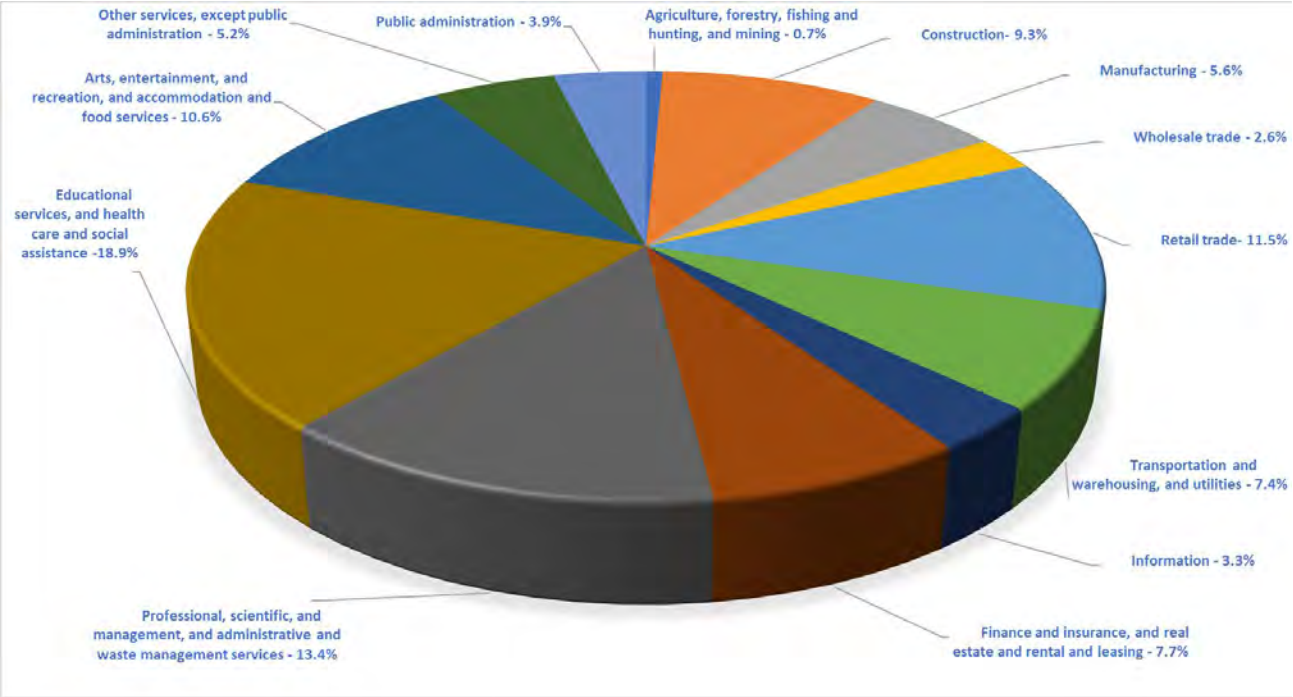
In the United States, individual households are expected to use private resources to prepare for, respond to, and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which may be more susceptible to damage. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on U.S. Census Bureau estimates, per capita income in the planning area in 2019 was $30,504, and the median household income was $65,100. It is estimated that 16.8% of households have an income between $100,000 and $149,999 per year and 5.1% are above $200,000 annually. Families with incomes below the poverty level in 2019 made up 7.9% of all families.

3.5.2 Occupations and Industries

According to 2019 American Community Survey data, the planning area's economy is strongly based in the education, health care and social assistance industries (18.9% of total employment), followed by the professional, scientific, and management, and administrative and waste management services (13.4 percent), and retail trade (11.5%). Figure 3-11 shows the distribution of industry types in City of Aurora, based on the share of total employment.

Figure 3-11 Percent of Total Employment by Industry in the City of Aurora



Source: US Census Bureau American Community Survey 2014-2019 5-year estimates, 2019

According to the Colorado Department of Labor and Employment, the following are the largest public employers in Aurora (Aurora EDC 2018):

- Children's Hospital Colorado
- Raytheon Company
- Kaiser Permanente
- HealthONE: The Medical Center of Aurora
- Amazon
- 24-7 Intouch

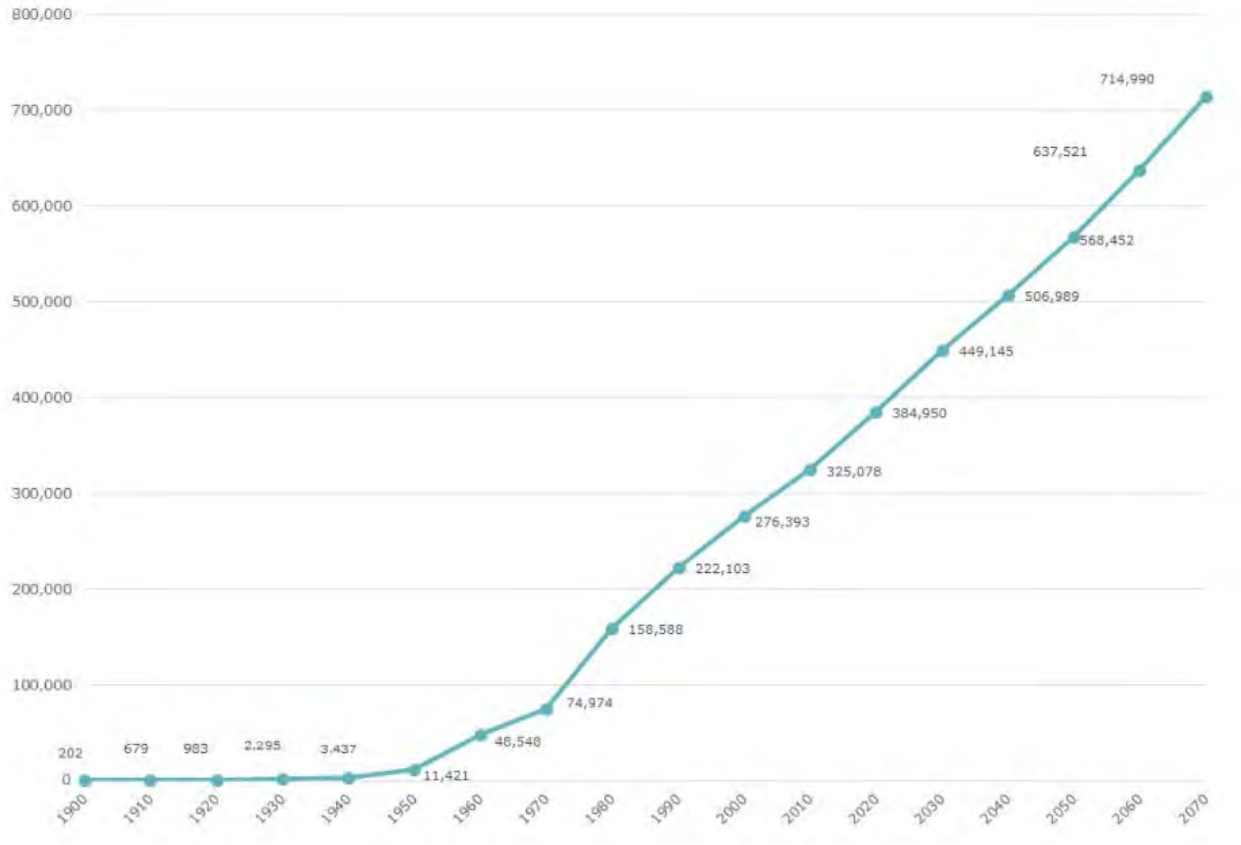
The U.S. Census estimates that 76.2 percent of City of Aurora workers commute alone (by car, truck, or van) to work, and mean travel time to work is 29.5 minutes.

3.6 Future Population Growth and Development Trends

A key strategy for reducing future losses in a community is to avoid development in known hazard areas and to enforce the development of safe structures in other areas. The purpose of this strategy is to keep people, businesses, and buildings out of harm's way before a hazard event occurs.

The City of Aurora has grown significantly in the past few decade and is one of the fastest growing communities in the Denver Metro Area. The amount of growth that Aurora has seen over the past decade has been dictated by the availability of undeveloped land. Based on observed population growth trends, housing demand within Aurora is expected to remain steady over the next five years. With an estimated population of 386,502 in 2020, Aurora has seen dramatic population growth over the past 50 years. The City has grown by about 300,000 people during that time period. Figure 3-12 below shows Aurora's past and current populations, as well as projected population growth through the year 2070 as calculated by the City of Aurora Planning and Development Services Department.

Figure 3-12 Aurora's Population Counts and Projections, 1900-2070



Source: US Census Bureau, Decennial Census 2010; City of Aurora Planning and Development Services Department, **City of Aurora Planning and Development Services calculated population estimate through July 2020 (https://www.auroragov.org/cms/One.aspx?portalId=16242704&pageId=16394086#)

The City of Aurora has most recently adopted the 2018 Aurora Places comprehensive plan, which helps to guide land use decisions, growth and development, and policy making. The City of Aurora Unified Development Ordinance, adopted in 2019, establishes zoning and land use regulations. Decisions on future land use will be governed by these programs. This plan will work together with these programs to support wise land use in the future by providing vital information on the risk associated with natural hazards.

The City of Aurora will incorporate information from this HMP update to inform strategic decision making. This will help ensure that future development trends can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan.

3.7 Hazard Mitigation Capabilities Assessment

The capability and resource assessment examines the City's ability to implement and manage the comprehensive mitigation strategy laid out in this Plan. The City's strengths, weaknesses, and resources are identified here as a means for evaluating and maintaining effective and appropriate management of the hazard mitigation program.

The information included in the capability assessment was gathered primarily from HMPC members and other representatives of the participating agencies. The 2021 update process afforded an opportunity to review these capabilities and how those capabilities have changed since the previous plan. Additionally,

in summarizing their current capabilities and identifying gaps, plan participants also considered their ability to expand or improve upon existing policies and programs as potential new mitigation strategies. Chapter 5 Mitigation Strategy includes mitigation actions aimed at improving community capability to reduce hazard risk and vulnerability. Together, the capabilities outlined in this plan highlight both strengths and areas of improvement that the City should consider to mitigate hazard impacts, reduce risk to life and property, and build a disaster resilient community.

3.7.1 Legal and Regulatory Capabilities

Table 3-8 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Aurora.

Table 3-8 City of Aurora Regulatory Mitigation Capabilities Matrix

Regulatory Tool (ordinances, codes, plans)	Yes/ No	2021 Comments and Changes Since 2016
General plan	Yes	Comprehensive Plan (2018): Aurora Places is the City's most current comprehensive plan, adopted on October 27, 2018 by Ordinance No. 2018-37.
Zoning ordinance	Yes	Chapter 146, Zoning, and 147, Subdivision, of city code were repealed and Chapter 146 replaced with a Unified Development Code on August 9, 2019 by Ordinance No. 2019-49
Subdivision ordinance	Yes	See above: Chapter 147 was repealed in August 2019.
Growth management	Yes	The City of Aurora is a Mile High Compact signatory and allocates urban or suburban growth according to an urban growth area to conform to DRCOG's MetroVision Plan. No Changes since 2016
Floodplain ordinance	Yes	City of Aurora Municipal Code Ch. 70 Floods, Article I: Floodplain Damage Prevention Ordinance: The purpose of this article is to promote public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas. This ordinance has also been incorporated into the city's unified development code and function as a flood control overlay zone. Floodplain ordinance was updated to add a dedicated Floodplain Administrator to the program.
Other special purpose ordinances (stormwater, steep slope, wildfire)	Yes	City of Aurora Municipal Code Ch. 147- Slope conditions Sec. 43; Ch. 66- Fire Prevention and Protection Sec. 31- Reckless kindling of fires.; Ch. 66- Fire Prevention and Protection Sec. 34- Fireworks
Building code	Yes	City of Aurora Municipal Code Ch.22 -Buildings and Building Regulations. Article IV- 2009 International Building Code. Currently transitioning to the 2021 version.
Erosion or sediment control program	Yes	UDO, Chapter 146.
Stormwater management	Yes	City of Aurora Municipal Code Ch. 138- Utilities, Article VIII-Stormwater. This article provides a comprehensive system of regulation and enforcement for the control of the quality of stormwater drainage.

Regulatory Tool (ordinances, codes, plans)	Yes/ No	2021 Comments and Changes Since 2016
Site plan review requirements	Yes	In the UDO Chapter 146, Section 5 includes Development Applications and Site Plans.
Capital improvement plan	Yes	Operating and Capital Improvement Budget-Capital Improvement Program.
Economic development plan	Yes	Aurora Economic Development Council- 2014 Strategic Plan. No changes since 2016.
Transportation plans	Yes	Northeast Area Transportation Study, Southeast Area Transportation Study, Fitzsimons Area Wide Multi-Modal Transportation Study, Northwest Aurora Bicycle & Pedestrian Plan, East Colfax East of I-225 Corridor Plan, Strategic Parking Plan & Program Study.
Local emergency operations plan	Yes	Development and conversion to a Comprehensive Emergency Management Plan (CEMP). Adding more detail and all state recommendations and requirements.
Local Energy Assurance Plan	Yes	Developed in 2011. This plan assesses resources for continuity of critical operations in the event of a major or prolonged power outage.
Flood insurance study or other engineering study for streams	Yes	Flood Insurance Study for Arapahoe County, Colorado, and Incorporated Areas dated December 17, 2010. Copies of the FIS, DFIRMs, FIRMs and/or FBFMs are on file in the office of the floodplain administrator. Multiple panels have been updated since 2016.
Elevation certificates	Yes	Maintained by the floodplain administrator. ECs are now available directly to the public over a web map.
DFIRM Digital Flood Insurance Rate Map		FIRM Flood Insurance Rate Map
FBFM Flood Boundary and Floodway Map		FIS Flood Insurance Study

Laws, Ordinances, and Agencies

Existing laws, ordinances and plans at the federal, state, and local level can support or impact hazard mitigation actions identified in this plan. In addition, federal, state, and local agencies perform functions that support hazard mitigation. HMPs are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). Pertinent federal, state, and local laws are described below.

Federal

Federal Emergency Management Agency

FEMA's mission remains "to lead America to prepare for, prevent, respond to, and recover from disasters with a vision of 'A Nation Prepared.'" FEMA coordinates the federal government's role in preparing for, preventing, mitigating the effects of, responding to, and recovering from all domestic disasters, whether natural or man-made, including acts of terror.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-707, was signed into law November 23, 1988; and amended the Disaster Relief Act of 1974, Public Law 93-288. It created the system in place today by which a presidential disaster declaration of an emergency triggers financial

and physical assistance through FEMA. The Act gives FEMA the responsibility for coordinating government-wide relief efforts. On March 1, 2003, FEMA became part of the U.S. Department of Homeland Security (DHS).

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Grant Program (HMGP) funds are available to communities. This plan is designed to meet the requirements of DMA, improving the City's eligibility for future hazard mitigation funds.

National Flood Insurance Program (NFIP)

The National Flood Insurance Program (NFIP) provides federally backed flood insurance in exchange for communities enacting floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act. The City of Aurora participates in the NFIP and has adopted regulations that meet the NFIP requirements. At the time of the preparation of this plan, the City of Aurora is in good standing with NFIP requirements.

As shown in Table 4-43 in the Flood profile, the City currently has 288 NFIP policies in effect, representing $77,358,900 in coverage. Records show 82 claims have been paid under NFIP policies in Aurora, totaling $286,899.

Community Rating System (CRS)

The City also participates in the Community Rating System (CRS), a voluntary program for NFIP participating communities focused on reducing flood damages to insurable property and encouraging a comprehensive approach to floodplain management. The CRS rewards communities that go above and beyond the minimum floodplain management requirements and develop extra measures to reduce flood risk by providing discounts to flood insurance premiums. Credit points are assigned for activities and actions under four categories:

- Public Information
- Mapping and Regulation
- Flood Damage Reduction
- Flood Preparedness

Participating communities then receive a rating from 10 (lowest) to 1 (highest), which determines the community's discount, as shown in Table 3-9.

The City of Aurora has participated in the CRS since 1992, and currently holds a Class 7 rating. This equates to a 15% discount on all NFIP policies in the City, saving policy holders $13,363 per year. Each Class improvement would translate into roughly $4,000 in additional savings.

Table 3-9 City of Aurora Community Rating System Statistics

CRS Class	% Discount	Annual Savings for Aurora Policyholders
10	0%	---
9	5%	$5,024
8	10%	$9,194
7*	**15%***	**$13,363***

CRS Class	% Discount	Annual Savings for Aurora Policyholders
6	20%	$18,388
5	25%	$22,557
4	30%	$26,726
3	35%	$30,895
2	40%	$35,065
1	45%	$39,234

Source: FEMA Community Information Systems
* City of Aurora's current CRS Class

State and Regional

Colorado Division of Homeland Security and Emergency Management

Pursuant to House Bill 12-1283, the former Division of Emergency Management moved from the Department of Local Affairs to the Division of Homeland Security and Emergency Management under the Colorado Department of Public Safety, effective July 1, 2012. The division is comprised of three offices:

- Office of Emergency Management
- Office of Preparedness
- Office of Prevention and Security

The Division of Homeland Security and Emergency Management operates under the following mission: "The mission of the Division of Homeland Security and Emergency Management is to support the needs of local government and partner with them before, during, and after a disaster and to enhance preparedness statewide by devoting available resources toward prevention, protection, mitigation, response, and recovery, which will ensure greater resiliency of our communities." The Division vision is: "…to unify homeland security and emergency management within the Colorado Department of Public Safety to support tribal and local government and ensure State and Federal agency coordination."

Colorado Water Conservation Board

The CWCB is an agency of the State of Colorado. The CWCB Flood Protection Program is directed to review and approve statewide floodplain studies and designations prior to adoption by local governments. The CWCB is also responsible for the coordination of the NFIP in Colorado and for providing assistance to local communities in meeting NFIP requirements. This includes CWCB prepared or partnered local floodplain studies. CWCB has recently partnered with the City on fluvial hazard zone mapping, as described in Section 4.6.

Colorado Geological Survey

The Colorado Geological Survey is a non-regulatory state government agency within the Colorado School of Mines. The mission of CGS is to help reduce the impact of geologic hazards on the citizens of Colorado, to promote responsible economic development of mineral and energy resources, provide geologic insight into water resources, provide avalanche safety training and forecasting, and to provide geologic advice and information to a variety of constituencies.

Colorado State Forest Service

The mission of the Colorado State Forest Service is to provide for the stewardship of forest resources and to reduce related risks to life, property, and the environment for the benefit of present and future generations. Its fire preparedness and response strategic priority is to provide leadership in wildland fire protection for state and private lands in Colorado and reduce wildfire-related loss of life, property, and critical resources.

Denver Regional Council of Governments

DRCOG was formed in 1955 when Denver Mayor Quigg Newton invited fellow elected officials from Adams, Arapahoe, Boulder, and Jefferson Counties to talk about joint issues and concerns. These leaders worked together to enhance the region's quality of life by fostering collaboration and cooperation, in order to speak with one voice.

DRCOG is a planning organization where local governments collaborate to establish guidelines, set policy, and allocate funding in areas of:

- Transportation and Personal Mobility
- Growth and Development
- Aging and Disability Resources

DRCOG includes the following committees and working groups:

- Administrative Committee
- Advisory Committee on Aging
- Citizens Advisory Committee
- Firefighter Advisory Committee
- Metro Vision Planning Advisory Committee
- Regional Transportation Committee
- Transportation Advisory Committee

Tri-County Health Department

Tri-County Health Department (TCHD) serves more than 1.3 million people in Adams, Arapahoe, and Douglas Counties, and offers over 60 programs/services ranging from birth certificates, immunizations and health care referrals to restaurant inspections and infectious disease investigations. The agency's jurisdiction includes 26 municipalities and 3 unincorporated counties, 15 school districts with more than 360 public schools, 12 acute care hospitals, 3 federally qualified healthcare centers with multiple facilities, 3 community mental health service providers, and 1 regional collaborative care organization (Colorado Access). The mission of the TCHD is to "Promote, protect and improve the lifelong health of individuals and communities in Adams, Arapahoe and Douglas Counties through the effective use of data, evidence- based prevention strategies, leadership, advocacy, and partnerships."

TCHD includes the Office of Emergency Preparedness and Response. This office "leads agency efforts to promote coordination, collaboration and communication among all divisions in TCHD to ensure that public health is an effective partner in preparedness and emergency response to all other disciplines in the TCHD jurisdiction." The office works closely with a wide variety of partners within Adams, Arapahoe, Douglas, and Elbert Counties, as well as the Denver Metro region and Statewide.

TCHD facilitates the Tri-County Healthcare Coalition Chapter of the North Central Region (NCR) Healthcare Coalition, a multi-disciplinary group organized to address planning, preparedness, and response to the health and medical portion of any incident impacting Adams, Arapahoe, Douglas, and Elbert Counties. Through this group, TCHD and partner agencies have developed the Emergency Support

Function #8 Annex to the Public Health Emergency Operations Plan to provide a framework for how response partners coordinate during incident response and recovery.

Adams County Office of Emergency Management

The City of Aurora is partially located within Adams County. The Adams County OEM plans, coordinates, and supports activities that help the county reduce its vulnerability to disaster. The Adams County OEM works with the local municipalities and fire districts to ensure a coordinated response and share available resources. The OEM also works with TCHD and neighboring Arapahoe, Boulder, Broomfield, Denver, Jefferson, Morgan, Washington and Weld Counties, to share best practices and provide county-to-county mutual aid when needed. The office oversees the County Emergency Operations and Recovery Plan; exercise and training; public education and preparedness outreach; Community Right-to-Know and Local Emergency Planning Committee; ambulance licensing; and whole community planning.

Arapahoe County Office of Emergency Management

The majority of the population of the City of Aurora is located within Arapahoe County. The City OEM may work with the Arapahoe County OEM to manage resources and coordinate activities during natural disasters. The purpose of the Arapahoe County OEM is to provide leadership, planning, education, and resources to protect lives, property, and the environment in the event a disaster were to strike Arapahoe County. In addition to emergency planning, mitigation, and training, the Arapahoe County Emergency Management Coordinator is in charge of the Environmental Crimes Unit, Wildland Fire Team, ambulance licensing, and county-wide disaster and emergency planning. The Environmental Crimes Unit handle hazardous materials related to investigation and fire code enforcement actions. The Wildland Fire Team assists other local firefighting agencies and responds when fires occur in areas of unincorporated Arapahoe County where there is not a designated fire jurisdiction. The Arapahoe County OEM works closely with all Arapahoe County offices as well as with TCHD.

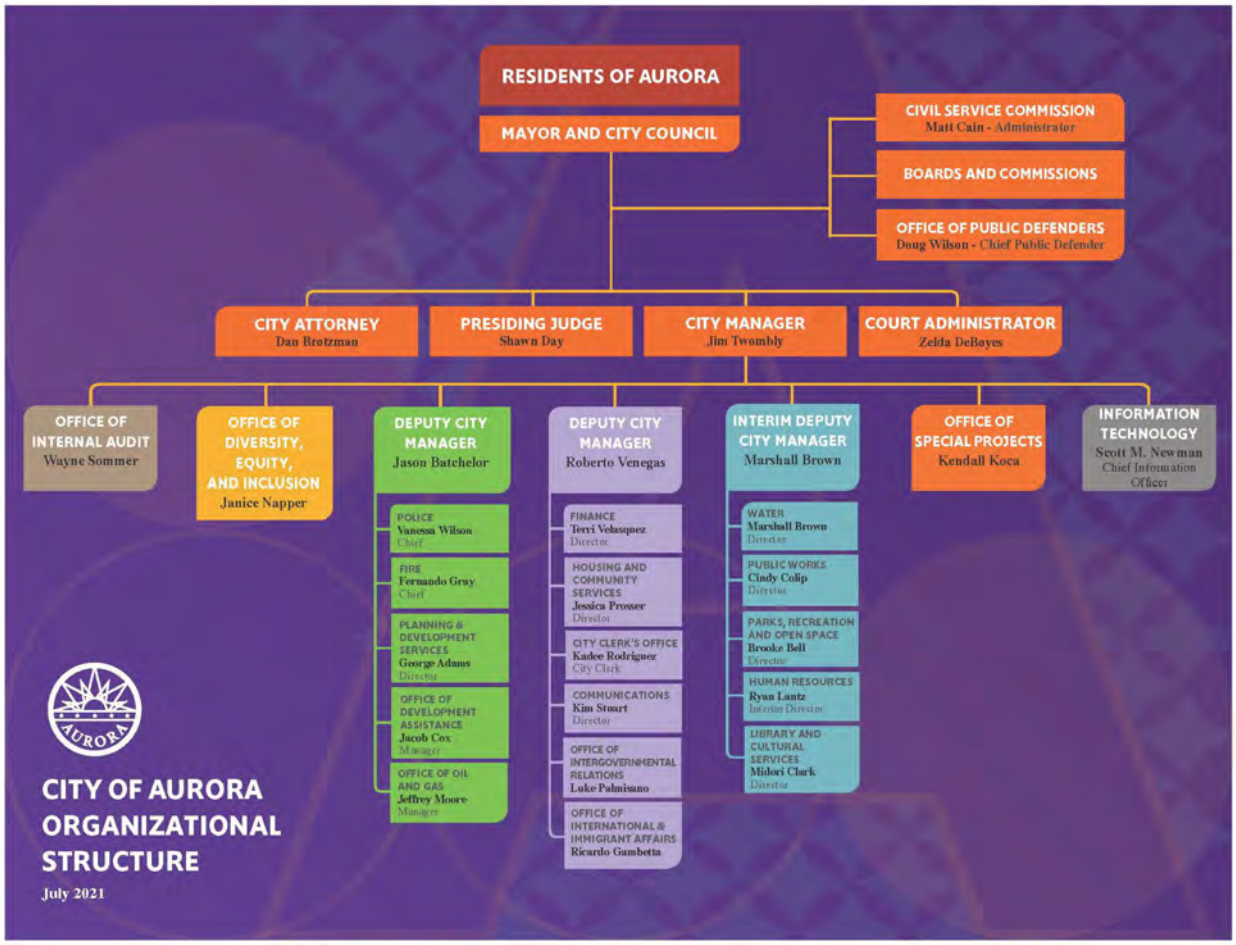
Douglas County Office of Emergency Management

A small portion of the City of Aurora is located within Douglas County. The Douglas County OEM is the main hub for the coordination of disaster management and training; homeland security; emergency preparedness and education; multi-agency cooperation; and emergency medical and trauma system coordination within the county. The county works in cooperation with other agencies including the Douglas County Sheriff's Office, TCHD, Public Works, and various municipal and district fire/rescue and police departments. Some additional responsibilities of this office include oversight of ambulance licensing, county-wide disaster and emergency planning and participation in the Local Emergency Planning Committee.

City of Aurora

The organizational chart for the City of Aurora government is shown in Figure 6-11.

Figure 3-13 City of Aurora Organizational Chart



Source: City of Aurora

Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Aurora Places Comprehensive Plan (2018)

The Aurora Places Comprehensive Plan recognizes major events affecting policy decisions and attempts to anticipate paradigm shifts that have the potential to significantly impact the economic, physical, and social landscape of the city. The comprehensive plan includes the following components:

- Chapter 1 The Right Place at the Right Time: What is Aurora Places and how is it used? It is a foundation for decision-making and focuses on planning and connecting places.
- Chapter 2 A City in Transition: How is Aurora changing, and what are some of the key issues that need to be addressed? It describes challenges associated with the economy, housing, population and natural resources.
- Chapter 3 A Community Conversation: What did we hear from the community? Aurora Places engaged residents, businesses, officials and city staff in an extended conversation concerning important matters in the city and ways to successfully move forward. The conversation provided ideas concerning a strong economy, population diversity, housing variety, health, the environment, improved mobility, and an improved and authentic reputation.

- Chapter 4 Placetypes: What types of places need to be planned and developed or improved in Aurora? Aurora Places describes types of places and principles to be employed in planning and developing these places. It includes a map showing the proposed general locations for these placetypes.
- Chapter 5 Connecting Places: How does the city connect the different places? This chapter describes concepts for city form, transportation, water, parks and open space, cultural resources, strategic areas and other means for providing connection and choice in the community.
- Chapter 6 Goals and Policies: What are the detailed goals and recommended practices for Aurora? Both were formulated based on an understanding of issues facing the city, what we heard during the community conversation and a grasp of placetypes and connections.
- Chapter 7 Action Strategies: What are the immediate action steps that should be taken to implement the goals and policies in the plan? It describes some of the tools that can be used immediately, along with specific strategies and measurements for success.

Consolidation Plan for City of Aurora (2010-2014)

The City of Aurora Community Development Division provided oversight to the development of the Consolidated Plan. The Consolidated Plan is a document mandated by the U.S. Department of Housing and Urban Development (HUD) for jurisdictions such as the City of Aurora that receive federal funding as an Entitlement Community. The main purpose of the Consolidated Plan is to be both a planning tool and an investment strategy, designed to create a link between the identified needs of Aurora residents and resources from HUD that can be brought to bear in the form of programs, projects, and initiatives.

Elements of the Plan

The three primary elements of the Consolidated Plan include sections identifying needs and priorities for the community, the strategies by which those needs will be addressed, and the annual Action Plan. A brief overview of the elements and the purpose of each are provided below:

1. Housing and Community Development Needs Analysis - A Housing and Community Development Needs Analysis was developed in order to determine the most important priorities on which to focus Consolidated Plan resources. The scope of the Consolidated Plan, with respect to the range of community needs, is very broad. The plan takes into account needs relating to housing for individuals and families, needs relating to the broader community such as services, public improvements, facilities, and employment. Specific sections include Community Profile, Market Analysis, Housing Gaps, and Community Development Needs. The data collection and evaluation for these sections were conducted by Economic and Planning Systems and RRC Associates, with oversight by Community Development Division staff. It is a primary source of data for the needs and priorities outlined in this Consolidated Plan.

2. Five Year Strategic Plan - Once the housing and community development needs were identified and prioritized, a strategic plan was developed to outline where resources could be directed over the next five years. Outcomes were developed to help guide the city and interested stakeholders in evaluating and sustaining effective programs and collaborations.

3. Action Plan - The Action Plan is provided at the conclusion of the document and provides a summary of the findings of the Consolidated Plan, identifies specific programs to implement the strategy, and provides the corresponding funding levels for each program. The Action Plan includes the most salient information from the Consolidated Plan to enable it to be used for the annual updates to HUD for the next five years.

City of Aurora Action Plan (2014)

The 2014 City of Aurora Action Plan represents a culmination of effort and cooperation between the city, citizen groups, and housing and supportive service providers. The document outlines Aurora's needs, goals and strategies for the 2014 fiscal year regarding housing and community development. While the Action Plan is a requirement for HUD funding, the process of identifying needs and fostering a cooperative relationship between city agencies, citizens, and providers in developing those priorities is an empowering exercise for any community. The priorities developed in the plan target a wide range of issues, from basic needs such as the availability of affordable housing for families and individuals, to overall community quality of life issues such as the reduction or elimination of blighting influences in Original Aurora, which is the city's historical business and residential district. In addition, the plan identifies economic opportunities within the community, the provision of support services for all residents, and the prevention of homelessness. In 2014, the city continued to implement many of its successful programs, such as:

- Single-family residential rehabilitation
- Home ownership assistance
- Commercial storefront renovation loans
- Colfax Economic Enrichment Program
- Alleyway paving
- Street and alley lighting
- Tenant-based rental assistance (Home of Our Own)
- Community outreach
- Code enforcement

The City of Aurora has established the following housing and community development priorities for the 2014 Action Plan:

Provide decent housing

- Priority 1.1: Maintain and improve the existing supply of affordable housing to meet the needs of low- and moderate-income residents
- Priority 1.2: Increase access to affordable housing options for Aurora residents
- Priority 1.3: Prevent homelessness

Provide a suitable living environment

- Priority 2.1: Improve or enhance public infrastructure and community resources
- Priority 2.2: Strengthen delivery and coordination of human services
- Priority 2.3: Support community outreach programs that connect Aurora residents with community resources and initiatives that improve the quality of life for low-income residents

Provide expanded economic opportunities

- Priority 3.1: Support programming that improves local business districts
- Priority 3.2: Enhance the economic vitality of the community through the support of the resident workforce

Aurora Unified Development Ordinance (UDO)

The purpose of the Unified Development Ordinance is to:

- Implement the Comprehensive Plan, as that plan may be amended or replaced from time to time.

- Ensure that all development in the City is consistent with the spirit and intent of any other plans and policies adopted by City Council.
- Promote the creation of safe, unique, interesting, inclusive, and economically vibrant places throughout the city.
- Protect the quality and character of stable residential neighborhoods.
- Promote the economic development and fiscal sustainability of the City.
- Encourage efficient and connected multimodal transportation and circulation systems serving drivers, bicyclists, pedestrians, and transit riders.
- Encourage the conservation and efficient use of water and other natural resources.
- Ensure the provision of adequate public facilities and services for new development and redevelopment.
- Provide for the consistent, predictable, and equitable administration of City land use and development regulations.
- Implement a connected system of parks, trails, and open spaces that promote improved outdoor activity and public health.
- Provide protection from nuisances and hazards.
- Protect the health, safety, and general welfare of the public.

Comprehensive Emergency Management Plan

The City of Aurora traditionally followed a common Emergency Operations Plan (EOP) which organized the city's response to emergencies and disasters while considering the welfare and safety of its citizens. The EOP was last updated in 2017. As of the update to this plan the Office of Emergency Management has converted to a Comprehensive Emergency Management Plan (CEMP) which was adopted by council in May of 2021. The CEMP add more detail and refers to the overall collection of emergency plans and includes the information from the previous plan. The CEMP sets forth lines of authority, responsibilities and organizational relationships, and indicates how these actions will be coordinated in the city and with the state and federal government. It also addresses emergencies and disasters caused by natural or manmade events, acts of terrorism, or any other circumstance necessary to address as determined by the city's emergency manager.

Energy Assurance Plan (2012)

The City developed a comprehensive local Energy Assurance Plan to identify critical facilities, buildings, and infrastructure in the City; identify required operations each facility during an energy emergency; identify and prioritize backup power capabilities; and identify improvements to reduce energy usage. The Plan helped to identify interdependencies across energy sectors and identify gaps, and included a risk and vulnerability assessment to determine the likelihood of power outages in the future.

Cherry Creek Dam Evacuation Plan (2017)

In 2017, the City coordinated with Arapahoe County, Adams County, and the City and County of Denver to develop a regional mass evacuation plan to ensure a coordinated evacuation effort in response to a failure of the Cherry Creek Dam. The plan builds upon studies performed by the US Army Corps of Engineers to provide strategies for comprehensive emergency management and multi-agency coordination for evacuation of the potential inundation areas impacted by a failure of the Cherry Creek Dam. Populations, including vulnerable populations in nursing homes and critical facilities were identified within eight evacuation zone. Functional annexes within the plan address key activities related to transportation of evacuees, crisis communications and public warning, animal and pet considerations, populations with access and functional needs, and reunification and re-entry protocols.

Fire Department

Aurora Fire Rescue includes the following divisions:

- Emergency Services Division – This division encompasses all activities related to fire suppression, emergency medical services, and personnel staffing for emergency response and includes specialty teams such as the Hazardous Materials (HAZMAT) Response Team, Technical Rescue Team, Air Team, and the Emergency Response Review Board.
- Support Services – This division is responsible for maintaining current buildings and apparatus and for the construction of new buildings and the purchase of new apparatus.
- Life Safety/Fire Marshal Division – This division is responsible for development review, facilities task force planning, procurement of Aurora Fire Department sites, placement of future resources and ensuring subordinate refresher training and direction of the Fire Code Inspection Bureau, Fire Investigations Bureau, Community Relations, and Internal Affairs.
- Special Services Division – This division is responsible for all activities related to training, health and safety, and emergency management.

Office of Emergency Management

The mission of the OEM is to effectively plan and prepare for, respond to, and recover from large scale disasters and emergencies. This is accomplished by taking an all-hazards approach to developing plans and programs designed to lessen the impacts of these large-scale events. The overarching goal of the OEM is to ensure a coordinated, city-wide response in order to protect lives, property, and the environment. While OEM is located within the Fire Department, it is responsible for coordinating with all agencies citywide.

Police Department

The Aurora Police Department is responsible for providing law enforcement services to a growing, urban/suburban community with unique and ever-changing needs. The department is committed to connecting with community leaders, school administrators, members of the business community, non-profit organizations, other government agencies, neighborhood groups, and most importantly, individual citizens. It is through this spirit of partnership that the police department and the city will continue to see further reductions in crime and will enhance the quality of life for those who live, work, and play in Aurora. The Aurora Police Department currently employs 657 officers and 131 civilians.

Department of Planning and Development Services

The Planning and Development Services Department helps to create a high-quality physical environment and a desirable community in which to live, work, play and visit through the support of effective planning by the community and the implementation of that planning. Its three divisions work together to manage growth within the city and coordinate economic development efforts and urban renewal projects. These three divisions are:

- Current and Long-Range Planning Divisions - These divisions provide zoning and development information to the public and processes development applications. The divisions provide guidance in transportation, environmental and land-use planning. The divisions update, maintain, interpret, and implement the Comprehensive Plan and related plans, documents and policies. They conduct special studies, and coordinate and communicate with other departments, governments, and agencies undertaking planning and plan implementation. In addition, the divisions supply a range of data services, including mapping and GIS applications, compilation and analysis of social and economic data, population and employment projections, and address assignment.

- Development Services Division - This division serves as the central contact for the coordination of economic development efforts, urban renewal projects, and small business development. The division pursues strategies that:
  - Ensure that the City of Aurora is the preferred location for new, existing, and expanding organizations by facilitating business, industrial, and retail development.
  - Promote ongoing and future development and redevelopment projects in the city's eight urban renewal areas.
  - Help existing businesses prosper and expand through our Small Business Development Center.
  - Enhance the community and create new, well-paying jobs.
  - Attract quality retail and sustain and redevelop existing retail centers.
  - Work strategically and in partnership with the Aurora Economic Development Council, Adams County Economic Development Council and others to ensure a vital and growing community

Department of Public Safety Communications

The Aurora Public Safety Communications Department was created in 2004 by combining the communications sections of the Aurora Fire Department and the Aurora Police Department. The Public Safety Communications Department is a consolidated dispatch center with a staff of 1 manager, 1 administrative specialist, 1 senior supervisor, 1 training supervisor, 6 supervisors, and 71 telecommunicators. The center provides direct dispatch service for the Aurora Police Department and the Aurora Fire Department.

Public Works Department

The Public Works Department is responsible for providing safe, effective transportation and building within the City of Aurora through quality planning, design, construction, and maintenance. The mission of the Public Works Department is to effectively promote and maintain a high level of economic welfare and quality of life in Aurora through the planning, design, construction, inspection, review, approval and maintenance of Aurora's transportation and drainage infrastructure.

Service divisions under the management of Public Works are:

- Engineering Services - Project and capital improvement design, specifications and review
- Real Property Services - Manages city real estate transactions and property records
- Technical Services - GIS, CAD, plan submittal and document management
- Land Survey Services - Boundary, benchmarks, project survey, and control
- Street Services Division - Improve and maintains roadways, street sweeping, and snow removal
- Facilities Maintenance - Maintains city buildings
- Building Division - Information on building in Aurora and Permit Center
- Public Improvement Inspections
  - Inspection of public improvements including streets, walks, and drainage
  - Due Diligence Checklist and P.I. Permit
  - Traffic Control Plan Instructions
- Materials Lab - Evaluates materials used in roadway and utility construction
- Traffic Section- Installs and maintains traffic control devices

Housing and Community Services

Housing and Community Services works to maintain community appearance and enhance the quality of life in Aurora's neighborhoods. Neighborhood Services includes the following divisions:

- Animal Services Division - The Aurora Animal Services Division provides animal-related services for the City of Aurora including sheltering, adoptions, and animal protection. The mission of the Aurora Animal Services Division is to balance the needs of people and animals by providing humane shelter, treatment and placement of animals and by enhancing and preserving the human-animal bond through education, outreach, adoptions, and cruelty prevention.
- Community Development - Community Development activities target a wide range of issues, from basic needs such as the availability of affordable housing for families and individuals, to overall community quality of life issues such as the reduction or elimination of blighting influences in Original Aurora, which is the city's historical business and residential district. In addition, Community Development addresses economic opportunities within the community, the provision of support services for all residents, and the prevention of homelessness.
- Community Relations - Working on behalf of all Aurora residents, the Community Relations Division's mission is to advocate the effective use of available human, community, and social service resources by coordinating programs to meet the needs of our diverse community.
- Neighborhood Support, Code Enforcement - The Neighborhood Support Division was established to enforce city codes. The Neighborhood Liaison Program joined forces with Code Enforcement in an effort to enhance communication with citizens and the city. Together, Code Enforcement Officers and Neighborhood Liaisons work together to be a pro-active link between the city and residents by fostering a spirit of self-reliance and promoting a positive physical image in Aurora's neighborhoods. The Neighborhood Support Division works with property owners, renters and businesses to meet the requirements related to the city's zoning and housing codes for property maintenance. Neighborhood Support provides enforcement, programs and services to the community in the following ways:
  - Zoning Code Enforcement
  - Sign Code Enforcement
  - Site Plan Inspections
  - Systematic Housing and Complaint-Based Inspections
  - Business Regulations and Use Enforcement
  - Mediation Services
- Neighborhood Support, Neighborhood Liaisons - The Neighborhood Liaisons work with community leaders and neighborhood groups as a point of contact between the citizens of Aurora and local municipal government through the Neighborhood Referral Program in the Neighborhood Support Division.
- Original Aurora Renewal - Original Aurora Renewal (OAR) is a program within the Community Development Division. OAR serves as a neighborhood resource center that develops and implements comprehensive strategies that will revitalize our community. OAR helps neighborhoods in Northwest Aurora help themselves to increase the quality of life and promote long-term community health, safety, and resilience.

3.7.2 Administrative and Technical Capabilities

Table 3-10 identifies the city personnel responsible for activities related to mitigation and loss prevention in the City of Aurora.

Table 3-10 City of Aurora Administrative/Technical Mitigation Capabilities Matrix

Personnel Resources	Yes /No	Department/Position
Planner/engineer with knowledge of land development/land	Yes	Planning & Development Services / Planner, Engineer

Personnel Resources	Yes /No	Department/Position
management practices		
Engineer/professional trained in construction practices related to buildings or infrastructure	Yes	Building Division, Public Works / Engineer
Planner/engineer/scientist with an understanding of natural hazards	Yes	Public Works, Aurora Water, Planning & Development Services / Planner, Engineer
Personnel skilled in GIS	Yes	Public Works Department, Technical Services Division, Information Technology / GIS Coordinator. Emergency Management, GIS division added to Water.
Full time building official	Yes	Building Division / Chief Building
Floodplain manager	Yes	Floodplain Administrator is now a dedicated position in Public Works.
Emergency manager	Yes	Office of Emergency Management / Bureau Manager
Grant writer	Yes	Multiple Departments / Grant Writer
GIS data: Hazard areas	Yes	Emergency Management
GIS data: Critical facilities	Yes	Emergency Management
GIS data: Building footprints	Yes	Planning & Development Services, Information Technology / GIS Coordinator
GIS data: Land Use	Yes	Planning & Development Services
GIS data: Links to Assessor's data	Yes	Information Technology / GIS Coordinator
Warning Systems/Services	Yes	Everbridge to Code Red and MIR3
Other?	Yes	Oil & Gas Division / Manager

3.7.3 Financial Capabilities

Table 3-11 identifies financial tools or resources that City of Aurora could use to help fund mitigation activities.

Table 3-11 City of Aurora Financial Mitigation Capabilities Matrix

Financial Resources	Accessible/Eligible to Use (Yes/No)	Has This Been Used in the Past?
Community Development Block Grants	Yes	No
Capital improvements project funding	Yes	Yes

Financial Resources	Accessible/Eligible to Use (Yes/No)	Has This Been Used in the Past?
Authority to levy taxes for specific purposes	Yes	No
Fees for water, sewer, gas, or electric services	Yes	Unknown
Impact fees for new development	Yes	Unknown
Incur debt through general obligation bonds	Yes	No
Incur debt through special tax bonds	Yes with voter approval	No
Incur debt through private activities	No	No
Withhold spending in hazard prone areas	No	No
City of Aurora departmental project funding	Yes	Yes

In 2011, Aurora received a 2,979,865 Flood Mitigation Assistance grant from FEMA to conduct flood mitigation projects in the City.

3.7.4 Education and Outreach

Table 3-12 lists additional education and outreach capabilities, such as specific programs, which the City of Aurora utilizes to implement hazard mitigation activities.

Table 3-12 City of Aurora Education and Outreach Capabilities

Programs	Yes/No
Local Citizen Groups That Communicate Hazard Risks	Yes
CRS/Floodplain Public Information Program	Yes
StormReady	No
Firewise	No

The Office of Emergency Management has in the past taught preparedness courses in the City, however it is not currently able to do so based on limited staffing and funding.

3.7.5 Summary of Capabilities

The capabilities assessment identifies the plans, regulations, personnel, and funding mechanisms available to the city to mitigate the effects of natural hazards. The City of Aurora strives to find the appropriate balance between regulatory authority and private property owners' rights.

The City of Aurora has a robust system of plans, programs, and personnel in place to directly and indirectly address emergency management and the implementation of a proactive HMP. These plans include the City's Comprehensive Plan, Consolidation Plan, Action Plan, Emergency Operations Plan, and several specific ordinances directed at flood damage prevention, zoning, construction, and development. While the City OEM (under the Mayor and City Council) has primary responsibility for the implementation of the HMP, it takes cooperation and coordination on the part of all city departments and regional organizations to successfully implement the mitigation plan. In addition to the city's full-time emergency management staff, the city has GIS, Planning and Development, Public Safety

Communication, Public Works, and other departments to coordinate the planning, mitigation, and response to natural hazard events. The city also may coordinate with TCHD and Adams, Arapahoe, and Douglas County departments to respond to a hazard event. In addition to the traditional FEMA funding mechanisms, the city can obtain funds for hazard mitigation projects through community development block grants, capital improvement project funds, taxes, and fees.

The capabilities of the City of Aurora to implement an HMP are strong. These programs should be maintained and reviewed periodically to proactively mitigate natural hazards in the community.

3.7.6 Opportunities for Enhancement

Based on the capability assessment, the City of Aurora has several existing mechanisms in place that already help to mitigate hazards, including numerous planning tools and many available funding mechanisms.

The 2020-2021 update provided the City and opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include the update or development of following plans, which should also cross reference this hazard mitigation plan:

- Explore possible funding of hazard mitigation activities in the Capital Improvement Plan update.
- Update the Aurora Economic Development Council's 2014 Economic Development Plan.
- Update City plans to include linkages to the hazard mitigation plan and consideration of hazards.
- Become a StormReady certified community.
- Explore the feasibility of improving the City's CRS rating (see Section 3.7.1).

4 Hazard Identification and Risk Assessment

DMA Requirement §201.6(c)(2):
[The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include: *(i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.* *(ii) A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of:* *(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;* *(B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate;* *(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.* *(iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

This section describes the local Hazard Identification and Risk Assessment summary undertaken by the Hazard Mitigation Planning committee (HMPC). Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. The process allows for a better understanding of a jurisdiction's potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment followed the methodology described in the FEMA publication: Local Mitigation Planning Handbook (March 2013), which breaks the risk assessment down to a four-step process:

1. Describe Hazards
2. Identify Community Assets
3. Analyze Risks
4. Summarize Vulnerability

A key step in preventing disaster losses is developing a comprehensive understanding of the hazards that pose risks to its communities. The following terms facilitate comparisons between communities and can be found throughout the Plan.

- **Hazard:** Event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, other types of harm or loss
- **Risk:** Product of a hazard's likelihood of occurrence and its consequences to society; the estimated impact that a hazard would have on people, services, facilities, and structures in a community
- **Vulnerability:** Degree of susceptibility to physical injury, harm, damage, or economic loss; depends on an asset's construction, contents, and economic value of its functions.

4.1 Hazard Identification

The Aurora Hazard Mitigation Planning Committee (HMPC) conducted a hazard identification study to determine the hazards that threaten the planning area. Hazards data was obtained from various federal, state, and local sources such as FEMA, the Colorado Geological Survey (CGS), the Colorado Dam Safety Branch (DSB), the National Oceanic and Atmospheric Administration's (NOAA) National Center for Environmental Information (NCEI), the United States Geological Survey (USGS), and the Colorado Division of Homeland Security and Emergency Management (DHSEM – including the 2018 Colorado State Hazard Mitigation Plan), among others. The hazards evaluated in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future.

4.1.1 Hazards Summary

For this plan, the HMPC considered the full range of natural hazards that could impact the planning area and then listed hazards that present the greatest concern. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used.

Fifteen natural hazards were profiled in the 2016 Aurora Hazard Mitigation Plan. The HMPC reviewed these hazards and determined they were all still relevant and should be continued into the 2021 Plan update.

- Dam/Levee Failure or Incident
- Drought
- Earthquake
- Erosion and Deposition
- Expansive Soil
- Extreme Heat
- Flood
- Hail
- Landslides, Mud/Debris Flow, Rockfalls
- Lightning
- Severe Wind
- Subsidence
- Tornado
- Wildfire
- Winter Storm

The HMPC reviewed a number of other natural hazards profiled in the Colorado State HMP such as dense fog, avalanche, and pest infestation, but determined that the risk they present to the City was not significant enough to warrant inclusion. The HMPC also discussed adding human-caused hazards to the plan but elected to retain the plan's focus on natural hazards for the 2021 Update.

Each of the hazards were analyzed based on geographic extent, previous occurrences, potential for future occurrence, and a discussion on the potential severity and magnitude of the event. Best available data was analyzed to provide a quantifiable assessment wherever possible. However, the analysis also reflects input from the HMPC based on their local knowledge and experience, which in some cases altered the overall rating of the hazard compared to the other hazards profiled. This element of subjective assessment is important given the limitations of available data. The potential impacts of climate change on each hazard were also considered to help identify where future impacts may differ from past events.

Once these elements were examined, each hazard was assigned an overall rating for the City. Table 4-1 reflects the hazard identification summaries discussed in detail in the rest of this section. When viewing these ratings, it is particularly important to remember that the hazards are all possible in the planning area, and therefore are potentially dangerous. The overall rating is a method of prioritizing hazards relative to one another for the development of mitigation actions and goals.

Table 4-1 Hazards Identification Summary

Hazard	Location/Extent	Probability of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Hail	Significant	Highly Likely	Critical	High
Winter Storm	Extensive	Highly Likely	Limited	High
Drought	Extensive	Likely	Critical	Medium
Extreme Heat	Significant	Likely	Critical	Medium
Flood	Significant	Likely	Limited	Medium
Lightning	Limited	Highly Likely	Limited	Medium
Severe Wind	Significant	Highly Likely	Limited	Medium
Tornado	Limited	Likely	Limited	Medium
Dam/Levee Failure or Incident	Limited	Unlikely	Critical	Low
Earthquake	Significant	Occasional	Limited	Low
Erosion and Deposition	Significant	Likely	Critical	Low
Expansive Soil	Extensive	Likely	Limited	Low
Subsidence	Limited	Occasional	Limited	Low
Landslides, Mud/Debris Flow, Rockfalls	Limited	Likely	Negligible	Low
Wildfire	Limited	Likely	Limited	Low

Frequency of Occurrence:

Highly Likely: Near 100% probability in next year.

Likely: Between 10 and 100% probability in next year or at least one chance in ten years.

Occasional: Between 1 and 10% probability in next year or at least one chance in next 100 years.

Unlikely: Less than 1% probability in next 100 years.

Spatial Extent/Location:

Limited: Less than 10% of planning area

Significant: 10-50% of planning area

Extensive: 50-100% of planning area

Potential Severity:

Catastrophic: Multiple deaths, complete shutdown of facilities for 30 days or more, more than 50% of property is severely damaged

Critical: Multiple severe injuries, complete shutdown of facilities for at least 2 weeks, more than 25% of property is severely damaged

Limited: Some injuries, complete shutdown of critical facilities for more than one week, more than 10 percent of property is severely damaged

Negligible: Minor injuries, minimal quality-of-life impact, shutdown of critical facilities and services for 24 hours or less, less than 10 percent of property is severely damaged.

Significance

Low: minimal potential impact

Medium: moderate potential impact

High: widespread potential impact

4.1.2 Disaster Declaration History

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public

entities. Some of the programs are matched by state programs. Federal disaster or emergency declarations are typically issued at the county level: the counties in which Aurora resides have experienced 16 declared disasters since 1955, as summarized in Table 4-2. Of those disasters, seven have been for severe weather and flooding, four have been for wildfires, two for snow, one for pandemic, and one for coastal storm (for assisting with evacuations from Hurricane Katrina).

Table 4-2 Past Federal Disaster Declarations in The City of Aurora

Disaster Declaration	Description	Incident Dates
DR-33	Flood	5/25/1955
DR-59	Flood	6/12/1956
DR-200	Tornadoes, severe storms and flooding	6/19/1965
DR-261	Severe storms and flooding	5/19/1969
DR-385	Heavy rains, snowmelt and flooding	5/23/1973
EM-3025	Drought	1/29/1977
FS-2407	CO-Schoonover Fire	5/21 – 5/29/2002
DR-1421	Wildfires	4/23 - 8/6/2002
FS-2421	Hayman Fire	6/8 - 7/20/2002
EM-3185	Snow	3/17 - 3/20/2003
FM-2510	CO- Cherokee Ranch Wildfire	10/29/2003
EM-3224	Hurricane Katrina evacuation	8/29 - 10/1/2005
EM-3270	Snow	12/18/2006
EM-3365 DR-4145	Severe storms, flooding, landslides, and mudslides	9/11 - 9/30/2013
DR-4229	Severe storms, tornadoes, flooding, landslides, & mudslides	5/4 – 6/16/2015
EM-3436 DR-4498	COVID-19 Pandemic	3/13/2020 – Present
DR = Major Disaster Declaration; EM = Emergency Declaration FM = Fire Management Assistance; FS = Fire Suppression Authorization		

Source: FEMA

Review of these events helps identify targets for risk reduction and ways to increase a community's capability to avoid large-scale events in the future. Still, many natural hazard events do not trigger federal disaster declaration protocol but have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for hazards of concern. More detailed event tables can be found in the individual hazard profile sections.

4.1.3 Methodology

Each hazard is profiled in a similar format to make information easy to find and compare between hazards. Profiles are based on best available data, and potential errors or omissions may exist in the data. In particular, there is a time variance between the different data sets. For example, winter storms have been tracked in the planning area for a longer period of time than swelling soils hazards have been documented, so the comparison of severity, previous occurrences, and rates of future occurrences between the two hazards is somewhat skewed. This variance exists between all known hazards in this plan. The information presented is for planning level assessments only.

Description

This subsection gives a generic description of the hazard and associated problems, followed by details on the hazard specific to the City.

Past Occurrences

This subsection contains an overview history of the hazard's occurrences, compiled from multiple data sources. This includes information provided by the HMPC. Significant or historic incidents are profiled in greater detail and include scope, severity, and magnitude, and known impacts.

Location

This subsection discusses what the geographic extent of the hazard is expected to be. It may also include specific discussions regarding which areas of the City are more likely to be affected by the profiled hazard. An extent rating is assigned based on the following methodology:

- **Negligible:** Less than 10 percent of planning area or isolated single-point occurrences
- **Limited:** 10 to 25 percent of the planning area or limited single-point occurrences
- **Significant:** 25 to 75 percent of planning area or frequent single-point occurrences
- **Extensive:** 75 to 100 percent of planning area or consistent single-point occurrences

Percent of planning area is calculated by comparing the amount of area affected to the total City area. Single point events, such as lightning, are evaluated for geographic extent by examining the density of the events collectively.

Magnitude and Severity

This subsection summarizes the anticipated magnitude and severity of a hazard event based largely on previous occurrences and specific aspects of risk as it relates to the planning area. Magnitude and Severity are classified in the following manner:

- **Negligible:** Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.
- **Limited:** 10 to 25 percent of property is severely damaged, facilities and services are unavailable for between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.
- **Critical:** 25 to 50 percent of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time or result in many permanent disabilities and a few deaths.
- **Catastrophic:** More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time or many deaths occur.

The rating is calculated by evaluating the event of record against these criteria. Since most events incur different levels of severity for each element, the rating is assigned to the classification with the most documented occurrences. The purpose of a magnitude and severity rating is to establish the highest known potential threshold of an event to help guide the mitigation goals and actions development. If there are significant events with much lower magnitude and severity ratings than the event of record, this discrepancy will be noted.

Probability of Future Occurrences

This subsection utilizes the frequency of known past events to calculate a probability or frequency of future occurrences. The likelihood is categorized into four different classifications:

- **Unlikely:** Less than 1 percent probability of occurrence in the next year or has a recurrence interval of greater than every 100 years.
- **Occasional:** Between a 1 and 10 percent probability of occurrence in the next year or has a recurrence interval of 11 to 100 years.
- **Likely:** Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years
- **Highly Likely:** Between 90 and 100 percent probability of occurrence in the next year or has a recurrence interval of less than 1 year.

A probability of future occurrence is calculated for each hazard by comparing the known number of events to the available data record. For example, 10 hazard events in 100 years would be expressed as a 10% chance of the hazard occurring in any given year. If data was only available for 30 years, but 15 events were recorded in that time period, it would be expressed as 50% chance of occurrence. The period of record will vary for each hazard and is based upon available data. In some instances, additional prediction methods are also measured by recurrence intervals, such as floods or hazards where the events occur more than once a year.

Climate Change Considerations

Climate includes patterns of temperature, precipitation, humidity, wind and seasons. Climate plays a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. “Climate change” refers to changes over a long period of time. It is generally perceived that climate change will have a measurable impact on the occurrence and severity of natural hazards around the world. Impacts include the following:

- Snow cover losses will continue, and declining snowpack will affect snow-dependent water supplies and stream flow levels around the world.
- The risk of drought and the frequency, intensity, and duration of heat waves are expected to increase.
- More extreme precipitation is likely, increasing the risk of flooding.
- The world’s average temperature is expected to increase.

In 2018, the U.S. Global Change Research Program released the Fourth National Climate Assessment (NCA4), the authoritative and comprehensive report on climate change and its impacts in the United States. Not only did the report confirm that climate induced hazards continue to affect Americans in every region of the U.S., the report identifies increased heat, drought, insect outbreaks, wildfire, and flooding as key climate-related concerns for the Southwest region of the U.S., which includes Colorado. The following is a summary of climate change impacts from the Fourth National Climate Assessment.

Recent warming in the southwest region is among the most rapid in the nation and is significantly greater than the global average, and the period since 1950 has been hotter than any comparable long period in at least 600 years. Summer temperatures across the state are expected to warm more than winter temperatures and projections suggest that typical summer months will be as warm as (or warmer than) the hottest 10% of summers that occurred between 1950 and 1999. Under the higher emissions scenario (RCP8.5) climate models predict an increase of 8.6°F in the southwest regional annual average temperature by 2100.

Projected increases in temperatures in the southwest region are also projected to increase probabilities of natural events such as wildfires, drought and summer precipitation. These temperature changes have great potential to directly affect public health through increased risk of heat stress and infrastructure through increased risk of disruptions of electric power generation. Water supplies are also vulnerable to impacts of higher temperatures. While water supplies generally change year-to-year due to variabilities in water use and precipitation, higher temperatures are projected to increase evapotranspiration, reducing the effectiveness of precipitation in replenishing surface water and soil moisture. This will have direct

impacts on crop yields and productivity of key regional crops and livestock a major risk for the agricultural industry and food security nationwide.

The impacts of climate induced hazards already pose a threat to people and property in the southwest region of the United States, including the City of Aurora. Vulnerable populations, in particular those who are low-income, children, elderly, disabled and minorities will likely be impacted by the effects of climate induced hazards disproportionately than other populations (Refer to Chapter 2 for more information on social vulnerability in the City). Together, these impacts represent a slow-onset disaster that is likely to manifest and change over time. Current projections predict even more rapid changes in the near future, which are likely to affect many of the natural hazards that Aurora has historically experienced.

The nature of erosion and public health hazards are likely to evolve in intensity and character due to a changing regional climate. For these reasons, the hazard identification and risk assessment for the 2021 City of Aurora Hazard Mitigation Plan update includes climate change considerations discussion on how climate change may impact the frequency, intensity, and distribution of specific hazards within the City. Because many impacts of climate induced hazards cross county boundaries, some of the discussion considers impacts on a regional scale. As climate science evolves, future mitigation plan updates may consider including climate change projections in the risk rankings and vulnerability assessments of the hazards included in the Plan.

Vulnerability Assessment

With the City's hazards identified and profiled, the HMPC conducted a vulnerability assessment to describe the impact that the significant hazards would have on the City. The vulnerability assessment quantifies, to the extent feasible, assets at risk to natural hazards and estimates potential losses. This vulnerability assessment followed the methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses, as well as Tasks 5 and 6 of the 2013 FEMA Local Mitigation Planning Handbook. The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard.

The vulnerability assessment was conducted based on the significance of the hazard utilizing best available data. This assessment is an attempt to quantify assets at risk, by jurisdiction where possible, to further define populations, buildings, and infrastructure at risk to natural hazards. The methods of analysis vary by hazard type and data available and are discussed further in 4.3.4 with each hazard analyzed. The information presented is for planning level assessments only. Data to support the vulnerability assessment was collected and compiled from the following sources:

- Current GIS data (hazards, base layers, critical facilities and assessor's data)
- 2010 US Census, 2019 American Community Survey, and 2019 CO Department of Local Affairs (DOLA) data
- 2020 Homeland Infrastructure Foundation-Level Data (HIFLD) data
- Written descriptions of inventory and risks provided by the HMPC and stakeholders;
- A refined flood loss estimation by jurisdiction with the use of geospatial analysis for both 1% and 0.2% annual chance flooding
- Updated modeling of earthquake loss potential with HAZUS-MH 2.2, including a 2,500 year probabilistic scenario
- Existing plans and studies
- Personal interviews with HMPC members, hazard experts, and City staff.

The scope of the vulnerability assessment is to describe the risks to the City as a whole. The vulnerability assessment first describes the assets in the City of Aurora, including the total exposure of people and property; critical facilities and infrastructure; natural, historic, and cultural resources; and economic assets. Development trends, including population growth and land status, are analyzed in relation to

hazard-prone areas. Next, where data was available, hazards are evaluated in more detail and potential losses are estimated. The methods to assess vulnerability presented here include an updated analysis from the 2016 Aurora Hazard Mitigation Plan. This includes a detailed risk assessment for all hazards based on advanced methods and updated hazard and inventory data. Thus this 2021 plan should be considered the baseline for measuring changes in vulnerability during future updates, recognizing that vulnerability information should become more refined as data sources and methodologies improve over time. Examples of refinements and changes made in this plan include:

- Updated population and building inventory information, including most recent values and 2020 assessor data;
- An updated and more comprehensive inventory of critical facilities;
- An updated inventory of natural, historic, and cultural resources;
- A refined flood loss estimation by jurisdiction with the use of geospatial data provided by the Assessor's office and FEMA NFHL to perform GIS analysis for both 1% and 0.2% annual chance flooding, supplemented by local flood payers;
- Updated modeling of earthquake loss potential with HAZUS-MH 2.2, including a 2,500-year probabilistic scenario M7.25 and a hypothetical M 6.5 event on the Golden Fault;
- Detailed inventory by jurisdiction of potential structures and critical facilities at risk to hazards

Development Trends

This section examines changes in growth and development since the last plan, along with predicted or anticipated changes in the future, and summarizes how those changes may change the City's vulnerability to that hazard.

Overall Hazard Significance

Overall potential impact of each hazard is summarized in this subsection, based on geographic extent, probability of future occurrences, and the magnitude and severity of the event of record. These ratings are averaged to provide an overall hazard significance rating, which is useful for comparing the hazards to one another and for guiding the development of actions and priorities. The overall hazard significance ratings are classified as follows:

- **Low:** Two or more of the criteria fall in the lower classifications, or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences and impacts or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications, and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.
- **High:** The criteria consistently fall along the high ranges of the classification and the hazard exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

4.2 Asset Summary

4.2.1 General Property

Table 4-3 shows the estimated total property exposure for the City of Aurora based on assessor's office data for all three counties – Adams, Arapahoe and Douglas – along with the most recent American Community Survey and Colorado State Demography Office data. This analysis estimates approximately 120,850 structures in the City with an estimated value of $59.9 billion.

Table 4-3 Total Property Exposure by Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Agriculture	26	31	$3,272,429	$3,272,429	$6,544,858
Commercial	2,492	5,301	$3,957,101,499	$3,957,101,499	$7,914,202,998
Exempt	569	1,134	$2,221,365,846	$2,221,365,846	$4,442,731,692
Industrial	67	110	$430,452,271	$645,678,407	$1,076,130,678
Residential	107,454	113,680	$30,915,010,354	$15,457,505,177	$46,372,515,531
Vacant -Improved	593	594	$38,029,279	$38,029,279	$76,058,558
Total	**111,201**	**120,850**	**$37,565,231,678**	**$22,322,952,637**	**$59,888,184,315**

Source: Adams County, Arapahoe County, and Douglas County Assessor's Offices

Note that assessor's office data calculates building values for the specific purpose of valuation for ad valorem tax purposes and values represented do not reflect actual building replacement values. Similarly, assessor's office data does not collect information on the contents of structures, so the contents values shown in the table are estimates based upon the structure value using FEMA recommended values (typically 50% for residential structures, 100% for commercial, 100% for agricultural, 150% for industrial, 100% for mixed use and 100% for exempt).

4.2.2 Population

The U.S. Census Bureau estimates the population of the City of Aurora at 369,111 as of 2019. However, because Census estimates are not broken down to the parcel level, a more granular method of estimating population was needed in order to analyze the population exposed to risk of various hazards across the City. Population for each parcel was therefore calculated by the number of residential properties multiplied by average household size of 2.84. This analysis results in an estimated total population of 379,859, which is within 3% of the Census Bureau estimate. For consistency, all population estimates in the hazard profiles are compared to this calculated population estimate, rather than to the Census Bureau estimate.

4.2.3 Critical Facilities and Infrastructure

For the purposes of this plan, a critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA sorts critical facilities into seven lifeline categories as shown in Figure 4-1.

Figure 4-1 Lifeline Categories

Source: FEMA

These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community. A lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g., infrastructure owners and operators)
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

To develop a comprehensive list of critical facilities in the City of Aurora, several data sources were compiled and broken down along the aforementioned critical asset categories: GIS databases of critical facilities and infrastructure from the City and three counties, where available, and the 2020 Homeland Infrastructure Foundation-Level Data (HIFLD) data.

The best available data was used, but some limitations include lack of complete or comprehensive data and values such as replacement costs. These databases were used in vulnerability assessments for hazards such as wildfire and flood and are represented in maps and tables in the vulnerability by hazard section that follows. This analysis identified 1,396 critical facilities in the City, as shown in Table 4-4. Nearly half of these (601) are communications sites. These sites are mapped in Figure 4-2, Figure 4-3, and Figure 4-4. Figure 4-5 also shows bridges in the City according to the National Inventory of Bridges.

Table 4-4 Critical Facilities by Lifeline and Type

FEMA Lifeline	Critical Facility Type	Count
Communications	Cellular Tower	1
	Land Mobile Towers	314
	Microwave Towers	280
	Paging Towers	6
	Total	**601**
Energy	Electric Substation	14
	Power Plant	4
	Total	**18**
Food, Water, Shelter	Religious Institution	86
	Library	4
	Wastewater Treatment Plant	4
	Total	**94**
Hazardous Materials	Risk Management Plan Facility	5
	Tier II	127
	Total	**132**
Health and Medical	Adult Day Care Facility	19
	Assisted Living/Nursing Home	59
	Clinic/Medical Facility	43
	Disability Care	5
	EMS Station	2
	Hospital	5
	Mental Health Facility	3
	Total	**136**
Safety and Security	Child Care Center	41
	Colleges/Universities	12
	Fire Station	20
	Government Facility	8
	Police	8
	School	143
	Total	**232**
Transportation	Airport	1
	Bridge - Good Condition	67

FEMA Lifeline	Critical Facility Type	Count
	Bridge - Fair Condition	103
	Bridge - Poor Condition	3
	Light Rail Station	9
	Total	**183**
	Grand Total	**1,396**

Source: Wood analysis, City of Aurora

Figure 4-2 Critical Facilities – Communications; Energy; Food Water & Shelter; and Health & Medical

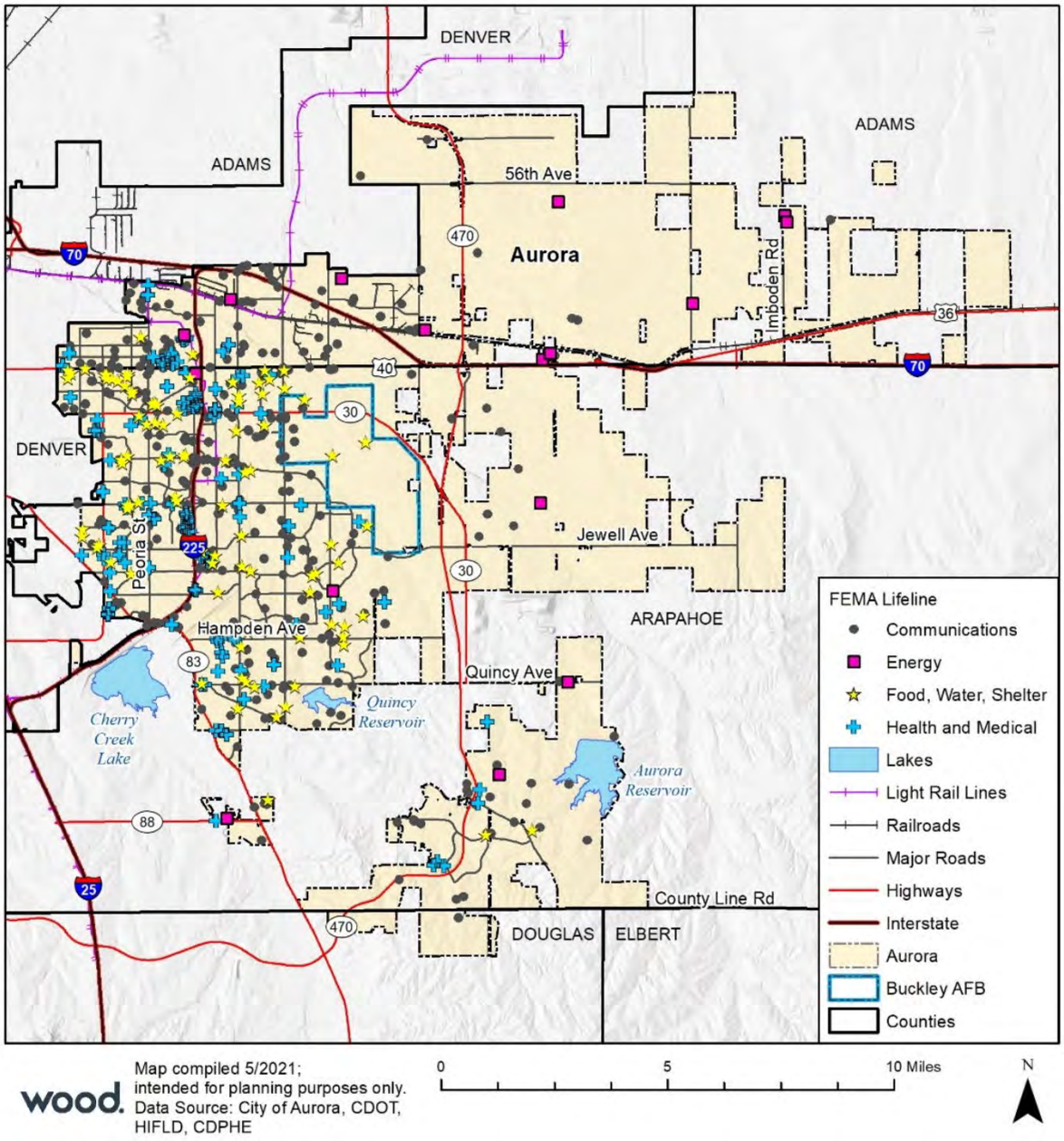


Figure 4-3 Critical Facilities – Safety & Security

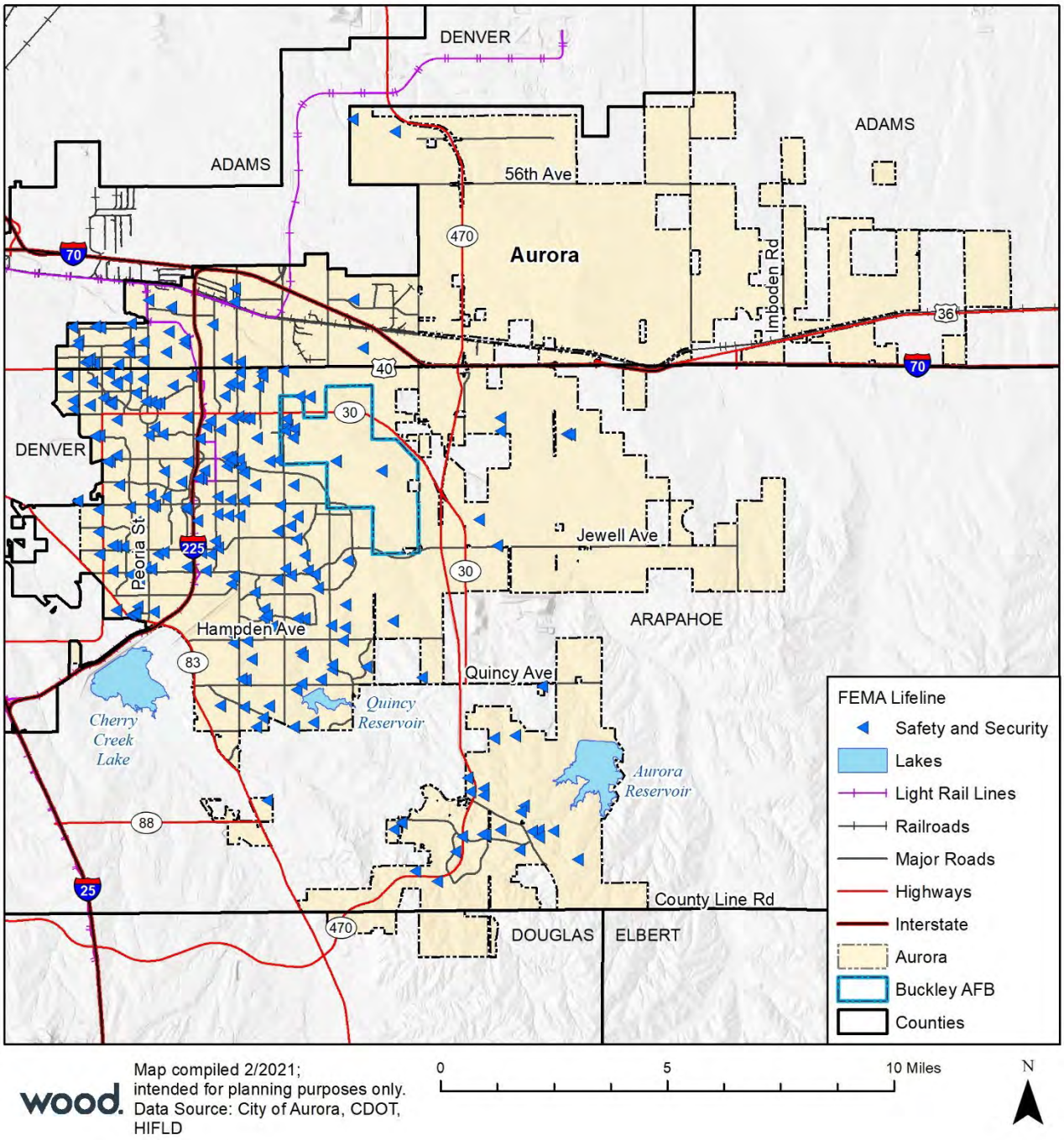


Figure 4-4 Critical Facilities – Hazardous Materials and Transportation

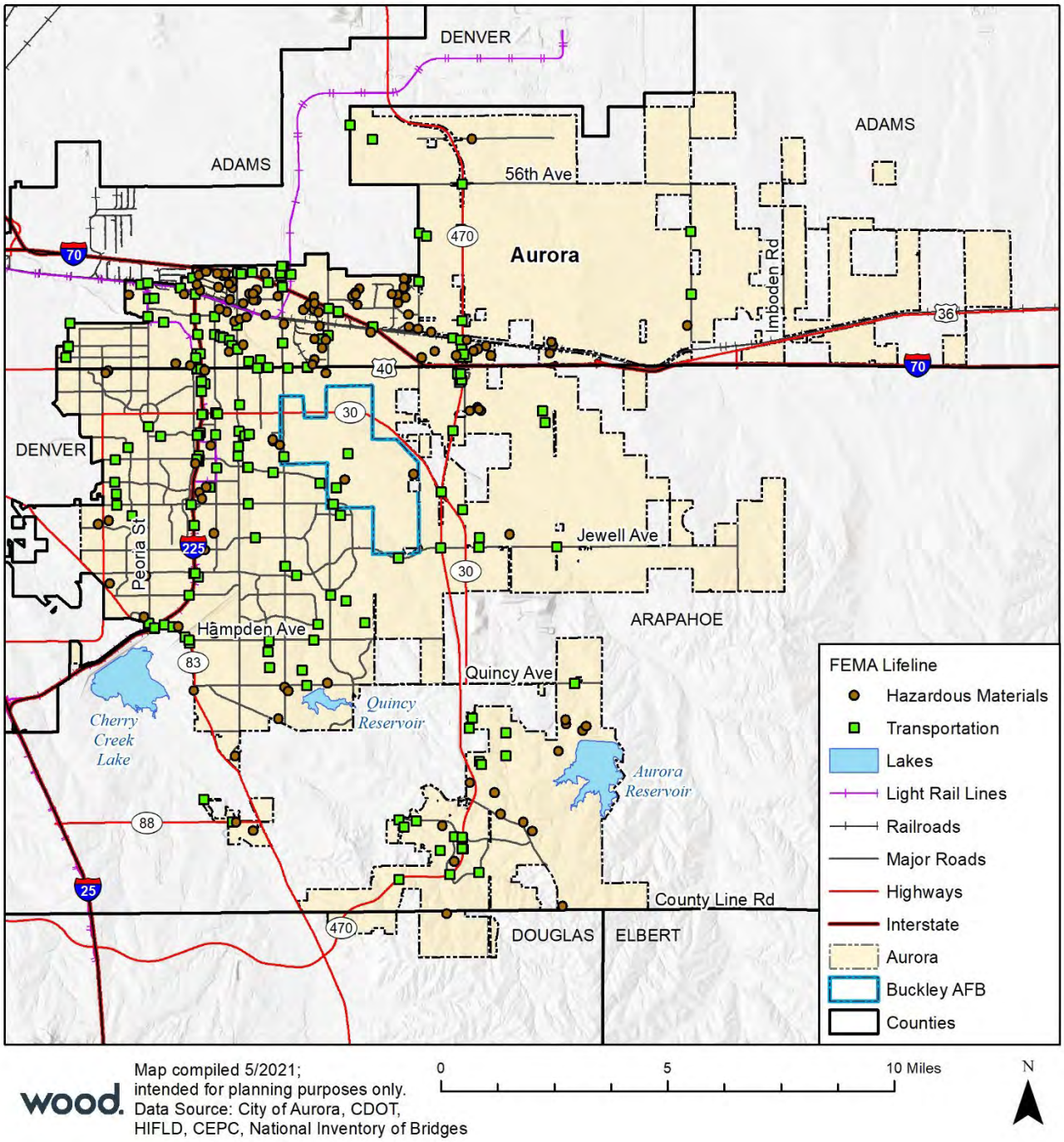
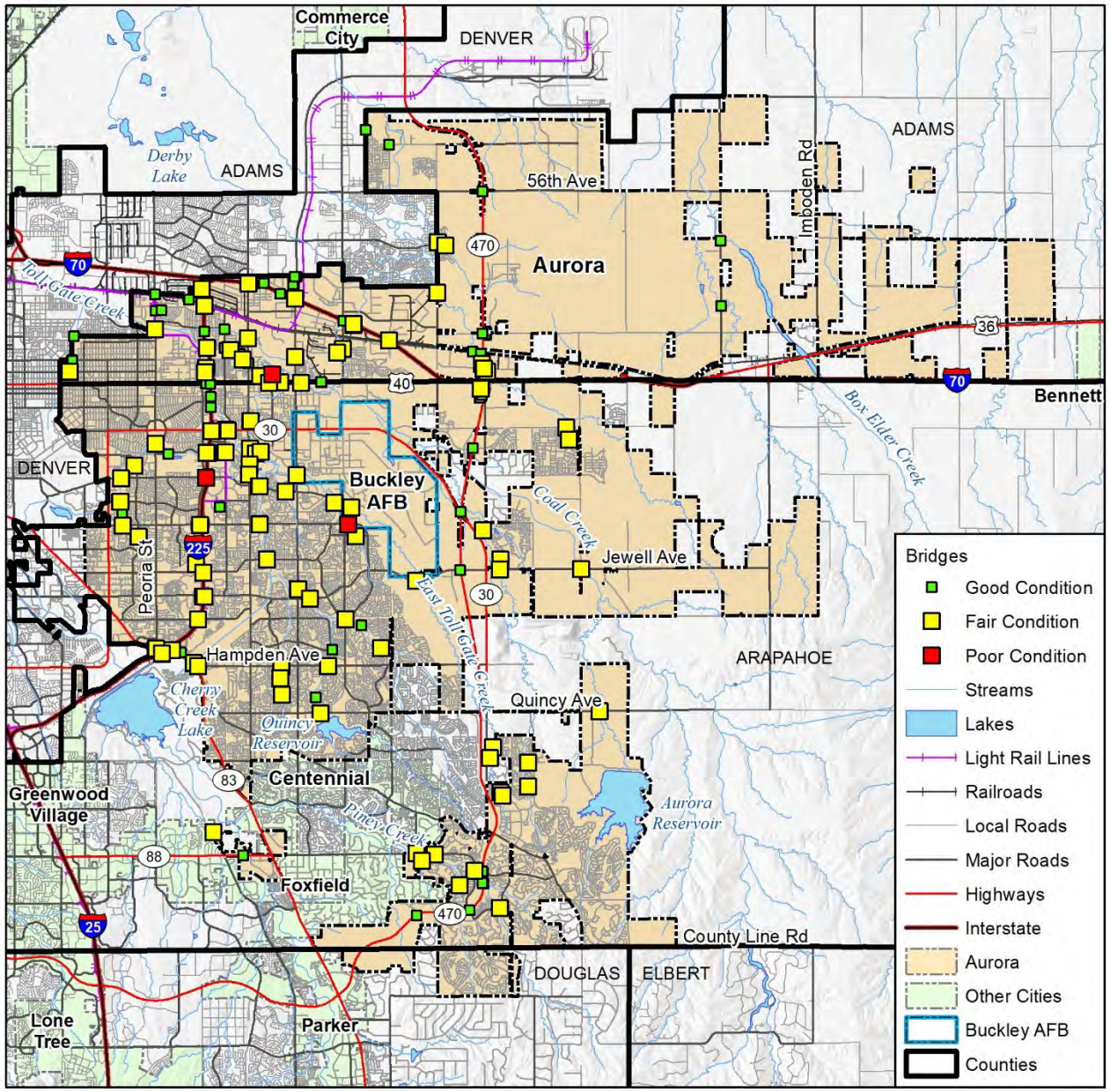


Figure 4-5 Critical Facilities – Bridges



Map compiled 5/2021;
intended for planning purposes only.
Data Source: City of Aurora, CDOT,
National Inventory of Bridges

4.3 Dam/Levee Failure or Incident

Hazard	Location	Potential of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Dam/Levee Failure or Incident	Limited	Unlikely	Critical	Low

A dam is a barrier constructed across a watercourse that stores, controls, or diverts water. The water impounded behind a dam is referred to as the reservoir and is usually measured in acre-feet: the volume of water that covers one acre of land to a depth of one foot. Depending on local topography, even a small dam may have a reservoir containing many acre-feet of water. Dams serve many purposes, including irrigation control, providing recreation areas, electrical power generation, maintaining water levels, and flood control.

Two factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

DEFINITIONS

Dam—A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding water. Flood control and storm runoff detention dams are included (2-CCR 402-1, Rule 4, Section 4.2.5).

Dam Failure—An uncontrolled release of impounded water due to structural deficiencies in dam.

Dam Incident— Situations at dams that require an immediate response by safety engineers. These are episodes that without intervention will likely result in a dam failure (ASDSO).

Emergency Action Plan—A document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize property damage and loss of life. The plan specifies actions the dam owner should take to alleviate problems at a dam. (FEMA 64)

High Hazard Dam—Dams where failure or operational error will probably cause loss of human life. (FEMA 333)

Significant Hazard Dam—Dams where failure or operational error will result in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities, or can impact other concerns. (FEMA 333)

Levee—A man-made structure, usually an earthen embankment or concrete floodwall, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide reasonable assurance of excluding temporary flooding from the leveed area.

4.3.1 Description

Causes of Dam Failure

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors. This accounts for 34 percent of all dam failures.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30 percent of all dam failures.
- Failure due to piping and seepage accounts are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure. These represent 20 percent of all failures.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10 percent of all failures.

The remaining 6 percent of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters. The prominent causes are earthquakes, landslides, extreme

storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage.

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

In general, there are three types of dams: concrete arch or hydraulic fill, earth-rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously: the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach: a flood wave will build gradually to a peak and then decline until the reservoir is empty. Lastly, a concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The Colorado Division of Water Resources Dam Safety Branch assigns hazard ratings to dams within the State. Two factors are considered when assigning hazard ratings: existing land use, and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- High Hazard Potential—Probable loss of life (one or more persons).
- Significant Hazard Potential—No probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns; often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- Low Hazard Potential—No probable loss of human life and low economic or environmental losses; losses are principally limited to the owner's property.

It is important to keep in mind that the hazard classification of a dam is a measure of the consequences if the dam were to fail, not a measure of how likely the dam is to fail.

Privately owned high and significant hazard dams are required by Colorado regulations to have Emergency Action Plans (EAPs) in place, which provide for the emergency response procedures in the event of a dam emergency. High hazard dams are also required to have inundation maps. Federally owned high hazard dams are also required to have EAPs by federal regulations. Based on the National Inventory of Dams (NID) database, as of 2021 all high-hazard dams in Colorado have EAPs in place.

Causes of Levee Failure

There is one 1 levee within the City of Aurora. The following information is excerpted from the State of Colorado Flood Mitigation Plan.

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning. In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations—areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers that cannot handle the amount of water.

The Colorado Water Conservation Board (CWCB) is committed to aiding local governments with the increased levels of compliance with federal regulations. CWCB will assist qualifying entities who are in

good standing with the National Flood Insurance Program (NFIP) through technical and financial assistance.

Non-Failure Dam Incidents

Dam inundation can also occur from non-failure events or incidents, such as when outlet releases increase during periods of heavy rains or high inflows. Controlled releases to allow water to escape when a reservoir is overfilling can help prevent future overtopping or failure. When outlet releases are not enough, spillways are designed to allow excess water to exit the reservoir and prevent overtopping. This can protect the dam but result in flooding downstream.

The Colorado DNR has identified non-failure dam risk with high hazard dams statewide where outlet capacity exceeds the downstream channel capacity. Dams are ranked as high, moderate, or low likelihood for outlet releases to cause conditions that could require an emergency response to reduce potential downstream consequences. The ranking is based on a statewide database of high hazard dams that includes 441 high hazard dams that have been analyzed by the Colorado DNR for this aspect of dam incident flooding. The high, moderate, or low designations were assigned by DNR by dividing the total number of ranked dams across the state into thirds. Should there be a need to relieve pressure on the dam (e.g., if there was excess inflow from high rains or snowmelt) releases from the dams ranked as high or moderate may result in downstream flooding. The dams in or near Aurora at the highest risk of non-failure inundation are shown in Table 4-6.

Low Head Dams

A low head dam is an engineered structure built into and across stream and river channels. Low head dams were historically built for a variety of purposes to support industrial, municipal, and agricultural water usage through the diversion of water from streams. Low head dams have also been built to provide recreational amenities for boating, rafting and tubing as well as improve aquatic habitats (Colorado DNR). Water flows over the dams creating a recirculating current that can trap unknowing river users. Due to the low height of this type of dam, low head dams can be difficult to see by river users that are not aware of them and because of the tranquil pool that gives the appearance there is no danger. According to Colorado's Low Head Dam Safety web-viewer, there are no low head dams in the City of Aurora.

4.3.2 Past Events

Colorado has a history of dam failure, with more than 130 known dam failures since 1890. A number of dams were breeched in September 2013, but none were in the City of Aurora. Dam safety incidents are defined as situations at dams that require an immediate response by dam safety engineers. One of these incidents included a previously unseen sand boil indicating a change in seepage conditions at the Spinney Mountain Dam. While this dam is not within the municipal boundary, it is owned and operated by the City of Aurora.

There have been no reported dam failures in the City of Aurora or surrounding area since the Castlewood Canyon State Park dam failure in August 1933 impacted Cherry Creek, which runs adjacent to the southwest portion of the City of Aurora. Since that time, the Cherry Creek Dam was constructed in 1950 and operated by the U.S. Army Corps of Engineers to prevent similar events in the future. The Billings Gazette describes the events that led to the dam failure as follows (Billings Gazette 1933).

> *"Crumbling under the terrific pressure a mountain cloudburst added to the three-square miles of water behind its walls, 43-year old Castlewood Dam sent a billion-gallon deluge roaring and battering through Denver Thursday, leaving two dead and an estimated $1,000,000 property damage in its 35-mile path of destruction."*

If failure were to occur on dams outside of the City of Aurora, like Cherry Creek Dam, there would be significant impacts for the people and property within the city.

4.3.3 Location

The location rating is **Limited.**

Based on the National Inventory of Dams database, there are twelve dams of concern to the City of Aurora which could cause impacts if they were to fail or have a significant incident. Of these dams, three within the city limits are rated as high hazard. The remaining nine dams of concern are located outside the city, eight are rated as high and one rated as significant. Table 4-5 lists all twelve dams of concern. Dam names with an asterisk (*) next to them have been given a conditionally satisfactory rating by the State Engineer, meaning they have storage restrictions due to structural concerns.

Table 4-5 Dams of Concern

Name	River	Near City	Storage (Acre-Feet)	Hazard Class
Chambers Reservoir*	Happy Canyon Creek	Parker	1,410	High
Cherry Creek*	Cherry Creek	Denver	13,226	High
Exposition Park	Westerly Creek	Aurora	239	High
Franktown Parker Fpb-1*	Cherry Creek	Parker	128	High
Franktown Parker Fpp-1	Baldwin Gulch	Denver	56	High
Franktown Parker Fps-1	Cherry Creek	Parker	40	High
Kelly Road Detention	Westerly Creek	Denver	360	High
Pinery	Cherry Creek	Parker	315	Significant
Quincy	West Toll Gate Creek	Aurora	2,800	High
Rueter Hess	Newlin Gulch	Parker	75,689	High
Senac	Senac Creek	Aurora	32,400	High
Westerly Creek	Westerly Creek	Denver	4,150	High

Note: (*) represents dams that have been rate conditionally satisfactory by the State Engineer

Source: National Inventory of Dams and City of Aurora

Figure 3-6 shows locations and potential inundation zones of the 12 dams with potential to impact the City. The southern portion of the City is most likely to be impacted by a dam failure because it is near the Aurora Reservoir, Quincy Reservoir, and adjacent to Cherry Creek Reservoir. The City owns three other dam facilities outside of the municipal boundary. Failure of these dams would not directly pose a flooding threat to the city.

There are likely some uncounted number of ‘non-jurisdictional’ dams on public and private lands in the City. These are small dams that normally do not store water but may impound water during heavy precipitation events. Because they are not monitored or maintained, there is potential for them to overtop or fail causing flooding and property damage during a significant rainfall event. The extent and risk associated with these dams is not known.

The U.S. Army Corp of Engineers National Levee Database lists no known levees within the City of Aurora. However, these databases are not always complete. The City of Aurora owns the Sand Creek Levee; the area protected by this levee is shown in Figure 4-19 in the Flood section. It is possible that there are other levees located within the City that are not listed in these databases.

Non-Failure Dam Incidents

The dams at the highest risk of non-failure inundation are shown in Table 4-6. The high, moderate, or low designations were assigned by DNR by dividing the total number of ranked dams across the state into thirds. Should there be a need to relieve pressure on the dam (e.g., if there was excess inflow from high rains or snowmelt) releases from the dams ranked as high or moderate may result in downstream flooding.

Figure 4-6 City of Aurora Dam Failure Inundation Zones

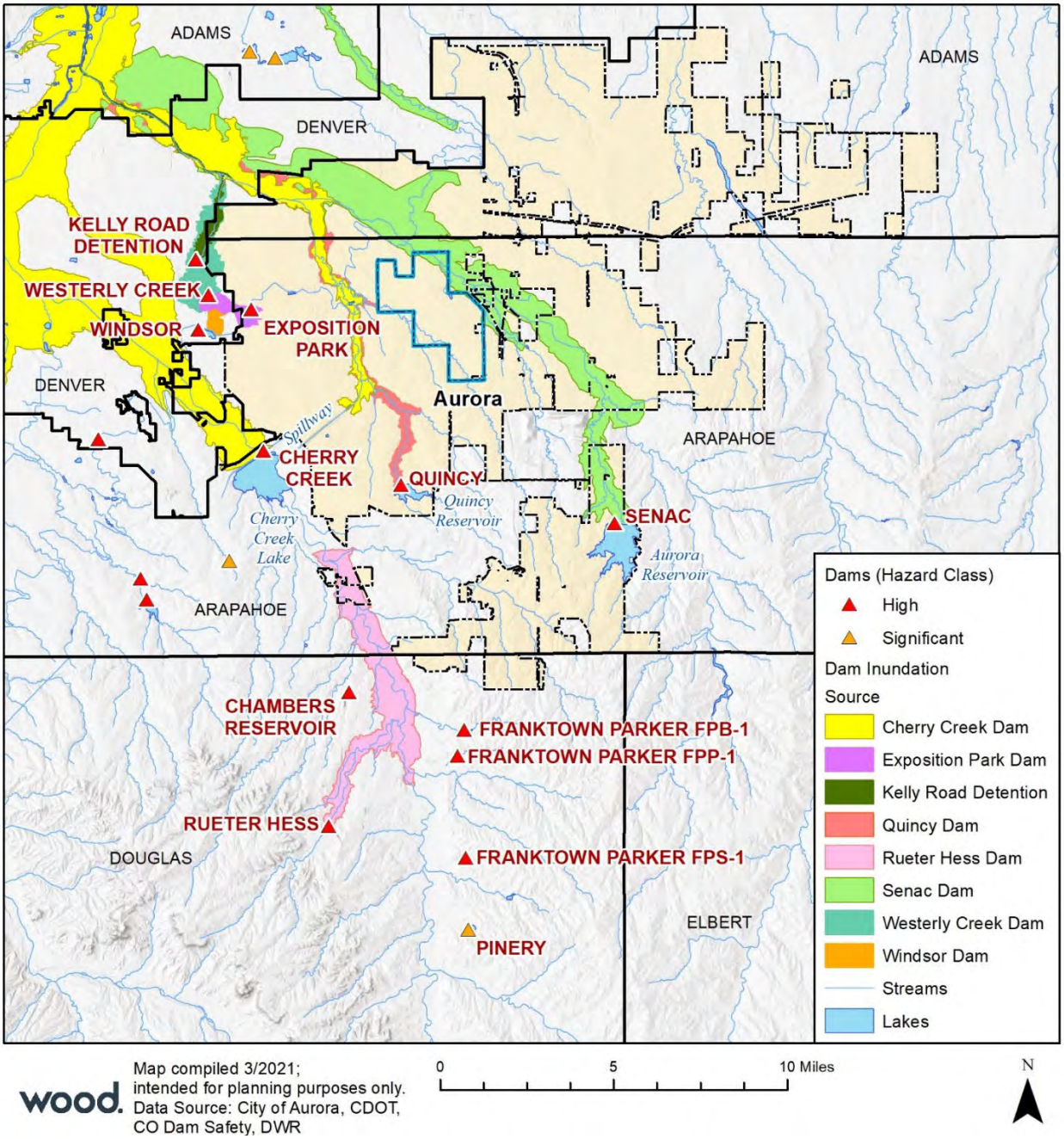


Table 4-6 Dams with Risk of Non-Failure Inundation

Dam ID	Dam Name	Outlet Description	Max Outlet Release Capacity (cfs)	Outlet Release Hazard Rating
020643	EXPOSITION PARK	36" RCP Ungated	109	High
020406	QUINCY	42" STEEL	180	High

Dam ID	Dam Name	Outlet Description	Max Outlet Release Capacity (cfs)	Outlet Release Hazard Rating
020614	SENAC	72 IN. STEEL-LINED CONCRETE	480	High

Source: State of Colorado Department of Natural Resources, Dam Safety

4.3.4 Magnitude and Severity

The magnitude and severity rating is **Critical.**

Potential severity of a dam failure is typically measured by the hazard classification developed by the U.S. Army Corps of Engineers classification system shown in Table 4-7 for the hazard potential of dam failures. The Corps hazard rating system is based only on the potential consequences of a dam failure and does not take into account the probability of such failures.

Table 4-7 U.S. Army Corps of Engineers Hazard Potential Classification

Hazard Category[a]	Direct Loss of Life[b]	Lifeline Losses[c]	Property Losses[d]	Environmental Losses[e]
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location (only transient or day-use facilities)	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more extensive residential, commercial, or industrial development)	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

Categories are assigned to overall projects, not individual structures at a project.
Loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.
Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.
Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers, 1995

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property located in the inundation area (downstream). The largest three dams in terms of maximum storage in or upstream of the City of Aurora are: the Rueter Hess in Douglas County along Newlin Gulch (normal storage of 75,689 acre-feet); the Senac Dam in the City of Aurora along the Senac Creek (with a capacity of 32,400 acre-feet); and the Cherry Creek Dam in Arapahoe County along the Cherry Creek River (with a capacity of 13,226 acre-feet).

The State Dam Safety program inspects dams in the state to determine the reservoir's safe storage level. Dams listed as unsatisfactory or conditionally satisfactory have structural concerns and have storage restrictions places on them. None of the dams within the City of Aurora are listed as unsatisfactory or conditionally satisfactory. There are three conditionally satisfactory rate dams outside the city that pose a risk to Aurora if there were a failure: Chambers Reservoir, Cherry Creek, and Franktown Parker FPP-1.

Warning time for dam or levee failure varies depending on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no warning time. A dam or levee's structural type also affects warning time. Earthen dams and levees do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted, or the breach resists further erosion. The time of breach formation ranges from a few minutes to a few hours (U.S. Army Corps of Engineers 1997). All of the dams listed in Table 4-5 are earthen dams.

Emergency action plans for all high hazard dams that would affect the City of Aurora are on file with the City of Aurora Office of Emergency Management (OEM). Additionally, possible evacuation routes in the event of a failure have been identified.

4.3.5 Probability of Future Occurrence

The probability of future occurrences is **Unlikely**.

The last reported dam failures in the City of Aurora or surrounding area was the Castlewood Canyon State Park dam failure in 1933. Therefore, the probability of a failure in the future is minimal. However as noted in Table 4-6, there are three dams – Exposition Park, Quincy and Senac – with potential for non-failure incidents.

4.3.6 Climate Change Considerations

With a potential for increase in extreme precipitation events due to climate change, dam failure and dam incidents could become a larger issue if increased rainfall events result in large floods that stress dam infrastructure. Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hydrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. Throughout the west, communities downstream of dams have historically experienced increases in stream flows from earlier dam releases.

Dams are constructed with safety features known as spillways. Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events can result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of spillway overflows.

4.3.7 Vulnerability

Overall, dam failure impacts would likely be significant if a high or significant hazard dam failed in or upstream of the City of Aurora. There is an estimated population of over 31,000 potentially exposed to dam failure events. As shown in Figure 3-6, inundation areas are in the northern and western portions of the City as well as some central areas due to the Quincy dam. Roads closed due to dam or levee failure floods could result in significant transportation disruptions.

People

The population impacted by dam failure was estimated using the structure count of buildings within the dam inundation area and applying the U.S. Census value of 2.84 persons per household for City of Aurora. Citywide, 31,862 people (8% of the city population) is at risk of dam inundation. Table 4-8 breaks down the population at risk for each of the high hazard dams identified above; note that because many dam inundation areas overlap, the individual numbers add up to more than the total population for all dams.

In practice, dam failures rarely result in fatalities because there is typically enough advance warning to allow people to evacuate the area. However, impacts to residential properties can be severe, to include not only direct flood damage but also contamination due to flooding of hazardous waste results in public health issues, as well as damage to sanitation services. Depending on the severity of the event, large numbers of people may be displaced or left homeless. Vulnerable populations are all populations downstream from dam or levee failures that are more likely to have difficulty evacuating the area within the allowable time frame. This population includes the elderly, disabled, and very young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television or radio emergency warning system.

Table 4-8 Population at Risk to Dam Inundation Exposure

Dam	Population
Cherry Creek Dam	11,976
Exposition Park Dam	660
Kelly Road Detention Dam	1,118
Quincy Dam	18,959
Rueter Hess Dam	47
Senac Dam	13,728
Westerly Creek Dam	2,201
Citywide Total	**31,862**

Source: Wood analysis, Assessor's data, U.S. Census data

Property

Vulnerable properties are those closest to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. In general, communities located below a high or significant hazard dam and along a waterway are potentially exposed to the impacts of a dam failure. For reference, high hazard dams threaten lives and property, significant hazard dams threaten property only. Inundation maps that identify anticipated flooded areas (which may not coincide with known floodplains) are produced for many high hazard dams. Six of the high or significant hazard dams contained dam inundation extents in spatial form that were analyzed to quantify risk across the planning area. Total building value and exposure numbers were based off parcel layers from Arapahoe, Adams and Douglas counties. County layers were merged together, using GIS, with the City of Aurora limits to create a parcel layer for this dam analysis. Building counts were based on an address point database to further refine the number of structures as one parcel may have multiple buildings.

Table 4-9 displays the number of structures in dam inundation areas within the city and their values. Based on these results, residential properties are the most exposed to a potential dam inundation event followed by commercial properties. A total value of $7,324,906,630 representing all property types, is potentially exposed to a dam failure event. Table 4-10 through Table 4-16 provide further analysis by breaking out the property exposure by individual dams; note that because many dam inundation areas overlap, the individual tables add up to more than the total exposure for all dams.

Note that properties in areas protected by levee are included and analyzed in the Flood section.

Table 4-9 Dam Inundation Exposure by Property Type

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Agriculture	5	7	$682,217	$682,217	$1,364,434
Commercial	557	944	$994,020,150	$994,020,150	$1,988,040,300
Exempt	65	134	$171,695,798	$171,695,798	$343,391,596

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Industrial	42	57	$186,481,384	$279,722,076	$466,203,460
Residential	8,802	11,339	$3,017,231,848	$1,508,615,924	$4,525,847,772
Vacant Land	2	2	$29,534	$29,534	$59,068
Total	**9,473**	**12,483**	**$4,370,140,931**	**$2,954,765,699**	**$7,324,906,630**

Source: Wood Analysis, Assessor's Data

Table 4-10 Cherry Creek Dam Inundation Exposure

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Commercial	365	316	$207,837,635	$207,837,635	$415,675,270
Exempt	42	38	$94,207,716	$94,207,716	$188,415,432
Industrial	10	10	$36,670,436	$55,005,654	$91,676,090
Residential	5,045	4,226	$1,276,752,322	$638,376,161	$1,915,128,483
Total	5,462	4,590	$1,615,468,109	$995,427,166	$2,610,895,275

Source: Wood Analysis, Assessor's Data

Table 4-11 Exposition Park Dam Inundation Exposure

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Commercial	28	28	$14,902,420	$14,902,420	$29,804,840
Exempt	5	5	$5,048,172	$5,048,172	$10,096,344
Residential	284	254	$158,595,500	$79,297,750	$237,893,250
Vacant Land	1	1	$20,229	$20,229	$40,458
Total	318	288	$178,566,321	$99,268,571	$277,834,892

Source: Wood Analysis, Assessor's Data

Table 4-12 Kelly Road Detention Dam Inundation Exposure

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Commercial	43	40	$10,115,432	$10,115,432	$20,230,864
Exempt	4	4	$4,670,209	$4,670,209	$9,340,418
Industrial	4	2	$9,102,869	$13,654,304	$22,757,173
Residential	364	363	$89,370,461	$44,685,231	$134,055,692
Vacant Land	1	1	$9,305	$9,305	$18,610
Total	416	410	$113,268,276	$73,134,480	$186,402,756

Source: Wood Analysis, Assessor's Data

Table 4-13 Quincy Dam Inundation Exposure

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Commercial	383	366	$229,284,902	$229,284,902	$458,569,804
Exempt	85	66	$125,869,736	$125,869,736	$251,739,472
Industrial	9	9	$25,007,952	$37,511,928	$62,519,880
Residential	7,544	6,931	$1,874,081,296	$937,040,648	$2,811,121,944
Total	8,021	7,372	$2,254,243,886	$1,329,707,214	$3,583,951,100

Source: Wood Analysis, Assessor's Data

Table 4-14 Rueter Hess Dam Inundation Exposure

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Commercial	36	36	$79,264,518	$79,264,518	$158,529,036
Residential	24	18	$92,700,000	$46,350,000	$139,050,000
Total	60	54	$171,964,518	$125,614,518	$297,579,036

Source: Wood Analysis, Assessor's Data

During the planning process, it was determined that the mapped inundation area for Rueter Hess Dam is incomplete and should continue downstream and intersect with Cherry Creek Res and further downstream. Thus, the actual exposure numbers for this dam may be higher.

Table 4-15 Senac Dam Inundation Exposure

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Agriculture	7	7	$682,217	$682,217	$1,364,434
Commercial	467	462	$696,421,085	$696,421,085	$1,392,842,170
Exempt	79	71	$63,589,959	$63,589,959	$127,179,918
Industrial	57	53	$177,378,515	$266,067,773	$443,446,288
Residential	5,131	4,490	$848,095,216	$424,047,608	$1,272,142,824
Total	5,741	5,083	$1,786,166,992	$1,450,808,642	$3,236,975,634

Source: Wood Analysis, Assessor's Data

Table 4-16 Westerly Creek Dam Inundation Exposure

Property Type	Improved Parcels	Buildings	Improved Value	Content Value	Total Value
Commercial	82	80	$16,240,278	$16,240,278	$32,480,556
Exempt	10	10	$10,027,026	$10,027,026	$20,054,052
Industrial	4	4	$9,102,869	$13,654,304	$22,757,173
Residential	782	772	$167,136,708	$83,568,354	$250,705,062
Vacant Land	1	1	$9,305	$9,305	$18,610
Total	879	867	$202,516,186	$123,499,267	$326,015,453

Source: Wood Analysis, Assessor's Data

Critical Facilities and Infrastructure

A total dam failure can cause catastrophic impacts to areas downstream of the water body, including critical infrastructure. Any critical asset located under the dam in an inundation area would be susceptible to the impacts of a dam failure. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads, and bridges in the path of the dam inundation. The most vulnerable transportation routes are those that are already in poor

condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, and cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

Based on the critical facility inventory considered in the updating of this plan, 240 critical facilities were found to intersect with the dam inundation extents obtained in GIS form from the Colorado Dam Safety Program. The Communication Lifeline category (73) which includes land mobile and microwave towers represent the greatest number of critical facilities exposed to dam inundation. Followed by Transportation (630), Hazardous Materials (51), and Safety and Security (25) Lifeline categories. The following tables show the results of the GIS analysis.

Table 4-17 Summary of Critical Facilities in Dam Inundation Areas

FEMA Lifeline	Count
Communications	73
Energy	6
Food, Water, Shelter	7
Hazardous Materials	51
Health and Medical	15
Safety and Security	25
Transportation	63
Total	**240**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Table 4-18 Critical Facilities in Dam Inundation Areas, by FEMA Lifeline and Type

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	50
	Microwave Towers	23
Energy	Electric Substation	5
	Power Plant	1
Food, Water, Shelter	Religious Institution	7
Hazardous Materials	RMP	1
	Tier II	50
Health and Medical	Adult Day Care Facility	5
	Assisted Living/Nursing Home	3
	Clinic/Medical Facility	5
	EMS Station	1
	Mental Health Facility	1
Safety and Security	Child Care Center	6
	Fire Station	2
	Government Facility	3
	School	14
Transportation	Bridge - Good Condition	24
	Bridge - Fair Condition	35
	Light Rail Station	4

FEMA Lifeline	Critical Facility Type	Count
	Total	**240**

Source: Wood Analysis, CO Dam Safety, City of Aurora

The following tables break out the facilities at risk by individual dams; note that because many dam inundation areas overlap, the individual tables add up to more than the facilities at risk for all dams.

Table 4-19 Critical Facilities in Cherry Creek Dam Inundation Area

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	15
	Microwave Towers	5
Food, Water, Shelter	Religious Institution	3
Hazardous Materials	RMP	3
Health and Medical	Adult Day Care Facility	4
	Assisted Living/Nursing Home	1
	Clinic/Medical Facility	2
Safety and Security	Child Care Center	2
	Fire Station	1
	Government Facility	1
	School	4
Transportation	Bridge - Good Condition	8
	Bridge - Fair Condition	16
	Light Rail Station	2
	Total	**67**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Table 4-20 Critical Facilities in Exposition Dam Inundation Area

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	1
Food, Water, Shelter	Religious Institution	2
Health and Medical	Clinic/Medical Facility	1
Safety and Security	School	2

FEMA Lifeline	Critical Facility Type	Count
Transportation	Bridge - Fair Condition	2
	Total	**8**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Table 4-21 Critical Facilities in Kelley Road Detention Dam Inundation Area

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	2
Health and Medical	Assisted Living/Nursing Home	1
Transportation	Bridge - Good Condition	3
	Bridge - Fair Condition	1
	Total	**7**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Table 4-22 Critical Facilities in Quincy Dam Inundation Area

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	26
	Microwave Towers	7
Energy	Electric Substation	2
Food, Water, Shelter	Religious Institution	4
Hazardous Materials	Tier II	2
Health and Medical	Assisted Living/Nursing Home	1
	Clinic/Medical Facility	4
	EMS Station	1
Safety and Security	Child Care Center	3
	Fire Station	1
	Government Facility	1
	School	8
Transportation	Bridge - Good Condition	11

FEMA Lifeline	Critical Facility Type	Count
	Bridge - Fair Condition	20
	Light Rail Station	4
	Total	**95**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Table 4-23 Critical Facilities in Rueter Hess Dam Inundation Area

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	1
Energy	Electric Substation	1
Hazardous Materials	Tier II	2
Transportation	Bridge - Good Condition	1
	Total	**5**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Table 4-24 Critical Facilities in Senac Dam Inundation Area

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	30
	Microwave Towers	17
Energy	Electric Substation	2
	Power Plant	1
Hazardous Materials	RMP	1
	Tier II	47
Health and Medical	Clinic/Medical Facility	1
	EMS Station	1
Safety and Security	Child Care Center	1
	Fire Station	2
	Government Facility	2
	School	1
Transportation	Bridge - Good Condition	14
	Bridge - Fair Condition	15
	Light Rail Station	2
	Total	**137**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Table 4-25 Critical Facilities in Westerly Creek Dam Inundation Area

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Tower	3
	Microwave Towers	2
Food, Water, Shelter	Religious Institution	1
Health and Medical	Adult Day Care Facility	1
	Assisted Living/Nursing Home	2
	Clinic/Medical Facility	1
Safety and Security	Child Care Center	1
	School	2
Transportation	Bridge - Good Condition	3
	Bridge - Fair Condition	1
	Total	**17**

Source: Wood Analysis, CO Dam Safety, City of Aurora

Government Services

Impacts to transportation corridors and communications lines could affect first responders' ability to effectively respond. Damage to facilities/personnel in incident area may require temporary relocation of some operations. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult. Impact may reduce deliveries. The public may question local government's ability to respond and recover if planning, response, and recovery are not timely and effective, regardless of the dam owner.

Economy

Extensive and long-lasting economic impacts could result from a major dam failure or inundation event, including the long-term loss of water in a reservoir, which may be critical for potable water needs. A major dam failure and loss of water from a key structure could bring about direct business and industry damages and potential indirect disruption of the local economy. A dam failure can have long lasting economic impacts and could deter visitors for a period of time.

Historic, Cultural and Natural Resources

Reservoirs held behind dams affect many ecological aspects of a river. River topography and dynamics depend on a wide range of flows, but rivers below dams often experience long periods of very stable flow conditions or saw-tooth flow patterns caused by releases followed by no releases. Water releases from dams usually contain very little suspended sediment; this can lead to scouring of riverbeds and banks.

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways. This could result in destruction of downstream habitat and could have detrimental effects on many species of animals.

4.3.8 Development Trends

Future land use in the planning area will be directed by the City Comprehensive Plan. The City of Aurora has established comprehensive policies regarding sound land use in identified flood hazard areas. Most of the areas vulnerable to the more severe impacts from dam failure are likely to intersect the mapped flood hazard areas. The City's floodplain management ordinance and policies to some degree will help to reduce the risk associated with the dam failure hazard for future development in the planning area, but it is recognized that inundation areas typically exceed the regulatory 1% annual chance flood hazard boundary.

4.3.9 Risk Summary

- The overall significance of this hazard to the City is Low.
- The presence of 12 high hazard and 1 significant hazard dams in or around the City and upstream, present the possibility of dam failure and non-dam failure flooding below them.
- The overall significance is considered low due to the low probability of occurrence.
- A total of 31,862 people are potentially at risk of dam failure or incident events based on the dam inundation analysis.
- A total of 12,483 buildings are potentially exposed to dam failure incident events, with over $7B in total values exposed.
- A total of 226 critical facilities are potentially exposed to dam failure events. Communication facilities are the most noted in the dam inundation analysis.
- A dam failure and loss of water from a critical reservoir or structure could include direct and indirect business and industry damages or disruption of the local economy and key resources (e.g., potable water).
- Related hazards: Flooding, Earthquake

4.4 Drought and Extreme Heat

Hazard	Location	Potential of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Drought	Extensive	Likely	Critical	Medium
Extreme Heat	Significant	Likely	Critical	Medium

4.4.1 Description

Drought

Drought is a normal phase in the climatic cycle of most geographical areas. According to the National Drought Mitigation Center, drought originates from a deficiency of precipitation over an extended period, usually a season or more. This results in a water shortage for some activity, group, or environmental sector. Drought is the result of a significant decrease in water supply relative to what is "normal" in a given location. Unlike most disasters, droughts normally occur slowly but last a long time.

Defining when drought begins is a function of the impacts of drought on water users and includes consideration of the supplies available to local water users as well as the stored water they may have available in surface reservoirs or groundwater basins. Different local water agencies have different criteria for defining drought conditions in their jurisdictions. Some agencies issue drought watch or drought warning announcements to their customers. Determinations of regional or statewide drought conditions are usually based on a combination of hydrologic and water supply factors.

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. The most significant impacts associated with drought in Colorado are those related to water intensive activities such as agriculture, wildland fire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. An ongoing drought may leave an area more prone to beetle kill and associated wildland fires. Drought conditions can also cause soil to compact, increasing an area's susceptibility to flooding, and reduce vegetation cover, which exposes soil to wind and erosion. A reduction of electric power generation and water quality deterioration are also potential problems. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline.

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-

DEFINITIONS

Drought—The cumulative impacts of several dry years on water users. It can include deficiencies in surface and subsurface water supplies and generally impacts health, well- being, and quality of life.

Meteorological Drought— An expression of precipitation's departure from normal over some period of time. Meteorological measurements are the first indicators of drought. Definitions are usually region-specific and based on an understanding of regional climatology. A definition of drought developed in one part of the world may not apply to another, given the wide range of meteorological definitions.

Agricultural Drought— Occurs when there is not enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought.

Hydrological Drought— Deficiencies in surface and subsurface water supplies. It is measured as stream flow and as lake, reservoir, and groundwater levels.

Socioeconomic Drought— Occurs when a physical water shortage starts to affect people, individually and collectively. Most socioeconomic definitions of drought are associated with the supply and demand of an economic good.

Extreme Heat—Summertime weather that is substantially hotter or more humid than average for a location at that time of year.

term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

Precipitation in the form of snow is the main source of Colorado's water supply. Annual precipitation in the City of Aurora is approximately 12 to 20 inches per year. According to the 2018 Colorado State Drought Mitigation and Response Plan, "there are no major rivers that flow into Colorado (McKee et al. 1999). There are several major river basins originating in the Colorado Rockies, which flow out of the state, providing water to much of the southwestern United States, and contributing to the Missouri and Mississippi Rivers as well. Thus, Colorado earns its title as "the Mother of Rivers" (CWCB 2013). This supply is stored in five forms throughout the state: snowpack, streamflow, reservoir water, soil moisture, and groundwater (McKee and others 2000). Aurora Water has a diverse portfolio of water rights including a substantial portion of senior water rights in the South Platte and Arkansas River Basins (CWCD 2018).

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. According to the State of Colorado 2018 Drought Response Plan, economic impacts may also occur for industries that are water intensive such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation and wildfire preservation. A reduction of electric power generation and water quality deterioration are also potential effects. Drought conditions can also cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion. A drought may also increase the speed at which dead and fallen trees dry out and become more potent fuel sources for wildfires. Drought may also weaken trees in areas already affected by mountain pine beetle infestations, causing more extensive damage to trees and increasing wildfire risk, at least temporarily. An ongoing drought that severely inhibits natural plant growth cycles may impact critical wildlife habitats. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline (CWCB 2013).

Extreme Heat

The Colorado State Hazard Mitigation Plan defines extreme heat as "temperatures over 90 degrees for an extended period of time, or that hover 10 degrees or more above the average high temperature for the region and last for multiple consecutive days." In a normal year, about 175 Americans succumb to the demands of summer heat. According to the National Weather Service (NWS), among natural hazards, only the cold of winter takes a greater toll—not lightning, hurricanes, tornadoes, floods, or earthquakes. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. More than 1,250 people died in the heat wave of 1980.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise, and heat-related illness may develop. Elderly persons, small children, those with chronic illnesses, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails.

4.4.2 Past Events

Drought

Colorado has experienced multiple severe droughts over the years. Including drought in, 2020, 2018, 2011-2013, 2006-2004, 1996, 1994, 1990, 1989, 1975-1979, 1963-1965, 1951-1957, 1931-1941, and 1893-1905 (CWCB, 2018). The most significant of the instrumented period (which began in the late

1800s) are listed in Table 4-26. Although drought conditions can vary across the state, it is likely that City of Aurora was affected by most of these dry periods.

Table 4-26 Historical Dry and Wet Periods in Colorado

Date	Dry	Wet	Duration (years)
1893-1905	X		12
1905-1931		X	26
1931-1941	X		10
1941-1951		X	10
1951-1957	X		6
1957-1959		X	2
1963-1965	X		2
1965-1975		X	10
1975-1978	X		3
1979-1999*		X	20
2000-2006*	X		6
2007-2010*		X	3
2011-2013*	X		2
2018-2019**	X		2

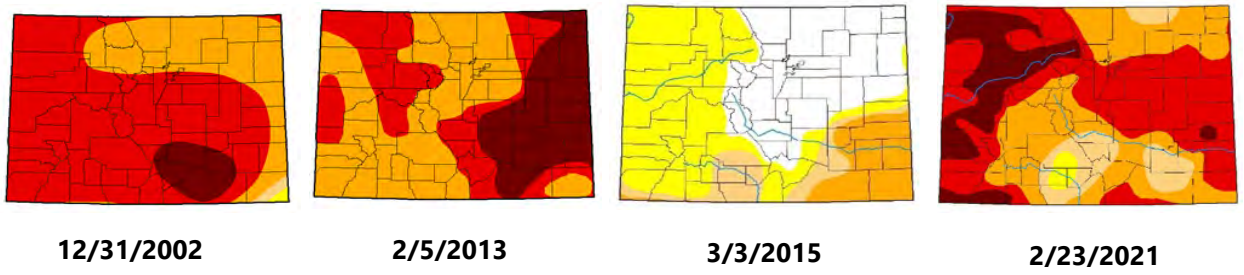
Notes:
*modified for 2018 State of Colorado Drought Mitigation and Response Plan Update based on input from the Colorado Climate Center
**Modified for 2021 City of Aurora HMP update

Source: McKee, et al. 1999

Beginning in 1998, the Colorado Front Range, including the City of Aurora, experienced below-normal precipitation and unseasonably dry air masses. Drought conditions continued over the next few years and the forests throughout the region became drier with each passing season. Drought conditions worsened in the winter of 2001/2002 and set the stage for the Hayman Fire, the fourth largest fire in Colorado history to date. During the 2002 drought, storage capacity for Aurora Water was reduced to 25% of total capacity (CWCB 2018). This drought brought many lessons for Aurora include the realization sufficient preparations were not in place for a drought of that magnitude. According to the 2018 Colorado Drought and Mitigation and Response Plan, after the 2002 drought a variety of tools to enhance water supply forecasting and planning guidance for future drought periods were developed by Aurora Water.

Figure 4-7 compares the severity of the drought in Colorado in June 2002 (three days after the start of the Hayman Fire) with the severity of the drought in February 2013, drought conditions as of March 2015 and conditions as of February 23,2021. Drought returned in 2018 and lasted through mid-2019 before returning in 2020, placing the City of Aurora in the most severe Drought Monitor ratings through February 2021.

Figure 4-7 Colorado Drought Conditions

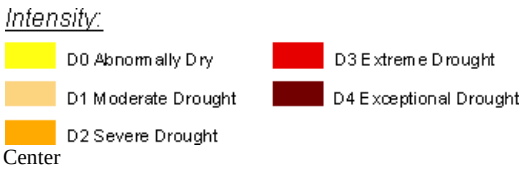


Source: National Drought Mitigation Center

Table 4-27 Colorado State Drought Conditions

(Expressed as the percentage of the state experiencing the drought intensity level or higher)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
12/31/2002	0%	100%	99.66%	98.98%	72.73%	7.06%
2/5/2013	0%	100%	100%	100%	54.29%	24.92%
3/3/2015	36.97%	63.03%	51.46%	12.20%	0%	0%
2/23/2021	0%	100%	98.57%	88.76%	56.93%	15.89%



Source: National Drought Mitigation Center

The National Drought Mitigation Center developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: on-line drought-related news stories and scientific publications; members of the public who visit the website and submit a drought-related impact for their region; members of the media; and members of relevant government agencies. The database is being populated beginning with the most recent impacts and working backward in time. The Drought Impact Reporter contains information on eight impacts from droughts that affected the City of Aurora between 2000 and 2020. Most of the impacts (three each) were classified as "Plants & Wildlife" (3) and "Relief, Response, & Restrictions" (3) and "Fire" (3). Other impacts included, "Water Supply & Quality" (2) and "Society and Public Health" (1). These categories are described as follows:

- **Plants & Wildlife (3)** – Drought effects associated with unmanaged plants and wildlife, both aquatic and terrestrial, include loss of biodiversity of plants or wildlife; loss of trees from rural or urban landscapes, shelterbelts, or wooded conservation areas; reduction and degradation of fish and wildlife habitat; lack of feed and drinking water; greater mortality due to increased contact with agricultural producers (as animals seek food from farms and producers are less tolerant of the intrusion); disease; increased vulnerability to predation (from species concentrated near water); migration and concentration (loss of wildlife in some areas and too much wildlife in others); increased stress on endangered species; salinity levels affecting wildlife; wildlife encroaching into urban areas; and loss of wetlands.

- **Relief, Response, & Restrictions (3)** – This category refers to drought effects associated with disaster declarations, aid programs, requests for disaster declaration or aid, water restrictions, or fire restrictions. Examples include: disaster declarations, aid programs, U.S. Department of Agriculture (USDA) Secretarial disaster declarations, Small Business Association disaster declarations, government relief and response programs, state-level water shortage or water emergency declarations, county-level declarations, a declared "state of emergency," requests for declarations or aid, non-profit organization-based relief, water restrictions, fire restrictions, National Weather Service (NWS) Red Flag warnings, and declaration of drought watches or warnings.
- **Fire (3)** – Drought often contributes to forest, range, rural, or urban fires, fire danger, and burning restrictions. Specific impacts include enacting or easing burning restrictions, fireworks bans, increased fire risk, occurrence of fire (number of acres burned, number of wildfires compared to average, people displaced, etc.), state of emergency during periods of high fire danger, closure of roads or land due to fire occurrence or risk, and expenses to state and county governments of paying firefighters overtime and paying equipment (helicopter) costs.
- **Water Supply & Quality (2)** – Drought effects associated with water supply and water quality include dry wells; voluntary and mandatory water restrictions; changes in water rates; increasing of water restrictions; increases in requests for new well permits; changes in water use due to water restrictions; greater water demand; decreases in water allocation or allotments; installation or alteration of water pumps or water intakes; changes to allowable water contaminants; water line damage or repairs due to drought stress; drinking water turbidity; change in water color or odor; declaration of drought watches or warnings; and mitigation activities.
- **Society & Public Health (1)** – Drought effects associated with human, public and social health include health-related problems related to reduced water quantity or quality, such as increased concentration of contaminants; loss of human life (e.g., from heat stress, suicide); increased respiratory ailments; increased disease caused by wildlife; increased human disease caused by changes in insect carrier populations; population migration (rural to urban areas, migrants into the United States); loss of aesthetic values; change in daily activities; elevated stress levels; communities creating drought plans; lawmakers altering penalties for violation of water restrictions; demand for higher water rates; cultural/historical discoveries from low water levels; cancellation of fundraising events; cancellation/alteration of festivals or holiday traditions; stockpiling water; public service announcements and drought information websites; protests; and conflicts within the community due to competition for water.

Extreme Heat

The Western Regional Climate Center reports data summaries from the Stapleton Weather Station (052220). Table 4-28 contains temperature summaries related to extreme heat for the station.

Table 4-28 Temperature Data from Denver Stapleton (052220) (1948-2016)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (degrees Fahrenheit)												
Average Max Temperature	43.9	46.7	52.9	61.4	70.7	81.7	88.3	86.0	77.5	66.2	52.7	45.0
Average Min Temperature	17.0	20.3	26.3	34.4	44.0	52.9	59.1	57.4	48.1	36.7	25.5	18.2
Average Temperature	30.5	33.5	39.6	47.9	57.3	67.3	73.7	71.7	62.8	51.5	39.1	31.6
Extreme Temperatures (degrees Fahrenheit)												
Extreme Max Temperature	74	76	84	90	96	104	104	102	97	89	81	75
Average Number of Days												
Max Temp	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**8.8**	**19.1**	**11.2**	**3.0**	**0.0**	**0.0**	0.0

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
above 90°F												

Source: Western Regional Climate Center

4.4.3 Location

Drought

The location rating is **Extensive.**

Droughts are regional events, sometimes impacting multiple states simultaneously. While several indices have been developed to measure and map the extent and location of droughts at the state and regional level, they are less useful at the city level. Therefore, as the climate of the planning region is fairly continuous, it is reasonable to assume that a drought will impact the entire planning region simultaneously. Based on this information, the geographic extent rating for drought is extensive.

Extreme Heat

The location rating is **Extensive**.

The City of Aurora is at risk of extreme heat events; however, these events may be exacerbated in urban areas, where reduced air flow, reduced vegetation, and increased generation of waste heat can contribute to temperatures that are several degrees higher than in surrounding rural or less urbanized areas. This phenomenon is known as urban heat island effect.

4.4.4 Magnitude and Severity

The magnitude and severity rating for drought and extreme heat is **Critical.**

Drought

Drought impacts are wide-reaching and may be economic, environmental, or societal. The most significant impacts associated with drought in Colorado are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. An ongoing drought may leave an area more prone to beetle kill and associated wildfires. Drought conditions can also cause soil to compact, increasing an area's susceptibility to flooding, and reduce vegetation cover, which exposes soil to wind and erosion. A reduction of electric power generation and water quality deterioration are also potential problems. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in streams and groundwater decline.

Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- Agricultural – Drought threatens crops that rely on natural precipitation
- Water supply – Drought threatens supplies of water for irrigated crops and for communities
- Fire hazard – Drought increases the threat of wildfires from dry conditions in forest and rangelands

On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the

more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly.

When measuring the severity of droughts, analysts typically look at economic impacts on a planning area. A drought directly or indirectly impacts all people in affected areas. All people could pay more for water if utilities increase their rates due to shortages. Agricultural impacts can result in loss of work for farm workers and those in related food processing jobs. Other water- or electricity-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them.

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest.

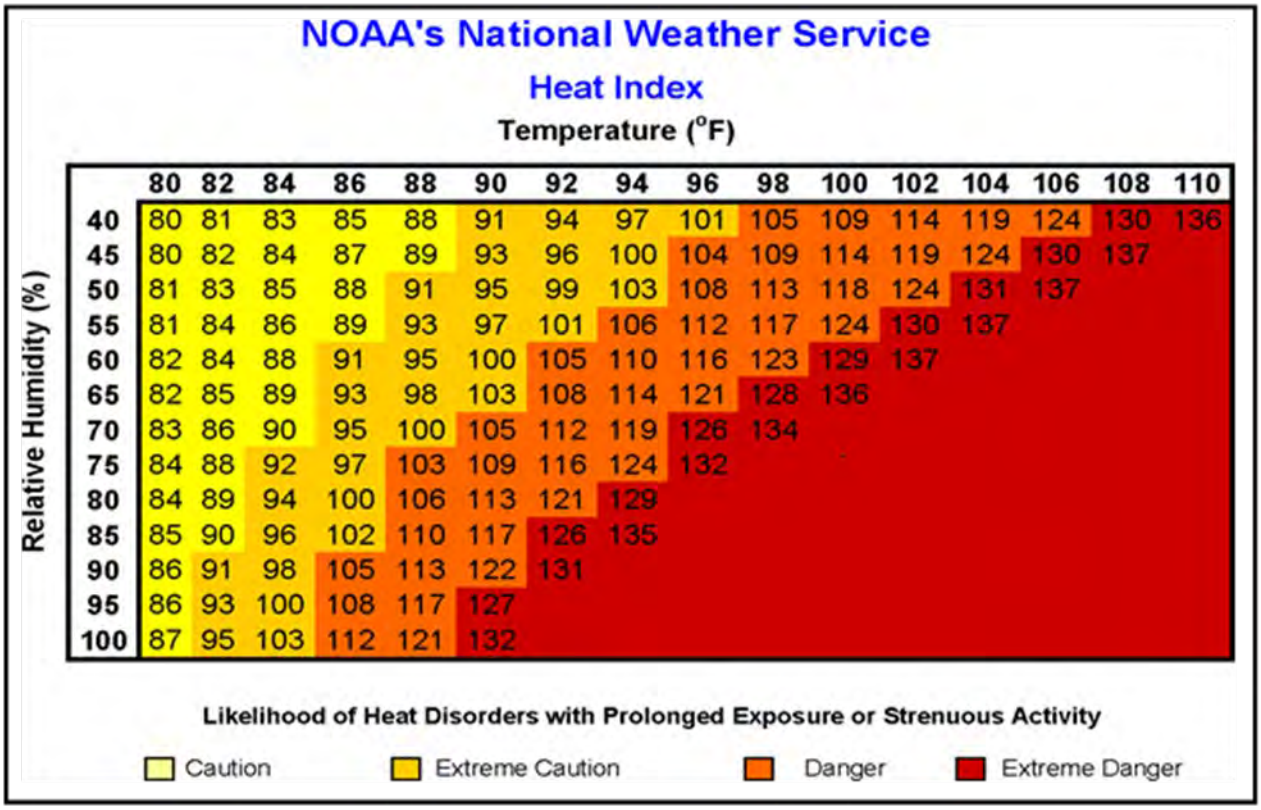
Additionally, there is increased danger of wildfires associated with most droughts.

Based on the information in this hazard profile, the magnitude/severity of drought is critical. Overall significance is considered to be medium impact.

Extreme Heat

Excessive heat events are often a result of more than just ambient air temperature. Heat index tables (see Figure 4-8) are commonly used to provide information about how hot it feels, which is based on the interactions between several meteorological conditions. Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

Figure 4-8 Heat Index



NOAA issues watch, warning, and advisory information for extreme heat. High temperatures can be forecasted days or weeks in advance. On average, there are 35 days per year where temperatures in the City of Aurora exceed 90ºF. When temperatures reach 90ºF and above, people are vulnerable to heat cramps, heat exhaustion, and heat stroke. Pets and livestock are also vulnerable to heat-related injuries. Crops can be vulnerable as well. There is no information available regarding the historical economic and medical effects of extreme heat events that have occurred in the city and, therefore, no way to assess the severity of past events.

Excessive heat events can cause failure of motorized systems such as ventilation systems used to control temperatures inside buildings. This can, in turn, exacerbate the effects of extreme heat on the population.

4.4.5 Probability of Future Occurrences

The probability of future occurrences for drought and extreme heat is **Likely**.

Droughts are climatic patterns that occur over long periods of time. Only generalized warnings can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions. Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

Colorado is semiarid; thus, drought is a regular and natural occurrence in the state. The main source of water supply in the state is precipitation and much of this occurs in the winter as snowfall. Although drought conditions are difficult to predict, low levels of winter snowpack may act as an indicator that drought conditions are occurring.

According to information from the 2018 Colorado State Drought Mitigation and Response Plan, over 119 years (1893 to 2012) there were 7 recorded drought incidents statewide that totaled 41 dry years. Short duration droughts occur much more frequently. According to a study cited in the 2018 Colorado Drought Mitigation and Response Plan, they occur somewhere in Colorado in nearly 9 out of every 10 years. (McKee and others 2000).

4.4.6 Climate Change Considerations

The Intergovernmental Panel on Climate has projected dramatic changes in regional climate characteristics between present-day and if global temperatures rise between 1.5 degrees Celsius and 2 degrees Celsius. Climate change can have impacts both in terms of inter-annual droughts and intra-annual runoff patterns (State of Colorado Drought Mitigation and Response Plan Update, 2018). Temperatures increased and resulting changes in evaporation and soil moistures will also add to the trend of decreasing runoff in a majority of Colorado Basins. The following table shows the challenges water managers may face with the projected changes in climate.

Table 4-29 Future Drought Vulnerability Due to Climate Change and Challenges Faced by Colorado Water Managers

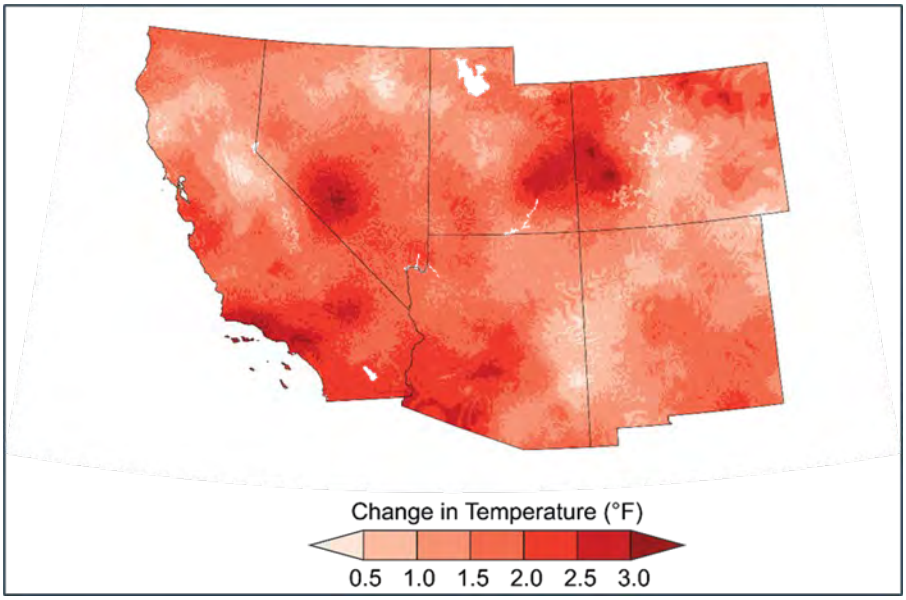
Challenge	Observed and/or Projected Change
Water demands for agriculture and outdoor watering	Increasing temperatures raise evapotranspiration by plants, lower soil moisture, alter growing seasons, and thus increase water demand.
Water supply infrastructure	Changes in snowpack, streamflow timing, and hydrograph evolution may affect reservoir operations including flood control and storage. Changes in the timing and magnitude of runoff may affect functioning of diversion, storage, and conveyance structures.
Legal water systems	Earlier runoff may complicate prior appropriation systems and interstate water compacts, affecting which rights holders receive water and operations plans for reservoirs
Water quality	Although other factors have a large impact, “water quality is sensitive both to increased water temperatures and changes in patterns of precipitation” (CCSP SAP 4.3, p. 149). For example, changes in the timing and hydrograph may affect sediment load and pollution, impacting human health.
Energy demand and operating costs	Warmer air temperatures may place higher demands on hydropower reservoirs for peaking power. Warmer lake and stream temperatures may affect water use by cooling power plants and other industries.
Mountain habitats	Increasing temperature and soil moisture changes may shift mountain habitats toward higher elevation.
Interplay among forests, hydrology, wildfires, and pests	Changes in air, water, and soil temperatures may affect the relationships between forests, surface and groundwater, wildfire, and insect pests. Water-stressed trees, for example, may be more vulnerable to pests.
Riparian habitats and fisheries	Stream temperatures are expected to increase as the climate warms, which could have direct and indirect effects on aquatic ecosystems (CCSP SAP 43.), including the spread of instream non-native species and diseases to higher elevation and the potential for nonnative plant species to invade

Challenge	Observed and/or Projected Change
	riparian areas. Changes in streamflow intensity and timing may also affect riparian ecosystems.
Water – and snow – based recreation	Changes in reservoir storage affect lake and river recreation activities; changes in streamflow intensity and timing will continue to affect rafting directly and trout fishing indirectly. Changes in the character and timing of snowpack and the ratio of snowfall to rainfall will continue to influence winter recreational activities and tourism.
Groundwater resources	Changes in long-term precipitation and soil moisture can affect groundwater recharge rates; coupled with demand issues, this may mean greater pressure on groundwater resources.

Source: State of Colorado Drought Mitigation and Response Plan 2018, reproduced from CWCB

Research cited in the Fourth National Climate Assessment indicates that average temperatures have already increased across the Southwest and will likely continue to rise. Figure 4-9 shows the difference between the 1986-2016 average temperature and the 1901-1960 average temperature. This trend toward higher temperatures is expected to continue and would cause more frequent and severe droughts in the Southwest as well as drier future conditions and an increased risk of megadroughts—dry periods lasting 10 years or more). Additionally, current models project decreases in snowpack, less snow and more rain, shorter snowfall seasons, and earlier runoff, all of which may increase the probability of future water shortages (Gonzalez et al., 2018).

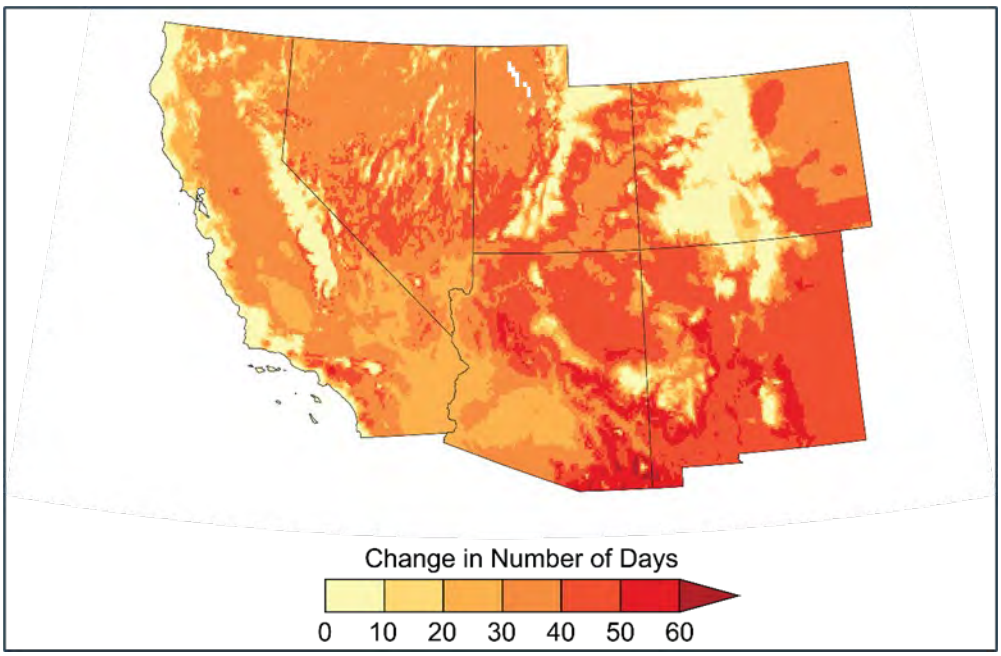
Figure 4-9 Change in Average Temperature Across the Southwest, 1901-1960 to 1986-2016



Source: Fourth National Climate Assessment

Extreme heat is also expected to increase in frequency. Figure 4-10 shows projected increases in extreme heat as an increase in the number of days per year when the temperature exceeds 90°F by the period 2036-2065 compared to the period 1976-2005. Under the higher emissions scenario (RCP8.5), the number of days of extreme heat would increase in the City of Aurora by 30 to 50 days based on the figure below.

Figure 4-10 Projected Increases in Extreme Heat



Source: Fourth National Climate Assessment *Based on higher emission scenario RCP8.5

4.4.7 Vulnerability

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental, and social activities. The vulnerability of an activity to the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand. Extreme heat can exacerbate the effects of drought.

People

Although drought events rarely pose immediate risks to public health, they can impact local public health in numerous ways. Drought-induced public health impacts may include: increased respiratory ailments due to increased particulate matter in the air; health problems due to decreased availability of clean water; increased disease caused by wildlife concentrations; and loss of human life from heat stress or suicide. Summer heat events can result in higher ground-level ozone, an acidic gas that damages the respiratory system. Drought may also impact mental and behavioral health as a result of elevated stress levels, higher costs for water, restrictions on water usage, and unemployment in the agricultural sector, tourism industries, and other businesses related to the natural environment and/or water.

The City of Aurora has the ability to minimize any impacts on residents and water consumers in the city should several consecutive dry years occur. No significant life or health impacts are anticipated as a result of drought within the planning area.

According to the U.S. EPA, individuals with the following combinations or characteristics are typically at greater risk to the adverse effects of excessive heat events: individuals with physical or mobility constraints, cognitive impairments, economic constraints, and social isolation. People who live or work in buildings without cooling systems are also more vulnerable. Populations living in densely populated urban areas are likely to be more exposed to extreme heat events.

Property

Drought does not typically have a direct impact on buildings, but foundations can begin to crack when soil moisture decreases. Additionally, an increase in expanding or collapsing soils could affect building foundations. Developed areas may experience damages to landscaping if water use restrictions are put in place, however these losses are not considered significant.

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

Typically, the only impact extreme heat has on general building stock is increased demand on air conditioning equipment, which in turn may cause strain on electrical systems.

Critical Facilities and Infrastructure

Most critical facilities will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

According to the State Drought Plan drought vulnerability within the Denver Metropolitan Area is relatively low when compared to other regions within the State. For the City of Aurora, this is primarily attributed to the fact that Aurora Water owns one of the most senior urban water rights portfolios along the Front Range. As noted under Past Events, Aurora Water has also taken additional drought mitigation actions since 2002 to further improve water supply reliability.

Power outages may occur as a result of extreme heat events. Additionally, transportation systems may experience disruption in services. According to the 2018 State of Colorado Hazard Mitigation Plan, concrete pavements have experienced "blowouts or heaves" both on local highway and the higher volume parkway and interstate systems. Blowouts occur when pavement expands and cannot function properly within its allotted spaces. Pavement sections may rise up several inches during such events. These conditions can cause motor vehicle accidents in their initial stages and can shut down traffic lanes or roadways entirely until such times as the conditions are mitigated (DHSEM 2018).

Government Services

Drought may require disaster declarations, aid programs, water restrictions, and/or fire restrictions. These needs may impact funding or administrative resources for other regular operations or may necessitate changes to existing operating procedures.

Water utilities are likely to face the greatest challenges to continuity of operations and delivery of services, especially during long-term widespread droughts, where opportunities for resource-sharing are limited. Water suppliers may need to change water rates, set usage restrictions, adjust to changes in demand, address water line damage or repairs due to drought stress, account for changes in water quality, and seek alternative water supplies. Should a public water system be severely affected, the cost of shipping in outside water could total into the millions of dollars.

Public confidence may be affected because of the drought response process. Water usage restrictions and potential penalties for violations of these restrictions can cause frustration with government. Meetings to discuss drought, efforts to create community drought plans, and public service announcements and education efforts may affect public confidence. Elevated stress levels may result from these processes as well as from demand for higher water rates, cancellation of fundraising events, cancellation/alteration of festivals or holiday traditions, stockpiling water, and/or protests.

Economy

Economic impact will be largely associated with industries that use water or depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. An extreme multi-year drought could impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Intensified by such conditions, extreme wildfires could break out around or within the planning area, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon by the planning partnership, causing social and political conflicts. If such conditions persisted for several years, the economy of the City of Aurora could experience setbacks, especially in water dependent industries.

Historic, Cultural, and Natural Resources

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

4.4.8 Development Trends

Vulnerability to drought will increase as population growth increases, putting more demands on existing water supplies. The City of Aurora considers future water use through an established comprehensive plan that includes policies directing land use and dealing with issues of water supply and the protection of water resources. These plans provide the capability at the local municipal level to protect future development from the impacts of drought.

4.4.9 Risk Summary

- The overall significance of these hazards to the City is Medium.
- Urban areas are more exposed to extreme heat events due to the Urban Heat Island Effect.
- On average, the City experiences 35 days per year where temperatures exceed 90°F.
- After the 2002 drought, Aurora Water increased its capacity and capabilities to respond to drought through new tools, plans, and water supply augmentation projects.
- The effects of climate change may result in an increase in frequency of drought and extreme heat events.

4.5 Earthquake

Hazard	Location	Probability of Future Occurrence	Severity/Magnitude	Overall Significance
Earthquake	Significant	Occasional	Limited	Low

4.5.1 Description

How Earthquakes Happen

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

Geologists classify faults by their relative hazards. Active faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). Potentially active faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years). Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. Although there are probably still some unrecognized active faults, nearly all the movement between the two plates, and therefore the majority of the seismic hazards, are on the well-known active faults.

DEFINITIONS

Earthquake—The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.

Epicenter—The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

Fault—A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.

Focal Depth—The depth from the earth's surface to the hypocenter.

Hypocenter—The region underground where an earthquake's energy originates.

Liquefaction—Loosely packed, water- logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

Faults are more likely to have earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve accumulating tectonic stresses. A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. In some areas, smaller, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant as a result of the fault's proximity to the area. In contrast, large regional faults can generate great magnitudes but, because of their distance and depth, may result in only moderate shaking in the area.

Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly mapped ground motion parameters are

the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short period structures" (e.g., single-family dwellings). Longer period response components create the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 4-30 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

Table 4-30 Mercalli Scale and Peak Ground Acceleration Comparison

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA[a] (%g)
		Resistant Buildings	Vulnerable Buildings	
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17% - 1.4%
IV	Light	None	None	1.4% - 3.9%
V	Moderate	Very Light	Light	3.9% - 9.2%
VI	Strong	Light	Moderate	9.2% - 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VIII	Severe	Moderate/Heavy	Heavy	34% - 65%
IX	Violent	Heavy	Very Heavy	65% - 124%
X - XII	Extreme	Very Heavy	Very Heavy	>124%

a. PGA measured in percent of g, where g is the acceleration of gravity PGA Peak Ground Acceleration

Sources: USGS, 2008; USGS, 2010

Effect of Soil Types

The impact of an earthquake on structures and infrastructure is largely a function of ground shaking, distance from the source of the quake, and liquefaction, a secondary effect of an earthquake in which soils lose their shear strength and flow or behave as liquid, thereby damaging structures that derive their support from the soil. Liquefaction generally occurs in soft, unconsolidated sedimentary soils. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table 4-31 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E, and F.

Table 4-31 NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

m Meter
m/s Meters per second

Source; NEHRP National Earthquake Hazard Reduction Program

Part of what makes earthquakes so destructive is that they generally occur without warning. The main shock of an earthquake can usually be measured in seconds, and rarely lasts for more than a minute. Aftershocks can occur within the days, weeks, and even months following a major earthquake.

By studying the geologic characteristics of faults, geoscientists can often estimate when the fault last moved and estimate the magnitude of the earthquake that produced the last movement. Because the occurrence of earthquakes is relatively infrequent in Colorado and the historical earthquake record is short, accurate estimations of magnitude, timing, or location of future dangerous earthquakes in Colorado are difficult to estimate.

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short, but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system.

4.5.2 Past Events

According to the U.S. Geological Survey (USGS), eastern Colorado is nearly aseismic, with just a few epicenters in the Arkansas and Platte river valleys. Most shocks in the history of Colorado have been centered west of the Rocky Mountain Front Range. The first seismographs in Colorado of sufficient quality to monitor earthquake activity were installed in 1962. Newspaper accounts are the primary source of published data for earthquake events before that time. Figure 4-11 and Figure 4-12 illustrate historic earthquakes and Quaternary faults in Colorado.

Colorado has a relatively short period of historical records for earthquakes. An earthquake and fault map developed by the Colorado Geological Survey (CGS) depicts the location of historical epicenters and potentially active faults in the state. The best-known Colorado earthquakes were a series of events in the 1960s that were later shown to have been triggered by the injection of liquid waste into a deep borehole at the Rocky Mountain Arsenal northeast of Denver. Figure 4-11 shows the epicenters and faults for the City of Aurora and the surrounding area. While the map shows other recorded earthquake events throughout Denver Metropolitan Area, the following recorded earthquake events from the USGS were specifically significant to the City of Aurora:

- December 4, 1962 – Epicenter just south of current Denver International Airport in the City of Aurora, Magnitude 3.2
- November 21, 1965 – Epicenter in northeast Denver in the current vicinity of the Green Valley Ranch neighborhood. Magnitude 3.8, Modified Mercalli intensity of V Moderate.
- August 9, 1967 – The strongest and most widely felt shock in Denver's history struck at 6:25 in the morning. The magnitude 5.3 tremor caused the most serious damage at Northglenn, where a church's

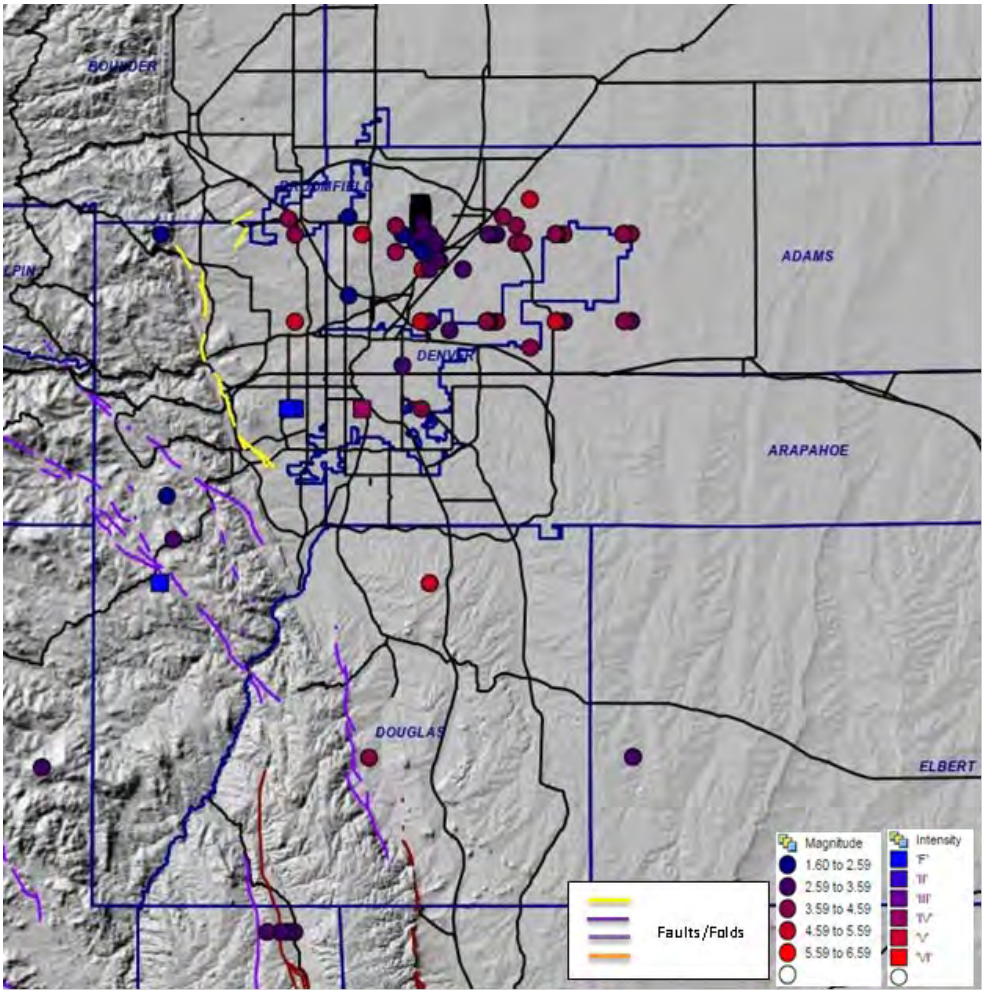
concrete pillar roof supports were weakened, and 20 windows were broken. An acoustical ceiling and light fixtures fell at one school. Many homeowners reported wall, ceiling, floor, patio, sidewalk, and foundation cracks. Several reported basement floors separated from walls. Extremely loud, explosive-like earth noises were heard. Damage on a lesser scale occurred throughout the area. The epicenter was located on the northern edge of the current Denver International Airport property. The event had a magnitude of 5.3, with a Modified Mercalli intensity of VII Very Strong.

- April 2, 1981 – On April 2nd a sharp earthquake, magnitude 4.1, occurred that was centered approximately 12 miles north of downtown Denver in the Thornton area. Some slight damage (MM VI) was observed at Commerce City and Thornton. The quake was felt in other parts of Adams County and in parts of Arapahoe, Boulder, Clear Creek, Denver, Douglas, Jefferson, Gilpin, and Weld Counties.
- December 25, 1994 – A moderate earthquake with an epicenter approximately 6 miles southeast of Castle Rock struck the central front range. With a magnitude of 4.0 and a maximum Modified Mercalli intensity of V, the shock was felt from Colorado Springs to Denver.

No known damage information specific to Aurora exists for these earthquakes because they are not considered major. The most economically damaging earthquake in Colorado history occurred on August 9, 1967, in the northeast Denver metropolitan area with a magnitude of 4.8. The effect was mainly on Denver and the northern suburbs (not the City of Aurora), where more than $1 million of damage was estimated.

Based on isolated historical occurrences, an earthquake is not likely to occur in the City of Aurora.

Figure 4-11 Earthquake Faults and Recorded Epicenters Map for Denver Metropolitan Area



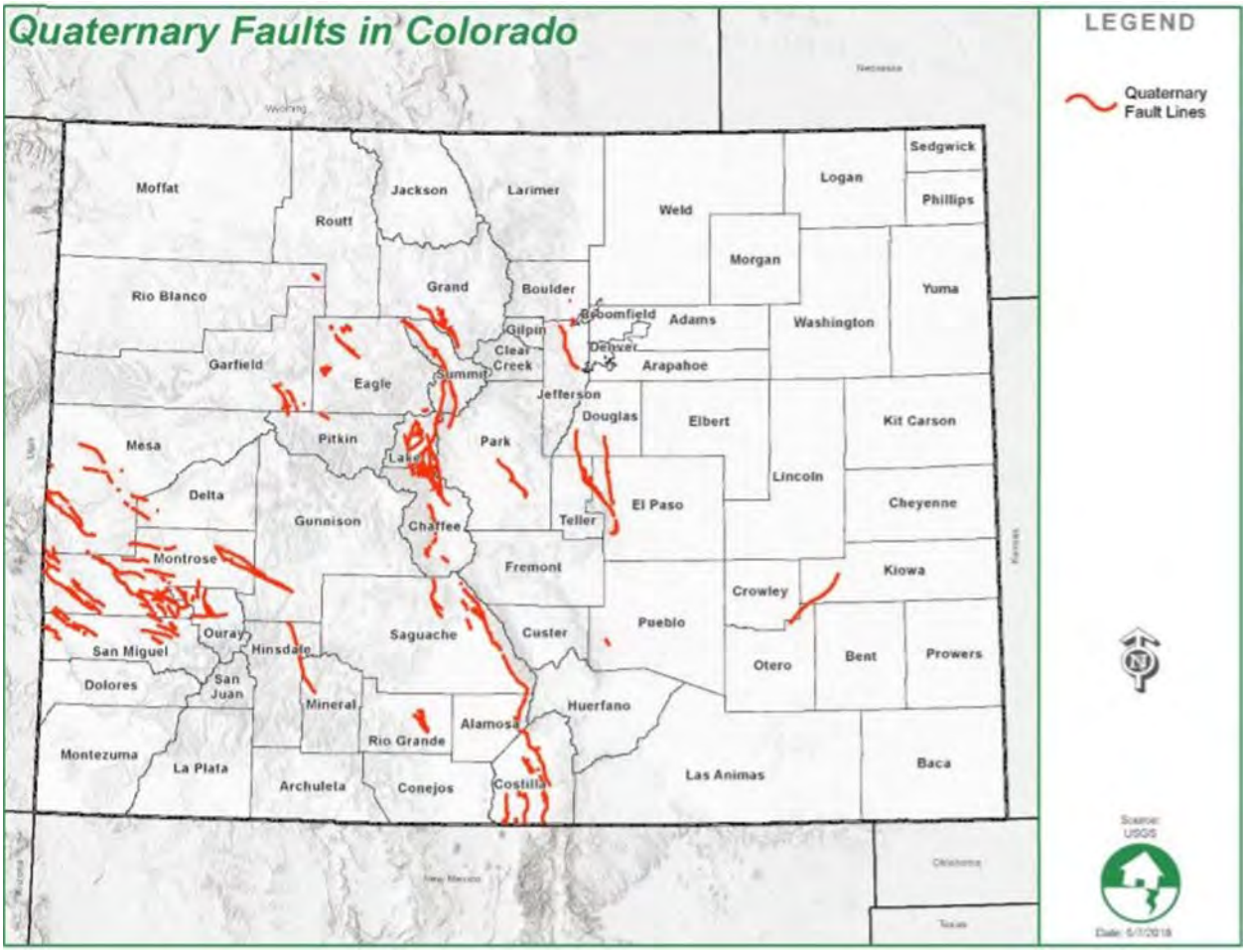
Source: CGS (http://dnrwebmapgdev.state.co.us/cgsonline/)

4.5.3 Location

The location rating for earthquakes is **Extensive**.

Geological research indicates that faults capable of producing earthquakes are prevalent in Colorado. There are approximately 90 potentially active faults in Colorado with documented movement within the last 1.6 million years. Figure 4-11 and Figure 4-12 show potentially active faults near the City of Aurora and in all of Colorado, respectively. According to the Colorado Geological Survey, more than 700 earthquake tremors of magnitude 2.5 or higher have been recorded in Colorado since 1867. This is considered relatively infrequent for a western state. While most of the faults are located within the Rocky Mountain Range, most of the population is located along the Front Range. Therefore, relatively minor earthquakes on the Front Range could cause the most damage.

Figure 4-12 Potentially Active Faults in Colorado



Source: State of Colorado Natural Hazard Mitigation Plan, 2018

Faults have been classified based on the geologic time frame of their latest suspected movement (in order of activity occurrence, most recent is listed first):

- H—Holocene (within past 15,000 years)
- LQ—Late Quaternary (15,000 to 130,000 years)
- MLQ—Middle to Late Quaternary (130,000 to 750,000 years)
- Q—Quaternary (approximately past 2 million years)
- LC—Late Cenozoic (approximately past 23.7 million years)

Although recorded earthquake events are well documented throughout the Denver Metropolitan Area, no named faults are located east of the foothills within the Denver Metropolitan Area or the City of Aurora. However, when earthquakes occur, they are very often felt across large geographic areas, with impacts and potential damage possible miles away from the epicenter.

4.5.4 Magnitude and Severity

The magnitude and severity rating for earthquake is **limited**.

Research based on Colorado's earthquake history suggests that an earthquake of 6.3 or larger has a one percent probability of occurring each year somewhere in Colorado (Charlie, Doehring, Oaks Colorado Earthquake Hazard Reduction Program Open File Report 93-01 1993). At least two published articles or

abstracts (Bott, JDJ and Wong, JG 1996; Evans, D.M. 1966b) referenced by the CGS propose that a magnitude 6.0 earthquake is possible on an unnamed minor fault that passes under the Rocky Mountain Arsenal. Such an earthquake would be estimated to cause more than $10 billion damage in the Denver Metro area.

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, communication, and transportation lines. Damage and life loss can be particularly devastating in communities where buildings were not designed to withstand seismic forces (e.g., historic structures). Other damage-causing effects of earthquakes include surface rupture, fissuring, settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, liquefaction, fires, dam failure, and hazardous materials incidents.

The severity of an earthquake can be expressed in terms of intensity or magnitude. Magnitude is related to the amount of seismic energy released at the hypocenter of an earthquake. It is calculated based on the amplitude of the earthquake waves recorded on instruments. Whereas intensity varies depending on location with respect to the earthquake epicenter, magnitude is represented by a single, instrumentally measured value for each earthquake event. Earthquakes are typically classified in one of two ways: by the amount of energy released, measured as magnitude; or by the impact on people and structures, measured as intensity.

Currently the most commonly used magnitude scale is the moment magnitude (Mw) scale, with the following classifications of magnitude:

- Great—Mw > 8
- Major—Mw = 7.0 - 7.9
- Strong—Mw = 6.0 - 6.9
- Moderate—Mw = 5.0 - 5.9
- Light—Mw = 4.0 - 4.9
- Minor—Mw = 3.0 - 3.9
- Micro—Mw < 3

Currently the most commonly used intensity scale is the modified Mercalli (MM) intensity scale, with ratings defined below in Figure 4-13.

Figure 4-13 Modified Mercalli (MM) Intensity Scale

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS

Estimates of Mw scale roughly match the local magnitude scale (ML) commonly called the Richter scale. One advantage of the Mw scale is that, unlike other magnitude scales, it does not saturate at the upper end. That is, there is no value beyond which all large earthquakes have about the same magnitude. For this reason, Mw scale is now the most often used estimate of large earthquake magnitudes.

In simplistic terms, the severity of an earthquake event can be measured in the following terms:

- How hard did the ground shake?
- How did the ground move? (horizontally or vertically)
- How stable was the soil? What is the fragility of the built environment in the area of impact?

According to the information in this hazard profile, a large earthquake's impact on the city would be relatively minimal.

4.5.5 Probability of Future Occurrences

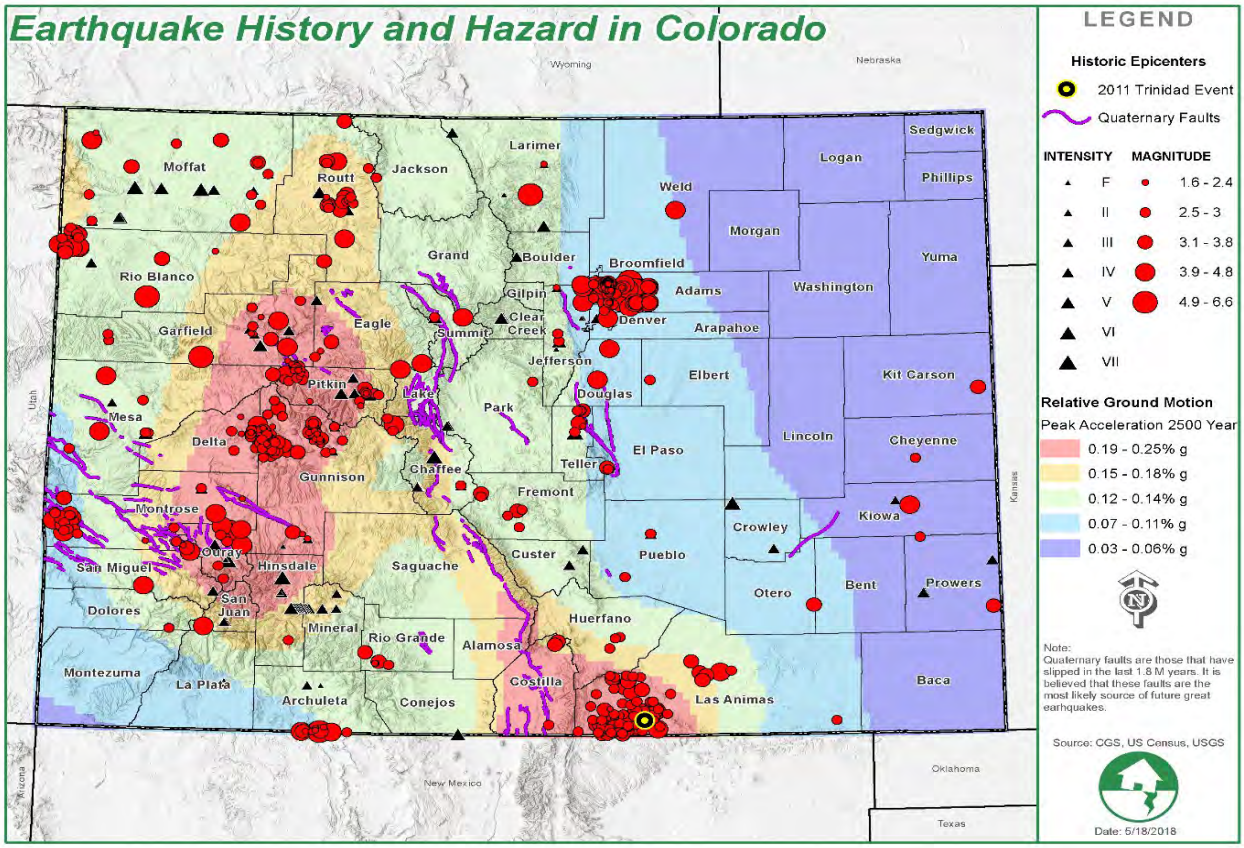
The probability rating for earthquake is **occasional** based on the 2% probability of exceedance in 50 years.

According to the Colorado Geological Survey, it is not possible to accurately estimate the timing or location of future dangerous earthquakes in Colorado because the occurrence of earthquakes is relatively infrequent in the state, and the historical earthquake record is relatively short (only about 145 years). It is prudent to expect future earthquakes as large as magnitude 6.6, the largest historical event in Colorado. Studies indicate earthquakes as large as 7.25 could occur within the state, but scientists are unable to accurately predict when and where it will occur (Source: Colorado Earthquake Hazards – Colorado Earthquake Mitigation Council 2008.)

National seismic hazard zone maps indicate the probability of earthquakes in the United States, based on analyses of faults, soils, topography, and past events. Figure 4-14 is a probabilistic seismic hazard map of Colorado that depicts

the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed for a particle at ground level that is moving horizontally because of an earthquake). Figure 4-14 represents the 2,500-year probability ground motion, which is more of a worst-case scenario, and depicts the shaking level that has a 2 percent chance of being exceeded over a period of 50 years. In this scenario, the City of Aurora lies in the range of 7 to 11 percent g. (Note that the map legend incorrectly shows this as 0.07-0.11%.) Ground motions become structurally damaging when average peak accelerations reach 10 to 15 percent of gravity, average peak velocities reach 8 to 12 centimeters per second, and when the Modified Mercalli Intensity Scale is about VII (18-34 percent peak ground acceleration), which is considered to be very strong (general alarm; walls crack; plaster falls).

Figure 4-14 Colorado Seismic Hazard Map – 2% Probability of Exceedance in 50 Years



Source: Colorado State Hazard Mitigation Plan 2018

4.5.6 Climate Change Considerations

The impacts of global climate change on earthquake intensity and probability are largely unknown but there is not expected to be a direct correlation.

4.5.7 Vulnerability

Earthquake vulnerability data was generated using a Level 1 HAZUS-MH analysis. Once the location and size of a hypothetical earthquake are identified, HAZUS-MH estimates the intensity of the ground shaking, the number of buildings damaged, the damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated costs of repair and clean up.

Population

The entire population of the City of Aurora is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of residential structures, the soil type under residences, their proximity to fault location, and other factors. Whether impacted directly or indirectly, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

Three population groups are particularly vulnerable to earthquake hazards:

- Linguistically Isolated Populations——According to the US Census Bureau, approximately 14.2 percent of the planning area population speaks English less than "very well". Problems arise when there is an urgent need to inform non-English speaking residents of an earthquake event. They are vulnerable because of difficulties in understanding hazard-related information from predominantly English-speaking media and government agencies.
- Population Below Poverty Level—The percent of individuals below the poverty line was 10.7% of Aurora's total population as of 2019. These families may lack the financial resources to improve their homes to prevent or mitigate earthquake damage. Poorer residents are also less likely to have insurance to compensate for losses in earthquakes.
- Population Over 65 Years Old—Approximately 11 percent of the residents in the planning area are over 65 years old. This population group is vulnerable because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly residents also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations.

Impacts on persons and households in the planning area were estimated for the M7 2,500-year probabilistic earthquake event through the Level 1 HAZUS-MH analysis. Under this scenario, HAZUS estimates that 427 households in Aurora would be displaced and 299 individuals would be in need of short-term shelter. Further estimates on casualties from the scenario can be found in Table 4-32.

Property

The HAZUS analysis estimates that there are 94,000 buildings in the planning area, with a total replacement value of $29.8 billion. Because all structures in the planning area are susceptible to earthquake impacts to varying degrees, this total represents the countywide property exposure to seismic events. Most of the buildings (93%) and most of the associated building value (84%) are residential.

Property losses were estimated through the Level 1 HAZUS-MH analysis for a 2,500-year probabilistic earthquake. The figure below is an excerpt from the HAZUS global summary report and shows the results for two types of building loss:

- Direct building losses, representing damage to building structures.
- Business interruption losses.

For the 2,500-year probabilistic earthquake scenario the estimated damage potential is $552.6 million.

Figure 4-15 HAZUS Building Related Economic Loss Estimates for 2,500 Year Scenario

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.8297	13.9430	0.4062	0.8373	16.0162
	Capital-Related	0.0000	0.3529	12.9863	0.2398	0.1806	13.7596
	Rental	6.0886	6.2657	8.9516	0.1624	0.3342	21.8025
	Relocation	21.5615	5.5372	12.8528	1.0436	2.7906	43.7857
	Subtotal	**27.6501**	**12.9855**	**48.7337**	**1.8520**	**4.1427**	**95.3640**
Capital Stock Losses							
	Structural	34.4953	11.8683	16.3821	2.4085	2.7973	67.9515
	Non_Structural	138.9155	72.8267	43.3724	8.1685	8.4236	271.7067
	Content	57.2251	21.7099	26.2329	5.3679	5.2587	115.7945
	Inventory	0.0000	0.0000	0.7438	0.9979	0.0456	1.7873
	Subtotal	**230.6359**	**106.4049**	**86.7312**	**16.9428**	**16.5252**	**457.2400**
	Total	**258.29**	**119.39**	**135.46**	**18.79**	**20.67**	**552.60**

Source: HAZUS-MH Global Summary Report, Wood analysis; values shown are in millions of dollars.

The HAZUS-MH analysis also estimated the amount of earthquake-caused debris in the planning area for the 2,500-year probabilistic earthquake scenario to be approximately 135,000 tons.

Critical Facilities and Infrastructure

All critical facilities and infrastructure in the planning area are exposed to the earthquake hazard. Facilities holding hazardous materials are of particular concern because of possible isolation of neighborhoods surrounding them. During an earthquake, structures storing these materials could rupture and leak into the surrounding area or an adjacent waterway, having a disastrous effect on the environment. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

Earthquakes can also affect power infrastructure and compromise power poles. Earthen dams and levees are potentially susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes, though the level of expected maximum ground shaking for the region makes this potential very low.

HAZUS-MH classifies the vulnerability of critical facilities and infrastructure to earthquake damage in two categories: at least moderate damage or complete damage. The analysis did not indicate any damages in these categories to specific facilities. The model also estimates lifeline damages to linear networks such as transportation and utilities. Damage to transportation systems is estimated at $1 million and utility lifelines at $105.7 million.

Government Services

Damage impacts to transportation corridors and communications lines could affect first responders' ability to effectively respond in the aftermath of an earthquake. Damage to government facilities/personnel in incident area may require temporary relocation of some operations. Regulatory waivers may be needed locally. The public may question local government's ability to respond and recover if planning, response, and recovery are not timely and effective. A significant earthquake may require disaster declarations and aid programs. These needs may impact funding or administrative resources for other regular operations or may necessitate changes to existing operating procedures.

Economy

HAZUS-MH models total economic losses that includes building and lifeline related losses previously described.

Table 4-32 HAZUS-MH Earthquake Loss Estimation 2,500-Year Scenario Results

Type of Impact	Impacts to City
Total Buildings Damaged	Slight: 10,020 Moderate: 3,867 Extensive: 645 Complete: 32
Building and Income Related Losses	$552.6 million 68% of damage related to residential structures 17% of loss due to business interruption
Total Economic Losses (includes building, income, and lifeline losses)	$659.3 Million Building: $552.6 Million Income: $95.4 Million Transportation/Utility: $106.7 Million
Casualties (based on 2 a.m. time of occurrence)	Without requiring hospitalization: 81 Requiring hospitalization: 10 Life threatening: 1 Fatalities: 1
Casualties (based on 2 p.m. time of occurrence)	Without requiring hospitalization: 130 Requiring hospitalization: 18 Life threatening: 2 Fatalities: 3
Casualties (based on 5 p.m. time of occurrence)	Without requiring hospitalization: 95 Requiring hospitalization: 13 Life threatening: 1 Fatalities: 2
Damage to Transportation and Utility Systems and essential facilities	No transportation or pipeline damage, no damage to essential facilities
Fire Following Earthquake	1 Ignition 0.02 sq. miles burnt
Debris Generation	135,000 tons of debris generated 5,400 truckloads
Displaced Households	427
Shelter Requirements	299

Source: HAZUS-MH 4.2

Historic, Cultural, and Natural Resources

Natural resource impacts are anticipated to be minor. Older structures may be more susceptible to earthquake damage.

4.5.8 Development Trends

Land use in the planning area will be directed by master plans adopted by the City of Aurora as well as local permitting departments and zoning maps. The information in this plan provides the City of Aurora with a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The International Building Code also establishes provisions to address seismic risk. Since the potential risk to earthquake is generally low, there is not anticipated to be much change in exposure to seismic hazards.

4.5.9 Risk Summary

- The overall significance of this hazard to the City is Low.
- Colorado has much lower seismic activity compared to other Western states.
- Earthquakes in Colorado have historically been generally low in magnitude and/or intensity.
- Significant damages could still result to building stock, utility lifelines, and critically infrastructure from a moderate sized event, according to HAZUS-MH modeling.
- Level 1 HAZUS-MH analysis for a 2,500-year probabilistic M7 for the planning area resulted in an estimated $552.6 million in losses, 427 displaced households, up to 153 casualties, and 135,000 tons of debris generated.
- Information regarding liquefaction susceptibility of soils in the planning area is lacking.

4.6 Erosion and Deposition, Expansive Soil, and Subsidence

Hazard	Geographic Extent	Potential of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Erosion and Deposition	Significant	Likely	Critical	Low
Expansive Soil	Extensive	Likely	Limited	Low
Subsidence	Limited	Occasional	Limited	Low

4.6.1 Description

Erosion and Deposition

The CGS defines erosion as the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice. Deposition is defined as the placing of eroded material in a new location. All material that is eroded is later deposited in another location. Both erosion and deposition are continually occurring phenomenon, although the rate of erosion and deposition varies tremendously and can be affected by a variety of factors including rate of scour, type of material being eroded, and the presence or absence of vegetation.

DEFINITIONS

Soil Erosion— Soil erosion is the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice.

Deposition— Deposition is the placing of eroded material in a new location.

Expansive Soil – Expansive or swelling soils are made up of layers of clay and can expand up to 20% by volume when exposed to water causing more property damage than any other natural hazard.

Ground Subsidence— Ground subsidence is the sinking of land over human-caused or natural underground voids and the settlement of native low-density soils.

Expansive Soil

Expansive and collapsible soils are some of the most widely distributed and costly geologic hazards. Collapsible soils are a group of soils that can rapidly settle or collapse the ground. They are also known as metastable soils and are unsaturated soils that undergo changes in volume and settlement in response to wetting and drying, often resulting in severe damage to structures. The sudden and usually large volume change could cause considerable structural damage.

Expansive soil and rock are characterized by clayey material that shrinks as it dries or swells as it becomes wet. In addition, trees and shrubs placed closely to a structure can lead to soil drying and subsequent shrinkage. The parent (source) rock most associated with expansive soils is shale. Figure 4-17 shows expansive soil distribution in Aurora.

Subsidence and Sinkholes

Ground subsidence is the sinking of land over human caused or natural underground voids and the settlement of native low-density soils). The Colorado Geological Survey defines land subsidence as the sinking of the land over manmade or natural underground voids. Subsidence can occur gradually over time or virtually instantaneously. Subsidence can occur gradually over time or virtually instantaneously. There are many different types of subsidence; however, in Colorado, there are three types of subsidence that warrant the most concern: settlement related to collapsing soils, sinkholes in karst areas, and the ground subsidence over abandoned mine workings.

Collapsible Soils

Collapsible soils consist of loose, dry, low-density materials that collapse and compact under the addition of water or excessive loading. Soil collapse occurs when the land surface is saturated at depths greater

than those reached by typical rain events. This saturation eliminates the clay bonds holding the soil grains together. Similar to expansive soils, collapsible soils result in structural damage such as cracking of the foundation, floors, and walls in response to settlement.

Collapsible soils are a group of soils that can rapidly settle or collapse the ground. The most common type of collapsible soil is hydrocompactive soil. According to the CGS, hydrocompactive soils form in semi-arid to arid climates in the western U.S. and large parts of Colorado in specific depositional environments. These soils are low in density and in moisture content and are loosely packed together. Agents that bind these loosely packed particles together, such as clay and silk buttresses, are water sensitive. When water is introduced to these soils, the binding agents may quickly break down, soften, disperse, or dissolve.

This results in a reorganization of the soil particles in a denser arrangement, which in turn results in a net volume loss indicated by resettlement or subsidence at the surface. Volume loss can be between 10 to 15 percent, which can result in several feet of surface-level displacement.

Abandoned Mine Workings

There are no mapped mine areas in the City of Aurora and given the location of the city on the plains of Colorado, it is unlikely that there are additional hazard areas for which no records exist.

4.6.2 Past Events

Erosion and Deposition

Soil erosion and deposition are ongoing events that can be affected by both natural and human-induced processes. Soil erosion and deposition events are continually occurring throughout the City of Aurora, particularly localized stream bank erosion. Specific erosion and deposition events are not tracked; therefore, past events are difficult to identify and measure.

Expansive Soil

Although expansive soils events have likely occurred in the City of Aurora, a lack of recorded data make their impacts difficult to identify and measure.

Subsidence and Sinkholes

The occurrence of subsidence is an on-going process resulting from natural and human-induced causes. There is no known database of subsidence and sinkhole events that have occurred within the City of Aurora; however, the CGS has undergone mapping studies to identify existing sinkholes and areas that are prone to subsidence events. One reported sinkhole event in the City of Aurora occurred on May 29, 2014 and was directly related to a water line break.

On June 29, 2018 a sinkhole swallowed a car with one person in it on near East Mississippi Ave and South Tower Road, as shown in Figure 4-16. The person was rescued by Aurora Fire Rescue and was fine. Aurora Water stated there was a pressure surge that caused a few water line breaks.

Another smaller sinkhole caused northbound Tower Road and East 19th Avenue to be closed for repairs on July 27, 2018. The sinkhole was 3-by-5 feet and four feet deep, and the cause was unclear (9News, 2018).

There have been no other reports of naturally occurring sinkholes in the City.

Figure 4-16 Car Stuck in a Sinkhole Caused by a Water Line Break in June of 2018

Source: Aurora Fire Rescue

4.6.3 Location

Erosion and Deposition

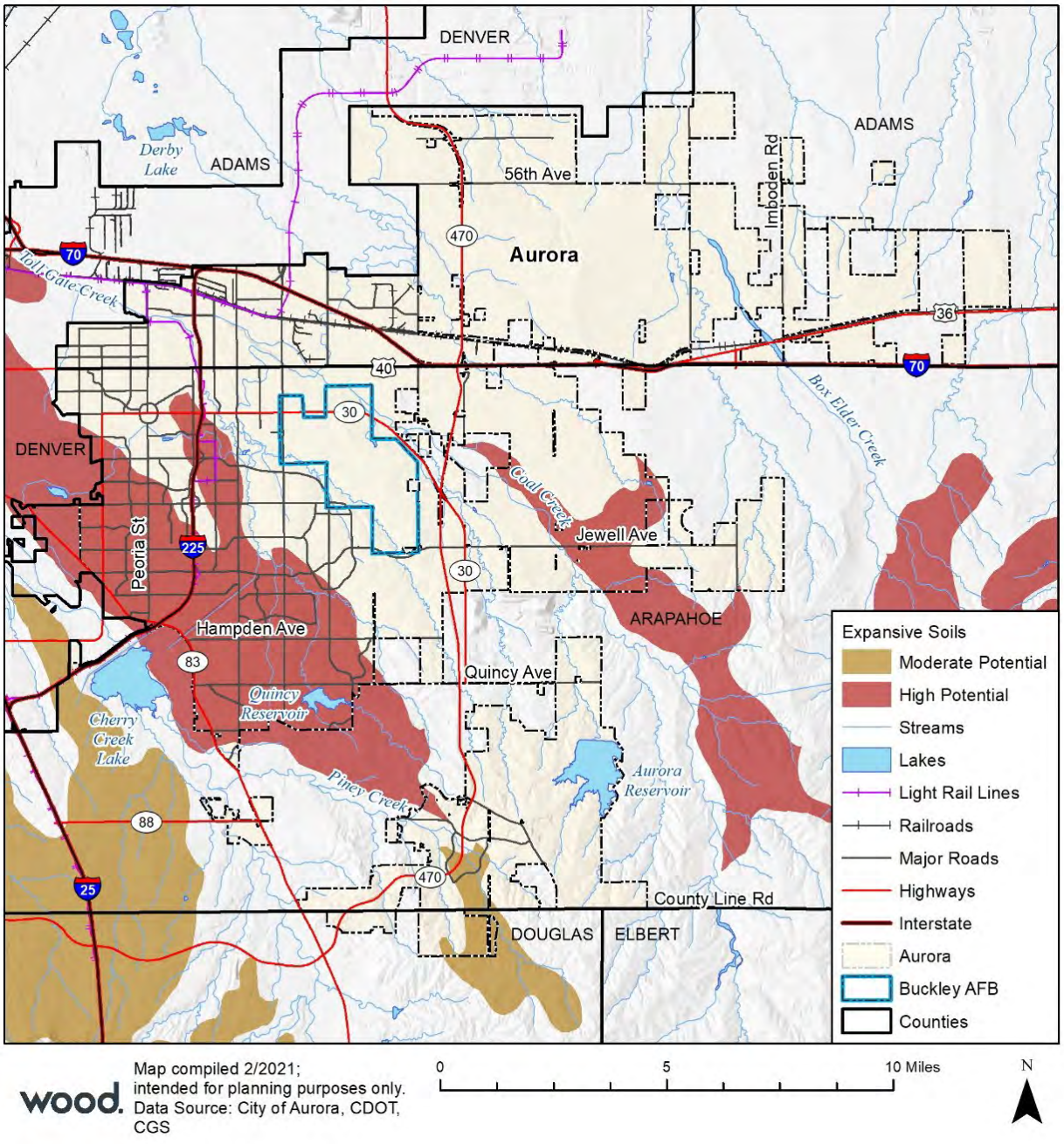
Soil erosion and deposition occur in all parts of the city. Point sources of erosion often occur in areas where humans interact with exposed areas of the earth's surface, such as construction sites. Waterways are continually involved in erosion and deposition processes. Soil erosion and deposition in the City of Aurora primarily occurs through human-induced processes and along streams. Soil erosion may result in the loss of property near streams and waterways. Soil deposition may impact the city's reservoirs, increasing maintenance frequency and cost.

Erosion and deposition may be exacerbated in areas where wildfires have occurred. According to the 2013 State of Colorado Natural Hazards Mitigation Plan, "there is a high risk for erosion in the aftermath of a wildfire event. As a fire burns, it destroys plant material and the layers of litter that blanket the floor of an ecosystem. These materials, as well as trees, grasses, and shrubs, buffer and stabilize the soil from intense rainstorms. The plant materials slow runoff to give rainwater time to percolate into the ground. When fire destroys this protective layer, rain and wind wash over the unprotected soil and erosion occurs" (Colorado Division of Emergency Management 2013).

Expansive Soil

Distribution of moderate and high potential for expansive soils is shown in Figure 4-17. Colorado is home to expansive soil, particularly bentonite. The leading cause of foundation damage in this type of soil is uneven moisture. Drying soil can shift and crack foundation as it shrinks. When moisture is applied the resulting swelling can crumble foundations.

Figure 4-17 Expansive Soils in the City of Aurora



4.6.4 Magnitude and Severity

The City of Aurora's soils are mostly underlain by soils with less than 50 percent of clays with high swelling potential (Figure 4-17). Therefore, the city is exposed to risks from expansive soil. Expanding soils can cause structural damage.

Subsidence and sinkholes occur infrequently in the City of Aurora, most often as a result of a water line break. Soil erosion and deposition are occurring continuously throughout the city, primarily through human-induced processes and along streams and waterways. Large precipitation events as well as human activity may influence the frequency of these events within the city.

The severity of subsidence and sinkholes, as well as soil erosion and deposition, is largely related to the extent and location of areas that are impacted. Such events can cause property damage and, in extreme events, loss of life; however, there is typically little to no impact to people or property.

According to the CGS, "In general, the type and severity of surface subsidence is governed by the amount of ground surface and the location of removal or compression, and the geological conditions of a particular site" (CGS 2014). The only reported sinkhole event in the City of Aurora occurred on May 29, 2014 and was directly related to a water line break. There have been no reports of naturally occurring sinkholes in the city.

4.6.5 Probability of Future Occurrence

Expansive soils and erosion will continue to occur and have significant reach throughout Aurora, albeit the impacts will be minimal due to building standards and modern mitigation.

Based on past events of three sinkholes in the last 7 years, one in 2014 and two in 2018, there is a chance for subsidence about every other year.

4.6.6 Climate Change Considerations

Changes in precipitation events and the hydrological cycle may result in changes in the rate of subsidence and soil erosion. Additionally, the future impacts of climate change are expected to influence future erosion and deposition events through changes to the frequency and intensity of wildfires.

4.6.7 Vulnerability

People

The risk of injury or fatalities because of these hazards are limited, but possible. Spontaneous collapse and opening of voids are rare, but still may occur resulting in death or injury to any people in the area at the time. It is likely that any such injuries would be highly localized to the area directly impacted by an event. Erosion can adversely impact populations who have respiratory issues by reducing air quality, so those with existing respiratory issues are likely to be more vulnerable.

Residents of the City of Aurora living or travelling in areas prone to subsidence and erosion are exposed to the hazard. Population exposure estimates are unavailable; however, most known hazard areas are outside of the city's incorporated areas to the west beginning at the foothills. Residents who live along streams or waterways may be exposed to soil erosion and deposition.

Property

Property exposed to subsidence and erosion can sustain minor damage or can result in complete destruction. According to CGS, merely an inch of differential subsidence beneath a residential structure can cause several thousand dollars of damage. Structures may be condemned because of this damage resulting in large losses. FEMA estimates that there are over $125 million in losses in the U.S. annually because of subsidence. Structures exposed to erosion hazard areas may be undermined, resulting in damages. This may also result in the condemnation of a structure. Additionally, physical loss land area may occur because of erosion.

There are over 52,000 buildings potentially exposed to high expansive soil risk in Aurora (Table 4-36). Of those, over 50,000 parcels are residential, with over 2,000 being commercial (Table 2).

Structures and other improvements located in areas prone to subsidence or soil erosion are exposed to risk from these hazards, particularly structures located along streams and other waterways. There are mapped fluvial hazard zones (FHZ) along nine miles of Sand Creek (Figure 4-18). Additionally, deposition may result in damage to structures and property. The City of Aurora provided FHZ GIS data as shown in the

online story map by Watershed Science and Design and Round River Design (https://storymaps.arcgis.com/stories/0892249499894dc19a8726c4145ddaf9). There are only two parcels within the Active Stream Corridor (ASC) (Table 4-33), but there are 45 parcels and 42 buildings in the Fluvial Hazard Buffer (FHB) around the ASC, which includes hillslopes and terraces that may be susceptible to failure and erosion Table 4-34).

Table 4-33 Property Risk in Sand Creek Fluvial Active Stream Corridor (ASC).

Property Type	Improved Parcels	Building	Total Value
Exempt	2	1	$275,070
Total	**2**	**1**	**$275,070**

Source: City of Aurora, Colorado Department of Transportation, Colorado Geological Survey

Table 4-34. Property Risk in Sand Creek Fluvial Hazard Buffer (FHB)

Property Type	Improved Parcels	Building	Total Value
Agriculture	6	6	$1,333,140
Commercial	7	7	$1,482,854
Exempt	17	14	$8,563,426
Residential	15	15	$3,942,615
Total	**45**	**42**	**$15,322,035**

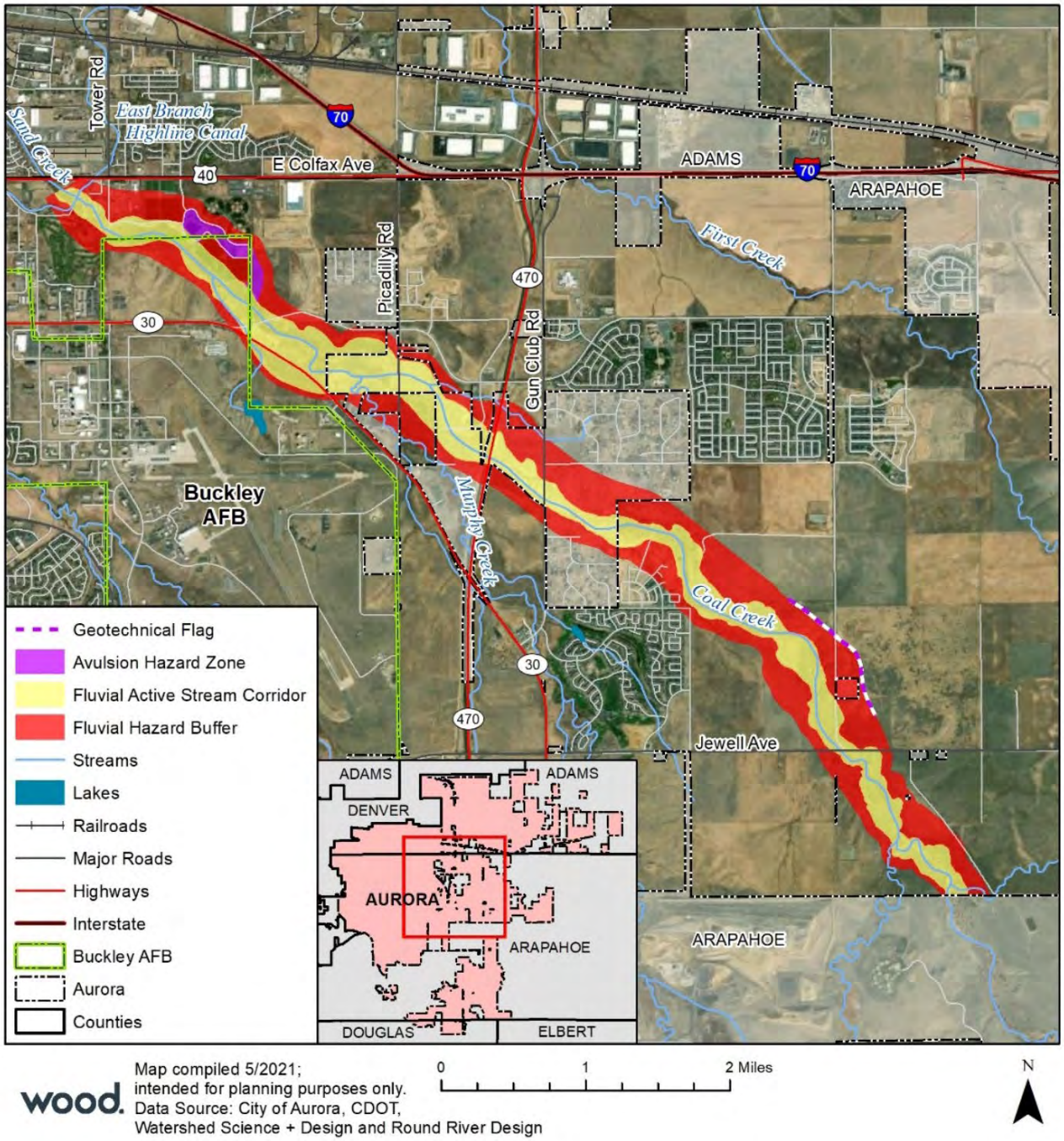
Source: City of Aurora, Colorado Department of Transportation, Colorado Geological Survey

Table 4-35. High Expansive Soil Risk

Property Type	Improved Parcels	Buildings
Agriculture	3	6
Commercial	814	2,196
Exempt	168	321
Residential	48,895	50,314
Vacant Land	6	6
Total	**49,886**	**52,843**

Source: City of Aurora, Colorado Department of Transportation, Colorado Geological Survey

Figure 4-18 City of Aurora Fluvial Hazards



Critical Facilities and Infrastructure

Any critical facilities or infrastructure that are located on or near areas prone to subsidence or soil erosion are exposed to risk from the hazard; particularly facilities located along streams and other waterways. Deposition may result in additional exposure to facilities and infrastructure, including dams, bridges, and roads.

Subsidence can result in structural damage to critical facilities and infrastructure such as roads, irrigation ditches, underground utilities, and pipelines. Minor cracking and distress may result as the improvements respond to small adjustments in the ground beneath them.

Sinkholes cause structural damage to infrastructure such as roads. Three sinkholes in roads in the last seven years have damaged vehicles in the City of Aurora, caused traffic interruptions, and required road repairs. Traffic can be slowed and detoured by more frequent or larger sinkholes occurring in streets.

Erosion can also impact structures such as bridges and roads by undermining their foundations. The shifting and settling of the structure can be seen in several ways:

- Settlement, cracking and tilting of concrete slabs and foundations,
- Displacement and cracking in door jams, window frames, and interior walls, or
- Offset cracking and separation in rigid walls such as brick, cinderblock, and mortared rock (CGS 2001).

A total of 517 critical facilities are exposed to high expansive soil risk with a majority of those, 247, belonging to the Communications FEMA Lifeline (Table 4-37).

Table 4-36 Expansive Soil Risk Summary

Expansive Soil Risk	Improved Parcels	Buildings
High	49,886	52,843
Moderate	1,869	1,900

Source: City of Aurora, Colorado Department of Transportation, Colorado Geological Survey

Table 4-37. Critical Facilities by Expansive Soil Exposure and Facility Type

Expansive Soil Risk	FEMA Lifeline	Critical Facility Type	Count
High	Communications	Land Mobile Towers	124
		Microwave Towers	118
		Paging Towers	5
	Energy	Electric Substation	3
	Food, Water, Shelter	Religious Institution	38
		EO Emergency Shelters	28
		Library	2
	Hazardous Materials	RMP	2
		Tier II	17
	Health and Medical	Adult Day Care Facility	13
		Assisted Living/Nursing Home	36
		Clinic/Medical Facility	17
		Disability Care	3
		EMS Station	1

Expansive Soil Risk	FEMA Lifeline	Critical Facility Type	Count
		Hospital	2
		Mental Health Facility	1
	Safety and Security	Child Care Center	19
		Colleges/Universities	5
		Fire Station	6
		Government Facility	3
		Police	4
		School	55
	Transportation	Bridge - Good Condition	9
		Bridge - Fair Condition	30
		Bridge - Poor Condition	1
		Light Rail Station	3
		Total	**517**
Moderate	Communications	Land Mobile Towers	1
	Hazardous Materials	Tier II	1
	Transportation	Bridge	1
		Total	**3**

Source: City of Aurora, Colorado Department of Transportation, Colorado Geological Survey

Government Services

Geologic hazards, including erosion/deposition, subsidence, and expansive soils may require aid programs, water restrictions, and/or fire restrictions. These needs may impact funding or administrative resources for other regular operations or may necessitate changes to existing operating procedures.

Impact to first responders from geologic hazards is likely to be minimal. A couple of exceptions would be if a flood conditions cause massive erosion/deposition, or a subsidence occurs in a heavily trafficked corridor. Responders may receive increased calls during extended periods of flooding or subsidence in trafficked corridor.

Public confidence may be affected because of the expansive soil response process. If a large area is experiencing expansive soil causing structural damage, such as aiding in structural repair.

Economy

Economic impact will be largely associated with traffic and residential areas. Extensive, but short-term economic impacts could result from the 50,314 residential parcels exposed to high potential expansive soil. Agriculture, while not a major industry in the City of Aurora, can also be impacted by erosion and deposition as it changes the topsoil content.

Historic, Cultural and Natural Resources

Erosion, deposition, expansive soils, and subsidence are all normal ecosystem processes. Ecosystems that are exposed to increased sedimentation because of erosion and deposition have degraded habitat. However, some erosion and deposition are required for healthful ecosystem functioning. Ecosystems that are already exposed to other pressures, such as encroaching development, may be more vulnerable to impacts from erosion hazards.

4.6.8 Development Trends

Development continues in areas south of Denver International Airport and on Aurora's eastern plains. The Mile High Flood District has begun mapping the Sand Creek Fluvial Hazards where deposition is likely to occur outside of flood plains, including the FHB around the ASC. Buildings in these areas are built to modern standards, but erosion hazards should be considered in site evaluations.

Increasing population, critical facilities and future growth create an increase in demand for services. Natural hazards can impact the need for these services. However, providing services and having funding to meet those needs can be challenging.

4.6.9 Risk Summary

- The overall significance of this hazard to the City is Low.
- Onset of actual or observed subsidence in many cases is related to changes in land use. Land uses permitted in known hazard areas should be carefully evaluated, but mapping of hazard areas is lacking.
- Human activities that affect waterways and sediment movement greatly influence the rate and extent of erosion and deposition.
- Fluvial Hazard Zones have been mapped along Sand Creek providing the ASC and FHB, where hillslopes and terraces are prone to erosion or failure. This FHZ analysis will be continued with other creeks in the City of Aurora, including Box Elder Creek, Second Creek, and Cherry Creek upstream of the dam.
- Erosion and deposition are likely to occur outside flood plains along Sand Creek in the FHB, where development will likely increase in eastern plains of Aurora.
- More detailed analysis should be conducted for critical facilities and infrastructure exposed to hazard areas. This analysis should address facility design and construction for structural mitigation.
- Two sinkhole events occurred on roadways in 2018 in Aurora, causing one car accident, but no injuries.

4.7 Flood

Hazard	Geographic Extent	Potential of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Flood	Significant	Likely	Limited	Medium

4.7.1 Description

Flood

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from:

- The overflow of stream banks
- The unusual and rapid accumulation of runoff of surface waters from any source, or
- Mudflows or the sudden collapse of shoreline land

Flooding results when the flow of water is greater than the normal carrying capacity of the stream channel. Rate of rise, magnitude (or peak discharge), duration, and frequency of floods are a function of specific physiographic characteristics. Generally, the rise in water surface elevation is quite rapid on small (and steep-gradient) streams and slow in large (and flat-sloped) streams.

DEFINITIONS

Flood—The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Floodplain—The land area along the sides of a river that becomes inundated with water during a flood.

100-Year Floodplain—The area flooded by a flood that has a 1-percent chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1-percent annual chance flood is the standard used by most federal and state agencies.

Special Flood Hazard Area (SFHA)— Defined areas identified on Flood Insurance Rate Maps, that will be inundated by the 1% annual chance flood.

Riparian Zone—The area along the banks of a natural watercourse.

Flash Flood— A rapid and extreme flow of high water into a normally dry area or rapid rise in a stream or creek above a predetermined flood level beginning within 6 hours of the causative events (NWS, FEMA).

The causes of floods relate directly to the accumulation of water from precipitation, rapid snowmelt, or the failure of manmade structures, such as dams or levees. Floods caused by precipitation are further classified as coming from: rain in a general storm system, rain in a localized intense thunderstorm, melting snow, rain on melting snow, and ice jams. Floods may also be caused by structural or hydrologic failures of dams or levees. A hydrologic failure occurs when the volume of water behind the dam or levee exceeds the structure's capacity resulting in overtopping. Structural failure arises when the physical stability of the dam or levee is compromised due to age, poor construction and maintenance, seismic activity, rodent tunneling, or myriad other causes. For more information on floods resulting from dam and levee failure refer to Section 4.3 of this Chapter.

Thunderstorm Floods

Damaging thunderstorm floods are caused by intense rain over basins of relatively small area. They are characterized by a sudden rise in stream level, short duration, and a relatively small volume of runoff. Because there is little or no warning time, the term "flash flood" is often used to describe thunderstorm floods. The average number of thunderstorm days per year in Colorado varies from less than 40 near the western boundary to over 70 in the mountains along the Front Range. The thunderstorm flood season in Colorado is typically from the middle of July through October.

Floodplain

A floodplain is the area adjacent to a river, creek, or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

4.7.2 Past Events

In the past, the City of Aurora experienced significant seasonal floods along Cherry Creek; however, these floods have been greatly reduced by the construction of Cherry Creek Reservoir. Additionally, development of the area with stormwater infrastructure has also helped to reduce the impacts of seasonal floods in the planning area.

Flooding in the city is now predominantly the result of cloudbursts or prolonged, significant rainfall that result in localized flooding that overwhelms stormwater infrastructure. The greatest threat is along streams after very large or intense storms where streams can come out of their banks and into developed areas. This occurred in 2013 where a 500-year storm resulted in significant localized flooding.

The National Center for Environmental Information (NCEI) Storm Events Database includes flood events that occurred in the City of Aurora between 1997 and 2020, as listed in Table 4-38. Note NCEI does not have records of damaging flood events occurring in the City of Aurora after 2015.

Table 4-38 City of Aurora Flood Events (1997 – 2020)

Location	Date	Event Type	Property Damage	Crop Damage
Buckley FLD NAS	7/27/1997	Flash Flood	$0	$0
Buckley FLD NAS	7/29/1997	Flash Flood	$30,000	$0
City of Aurora	7/25/1998	Flash Flood	$0	$0
Buckley FLD NAS	8/19/1999	Flood	$0	$0
Aurora Cherry Creek	7/8/2001	Flash Flood	$0	$0
Aurora Cherry Creek	7/23/2004	Flash Flood	$0	$0
Aurora Cherry Creek	6/3/2005	Flash Flood	$0	$0
Buckley FLD NAS	7/2/2006	Flash Flood	$0	$0
Buckley Air Force Base	8/3/2013	Flash Flood	$5,000	$0
City of Aurora, Buckley AFB	9/11-14/ 2013	Flash Flood	$0	$0
Buckley Air Force Base	6/11/2015	Flood	$15,000	$0
		Total	**$50,000**	**$0**

Source: National Center for Environmental Information. *See below for discussion of impacts

Notable incidents from the Storm Events Database and the in the City of Aurora are described below:

- July 29-30, 1997 – Heavy rain caused flooding and flash flooding in portions of Adams and Arapahoe Counties. A portion of Quincy Road was closed in Arapahoe County when 4 feet of water covered the roadway. Property damage occurred when the basements of several homes flooded.
- August 8, 2013 – Heavy rain caused localized flash flooding in Aurora. An underground parking garage at an apartment complex was inundated with 3 to 4 feet of water. Flash flooding forced a road closure at East Mississippi Ave. and Alton St. Also, several people had to be rescued when three vehicles stalled in flood waters at Alameda Ave. and Havana St.
- September 11-14, 2013 – Colorado's Front Range experienced several days of major flooding and flash flooding. Localized rainfall rates in Aurora exceeded 3" per hour in some spots, causing numerous street closures. The Aurora Public Safety Communications Department received an additional 1,156 calls for assistance in the four-day period between September 11-14th over the same period the previous year. While the NCEI data referenced in Table 4-38 does not list any damages in Aurora, in reality the City sustained damage to a number of homes, businesses, and infrastructure and was included in the Presidential Major Disaster Declaration. In all, 2,690 Aurora residents received more than $3.3M in Individual Assistance funds from FEMA. The City also received over $5.3M in FEMA Public Assistance funds to repair damaged infrastructure.
- June 2015 – A flash flood warning was issued for Denver, Arapahoe, and Adams Counties (encompassing the City of Aurora) due to heavy rain and hail. Water was reportedly flowing over the roads at East 6th Ave. and South Picadilly Road. Additional flooding was reported on South Gun Club Road between East Alameda Ave. and East Exposition Avenue, forcing the closure of the road. No one was hurt in the event and it appeared that only several cars were damaged as a result of the flooding.

4.7.3 Location

The location rating is **Significant**.

The City of Aurora is within the Platte River watershed, and all streams in the City are tributaries of the South Platte River. The tributaries flow in a northwestern direction to meet with the South Platte River near downtown Denver. Significant tributary watersheds spanning the City of Aurora include: Cherry Creek, Toll Gate Creek, Piney Creek, Coal Creek, Sand Creek, First Creek, Second Creek and Box Elder Creek. These streams normally flow year round, although they may dry up during unusually dry years.

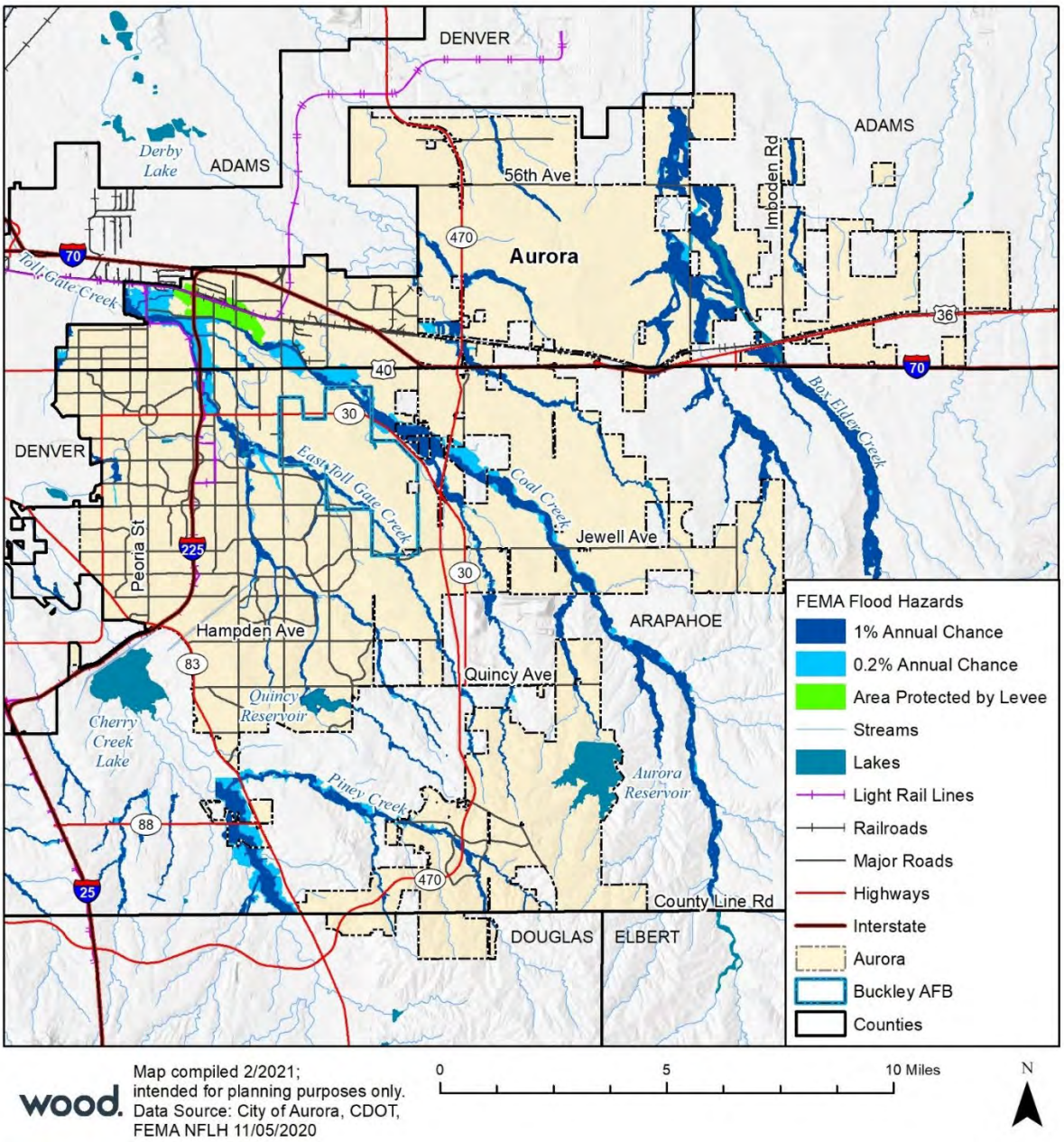
The 2018 State of Colorado Flood Hazard Mitigation Plan describes the South Platte River basin as follows:

> *Including the Republican River basin, the South Platte basin encompasses all or part of 23 counties over 27,660 square miles. Elevation in the basin ranges from 14,000 feet at the Continental Divide to 3,400 feet at the Colorado-Nebraska state line. The largest population centers in the basin are Denver with a population of about 634,265 people and Aurora with 339,030 people. The South Platte River is the major stream in the basin. The South Platte basin is expected to experience major strains on water use from population growth. Population growth could also potentially mean that more people will be at risk to flood. Some of the state's most devastating floods have occurred in the South Platte basin. In a 2006 report by the CWCB, historic flood damages for the basin were estimated to be $3.4 billion at the time of the study. Adding in damages from the 2013 and 2015 floods, both of which were primarily focused in the South Platte River Basin, would bring that total to over $6 billion.*

Figure 3-60 shows the Special Flood Hazard Areas (SFHAs) in the City of Aurora. The effective date for the current Flood Insurance Rate Map (FIRM) for the city is September 4, 2020. However, it is important

to keep in mind that thunderstorm flooding or flash flooding can occur anywhere in the City, not just in identified floodplains.

Figure 4-19 Special Flood Hazard Areas in the City of Aurora



4.7.4 Magnitude and Severity

The magnitude and severity rating is **Limited.**

Magnitude and severity can be described or evaluated in terms of a combination of the different levels of impact that a community sustains from a hazard event. Several factors contribute to the relative vulnerabilities of certain areas in the floodplain. Development, or the presence of people and property in the hazardous areas, is a critical factor in determining vulnerability to flooding. Additional factors that contribute to flood vulnerability range from specific characteristics of the floodplain to characteristics of

the structures located within the floodplain. The following is a brief discussion of some of these flood factors which pose risk.

- **Elevation**: The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage, due to the higher likelihood that it will come into contact with water for a prolonged amount of time.
- **Flood depth**: The greater the depth of flooding, the higher the potential for significant damages due to larger availability of flooding waters.
- **Flood duration:** The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage.
- **Velocity**: Flowing water exerts forces on the structural members of a building, increasing the likelihood of significant damage (e.g., such as scouring).
- **Construction type**: Certain types of construction and materials are more resistant to the effects of floodwaters than others. Typically, masonry buildings, constructed of brick or concrete blocks, are the most resistant to damages simply because masonry materials can be in contact with limited depths of flooding without sustaining significant damage. Wood frame structures are more susceptible to damage because the construction materials used are easily damaged when inundated with water.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

Based on the information in this hazard profile, the magnitude/severity of flooding is limited, even during a 500-year event, there is minor structural damage. Overall significance is considered medium: moderate potential impact.

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger. Flood warnings are issued by radio and television media, NOAA weather radio, public address systems, emergency sirens, or emergency personnel. Police and fire officials may be on hand to direct evacuations.

The NWS has issued general flood forecasting guidance for the region. Although it can be difficult to predict how much rain will result in a flood event on any given day, there are some general principles regarding when flood events are more likely to occur (NWS 2010):

- If 1 inch or more of rain falls in an urban area in 1 hour, a flood statement should be issued. In mountain areas, a flash flood warning may be necessary.
- If 2 or more inches of rain falls in an urban area in 1 hour, a flash flood warning should be issued.
- In rural areas on the plains, if rainfall reaches 2 inches in 1 hour, a flood statement should be issued and if rainfall reaches 3 inches in 1 hour, a flash flood warning should be issued.
- If precipitable water values exceed 150 percent of normal, this is a good indicator that flash flood-producing rains will develop if precipitation occurs.

4.7.5 Probability of Future Occurrences

The probability of future occurrences is **Likely**.

Riverine flooding in the City of Aurora has been decreasing through time due to the increased attention to floodplain and stormwater management issues. Flash floods, however, are still considered to be likely to occur. Floods are considered to be highly likely to recur, with nearly a 52-percent chance of occurrence in any given year. This probability is based on the 12 events occurring over the 23 years reported in the NCEI Storm Events Database.

4.7.6 Climate Change Considerations

Climate change has the potential to intensify rain events and storms in Colorado. According to the National Oceanic and Atmospheric Administration, there is generally more rain and snow falling in the Northern Hemisphere and precipitation has increased by about 5% over the last century. An increase in precipitation alone is not immediately alarming, but "factors such as precipitation intensity, soil moisture and snow conditions, and basin topography are also important in determining the occurrence and severity of flooding." As with temperature, it is the extremes that matter most with regard to rainfall. According to Robert Hanson, author of The Thinking Person's Guide to Climate Change, "Data shows a clear ramp up in precipitation intensity for the United States, Europe, and several other areas over the last century, especially since the 1970s. When it rains or snows in these places, it now tends to rain or snow harder, over periods ranging from a few hours to several days." The 1997 and 2013 flood events caused widespread infrastructural damage, social instabilities and changes along the waterways throughout Colorado.

These events can lead to increased infrastructure damage, injury, illness, and death. Additionally, warmer temperatures in the winters may cause increased precipitation to fall as rain instead of snow in mountain regions of Colorado. This may lead to elevated stream flows and increased flood risk across the state. As climate science and data evolves it will be important for the City of Aurora to address how our changing climate will affect how water moves through local streams and regional landscapes.

4.7.7 Vulnerability

Many of the areas exposed to flooding may not experience serious flooding or flood damage. This section describes vulnerabilities in terms of population, property, infrastructure, and environment.

People

Based on the GIS analysis performed, where the FEMA special flood hazard areas were overlaid with the City of Aurora parcel layer to obtain the number of vulnerable residential properties (i.e., those intersecting the hazard layer), the total at-risk population to this hazard was estimated. The total population exposed to flooding hazards was calculated by multiplying the average persons per household value by the total properties of residential nature found to intersect with the flood hazard layers. This assessment estimates that 265 people (0.1% of total population) reside within the 1% flood hazard area, while an additional 8,405 people reside in the 0.2% flood hazard area and 1,177 in areas protected by levee. Refer to Table 4-39 for more details.

Table 4-39 Flood Exposure Summary by Flood Type

Flood Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
1% Annual Chance	71	118	$87,115,310	$75,238,805	$162,354,115	$40,588,529	**265**
0.2% Annual Chance	1,169	3,047	$994,668,682	$636,923,790	$1,631,592,472	$407,898,118	**8,405**
Protected by Levee	439	458	$135,435,421	$98,916,654	$234,352,075	$58,588,019	**1,177**

Source: Wood Analysis with Assessor's Data

The impacts of flooding on vulnerable populations can be more severe. Families may have fewer financial resources to prepare for or recover from a flood, and they may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to evacuate, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods.

It should also be noted that historically most people killed or injured in floods in Aurora have been pedestrians or motorists in flooded streets, not necessarily people in flooded structures.

Property

A flood vulnerability assessment was performed for City of Aurora using GIS. The city's parcel layer and associated assessor's building improvement valuation data were provided by Arapahoe, Adams and Douglas counties and were used as the basis for the inventory. The latest FEMA NFHL data along with the City of Aurora parcel layer the provided by the Assessor's Office. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Flood zones A, AE, AH and AO are variations of the 1% annual chance event and were included in the analysis.

Building counts were based on an address point database to further refine the number of structures, as one parcel may have multiple buildings. The FEMA flood zones were overlaid in GIS on the address point data to identify structures that would likely be inundated during a 1% annual chance or 0.2% annual chance flood event. Property improvement values for the points were based on the assessor's parcel data from the three counties Aurora is part of and summed by parcel type.

Results of the overlay analysis are summarized in Table 4-40 through Table 4-42. and shown on Figure 4-20 Contents values were estimated as a percentage of property improvement values based on their occupancy type, using FEMA HAZUS guidance as follows: a) Commercial parcels received content values worth 100% of their improvements; b) Residential parcels received content values worth 50% of their improvements; and c) Exempt and Vacant parcels received content values worth 0% of their improvements. Property improvements and content values were then totaled, and a 25% loss estimation factor was applied based on those totals, per the FEMA depth damage functions.

There are 71 improved parcels in the 1% annual chance flood zone. The total property exposure (actual building value plus content value estimate) in that flood zone is $162,354,115, with a loss estimate of $40,588,529. In the 0.2% annual chance flood there are 1,169 improved parcels, with a total exposure value of $1,631,592,472 and a loss estimate of $407,898,118 additional for that zone. There are an additional 439 improved parcels within the area protected by levee. The total property exposure in that area is $234,352,075 with a loss estimate of $58,588,019; these areas are protected to the 1% annual chance flood, but a large flood or failure of the levee could result in damage.

Table 4-40 Improved Properties at Risk of 1% Annual Chance Flood Hazard

Property Type	Improved Parcels	Building Counts	Improved Value	Content Value	Total Value	Estimated Loss
Agriculture	1	1	$8,394	$8,394	$16,788	$4,197
Commercial	12	14	$36,023,448	$36,023,448	$72,046,896	$18,011,724
Exempt	3	10	$27,310,228	$27,310,228	$54,620,456	$13,655,114
Residential	54	92	$23,753,011	$11,876,506	$35,629,517	$8,907,379
Vacant Land	1	1	$20,229	$20,229	$40,458	$10,115
Total	**71**	**118**	**$87,115,310**	**$75,238,805**	**$162,354,115**	**$40,588,529**

Source: Wood Analysis with Assessor's Data

Table 4-41 Improved Properties at Risk of 0.2% Annual Chance Flood Hazard

Property Type	Improved Parcels	Building Counts	Improved Value	Content Value	Total Value	Estimated Loss
Commercial	138	204	$213,482,943	$213,482,943	$426,965,886	$106,741,472
Exempt	15	30	$14,599,061	$14,599,061	$29,198,122	$7,299,531
Industrial	9	9	$25,543,794	$38,315,691	$63,859,485	$15,964,871
Residential	1,006	2,803	$741,033,579	$370,516,790	$1,111,550,369	$277,887,592
Vacant Land	1	1	$9,305	$9,305	$18,610	$4,653
Total	**1,169**	**3,047**	**$994,668,682**	**$636,923,790**	**$1,631,592,472**	**$407,898,118**

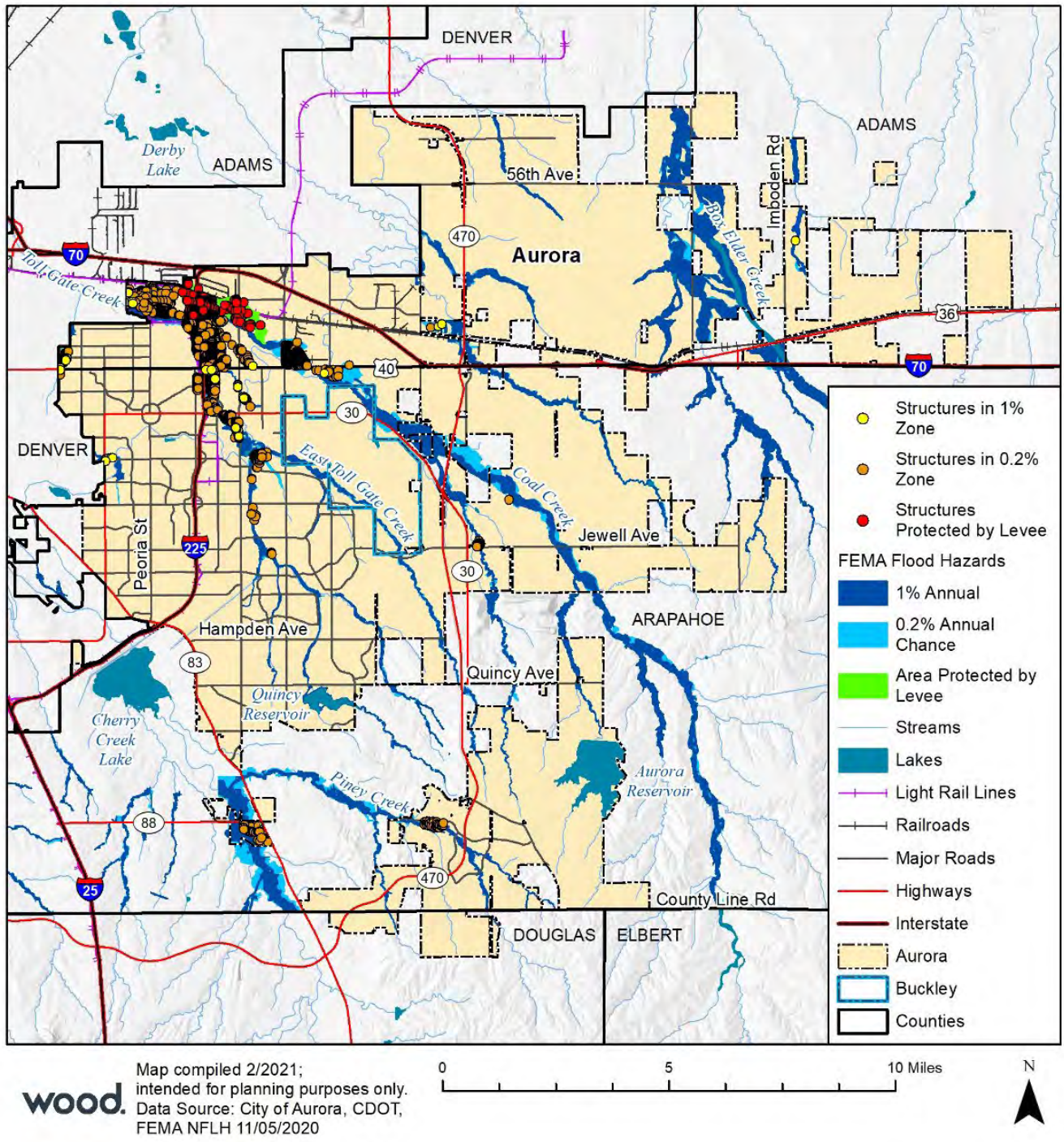
Source: Wood Analysis with Assessor's Data

Table 4-42 Improved Properties Within Areas Protected by Levee

Property Type	Improved Parcels	Building Counts	Improved Value	Content Value	Total Value	Estimated Loss
Commercial	48	62	$25,994,152	$25,994,152	$51,988,304	$12,997,076
Exempt	6	6	$7,599,425	$7,599,425	$15,198,850	$3,799,713
Industrial	3	8	$14,402,155	$21,603,233	$36,005,388	$9,001,347
Residential	382	382	$87,439,689	$43,719,845	$131,159,534	$32,789,883
Total	**439**	**458**	**$135,435,421**	**$98,916,654**	**$234,352,075**	**$58,588,019**

Source: Wood Analysis with Assessor's Data

Figure 4-20 Properties Exposed to Flooding



National Flood Insurance Program

The City of Aurora participates in the National Flood Insurance Program (NFIP). Structures permitted or built in the City before the initial Flood Insurance Rate Map (FIRM) in 1978 are called “pre-FIRM”

structures, and structures built afterwards are called "post- FIRM." The insurance rate is different for the two types of structures. The risk assessment used the most recent update to the citywide FIRM, September 4, 2020. Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas.

The City is currently in good standing with the provisions of the NFIP. Compliance is monitored by FEMA regional staff. Maintaining compliance under the NFIP is an important component of flood risk reduction.

Table 4-43 lists flood insurance statistics that help identify vulnerability in the planning area. Note that while NFIP reports 82 claims in the city, only 24 of those were in the A Zones associated with the 1% annual chance floodplain.

Table 4-43 City of Aurora National Flood Insurance Program Statistics

Policies in Force	Insurance in Force	# of Paid Losses	Total Losses Paid
288	$77,358,900	82	$286,899

Source: FEMA Community Information Systems

The City of Aurora has been participating in the NFIP Community Rating System (CRS) program since October 1992 and has a current rating class of 7, allowing citizens to received up to a 15% discount on flood insurance. Refer to the Capability Assessment in Chapter 2 for more details on Aurora's participation in the CRS program.

Repetitive Losses

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced two paid losses in excess of $1,000 within any rolling 10-year period since 1978, regardless of any changes in ownership.

Based on information from the Colorado Water Conservation Board (CWCB), the City of Aurora has three repetitive loss structures, all single-family residences, that between them have had seven losses.

Severe repetitive loss properties (SRL) are those that the program has either made at least four payments for buildings and/or contents of more than $5,000 or at least two building-only payments that exceeded the value of the property. As of March 2021, there are no severe repetitive loss properties structures located in Aurora.

Critical Facilities and Infrastructure

During and after floods, roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the city. This can impede emergency service providers needing access to get to vulnerable populations or to make repairs. The major highways that pass through the 100-year floodplain are mostly raised infrastructure and have little flooding potential. However, significant roads are exposed to flooding, which include U.S. Highway 30 and State Highways 287 and 36. Multiple other major local throughways would be exposed to flooding when stormwater infrastructure has been overwhelmed as the city is a well-developed urban area. In severe flood events, these roads can be blocked or damaged, preventing access to some areas.

Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect. Culverts can be

blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams.

To estimate the potential impact of floods on critical facilities, a GIS overlay was performed of the flood hazard layer for critical facility point locations. In total there are 42 critical facilities exposed to the 1% annual chance flood and 66 facilities exposed to the 0.2% annual chance flood. An additional 14 critical facilities are in areas protected by levee. The transportation lifeline category (bridges), followed by communications category have the greatest number of structures exposed to both the 1% annual and 0.2% annual chance flood. Table 4-45 through Table 4-47 summarize critical facilities at-risk to the 1% annual chance flood 0.2% annual chance flood and areas protected by levee.

Replacement values were not available with the data thus an estimate of potential monetary loss could not be performed. Impacts to any of these facilities could have wide ranging ramifications, in addition to property damage.

Table 4-44 Critical Facilities in Flood Hazard Areas Summary

Flood Hazard	FEMA Lifeline	Count
1% Annual Chance Flood	Communications	14
	Hazardous Materials	1
	Transportation	27
	Total	**42**
0.2% Annual Chance Flood	Communications	19
	Food, Water, Shelter	1
	Hazardous Materials	6
	Health and Medical	4
	Safety and Security	1
	Transportation	35
	Total	**66**
Areas Protected by Levee	Communications	4
	Energy	1
	Hazardous Materials	8
	Safety and Security	1
	Total	**14**

Source: Wood analysis, City of Aurora

Table 4-45 Critical Facilities in 1% Annual Chance Flood Hazard Areas

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Towers	11
	Microwave Towers	3
	Total	**14**
Hazardous Materials	Tier II	1
	Total	**1**
Transportation	Bridge - Good Condition	9
	Bridge - Fair Condition	18
	Total	**27**
	Grand Total	**42**

Source: Wood analysis, City of Aurora

Table 4-46 Critical Facilities in 0.2% Annual Chance Flood Hazard Areas

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Towers	15
	Microwave Towers	4
	Total	**19**
Food, Water, Shelter	Religious Institution	1
	Total	**1**
Hazardous Materials	Tier II	6
	Total	6
Health and Medical	Assisted Living/Nursing Home	1
	Clinic/Medical Facility	2
	EMS Station	1
	Total	**4**
Safety and Security	Fire Station	1
	Total	**1**
Transportation	Bridge - Good Condition	16
	Bridge - Fair Condition	18
	Light Rail Station	1
	Total	**35**
	Grand Total	**66**

Source: Wood analysis, City of Aurora

Table 4-47 Critical Facilities in Area Protection by Levee

FEMA Lifeline	Critical Facility Type	Count
Communications	Land Mobile Towers	2
	Microwave Towers	2
	Total	**4**
Energy	Electric Substation	1
	Total	**1**
Hazardous Materials	Tier II	8
	Total	8
Safety and Security	Government Facility	1
	Total	1
	Grand Total	**14**

Source: Wood analysis, City of Aurora

Government Services

Publicly owned facilities are a key component of daily life for all citizens of the county. Public buildings are of particular importance during flood events because they house critical assets for government response and recovery activities. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of the government to deliver services. Loss of power and communications can be expected. Drinking water and wastewater treatment facilities may be temporarily out of operation.

Flooding can have various impacts to responders in terms of response time and the personal safety of first responders. Flooded roadways are a common occurrence in City of Aurora and can block emergency vehicles from crossing certain areas, delaying response times. These rescues can often be dangerous for the first responders due to potentially polluted waters as well as swift waters that can make the response challenging.

Public confidence in government services may be hindered if warnings and alerts prior to the flood event are not communicated effectively. The government's ability to respond and recover may be questioned and challenged by the public if planning, response, and recovery is not timely and effective, particularly in areas that have repeated flooding.

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, reduced tourism and visitation, and other downtime costs. Flood events can cut off customer access to a business as well as close a business for repairs or permanently. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.

Historic, Cultural and Natural Resources

There are significant historic, cultural, and natural resources and assets located throughout the City (e.g., trails and natural spaces). Natural areas within the floodplain often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Natural resources are generally resistant to flooding except where natural landscapes and soil compositions have been altered for human development or after periods of previous disasters such as drought and fire. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought.

4.7.8 Development Trends

The City of Aurora manages future growth within flood hazard areas; thus, development trends are not likely to exacerbate vulnerability. The City of Aurora participates in the NFIP and has adopted flood damage prevention codes in response to its requirements (Chapter 70 of the Municipal Code). The City participates in the CRS program and is committed to maintaining its good standing under the NFIP through initiatives identified in this plan.

Urban flooding issues that contribute to flash floods are also a concern in the City of Aurora as areas continue to become rapidly developed. The City of Aurora maintains its own stormwater program compliant with the National Pollutant Discharge Elimination System. This program helps jurisdictions apply effective mitigation measures for stormwater runoff.

4.7.9 Risk Summary

- The overall significance ratings for flood in the City is Medium.

- There have been 12 flood and flash flood events in the City in the last 23 years. There is a 52% chance of occurrence in any given year.
- Historically, stormwater and street flooding have been the more significant types of flooding to affect the City.
- 265 people reside within the 1% annual chance flood areas, 8,405 reside within the 0.2% annual chance and 1,117 in areas protected by levee.
- Within the 1% annual chance flood areas there is a total property exposure of $162,354,115 with a loss estimate of $40,588,529. Within the 0.2% annual chance flood areas there is a total property exposure of $1,631,592,472 and a total loss estimate of $407,898,118.
- As of March 2021, there are 288 NFIP policies in force in the City, $77,358,900 insurance in force and $286,899 losses paid.

4.8 Hail

Hazard	Location	Probability of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Hail	Significant	Highly Likely	Critical	**High**

4.8.1 Description

Hailstorms are any storm events where hailstones fall, most often occurring during thunderstorm events. Hail occurs when updrafts carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. The process of falling, thawing, moving up into the updraft and refreezing before falling again may repeat many times, increasing the size of the hailstone. Hail eventually falls when it becomes heavy enough to overcome the strength of the updraft and is pulled by gravity towards the earth. Hailstones are usually less than two inches in diameter, but have been reported much larger and may fall at speeds of up to 120 mph. Hailstorms occur throughout the spring, summer, and fall in the region, but are more frequent in late spring and early summer. These events are often associated with thunderstorms that may also cause high winds and tornadoes. Hail is also one of the requirements which the National Weather Service uses to classify thunderstorms as severe; if hail more than ¾ of an inch is produced in a thunderstorm, it qualifies as severe.

DEFINITIONS

Severe Local Storm—Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Thunderstorm—A storm featuring heavy rains, strong winds, thunder, and lightning, typically about 15 miles in diameter and lasting about 30 minutes. Hail and tornadoes are also dangers associated with thunderstorms.

Severe Hail—Generally defined by NOAA as hailstones 1 inch or greater in diameter.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a super-cooled drop, the water does not freeze onto the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Because the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are “frozen” in place, leaving cloudy ice.

Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are “balanced” in an updraft. It is possible to tell how many times a hailstone traveled to the top of the storm by counting its layers. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail. The NWS classifies hail as non-severe and severe based on hail diameter size. Descriptions and diameter sizes are provided in Table 4-48.

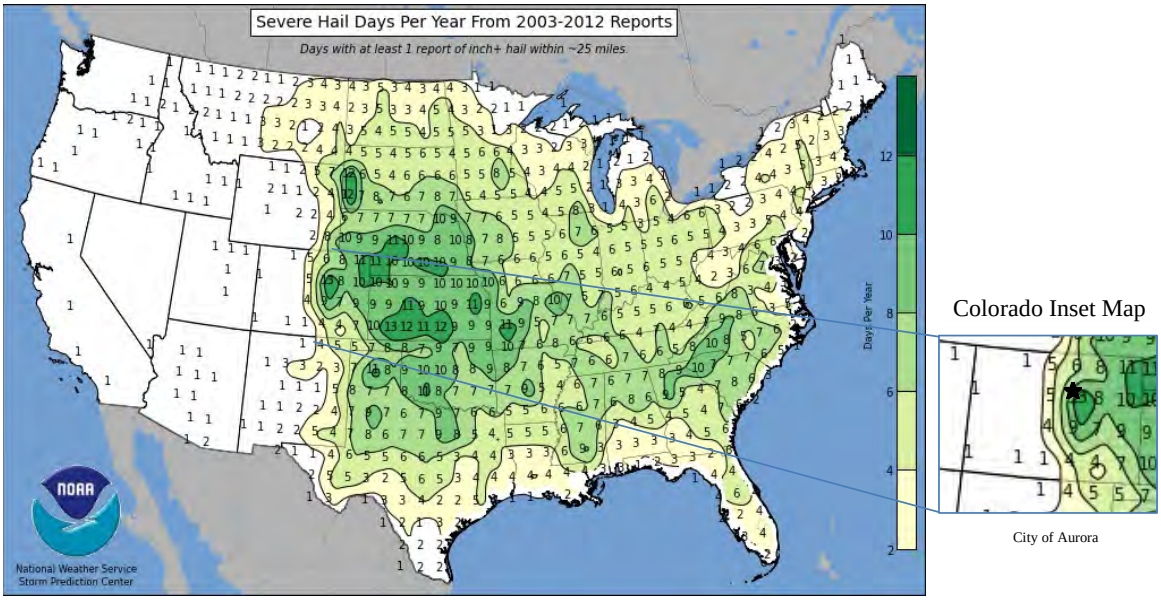
Table 4-48 National Weather Service Hail Severity

Severity	Size Description	Hail Diameter Size (inches)
Non-Severe Hail Does not typically cause damage and does not warrant severe thunderstorm warning from the National Weather Service.	Pea	1/4
	Mothball	½
	Penny	¾
	Nickel	7/8
Severe Hail Research has shown that damage occurs after hail reaches around 1 inch in diameter and larger. Hail of this size will trigger a severe thunderstorm warning from the National Weather Service.	Quarter	1 (severe)
	Half Dollar	1 ¼
	Walnut/Ping Pong Ball	1 ½
	Golf Ball	1 ¾
	Hen Egg/Lime	2
	Tennis Ball	2 ½
	Baseball	2 ¾
	Teacup/Large Apple	3
	Grapefruit	4
	Softball	4 ½
	Computer CD-DVD	4 ¾ - 5

Source: National Weather Service, Severe Weather 101 Hail Basics

The number of severe hail days per year in the United States is shown on Figure 4-21. On average, the Front Range area has 6 to 13 days per year with hail exceeding 1 inch in diameter.

Figure 4-21 National Severe Hail Days per Year (2003-2012)



4.8.2 Past Events

The National Centers for Environmental Information database lists 191 hail events in the City of Aurora between 1963 and 2020. Between 1997 and 2020, three hail events of note resulted in significant property damage recorded in the NCEI database:

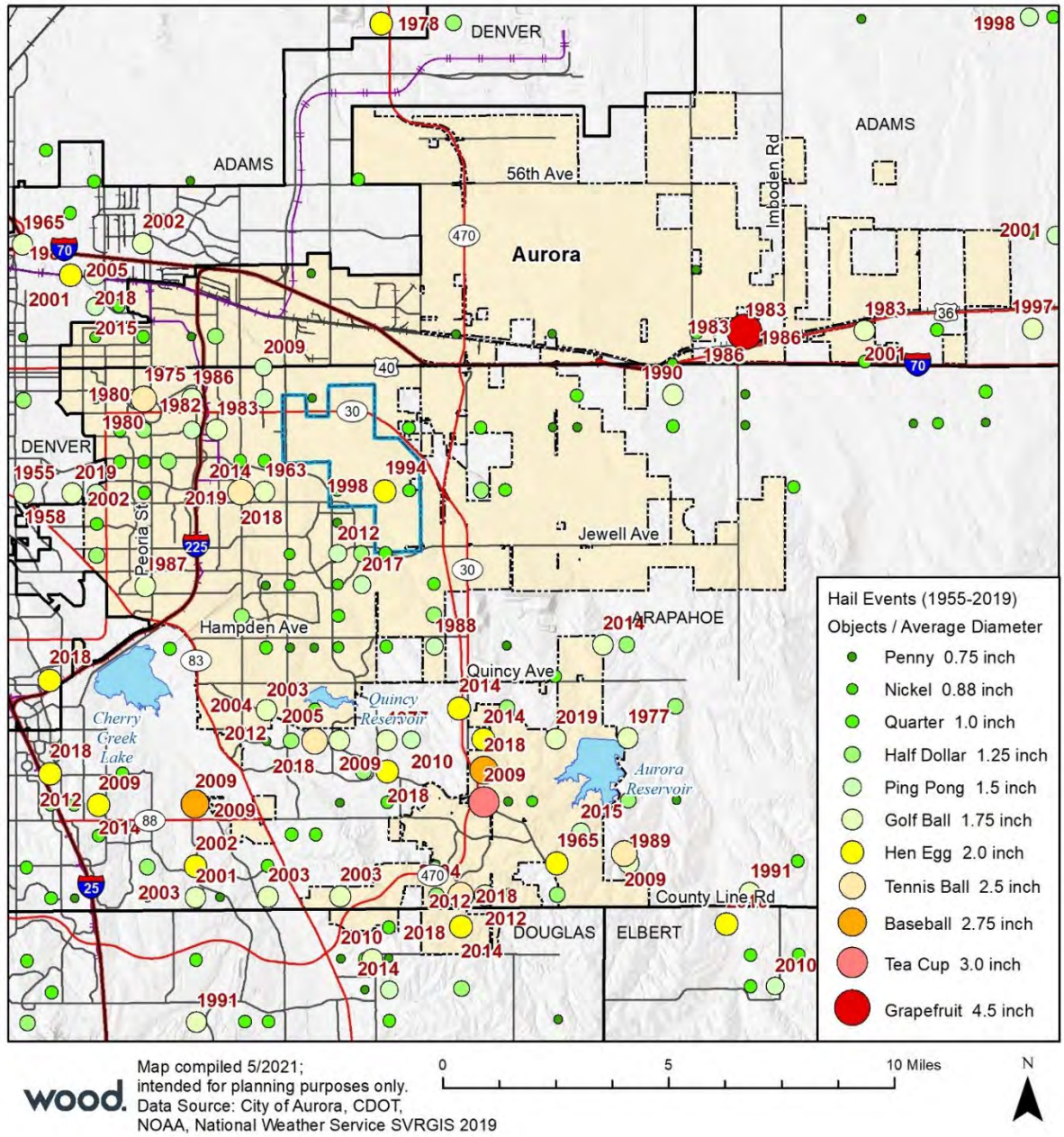
- On October 16, 1998, an event recorded at Buckley Air Force Base in Aurora had hailstones up to 2 inches in diameter. This event resulted in $87.8 million in damage, with $27.3 million of that total

comprised of homeowner insurance claims and the remaining $60.5 million in automobile insurance claims.

- On June 14, 1999, several hailstorms struck areas in and near the Denver Metropolitan area affecting the City of Aurora. Damage throughout the metro area totaled $35 million, with some of the hardest hit areas being Castle Rock, Commerce City, Evergreen and Golden.
- On June 7, 2009, the same series of severe thunderstorms in Denver and the surrounding metropolitan area which resulted in a tornado touching down at Southlands Mall, also resulted in large hail from 1 to 3 inches in diameter. Damages along the front range totaled $161 million.

Figure 4-21 shows the approximate locations and size of observed hail events in Aurora since 1955.

Figure 4-22 Recorded Hail Events in the City of Aurora, 1955-2019



4.8.3 Location

The location rating for hail is **Extensive**.

Hail most often forms during thunderstorms, which are regional in nature, and can impact the entire extent of the planning area. However, just as the amount of precipitation in the form of snow or rain may vary significantly within a single storm, so may the amount, size, and duration of hail within a severe storm. In general, hail can fall anywhere in Colorado. The areas where hail is most frequently reported with damaging effects are in the eastern plains, where hail damages crops and livestock, and in the Denver metro area, where hailstorms damage buildings, cars and trees, and may cause driving conditions to deteriorate. While hail is *possible* anywhere in the planning area, it is not likely to affect the entire City simultaneously. Previous instances of hail events in the city are shown in Figure 4-22.

4.8.4 Magnitude and Severity

The magnitude/severity rating for hail is **critical**.

Severe hailstorms can be quite destructive. According to a 2020 report from the National Insurance Crime Bureau, insurance claims resulting from hailstorm damage have decreased in recent years, dropping 31% from 2017 to 2019. However, total claims nationwide have increased 68% percent from the 2010 level. In 2010, there were 467,602 hail damage claims filed in the United States. That number increased to 1,139,616 in 2017, dropping to 784,814 in 2019 – representing an overall increase of 68% percent from 2010 to 2019.

The nation has experienced severe storms (wind, tornado, hail) that are occurring with more intensity and affecting more areas of the country. While scientists debate why these storms occur, no one argues with their effects – extensive property damage and, many times, loss of life. The property damage can be as minimal as a few broken shingles to total destruction of building roof, windows and siding and extensive damage to vehicles.

380,066 total hail damage claims were processed from 2017 to 2019, with Colorado ranking second in overall claims. In the last 10 years, hail has caused upwards of $5 billion in insured damage in Colorado. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans and occasionally has been fatal.

Of Colorado's ten most costly hailstorms, eight were centered in the Denver Metropolitan Area (Table 4-32).

Table 4-49 Damage From 10 Most Costly Hail Events in Colorado

Date	Location	2020 Dollars (Millions)
May 8, 2017	Denver Metro	$2,400
July 20, 2009	Denver Metro	$924
July 11, 1990	Denver Metro	$1,230
June 6-15, 2009	Denver Metro	$425
July 28, 2016	Colorado Springs	$379
June 6-7, 2012	CO Front Range	$361
June 13-14, 1984	Denver Metro	$687
June 18-19, 2018	North Denver and Denver Metro	$284
July 29, 2009	Pueblo	$280
October 1, 1994	Denver Metro	$392
September 29, 2014	Denver Metro	$232

Source: Rocky Mountain Insurance Information Association

4.8.5 Probability of Future Occurrence

The probability rating for hail is **highly likely**, with damaging hail events occurring in the Front Range region annually.

A total of 191 hail events have taken place in the City of Aurora between 1963 and 2020, resulting in an annual rate of occurrence of 3.35 events per year. This results in an expected probability of future occurrence of 100%. Additionally, according to the 2018 Colorado State Hazard Mitigation Plan, there have been 1,313 events impacting Metro Denver from 1996-2017. Based on this number of events and the total recorded losses of $4 billion, the average loss expectancy is $3,071,710 per event.

4.8.6 Climate Change Considerations

Climate change presents a significant challenge for risk management associated with severe weather, such as hail. The frequency of severe weather events has increased steadily over the last century. According to the 2018 Colorado State Hazard Mitigation Plan, the future impacts of climate change are expected to reduce both the frequency and severity of hail events along the Front Range by 2070.

4.8.7 Vulnerability

All assets located in the City of Aurora can be considered exposed to severe hail events. This includes all individuals who may be caught outdoors during a severe hail event, and all buildings and infrastructure within the City.

Population

People are at the most risk from hail when caught outside in the open without shelter. Large hail has the potential to cause significant bruising, concussions, the potential for broken bones, and even death. The impacts of hail on vulnerable populations can be more severe. Low income families are more likely to live in poorly constructed homes that are more likely to be damaged, and are more likely to be uninsured or underinsured, making it more difficult for them to recover from hail events. Individuals with disabilities may need more assistance after a major event, especially if transportation or utility services are disrupted. Severe weather warnings must use methods that reach vision or hearing-impaired people and those with limited English proficiency.

Property

All property is vulnerable during hail events, and hail poses perhaps the greatest economic impacts with nine separate incidents falling within the top ten costliest insured disasters in the state. According to analysis conducted by Wood using data from the Arapahoe, Adams, and Douglas County Assessors, there are 120,850 buildings in the City of Aurora. Hail impacts structures, infrastructure, landscaping, personal property and vehicles, people, agriculture, and livestock. Existing development remains exposed to hail with minimal mitigation opportunities. Vehicles can be parked under shelters to help minimize damage costs incurred in that arena. Hail heavily impacts the economic contributors who house merchandise outdoors, such as car retailers, home improvement stores and gardening stores. Damage to landscape and agriculture is also almost impossible to prevent, as the plants cannot be transported indoors for the storm.

Critical Facilities and Infrastructure

Hail can lead to the temporary incapacitation of roads when small hail stones build up so deep, they block roads, requiring snow removal equipment in order to clear blockages. Hail has also been observed to block storm drains and prevent proper runoff, potentially resulting in flooding as a secondary hazard. Most structures, including the County's critical facilities, should be able to provide adequate protection from hail but the structures could suffer broken windows and dented exteriors. Those facilities with back-up generators are better equipped to handle a severe weather situation, should the power go out.

Government Services

Hail may pose a significant risk to the provision of government services. Government buildings and facilities are vulnerable to damage from hail events, similar to all property. Significant damage to an essential government facility could force the temporary closure of that facility, disrupting the ability of local governments to provide the usual level of service to residents.

Economy

The economic impact from hail can be severe and potentially long lasting. As mentioned throughout this section, hail is the costliest hazard insured hazard in Colorado. Direct damages have totaled $5 billion over the last 10 years statewide, but severe indirect economic impacts can also be felt through businesses forced to close for repairs. For example, the 2017 event of record led to the city of Lakewood losing an estimated $350,000 in monthly sales tax revenue due to a several month closure of the Colorado Mills mall. A similar scale event impacting one of the major commercial areas of Aurora could result in similar extended losses and indirect economic impacts in addition to the direct damage costs.

Historic, Cultural, and Natural Resources

While hail is a natural environmental process, it can cause significant environmental damage. As discussed throughout this section, hail poses a significant threat to crops. Additionally, hail can cause tree limbs to break, damage to trees and other plants in bloom, and shred foliage. Some cultural and historic properties may also potentially be at risk of damage from hail.

4.8.8 Development Trends

Future growth and development in the City of Aurora will increase the level of exposure to hail. Consideration for future development's ability to avoid excessive hail damages may include the use of hail resistant roofing/shingles, resilient landscaping, construction of covered parking, or semi-sheltered structures to minimize extensive losses. The availability of shelters in the many open spaces and parks throughout Aurora may afford some protection to recreation populations. The enforcement of existing land use and zoning ordinances requiring durability of building materials may improve the resilience of future buildings. In some cases, the costs of future mitigation efforts, even in new future development, may outweigh the potential insurance losses.

4.8.9 Risk Summary

- The overall significance of this hazard to the City is High.
- Hail is not as high profile as hazards such as tornadoes, blizzards, or floods, because losses are typically covered by insurance, but hail events consistently inflict one of the highest rates of damage on the planning area.
- Severe hail events can cause significant damage to buildings, vehicles, and above ground utility lines, as well as catastrophic damage to vegetation and crops.
- On average, the Front Range area has 6 to 13 days per year with hail exceeding 1 inch in diameter
- For people caught outdoors in the open, large hail has the potential to cause significant bruising, concussions, broken bones, and even death.
- Older structures and those made of less durable materials could be highly vulnerable to severe hail events.

4.9 Landslide, Mud/Debris Flow, and Rockfall

Hazard	Geographic Extent	Potential of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Landslides, Mud/Debris Flow, Rockfalls	**Limited**	**Likely**	**Negligible**	**Low**

4.9.1 Description

Landslide

A landslide is a general term for a variety of mass-movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Some of the natural causes of ground instability are stream and lakeshore erosion, heavy rainfall, and poor-quality natural materials. In addition, many human activities tend to make the earth materials less stable, thus increasing the chance of ground failure. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation. Landslides typically have a slower onset and can be predicted to some extent by monitoring soil moisture levels and ground cracking or slumping in areas of previous landslide activity.

DEFINITIONS

Landslide—The sliding movement of masses of loosened rock and soil down a hillside or slope. Such failures occur when the strength of the soils forming the slope is exceeded by the pressure, such as weight or saturation, acting upon them.

Mass Movement—A collective term for landslides, debris flows, falls, and sinkholes.

Mudslide (or Mudflow or Debris Flow)—A river of rock, earth, organic matter and other materials saturated with water.

Landslides are caused by one or a combination of the following factors: change in slope of the terrain, increased load on the land, shocks and vibrations, change in water content, groundwater movement, frost action, weathering of rocks, and removing or changing the type of vegetation covering slopes. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 30 percent
- A history of landslide activity or movement during the last 10,000 years
- Stream or wave activity, which has caused erosion, undercut a bank, or cut into a bank to cause the surrounding land to be unstable
- The presence or potential for snow avalanches
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, which are mixed with granular soils such as sand and gravel

Flows and slides are commonly categorized by the form of initial ground failure. Figure 14-1 through Figure 14-4 show common types of slides. The most common is the shallow colluvial slide, occurring particularly in response to intense, short-duration storms. The largest and most destructive are deep-seated slides, although they are less common than other types.

Figure 4-23 Deep Seated Slide

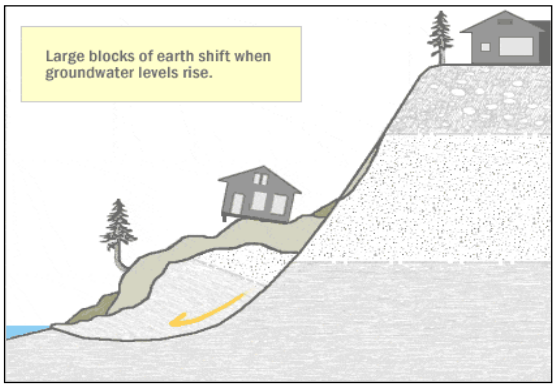


Figure 4-24 Shallow Colluvial Slide

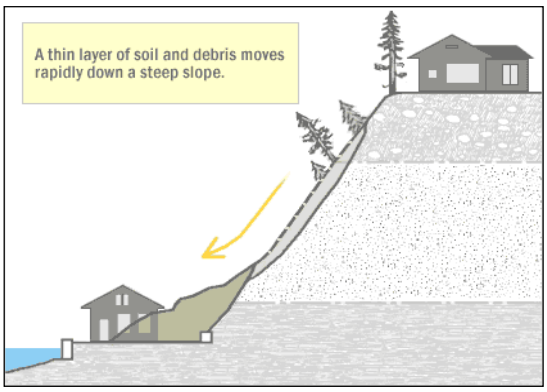


Figure 4-25 Bench Slide

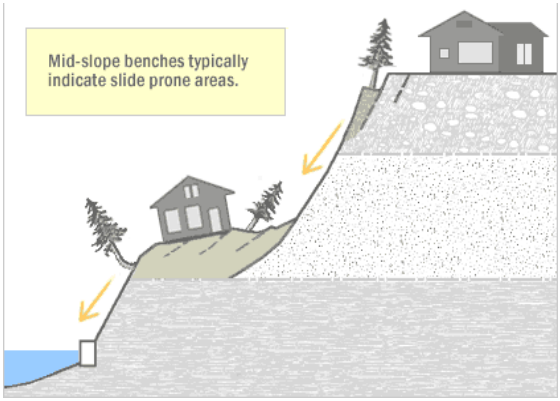
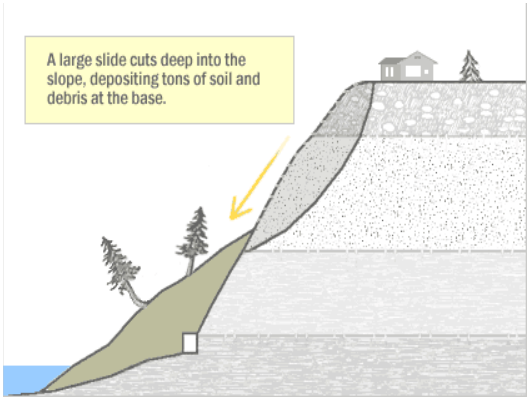


Figure 4-26 Large Slide



Slides and earth flows can pose serious hazard to property in hillside terrain. They tend to move slowly and thus rarely threaten life directly. When they move—in response to such changes as increased water content, earthquake shaking, addition of load, or removal of downslope support—they deform and tilt the ground surface. The result can be destruction of foundations, offset of roads, breaking of underground pipes, or overriding of downslope property and structures.

Landslides are most likely during late spring and summer months. After heavy spring and summer rains, soils become saturated with water. As water seeps downward through upper soils that may consist of permeable sands and gravels and accumulates on impermeable silt, it will cause weakness and destabilization in the slope. A short intense storm could cause saturated soil to move, resulting in landslides. As rains continue, the groundwater table rises, adding to the weakening of the slope. Burn scars, gravity, poor drainage, a rising groundwater table, and poor soil exacerbate hazardous conditions.

Mud and Debris Flow

A mudslide is a mass of water and fine-grained earth that flows down a stream, ravine, canyon, arroyo, or gulch. If more than half of the solids in the mass are larger than sand grains- rocks, stones, boulders—the event is called a debris flow. A debris fan is a conical landform produced by successive mud and debris flow deposits, and the likely spot for a future event. The mud and debris flow problem can be exacerbated by wildfires that remove vegetation that serves to stabilize soil from erosion. Heavy rains on the denuded landscape can lead to rapid development of destructive mudflows.

Rockfall

A rockfall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rock falls. Rockfalls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting and filling activities can also increase the risk of a rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Rockfalls can threaten human life, impact transportation corridors and communication systems, and result in other property damage. Spring is typically the landslide/rockfall season in Colorado as snow melts and saturates soils and temperatures enter into freeze/thaw cycles. Rockfalls and landslides are influenced by seasonal patterns, precipitation, and temperature patterns. Earthquakes can also trigger rockfalls and landslides.

4.9.2 Past Events

NOAA's National Centers for Environmental Information (NCEI) database does not list any landslide, mud/debris flow, or rockfall events that impacted the City of Aurora between 1996 and 2020.

4.9.3 Location

There have been no reported incidences of landslides, mud/debris flows, or rockfalls in the City of Aurora. The susceptibility of the area around the City of Aurora to landslides is very limited as it is relatively flat and does not have topography that would indicate high susceptibility to landslides, mud/debris flows, and rockfalls. The only areas of potential concern to very small landslides, more similar to erosion of a stream bank, in the City of Aurora are along stream banks and along reservoirs.

4.9.4 Magnitude and Severity

Because of the relative flat terrain in the City of Aurora, the conditions are not present for regular landslides or rockfalls. Past events have not been reported because they either have not occurred or are so small and localized that they are not recorded.

Landslides can destroy property and infrastructure and can take the lives of people. Slope failures in the United States result in an average of 25 lives lost per year and an annual cost of approximately $1.5 billion. However, the magnitude/severity of landslide, mud/debris flow, and rockfall events in the City of Aurora is minimal because of the relatively flat terrain found throughout the City. Overall significance of the hazards is considered to have a minimal potential impact.

Mass movement events can cause several types of secondary effects, such as blocking access to roads, which can isolate residents and businesses and delay commercial, public, and private transportation. This could result in economic losses for businesses. More significantly, landslides or mud/debris flows can limit the ability of emergency response services to access and serve the City of Aurora. Additionally, rockfalls into waterways can cause blockages resulting in flooding, damage to rivers or streams, potential harm to water quality, fisheries, and spawning habitat. Other potential problems resulting from landslides or flows are power and communication failures. Vegetation or poles on slopes can be knocked over, resulting in possible losses to power and communication lines. Mass movement events also have the potential of destabilizing the foundation of structures, which may result in monetary loss for residents.

Mass movements can occur suddenly or slowly. The velocity of movement may range from a slow creep of inches per year to many feet per second, depending on slope angle, material, and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to identify what areas are at risk during general time periods. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides. The current standard operating procedure is to monitor situations on a case-by-case basis and respond after the event has occurred.

4.9.5 Probability of Future Occurrences

Future occurrences of landslide, mud/debris flow, or rockfall hazards are considered low and unlikely based on no known past events and the relatively flat topography of the city. Very small, debris movements on stream banks have a potential to occur but would be more similar to erosion than landslides.

4.9.6 Climate Change Considerations

Climate change could increase the probability for debris flow occurrences. Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. However, steep slopes are not common in the City of Aurora.

4.9.7 Vulnerability

People

Exposure to landslide hazard areas is likely very limited. There are no known landslide, mud/debris flow, and rockfall hazard areas in the City, based on no known past events.

Property

Property exposure to landslide hazard areas is also likely to be minimal because of the relatively flat terrain. The areas of potential concern along stream banks and reservoirs have low population levels and development.

Loss estimations for the landslide hazards are not based on modeling using damage functions, because no such damage functions have been generated. There are no landslide areas in the City of Aurora, so no property is exposed to the hazard. If landslide, mud/debris flow, and rockfall events were to occur, property damage is likely to be minimal.

Critical Facilities and Infrastructure

Critical facilities and infrastructure are not actively exposed to landslides and rockfalls in the City of Aurora. A more in-depth analysis of the mitigation measures taken by these facilities to prevent damage from mass movements could be done to refine the exposure of critical facilities and infrastructure and to evaluate whether they could withstand impacts of a mass movement.

No loss estimation of these facilities was performed due to the lack of established damage functions for the landslide hazard. In general, mass movement events can impact critical facilities and infrastructure as follows:

- Roads—Mass movement events can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems, and delays for public and private transportation. This can result in economic losses for businesses.
- Bridges—Landslides, mud/debris flows, and rockfalls can significantly impact road bridges. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- Power Lines—Power lines are generally elevated above steep slopes; the towers supporting them can be subject to landslides. A landslide could trigger failure of the soil underneath a tower, causing it to collapse and ripping down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses.

Government Services

Because of the relative flat terrain in the City of Aurora, the conditions are not present for regular landslides or rockfalls. If landslide or debris flows did occur, it may require aid programs for loss of structures.

Impact to first responders from geologic hazards is likely to be minimal. An exception event would increase calls for first responders during extended periods of flooding or debris flows in traffic corridors or residential areas.

Economy

As already discussed, due to the flat terrain and no known past occurrences of landslides or debris flow, the economy will likely not be affected by landslides.

Historic, Cultural and Natural Resources

Due to flat terrain and no known past occurrences of landslides or rockfall, it is unlikely for any historic, cultural, and nature resources to be impacted. Minimal nature resource impacts have a slight potential as landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affect water quality downstream. Hillsides that provide wildlife habitat can be lost for prolonged periods of time due to landslides or mud/debris flow. Although streams in Aurora flow west and north eventually into the South Platte River, so they are not downstream from other potential landslide areas such as in the mountains.

4.9.8 Development Trends

The severity of mass movement events is directly related to the extent of human activity in hazard areas. Adverse effects can be mitigated by early recognition and avoiding incompatible land uses in these areas or by corrective engineering.

Continued adherence to the land development codes and regulations in the city will decrease the risk of future development to landslide, mud/debris flow, and rockfall hazard areas. Development of lands within identified hazard areas are restricted to meet the requirements set forth by the Planning and Development Services Department of the City of Aurora at the time of construction. Most construction has been limited to areas that are not in these hazard areas.

Mass movements are becoming more of a concern as development moves outside of city centers and into areas less developed in terms of infrastructure. Most mass movements would be isolated events affecting specific areas. It is probable that private and public property, including infrastructure, will be affected. Mass movements could affect bridges that pass over landslide prone stream banks.

4.9.9 Risk Summary

- Exposure and vulnerability estimates for the landslide, mud/debris flow, and rockfall hazard are considered low.
- The risk of large mass movement events in the City of Aurora is low based on no known past events and the relatively flat topography of the city.
- The southern portion of the City has the most elevation variability along several creeks.

4.10 Lightning

Hazard	Location	Probability of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Lightning	Limited	Highly Likely	Limited	Medium

4.10.1 Description

DEFINITIONS

Intra-Cloud Lightning—Lightning that occurs between opposite charges within the thunderstorm cloud.

Cloud-to-Ground Lightning—Lightning that occurs between opposite charges in the cloud and on the ground. This is the most damaging and dangerous form of lightning.

Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four. The length and duration of each lightning stroke vary, but typically average about 30 microseconds.

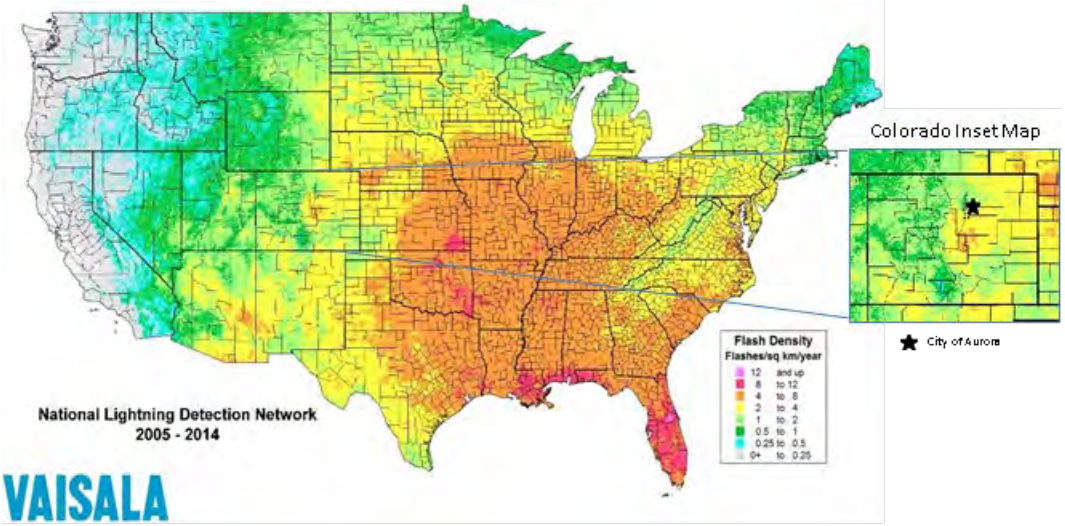
Lightning is one of the more dangerous and unpredictable weather hazards in the United States and in Colorado. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage to buildings, communications systems, power lines, and electrical systems. Lightning also causes forest and brush fires as well as deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning strikes the United States about 25 million times each year and causes more than 26,000 fires nationwide each year. The institute estimates property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects to be in excess of $6 billion per year. Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually, it takes place inside the cloud and looks from the outside like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel can be visible for many miles.

Although not as common, cloud-to-ground lightning is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. When positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

The ratio of cloud-to-ground and intra-cloud lightning can vary significantly from storm to storm. Depending upon cloud height above ground and changes in electric field strength between cloud and earth, the discharge stays within the cloud or makes direct contact with the earth. If the field strength is highest in the lower regions of the cloud, a downward flash may occur from cloud to earth. Using a network of lightning detection systems, NOAA monitors a yearly average of 25 million strokes of lightning from the cloud to ground. Figure 4-26 shows the lightning flash density for the nation. According to the National Lightning Detection Network, the City of Aurora has approximately 0.25 to 4 flashes of lightning per square kilometer per year.

Figure 4-27 National Lightning Detection Network (2008-2014)



4.10.2 Past Events

Data from NOAA's NCEI Storm Events Database was used to determine previous occurrences of lightning in the City of Aurora. Since 1997, there have been 5 recorded lightning strikes in the City of Aurora that resulted in injuries according to the NCEI database. Between 1997 and 2020, there were 8 lighting events that caused property damage, totaling $643,000 in recorded damage. This gives an annual rate of occurrence for damaging lighting of 0.35 events per year. The average loss expectancy is $80,375 per event, resulting in an annualized loss of approximately $28,131.

Table 4-50 Lightning Strike Events Reported in Aurora, 1997-2020

Date of Event	# Fatalities	# Injuries	Property Damages	Crop Damages	Description
7/27/1997	0	0	$75,000	0	Lightning sparked a fire causing extensive damage to a home.
7/30/1997	0	0	$75,000	0	Lightning struck a home in unincorporated Arapahoe County. The fire started in the electrical panel boxes causing extensive damage to the home.
8/11/1997	0	1	$1,000	0	A man received minor injuries when he was struck by lightning while talking on the telephone.
8/8/2000	0	0	$47,000	0	Lightning struck three homes in Arapahoe County.
8/16/2000	0	0	$250,000	0	Lightning ripped most of the roof off a home in southeast Aurora. The bolt sparked a fire which destroyed the residence.
4/28/2001	0	1	0	0	A 21-yr old man was struck by lightning, along the shoulder of Interstate 225 near Parker Road. The bolt stopped the man's heart briefly and caused the right side of his body to go numb.
5/29/2001	0	0	$100,000	0	Lightning sparked a fire at an apartment complex, forcing the evacuation of 24 units. Most of the fire damage was confined to the attic.
8/15/2008	0	0	$20,000	0	At least three homes were hit by lightning during the early morning hours in Arapahoe County.

Date of Event	# Fatalities	# Injuries	Property Damages	Crop Damages	Description
					Lightning also struck two homes in Castle Rock, damaging the roofs.
8/25/2008	0	0	$75,000	0	Lightning struck a home. The ensuing fire caused extensive roof damage.
7/3/2009	0	0	0	0	Six children received minor injuries when lightning struck a nearby tree. The injuries occurred when they were knocked down by the blast. None of the children suffered burns or appeared to have been directly hit by the lightning.
6/29/2011	0	2	0	0	Two airmen from the Colorado National Guard received minor injuries when they were struck by lightning. They were struck while on duty at a flight line at Buckley Air Force Base.
5/1/2015	0	1	0	0	Juvenile male struck by lightning in field near Town Center Mall.
Total: 12	**0**	**5**	**$643,000**	**$0**	

Source: NCEI Storm Events Database

Lightning statistics for the United States compiled by NOAA between 1959 and 1994 indicate that most lightning incidents occur during the summer months of June, July, and August, and during the afternoon hours between 2 and 6 p.m.

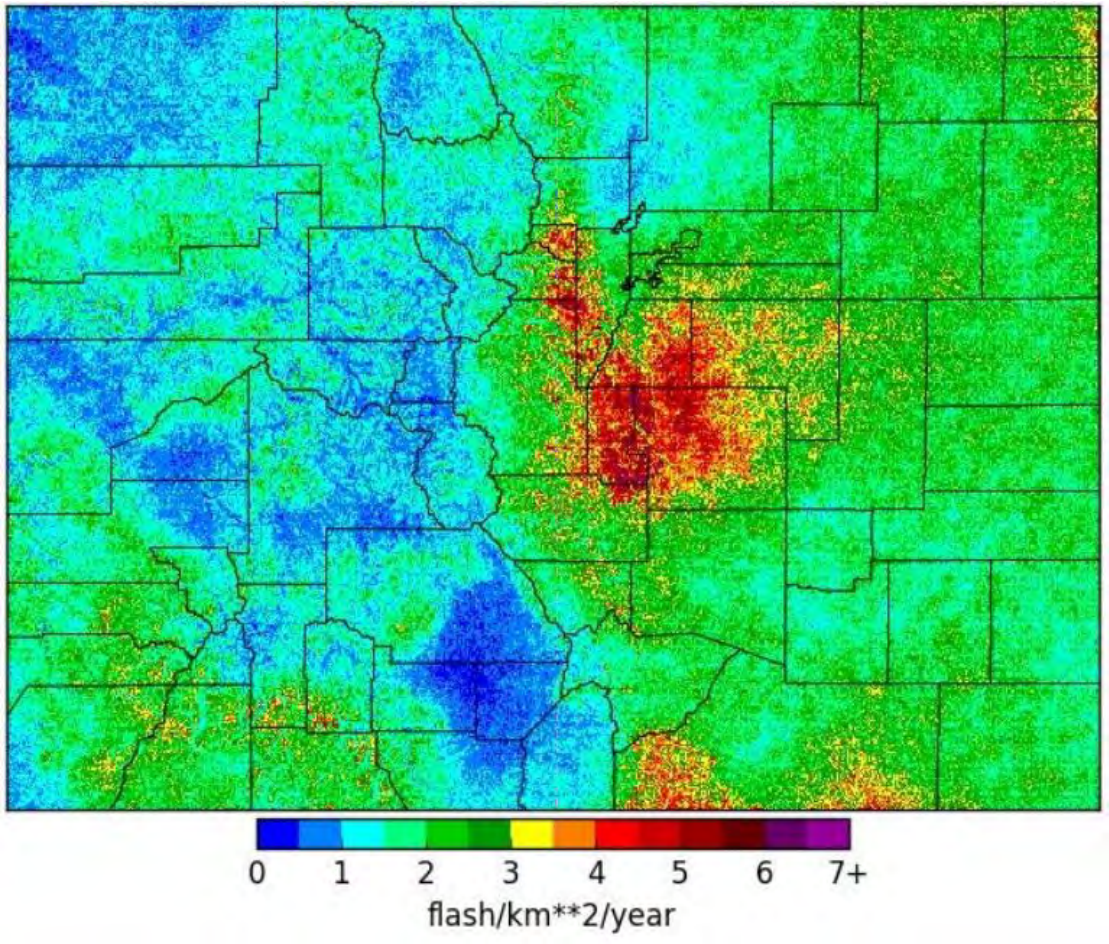
Based on the information in this hazard profile the risk of damaging lightning events in the City of Aurora is moderate. Significance is considered to have a moderate potential impact because of risk to life safety, power outages, and fire ignitions.

4.10.3 Location

The location rating for lighting is **limited**.

The location for lightning may be examined in two ways. In one regard, 'lightning' is a regional hazard measured by the possible places of occurrence. In the other, 'lightning incidents' refer to single-point occurrences and are measured according to density. Examining the density of the lightning flashes may yield more useful information, particularly when the impacts of the hazard are examined. Lightning can strike anywhere in the City of Aurora. Figure 4-28 shows the lightning flash density for Colorado from 1994 to 2014.

Figure 4-28 Colorado Annual Lightning Flash Density, 1994-2014



Source: NOAA, 2018 Colorado State Hazard Mitigation Plan

4.10.4 Magnitude and Severity

The magnitude and severity of lightning is **limited**.

Impacts for lightning are both direct and indirect. People or objects are directly impacted when struck, or indirectly damaged when the current of the bolt passes through or near the person or object. Other impacts include the ignition of wildfires. The Colorado Division of Homeland Security and Emergency Management estimates that more than half of all forest fires in Colorado are ignited by lightning, in addition to the rangeland and wheat-field fires that lightning causes. Lightning is most likely to cause wildfires during dry conditions or during dry thunderstorms. Records of previous incidents in the NCEI database indicates that most events damage only personal property, and do not significantly impact the availability of critical services or infrastructure, corresponding to negligible severity ratings in both categories. Isolated cases, usually those which trigger large wildfires, have a more significant impact on property damages, but the ratings are still classified as limited.

The majority of lightning strikes with casualties for Colorado occurred between the hours of noon and 5:00 pm, peaking between 2:00 and 4:00 pm. This correlates to the times when the population are most exposed, as well: during the temperate summer months, on days where people are most likely to be outside, during peak times of day where outdoor activities are expected to occur. The injury and fatality rates associated with lightning are the greatest indicators of magnitude and severity. It is particularly

telling when the flash density of the State is considered. As discussed in the geographic extent section, Colorado experiences an average number of cloud-to-ground strikes when compared to the nation. However, Colorado's injury and fatality ratings are consistently in the top five, or top three when adjusted for population. While these impacts on the population indicate a higher severity, the overall impacts of this hazard are still limited given the relatively infrequent occurrence of significant damage and the single-point nature of lightning strikes.

4.10.5 Probability of Future Occurrence

The probability of future occurrences of lightning is **highly likely**.

As identified earlier, lightning occurs thousands of times a year in Colorado alone. According to information retrieved from NOAA, the planning area receives between 6.5 to 10.4 lightning strikes per square mile, or an average of 8.4 lightning strikes per square mile. This means the planning area, which is 154 square miles in size, experiences an average of 1,294 cloud-to-ground strikes of lightning a year. Knowing that the probability of any lightning event occurring in the future is highly likely helps underscore the importance of increased public education about the hazard. In order to fairly compare the lightning hazard to other hazards in the planning area, the probability of future occurrences for a lightning event that causes damage should also be computed.

The NCEI database is the only available dataset for county-specific lightning incidents that includes property and fire damages. Although this dataset is probably incomplete, it will be used as the source for the probability of occurrence calculation below. If additional lightning data becomes available for the City of Aurora, then this section may need to be revisited. As previously discussed, there were 8 lightning events that caused property damage between 1997 and 2020. This results in a probability of 35% for a damaging lightning strike occurring somewhere in the planning area in any given year.

4.10.6 Climate Change Considerations

According to the 2018 Colorado State Hazard Mitigation Plan, the future impacts of climate change on lightning in Colorado are still unclear. No clear projected trend in the frequency or intensity of warm-season convective storms has been identified for Colorado. Therefore, the intensity and extent of thunderstorm and lightning events is not projected to change. However, according to studies referenced by the National Lightning Safety Institute, it could be possible globally to see an increase of 10-20% in the incidence of lightning with each degree of global temperature increase. This could potentially lead to higher frequency of occurrence in Colorado.

4.10.7 Vulnerability

People

Persons recreating or working outdoors during the months of April through September will be most at risk to lightning strikes, especially those out in open areas without shelter. It is difficult to quantify future deaths and injuries due to lightning, other than to note that future occurrences are likely without increased public education.

Property

Lightning strikes can damage property, facilities, and infrastructure. If struck by lightning, structural damage is possible, as well as the potential for a fire. There have been $643,000 in property damages recorded from lightning in the City from 1997 through 2020, which averages out to $26,792 per year. Much of these damages were a result of lightning-caused structural fires.

Critical Facilities and Infrastructure

Critical facilities and infrastructure will have the greatest consequences if damaged by a lightning strike. According to the 2018 Colorado State Hazard Mitigation Plan, statewide between 2008 and 2017, the

Office of Risk Management (ORM) reported that 48 severe thunderstorm and lightning events damaged state assets. In this timeframe, these events resulted in $1,041,989 in losses, some of which occurred to critical facilities such as within the state correctional system. Forty-five of the 48 events were due to lightning strikes, equating to $1,010,944 of the $1,041,989 in losses. These lightning strikes resulted in damages to building contents such as electric and power equipment connected to the electrical system more than causing structural damage.

Lightning events in the city can have destructive effects on power and information systems. Failure of these systems could have cascading effects throughout the city and could possibly disrupt critical facility functions.

Government Services

Lightning is not likely to cause a significant disruption to the provision of government services. Similar to the property and critical facilities sections, the greatest potential risk would be to government property and buildings struck by lightning.

Economy

Economic impact of a severe thunderstorm is typically short term. Lightning and high wind events can cause power outages and fires. Generally, long-term economic impacts center more around hazards that cascade from a severe thunderstorm, including wildfires ignited by lightning. Similarly, with the above section, lightning can cause structural damage or damage to electrical systems to private buildings as well as critical infrastructure.

Historic, Cultural, and Natural Resources

Lightning can cause significant damage or destruction to trees, as well as the potential for many lightning strikes in open field areas of the city to spark small wildfires and brush fires. The greatest losses from lightning result from the secondary hazard of wildfire, which can have cascading impacts on natural resources.

4.10.8 Development Trends

New critical facilities such as communications towers typically are built with lightning protection measures. As the population continues to increase and the number of people exposed to the hazard increases, it is reasonable to assume that injuries and deaths will also increase to some degree.

4.10.9 Risk Summary

- The overall significance of this hazard to the City is Medium.
- Lightning is one of the more dangerous and unpredictable weather hazards in the United States and in Colorado, but impacts are typically isolated.
- According to the National Lightning Safety Institute, every year lightning strikes the U.S. about 25 million times, causes more than 26,000 fires, and causes losses in excess of $6 billion through direct or indirect impacts.
- Since 1997, the City of Aurora has experienced 5 lightning strikes that resulted in injuries and 8 that caused property damage, totaling $643,000.
- The majority of lightning strikes with casualties occurred between the hours of noon and 5:00 pm.
- Lightning poses a significant threat to personal life safety for the jurisdiction’s citizens, specifically those working or recreating outdoors.

4.11 Severe Wind

Hazard	Location	Probability of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Severe Wind	Significant	Highly Likely	Limited	Medium

4.11.1 Description

Damaging winds are classified as those exceeding 60 mph. Damage from such winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach upwards of 100 mph and can produce a damage path extending for hundreds of miles. There are seven types of damaging winds, which are defined to the right.

Straight-line winds may exacerbate existing weather conditions, such as blizzards, by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snowstorms. High winds may also exacerbate fire conditions by drying out the ground cover, propelling fuel, such as tumbleweeds, around the region, and increasing the ferocity of existing fires. These winds may damage crops, push automobiles off roads, damage roofs and structures, and cause secondary damage due to flying debris. Shorter duration winds, such as wind gusts, can cause substantial damage to power lines. Winds with an intermediate duration, which sharply increase and last for a minute, are called squalls. Long-duration wind speeds have various names associated with their average strength, such as breeze, gale, storm, hurricane, and typhoon.

Downslope winds in Colorado are referred to as Chinook winds, after the Native American tribe of the Pacific Northwest. As shown in Figure 4-29, these downslope winds can occur with violent intensity in areas where mountains stand in the path of

DEFINITIONS

Straight-line Winds— Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.

Downdrafts— A small-scale column of air that rapidly sinks toward the ground.

Downbursts— A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.

Microbursts— A small, concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.

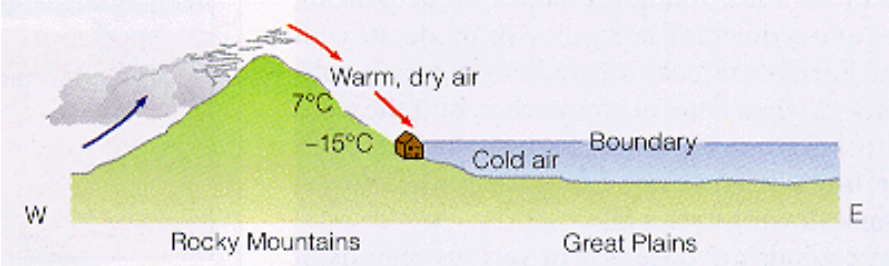
Gust Front— A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.

Derecho—A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word “derecho” is of Spanish origin and means “straight ahead.” Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.

Bow Echo—A bow echo is a linear wind front bent outward in a bow shape. Damaging straight- line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive wind damage at the ground.

strong air currents. These warm and dry winds occur when the winds from the west blow across the Continental Divide and descend from the foothills and out onto the plains.

Figure 4-29 Chinook Wind Pattern



Source: University of Colorado at Boulder ATOC Weather Lab

Wind can be very dangerous. Areas of wind shear, caused by various weather phenomena, can make treacherous situations for airplanes and other flying aircraft. When winds become too strong on the ground, boats can capsize, trees can be stripped of their branches or uprooted, and man-made structures become vulnerable to damage or destruction. The NWS can issue High Wind Watch, High Wind Warning, and Wind Advisory to the public. The following are the definitions of these issuances:

- **High Wind Watch**—This is issued when there is the potential of high wind speeds developing that may pose a hazard or are life-threatening.
- **High Wind Warning**—The 1-minute surface winds of 35 knots (40 mph) or greater lasting for one hour or longer, or winds gusting to 50 knots (58 mph) or greater, regardless of duration, that are either expected or observed over land.
- **High Wind Advisory**—This is issued when high wind speeds may pose a hazard. Sustained winds 25 to 39 mph and/or gusts to 57 mph.

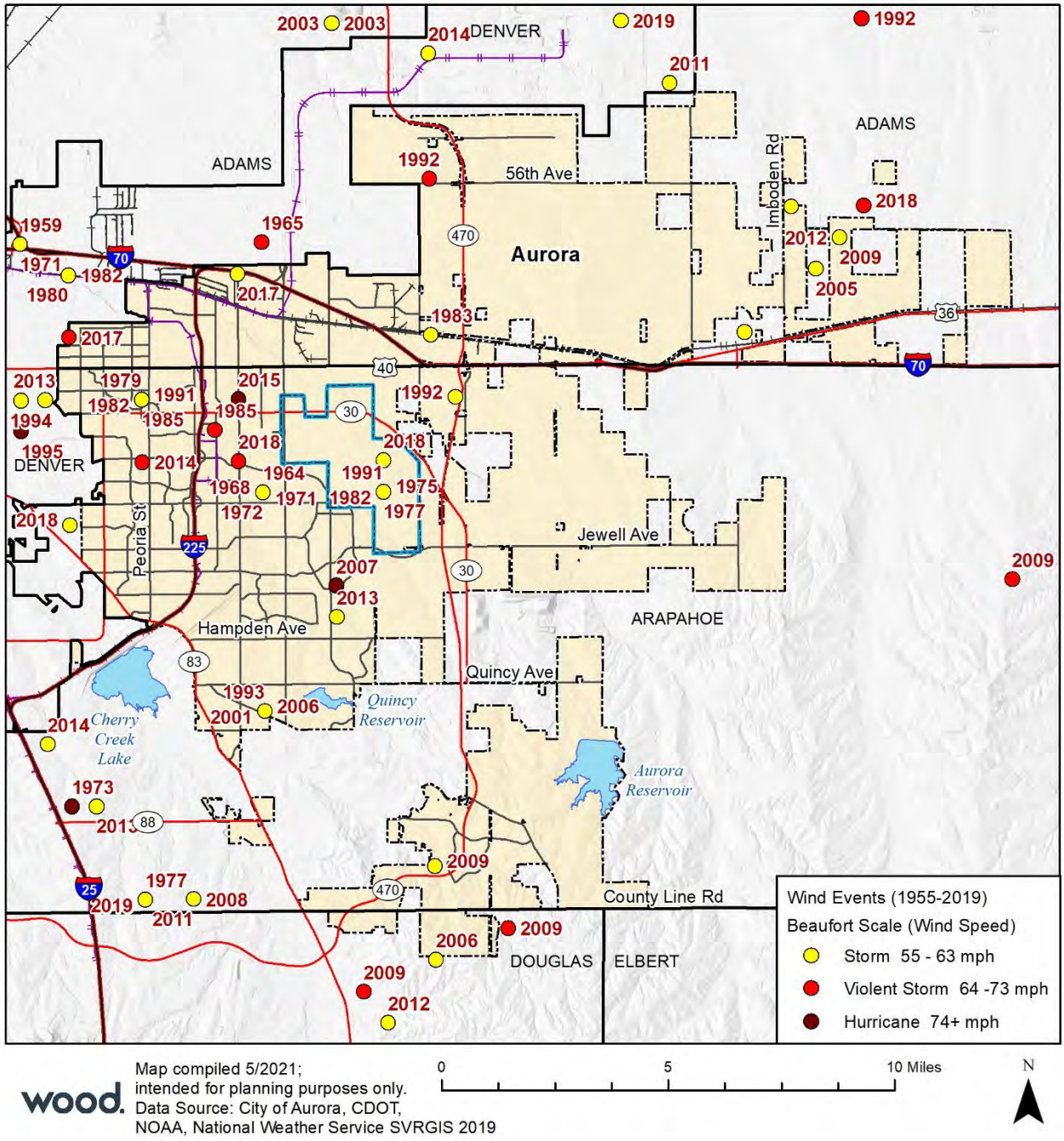
Wind patterns in the Front Range region range from light and breezy to severe gale force winds. There is usually some level of a constant breeze due to the City of Aurora's plains topography.

4.11.2 Past Events

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Windstorms in the City of Aurora are rarely life threatening, but do disrupt daily activities, cause damage to buildings, and structures, and increase the potential for other hazards, such as wildfire. Winter winds can also cause damage, close highways (blowing snow), and induce avalanches. Winds can also cause trees to fall, particularly those killed by pine beetles or wildfire, creating a hazard to property or those outdoors.

Historical severe weather data from the NCEI Storm Events Database only provides information at the county level. Often high wind events occur over large areas beyond just the limits of one municipality, but NOAA instruments record specific wind speeds at single point locations. Across the three counties that Aurora spans, the NCEI database includes 156 days with high wind events and 122 days with thunderstorm wind events between 1990 and 2020. However, it is unclear how many of these events impacted the City of Aurora specifically. Figure 4-30 below shows locations of high wind events with measured wind speeds greater than 55 miles per hour from 1955-2019.

Figure 4-30 High Wind Events in Aurora, 1955-2019



4.11.3 Location

The location rating for severe wind is **Extensive**.

The entire planning area is susceptible to wind, windstorms, and wind associated with other storm systems that can have negative impacts on a community. Depending on the origination of the atmospheric system, its direction of travel, and its duration, a part of the planning area can be affected or the entire City. Figure 4-31 depicts wind zones for the United States. The map shows that the City of Aurora falls

into Zone II which is characterized by high winds of 160 mph. The eastern portion of the city can experience stronger winds as there is a lack of trees, hills, and other terrain features to provide friction.

Figure 4-31 Wind Zones in the United States

Source: FEMA

4.11.4 Magnitude and Severity

The magnitude and severity of severe wind in Aurora is **limited**.

As mentioned above, Aurora is located in Wind Zone II, meaning wind speeds up to 160 mph are possible, however sustained winds of this speed are quite uncommon and fall on the extreme end of possible wind gusts. As shown in Figure 4-30, the City has recorded numerous high wind speeds in excess of 55 mph, including multiple above 74 mph which is equivalent to a Category 1 hurricane. According to data from NOAA, the highest wind speed recorded in Aurora was 94 mph.

Damage from windstorms can be difficult to quantify. Wind, by itself, has not historically caused high insured dollar losses. For the insurance industry to track a weather event, it must be a large enough storm that insurance companies may declare it a catastrophe, and then damage estimates for auto and homeowner claims are collected and published. This generally equates to damages in excess of $25 million, though significant events impacting small communities are also tracked occasionally.

Table 4-51 shows The Beaufort Wind Scale. The replication of the scale only reflects land-based effects.

Table 4-51 The Beaufort Wind Scale

Beaufort Number	Description	Windspeed (Knots)	Land Conditions
0	Calm	<1	Calm. Smoke rises vertically.
1	Light air	1 – 3	Wind motion visible in smoke.
2	Light breeze	4 – 6	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 16	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	17 – 21	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	22 – 27	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	Near Gale	28 – 33	Whole trees in motion. Effort needed to walk against the wind.
8	Gale	34 – 40	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	Slight structural damage occurs; slate blows off roofs
10	Storm	48 – 55	Seldom experienced on land; trees uprooted or broken; considerable structural damage
11	Violent storm	56-63	
12	Hurricane	64+	

Source: National Oceanographic and Atmospheric Association

Table 4-52 and Table 4-53 show typical levels of damage that can be expected based on windspeed.

Table 4-52 Damage to Institutional Buildings from High Wind

Damage Description	Wind Speed Range (Expected Speed)
Threshold of visible damage	59-88 MPH (72 MPH)
Loss of roof covering (<20%)	72-109 MPH (86 MPH)
Damage to penthouse roof & walls, loss of rooftop HVAC equipment	75-111 MPH (92 MPH)
Broken glass in windows or doors	78-115 MPH (95 MPH)
Uplift of lightweight roof deck & insulation, significant loss of roofing material (>20%)	95-136 MPH (114 MPH)
Façade components torn from structure	97-140 MPH (118 MPH)
Damage to curtain walls or other wall cladding	110-152 MPH (131 MPH)
Uplift of pre-cast concrete roof slabs	119-163 MPH (142 MPH)
Uplift of metal deck with concrete fill slab	118-170 MPH (146 MPH)
Collapse of some top building envelope	127-172 MPH (148 MPH)
Significant damage to building envelope	178-268 MPH (210 MPH)

Source: National Oceanographic and Atmospheric Association

Table 4-53 Damage to Electric Transmission Lines from High Wind

Damage Description	Wind Speed Range (Expected Speed)
Threshold of visible damage	70-98 MPH (83 MPH)
Broken wood cross member	80-114 MPH (99 MPH)
Wood poles leaning	85-130 MPH (108 MPH)
Broken wood poles	98-142 MPH (118 MPH)

Source: National Oceanographic and Atmospheric Association

4.11.5 Probability of Future Occurrence

The probability rating for severe wind is **highly likely**.

According to the NCEI, there have been 144 separate events with NCEI-recorded high winds above 57 mph (50 knots) within Arapahoe, Adams, and Douglas Counties from January 2000 to December 2020, an average of 7 per year. This historic frequency suggests that the probability of a Severe Wind event occurring in the planning area in any given year is 100%.

4.11.6 Climate Change Considerations

According to the best data available at the time of this plan update, the future impacts of climate change on severe wind events are unclear.

4.11.7 Vulnerability

People

Windstorms can cause injury and death, although historically this has been extremely rare in Aurora. Those working or recreating outdoors will be susceptible to injury from wind borne debris. First responders who are dealing with emergency situations resulting from the windstorm are also at risk.

Vulnerable populations also include the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Those individuals in Aurora who rely on electricity to live independently in their homes are vulnerable in the event of power outages. Isolation of these populations is a significant concern. These populations face isolation and exposure during wind events and could suffer more secondary effects of the hazard.

Property

All property is vulnerable during high wind events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Generally, damage is minimal and goes unreported. Property located under or near overhead lines or near large trees may be damaged in the event of a collapse. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building's protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage. This occurred during a high wind event in 1993 which tore the roof off six apartments at a complex in Aurora, resulting in $500,000 in damage.

Critical Facilities and Infrastructure

High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular

concern are roads providing access to isolated areas and to the elderly. Severe windstorms and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

Government Services

High wind events can potentially cause disruption to the delivery of government services in the event of power disruptions to government buildings, similarly to commercial and residential power losses.

Economy

Economic impacts of severe wind are typically short term. These events can disrupt travel into and out of all areas of the county and create perilous conditions for residents, tourists, and nature alike.

The effect of high winds on power delivery is a relevant factor when assessing current development exposure. FEMA Standard Values for Loss of Service for Utilities estimate that a power supply interruption costs the average person $126 per day of service outage. A high wind event that impacted a large area of the Front Range, including Aurora, on June 6th, 2020 resulted an estimated 208,000 customers losing power throughout the state according to Xcel energy and the NCEI database. Using the FEMA Standard Values, an outage this widespread which lasts for a full day or more can be expected to cost more than $26 million per day.

Historic, Cultural, and Natural Resources

The environment is highly exposed to high winds. Environmental impacts include the downing of trees, which can further result in property damage or injuries, and localized flattening of plants by high wind.

4.11.8 Development Trends

Construction sites are particularly vulnerable to windstorms. Wind-borne construction materials can become hazards to life and property. This could become particularly apparent for areas of Aurora experiencing rapid residential growth and expansion on the eastern and northeastern plains areas of the city, where there are fewer natural barriers to high wind.

4.11.9 Risk Summary

- The overall significance of this hazard to the City is Medium.
- The City of Aurora is located in Wind Zone II, an area of the United States that can experience wind speeds up to 160 MPH, which is the equivalent of Category 5 Hurricane wind speeds.
- Based on the frequency of past events, it can be assumed that the City will experience an average of seven high wind events every year.
- High winds often cause damage to trees, breaking off limbs or uprooting them entirely, which in turn pose a significant threat to buildings, utility lines, vehicles, and people.
- Reducing vulnerability of power utilities to damage from high wind by undergrounding utilities could improve the city's resilience to this hazard.

4.12 Tornado

Hazard	Location	Probability of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Tornado	Limited	Likely	Limited	Medium

4.12.1 Description

A tornado is a narrow, violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The visible sign of a tornado is the dust and debris that is caught in the rotating column made up of water droplets. Tornadoes are the most violent of all atmospheric storms. The following are common ingredients for tornado formation:

DEFINITIONS

Tornado – Funnel clouds that generate winds up to 500 miles per hour. They can affect an area up to three-quarters of a mile wide, with a path of varying length. Tornadoes can come from lines of cumulonimbus clouds or from a single-storm cloud. They are measured using the Fujita Scale, ranging from F0 to F5, or the Enhanced Fujita Scale.

- Very strong winds in the mid and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet.)
- Very warm, moist air near the ground with unusually cooler air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from a previous shower or thunderstorm activity

Tornadoes can form from individual cells within severe thunderstorm squall lines. They also can form from an isolated super-cell thunderstorm. Weak tornadoes can sometimes occur from air that is converging and spinning upward, with little more than a rain shower occurring in the vicinity.

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage, shown in Table 4-54. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. These estimates vary with height and exposure. Standard measurements are taken by weather stations in open exposures.

Table 4-54 The Fujita Scale and Enhanced Fujita Scale

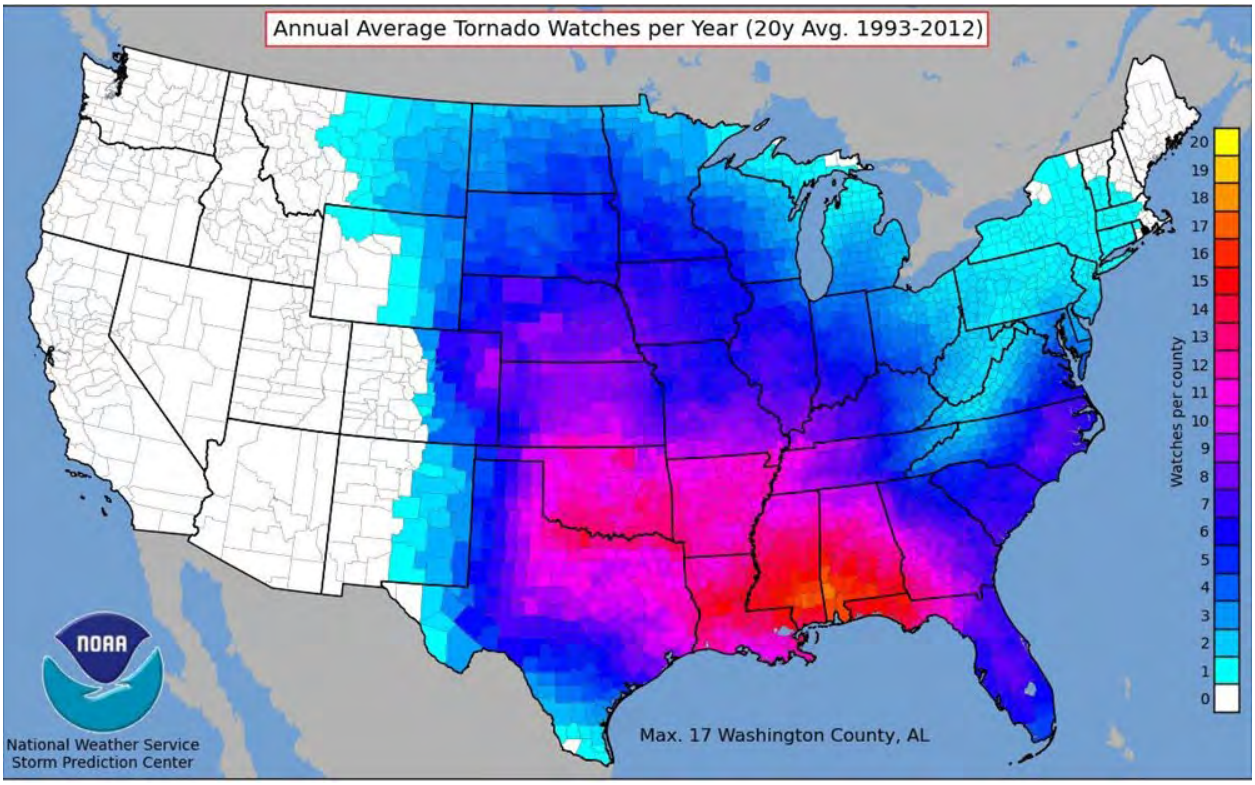
Fujita Scale		Enhanced Fujita Scale	
F Number	Wind Speed (mph)	EF Number	Wind Speed (mph)
0	40-72	0	65-85
1	73-112	1	86-110
2	113-157	2	111-135
3	158-207	3	136-165
4	208-260	4	166-200
5	261-318	5	201+

Source: National Oceanographic and Atmospheric Association

When weather systems occur which can potentially lead to the formation of tornadoes, the National Weather Service will issue a tornado watch. This means that tornadoes are possible in and near the watch area and is a notice to area residents to be prepared for the possibility of a tornado. A tornado warning is issued when a tornado has been sighted or indicated by weather radar. In the event of a tornado warning there is imminent danger to life and property. Those in the area of the warning should move to an interior room on the lowest floor of a sturdy building and avoid any windows. Those in a mobile home, a vehicle, or outdoors, should move to the closest substantial shelter and protect yourself from flying debris. Figure 4-32 shows the average number of annual tornado watch issuances from the National Weather Service. According to this figure, the City of Aurora has approximately 5-6 tornado watches annually.

Once a warning has been issued, residents may have only a matter of seconds or minutes to seek shelter. If an EF3 or higher tornado were to hit populated areas of the City of Aurora, substantial damage to property and loss of life could result. Likelihood of injuries and fatalities would increase if warning time was limited before the event or if residents were unable to find adequate shelter.

Figure 4-32 Total Annual Tornado Watches in the U.S. (1993-2012)



Source: NOAA

4.12.2 Past Events

The United States experiences more tornadoes than any other country. In a typical year, approximately 1,200 tornadoes affect the United States. The peak of the tornado season is April through June, with the highest concentration of tornadoes in the central United States. From 1991 to 2010 Colorado experienced an average of 53 tornado events annually. Colorado ranks 9th among the 50 states in frequency of tornadoes, but 38th for the number of deaths. Colorado ranks 31st for injuries and 30th for the cost of damages due to tornadoes. When these statistics are compared to other states by the frequency per square mile, Colorado ranks 28th for injuries per area and 37th for costs per area.

Table 4-55 lists tornadoes recorded in the City of Aurora by the NOAA storm prediction center from 1967 to 2019; some of the listed tornados occurred on the same day and represent two different locations where the tornado touched the ground. Additionally, some tornadoes which may have originated outside of the City of Aurora but crossed into the city may not be listed. One such event occurred in 2009, where a tornado touched down outside of Aurora but crossed into the city causing substantial damage at Southlands Mall; $500,000 in property damage and 2 injuries resulted from the event, and 8,000 structures lost power. One tornado that did not cause property damage, but resulted in an injury occurred on June 8, 2014, and was rated an EF1. Another tornado caused property damage totaling $6 million and resulted in one injury on August 29, 2002, after destroying four condominium buildings that were under construction. There are no known fatalities from tornadoes within the city.

Table 4-55 City of Aurora Tornado Events (1967 – 2019)

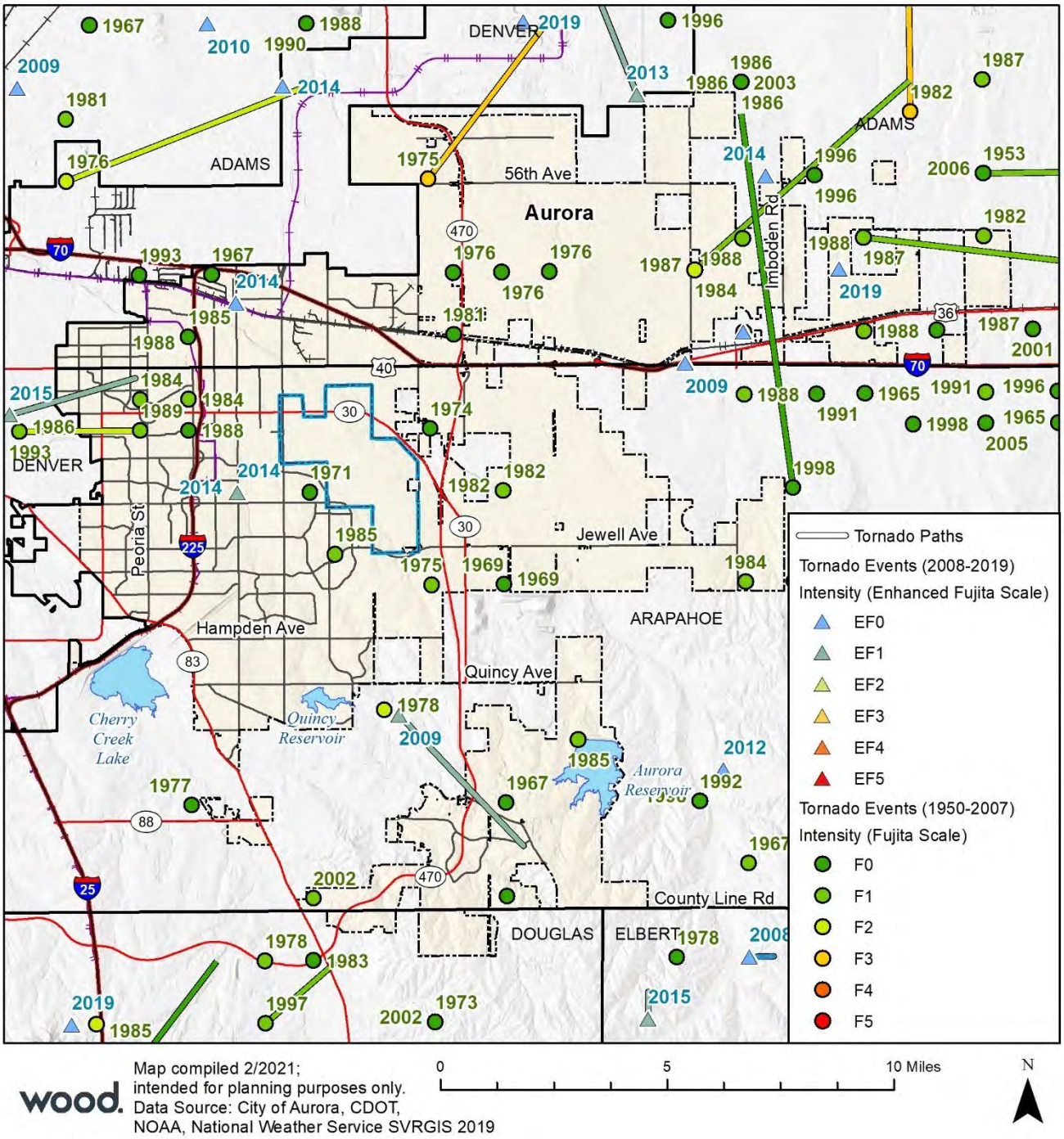
				Estimated Damage Cost	
Location	Date	Magnitude	Injuries	Property	Crops
Adams County	6/9/1967	F0	0	$250,000	$0
Douglas County	6/14/1967	F0	0	$0	$0
Arapahoe County	7/3/1967	F0	0	$0	$0
Arapahoe County	8/5/1969	F0	0	$0	$0
Arapahoe County	8/5/1969	F0	0	Unknown	Unknown
Arapahoe County	4/19/1971	F0	0	$0	$0
Arapahoe County	7/28/1974	F0	0	$0	$0
Adams County	5/18/1975	F1	0	$0	$0
Arapahoe County	5/18/1975	F3	0	$0	$0
Adams County	9/14/1976	F0	0	$0	$0
Adams County	9/14/1976	F0	0	Unknown	Unknown
Adams County	9/14/1976	F0	0	Unknown	Unknown
Arapahoe County	8/16/1981	F1	0	$0	$0
Arapahoe County	6/3/1982	F1	0	$3,000	$0
Arapahoe County	6/3/1982	F1	0	$3,000	$0
Adams County	6/12/1982	F1	0	$3,000	$0
Adams County	6/3/1984	F1	0	$0	$0
Arapahoe County	7/6/1984	F1	0	$25,000	$0
Arapahoe County	6/3/1985	F1	0	$2,500	$0
Arapahoe County	6/3/1985	F1	0	$0	$0
Arapahoe County	8/3/1985	F1	0	$0	$0
Arapahoe County	6/8/1986	F2	0	$2,500,000	$0
Arapahoe County	6/10/1988	F0	0	$0	$0
Arapahoe County	6/10/1988	F0	0	Unknown	Unknown
Adams County	6/26/1988	F1	0	$0	$0
Adams County	7/9/1988	F1	0	$0	$0
Arapahoe County	6/8/1989	F1	0	$250,000	$0
Arapahoe County	8/29/2002	F1	1	$6,000,000	$0
Arapahoe County	6/7/2009	EF1	2	$500,000	$0
Buckley Air Force Base	5/21/2014	F1	0	$0	$0
Arapahoe County	5/21/2014	F1	0	$0	$0
Buckley Air Force Base	6/8/2014	EF1	1	$0	$0
Adams County	5/26/2019	EF0	0	$0	$0

EF Enhanced Fujita
F Fujita
Source: National Climatic Data Center

4.12.3 Location

The location rating for tornadoes is **limited**.

Figure 4-33 Tornado Paths in the City of Aurora (1950-2019)



Recorded tornadoes in the City of Aurora are typically small and short-lived. Tornadoes can occur throughout the entire City. The tornado paths that have occurred in the City of Aurora between 1950 and 2019 are shown in Figure 4-33. There are 32 reported tornado events documented in Figure 4-33 and in Table 4-55.

4.12.4 Magnitude and Severity

The magnitude and severity for tornadoes is **limited**.

Tornadoes have been reported nine months of the year in Colorado, with peak occurrences between mid-May through mid-August. Statewide, June is by far the month with the most recorded tornadoes. The City of Aurora has had 13 tornadoes in June, more than any other month.

An average of 28% of the tornadoes which have occurred in Aurora resulted in recorded property damage. The average loss expectancy per damaging tornado event is $1,004,055, with an annualized loss of $170,500.

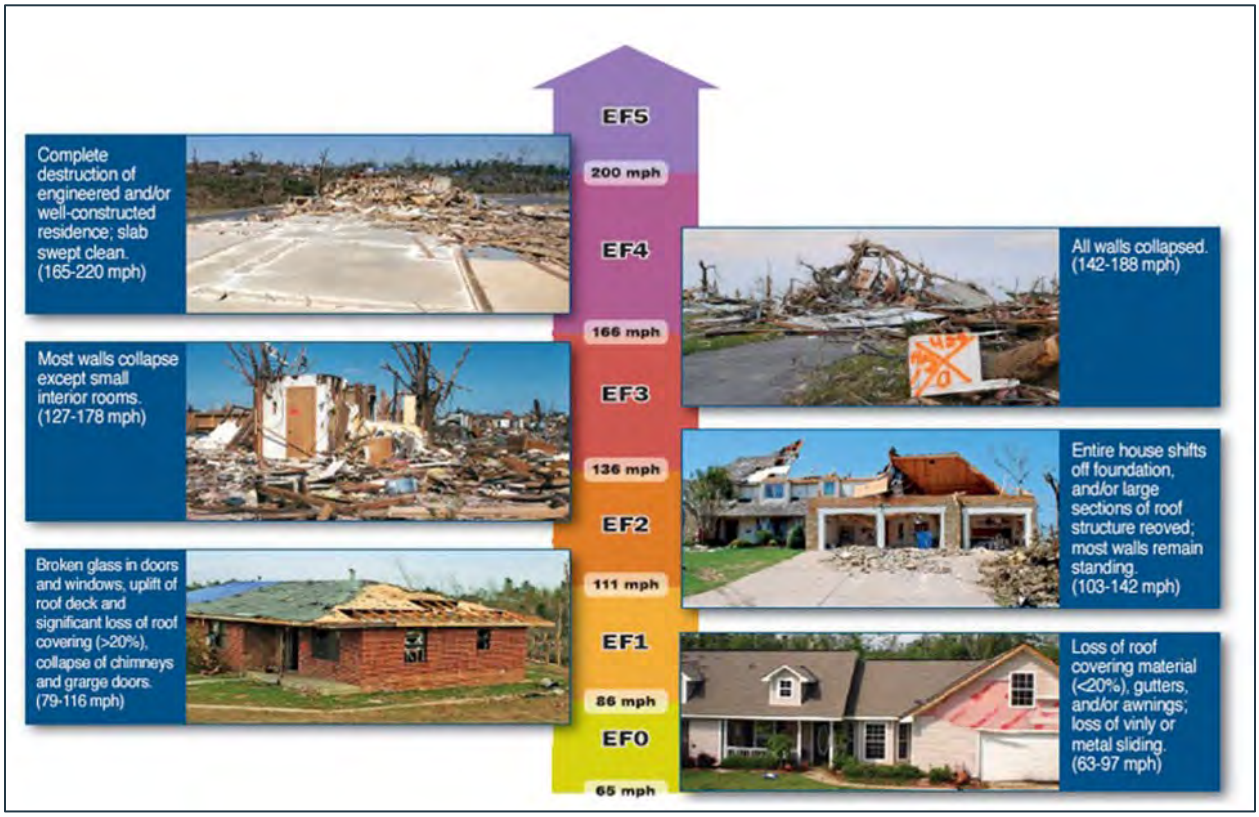
Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike within the populated areas of the City of Aurora, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings may be damaged or destroyed. Historically, tornadoes have not been severe or caused extensive damage in the city. Table 4-56 below summarizes the wind speeds and relative frequency on a national level of each of the EF scales. Descriptions of the expected damage at each scale are also summarized in Table 4-56.

Table 4-56 Enhanced Fujita Scale with Damage Descriptions

Enhanced Fujita Scale			
Scale	**Wind Speed (mph)**	**Relative Frequency**	**Potential Damage**
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: National Oceanic and Atmospheric Administration

Figure 4-34 Potential Damage Impacts from a Tornado



Source: NOAA

4.12.5 Probability of Future Occurrences

The probability rating for tornadoes, both weak and damaging events, is **likely**.

As noted above, 32 tornadoes have been recorded in Aurora over a 52-year period. This results in a 61.5% probability of tornadoes occurring in Aurora in any given year, which would be considered a likely occurrence. However, over this same time period only 9 tornadoes resulted in recorded property damage. This results in a much lower probability of 17% in any given year for a damaging tornado.

4.12.6 Climate Change Considerations

There presently is not enough data or research to quantify the magnitude of change that climate change may have related to tornado frequency and intensity. NASA's Earth Observatory has conducted studies which aim to understand the interaction between climate change and tornadoes. Based on these studies meteorologists are unsure why some thunderstorms generate tornadoes and others do not, beyond knowing that they require a certain type of wind shear. Tornadoes spawn from approximately one percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. Some studies show a potential for a decrease in wind shear in mid-latitude areas. Because of uncertainty with the influence of climate change on tornadoes, future updates to the mitigation plan should include the latest research on how the tornado hazard frequency and severity could change. The level of significance of this hazard should be revisited over time.

4.12.7 Vulnerability

People

Community members are the most vulnerable to tornado events. Over the past 53 years there have been 4 injuries and no deaths reported in the City of Aurora due to tornadoes. The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. However, there are also segments of the population that are especially exposed to the indirect impacts of damaging winds and tornadoes, particularly the loss of electrical power. These populations include the elderly or disabled, especially those with medical needs and treatments dependent on electricity. Nursing homes, community-based residential facilities, and other special needs housing facilities are also vulnerable if electrical outages are prolonged, since backup power generally operates only minimal functions for a short time.

Property

General damages can be both direct and indirect. Direct damage refers to what the wind event physically destroys. Indirect damage focuses on additional costs, damages and losses from secondary hazards spawned by the event. Depending on the magnitude as well as the size of the tornado and its path, a tornado is capable of damaging and eventually destroying almost anything. Construction practices and building codes can help maximize the resistance of the structures to damage. Mobile homes, which are most often occupied by low-income, socially vulnerable residents, are the most dangerous places during a tornado. Studies indicate that 45% of all fatalities during tornadoes occur in mobile homes, compared to 26% in traditional site-built homes (Ashley 2008). According to the 2019 American Community Survey, there are 2,487 mobile homes in Aurora, which makes up approximately 1.8% of the total housing units in the city.

Secondary impacts of damage caused by wind events often result from damage to infrastructure. Downed power and communications transmission lines, coupled with disruptions to transportation, create difficulties in reporting and responding to emergencies. These indirect impacts of a tornado event put tremendous strain on a community. In the immediate aftermath, the focus is on emergency services.

Critical Facilities and Infrastructure

Inventory assets exposed to severe wind is dependent on the age of the building, type, construction material used, and condition of the structure. Possible losses to critical infrastructure include:

- Electric power disruption
- Communication disruption
- Water and fuel shortages
- Road closures
- Damaged infrastructure components, such as sewer lift stations and treatment plants
- Damage to homes, structures, and shelters

Because of the unpredictability of tornado events' strength and path, most critical infrastructure that is above ground is equally exposed to the storm's impacts. Downed power lines can cause power outages, leaving large parts of the City isolated, and without electricity, water, and communication. Damage may also limit timely emergency response and the number of evacuation routes. Downed electrical lines following a storm can also increase the potential for lethal electrical shock and can also lead to other hazard events such as wildfires.

Government Services

Damage impacts to transportation corridors and communications lines could affect first responders' ability to effectively respond in the aftermath of a tornado. Damage to government facilities/personnel in incident area may require temporary relocation of some operations, and potentially disrupt government

services. The public may question local government's ability to respond and recover if planning, response, and recovery are not timely and effective. A significant tornado may require disaster declarations and aid programs. These needs may impact funding or administrative resources for other regular operations or may necessitate changes to existing operating procedures.

Economy

Loss of power and minimal damage following a tornado could cause disruptions to the local economy through forced temporary closures of businesses and preventing people from traveling to work. More severe tornadoes could result in significant economic disruption and hinder recovery through the forced extended or permanent closure of businesses damaged in the event. Additionally, tornadoes which cause significant property damage could negatively impact the local economy.

Historic, Cultural, and Natural Resources

Damaging winds and tornadoes can cause massive damage to the built and natural environment, uprooting trees and other debris. Historic properties may have increased vulnerability to the wind speeds generated by a tornado due to their age.

4.12.8 Development Trends

All future development will be potentially exposed to tornadoes. Development regulations that require safe rooms, basements, or other structures that reduce risk to people would decrease vulnerability but may not be cost-effective given the relative infrequency of damaging tornadoes in Aurora.

4.12.9 Risk Summary

- The overall significance of this hazard to the City is Medium.
- There have been 32 recorded tornado events in the City of Aurora. Additional tornadoes may have impacted the City and not been listed in previous sections due to originating outside of the City.
- Upwards of $9 million in damages has been attributed to tornadoes in Aurora.
- Those who reside in mobile homes are particularly vulnerable to a tornado. There are 2,487 mobile homes in the city and an average household size of 2.8, resulting in an estimated population of 6,964 in this vulnerable group.
- The City's Local Energy Assurance Plan has identified critical facilities and their capabilities and limitations for backup power supply.
- Roads and bridges blocked by debris or otherwise damaged might isolate populations.
- Warning time may not be adequate for residents to seek appropriate shelter or such shelter may not be widespread throughout the planning area.
- The impacts of climate change on the frequency and severity of tornadoes are not well understood.

4.13 Wildfire

Hazard	Geographic Extent	Potential of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Wildfire	**Limited**	**Likely**	**Limited**	**Low**

4.13.1 Description

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, or arson.

Fire hazards present a considerable risk to vegetation and wildlife habitats. Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure. Vulnerability to flooding increases due to the destruction of watersheds. The potential for significant damage to life and property exists in areas designated as wildland urban interface (WUI) areas, where development is adjacent to densely vegetated areas.

DEFINITIONS

Wildfire—Fires that result in uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. Because of their distance from firefighting resources, they can be difficult to contain and can cause a great deal of destruction.

Conflagration—A fire that grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel buildup, and explosions are usually the elements behind a wildfire conflagration.

Wildland Urban Interface (WUI) —An area susceptible to wildfires and where wildland vegetation is adjacent to or intermixed with developed areas. An example would be smaller urban areas and dispersed rural housing in forested areas.

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause indirect economic losses in reduced tourism. Wildfires cause reservoir contamination, destroy transmission lines, and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing imperviousness of the soil. This increases the runoff generated by storm events, thus increasing the chance of flooding.

Wildfires are of significant concern throughout Colorado. The impacts of wildfires on the City of Aurora have historically been fairly limited but may be increasing as human development and population increases as the WUI expands as in the City of Aurora.

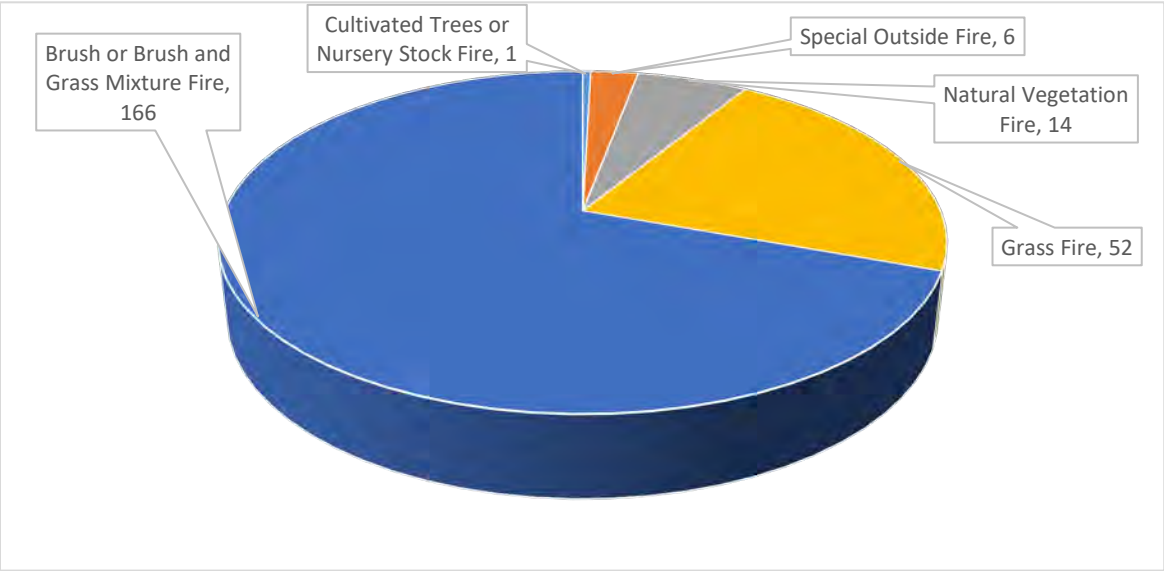
Fire Protection in the City of Aurora

Fire protection in the City of Aurora is handled by Aurora Fire Rescue. The department was created in 1902 and currently has 17 stations and more than 450 employees. The department also maintains a Wildland Response Program to provide resources to combat WUI fires in the City of Aurora and throughout Colorado.

4.13.2 Past Events

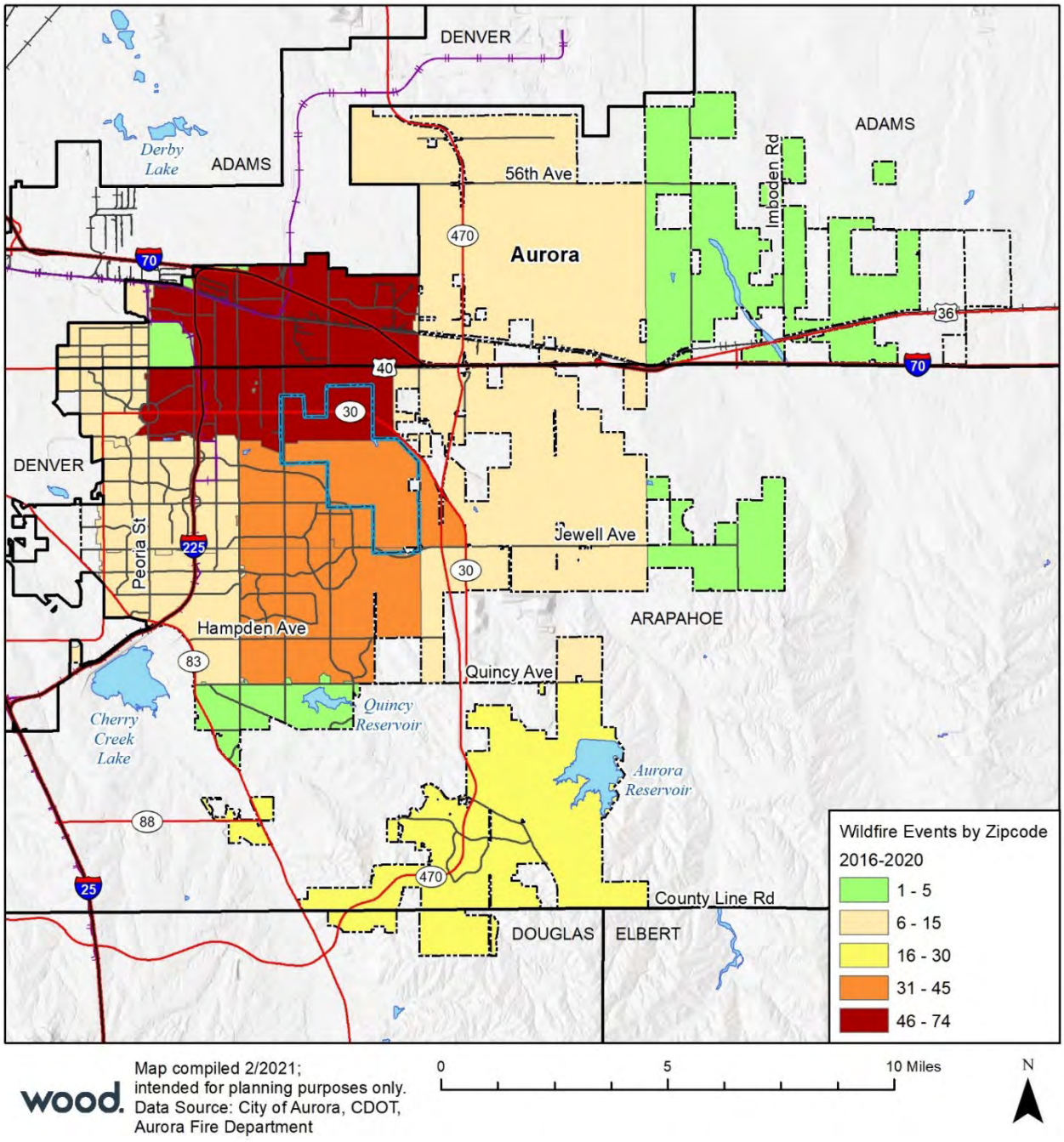
The Federal Wildland Fire Occurrence Database does not list any past wildfires in the City of Aurora, largely because there are few federal lands in the City. Records from Aurora Fire Rescue list 770 fire responses during the period 2016-2020, 239 of which could be characterized as wildland fires. As show in Figure 4-35, the vast majority of those (91%) have been brush or grass fires. The locations of these fires by postal zip code are shown in Figure 4-36.

Figure 4-35 Wildfires in the City of Aurora by Type, 2016-2020



Source: City of Aurora

Figure 4-36 Wildfire Events in the City of Aurora by Zip Code, 2016-2020



Only ten of these fires (4%) resulted in any recorded damages or losses, totaling one injury, no fatalities, and $7,570 in property damage. This averages out to $1,514 a year for the past five years.

4.13.3 Location

The Colorado State Forest Service (CSFS) Colorado Forest Atlas calculates wildfire risk by combining the likelihood of a fire occurring (threat) with those areas of most concern that are adversely impacted by fire to derive a single overall measure of wildfire risk. Figure 4-37 shows the wildfire risks for areas within the City of Aurora.

Figure 4-37 Wildfire Risk for the City of Aurora

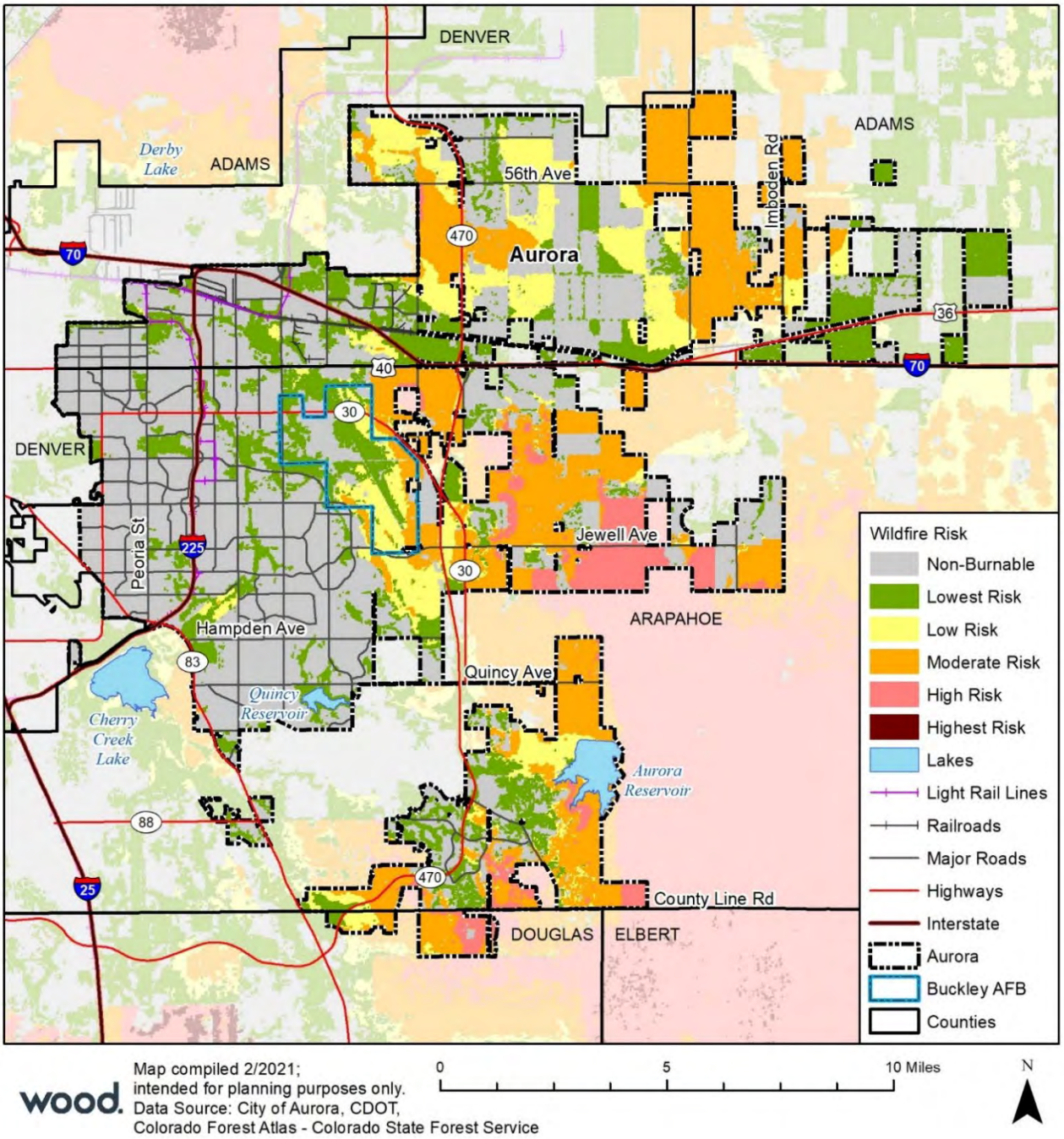
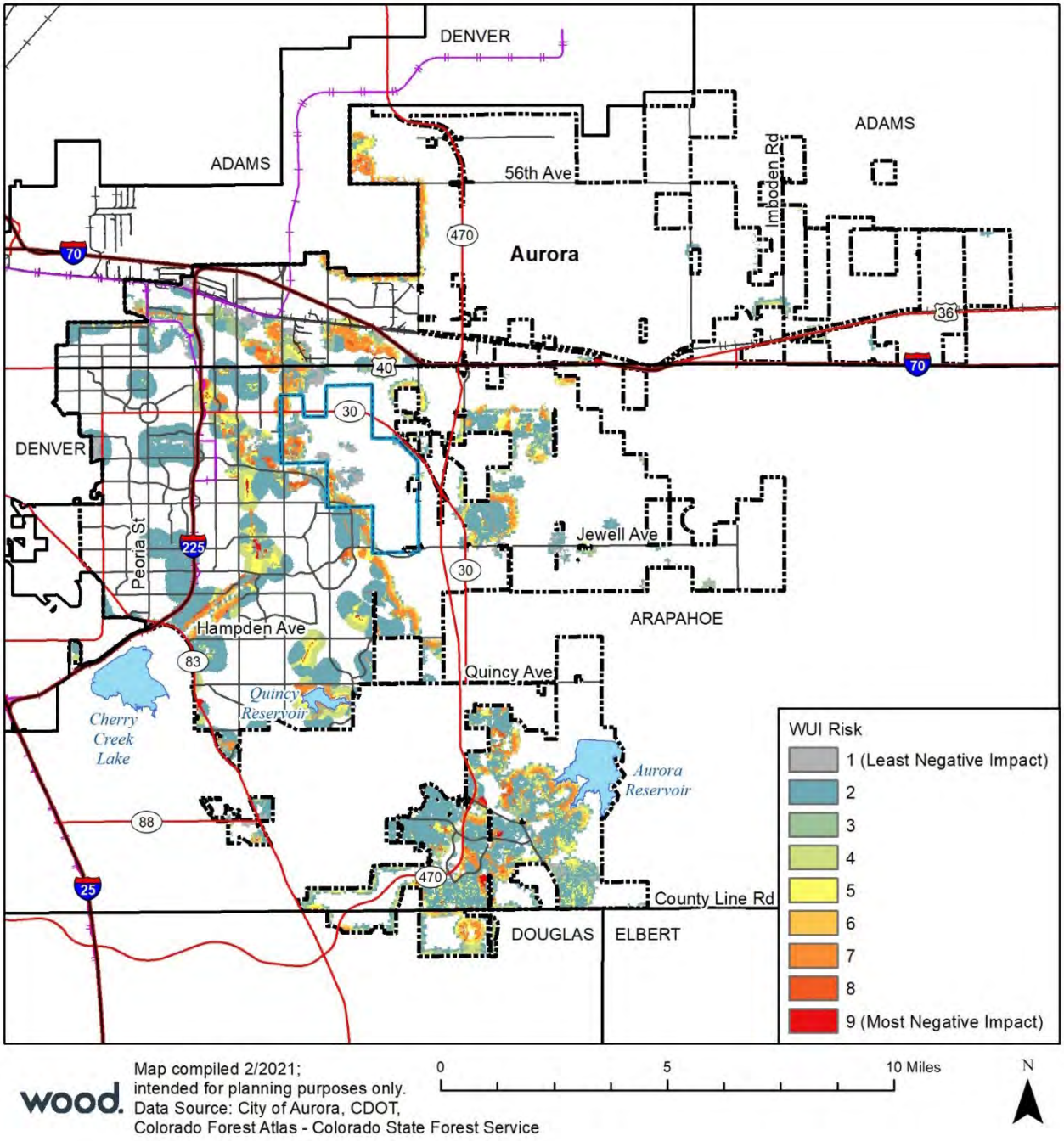


Figure 4-38 shows the wildfire risk within the City of Aurora's WUI zones.

Figure 4-38 Wildland Urban Interface (WUI) Risk for the City of Aurora

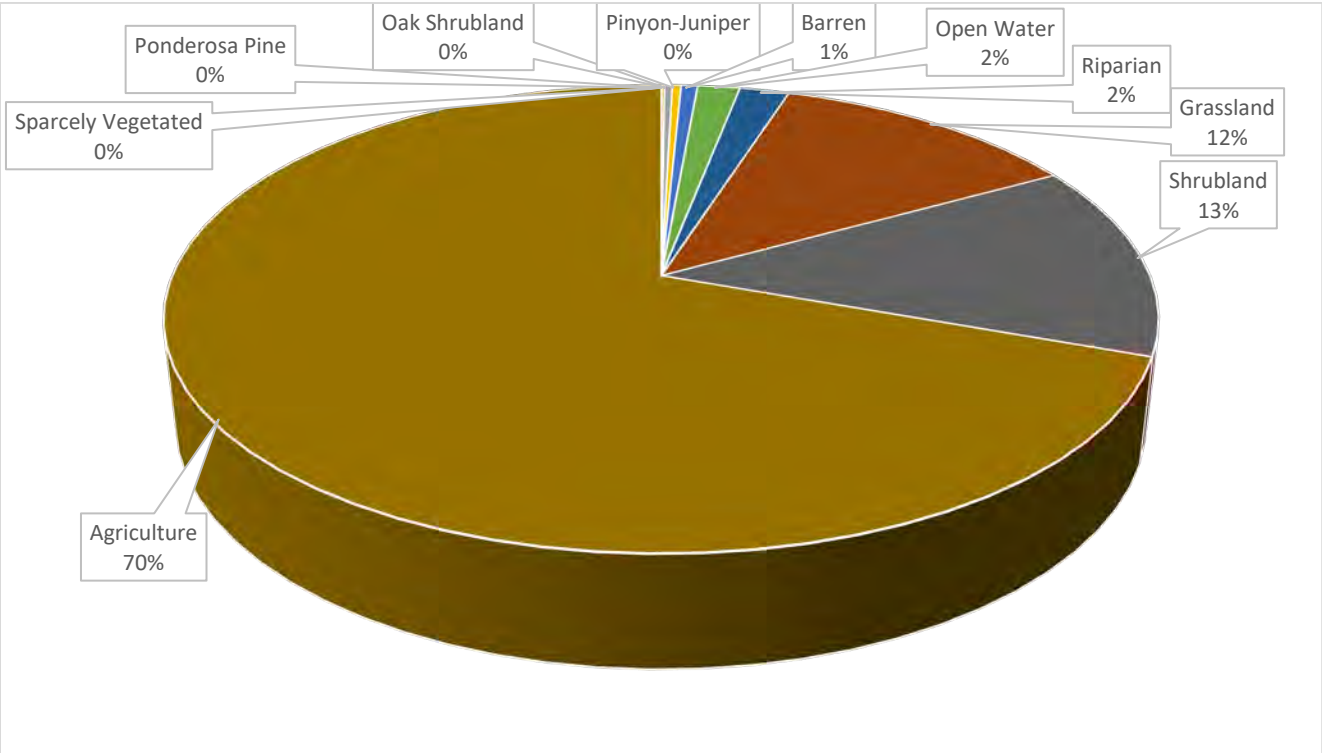


4.13.4 Magnitude and Severity

Wildfire behavior is dictated in part by the quantity and quality of available fuels. Fuel quantity is the mass of material per unit area. Fuel quality is determined by several factors, including fuel density, chemistry and arrangement. Arrangement influences the availability of oxygen surrounding the fuel source. Another important aspect of fuel quality is the total surface area of the material that is exposed to heat and air. Fuels with large area-to-volume ratios, such as grasses, leaves, bark, and twigs are easily ignited when dry.

The general breakdown of vegetation in the undeveloped portions of the City of Aurora is shown in Figure 4-39. The most common vegetation class in the undeveloped City is agriculture comprising over 70 percent. Grassland, shrubland, and riparian areas together comprise another 27% percent of the undeveloped acreage.

Figure 4-39 Vegetation Classes in Aurora's Undeveloped Acreage



Source: Colorado Forest Atlas

Note that even in developed areas, landscaping can also contribute to wildfire fuels.

Climatic and meteorological conditions that influence wildfires include solar insulation, atmospheric humidity, and precipitation, all of which determine the moisture content of wood and leaf litter. Dry spells, heat, low humidity, and wind increase the susceptibility of vegetation to fire.

4.13.5 Probability of Future Occurrence

The probability of wildfires occurring in the City of Aurora is Highly Likely.

Based on the Aurora Fire Rescue data described above, the City averages approximately 48 fires a year that can be characterized as wildfires. The vast majority of these are minor incidents with minimal impacts. Approximately 2 wildfires per year result in significant property damage or injuries.

4.13.6 Climate Change Considerations

Climate is a major determinant of wildfire through its control of weather, as well as through its interaction with fuel availability, fuel distribution and flammability at the global, regional and local levels. With hotter temperatures, drier soil and worsening drought conditions in the County, wildfires have the potential to become more extreme. Colorado and the Western United States have seen significant increases in forest area burned in recent years, and the risk of wildfires in the future are expected to increase due to a lengthening fire season and drier conditions. According to a report from the International Panel on Climate Change:

Fire season has already lengthened by 18.7% globally between 1979 and 2013, with statistically significant increases across 25.3% but decreases only across 10.7% of Earth's land surface covered with vegetation; with even sharper changes being observed during the second half of this period. Correspondingly, the global area experiencing long fire weather season has increased by 3.1% per annum or 108.1% during 1979–2013. Fire frequencies under 2050 conditions are projected to increase by approximately 27% globally, relative to the 2000 levels, with changes in future fire meteorology playing the most important role in enhancing global wildfires, followed by land cover changes, lightning activities and land use, while changes in population density exhibit the opposite effects.

Land use, vegetation, available fuels, and weather conditions (including wind, low humidity, and lack of precipitation) are chief factors in determining the number and size of fires in Colorado each year. Generally, fires are more likely when vegetation is dry from a winter with little snow and/or a spring and summer with sparse rainfall. As a result, climate induced hazards in Colorado (specifically, a pattern of extended drought conditions) have contributed to increased concern about wildfire across the State.

The frequency, intensity, and duration of wildfires have increased across the Western United States since the 1980s. The US Department of Agriculture's "Effects of Climate Variability and Change on Forest Ecosystems" General Technical Report, published in December 2012, found that the Colorado region, among others, will face an even greater fire risk over time. The report expects Colorado to experience up to a five-fold increase in acres burned by 2050. The report's findings are consistent with previous studies on the relationship between climate change and fire risk. Colorado landscapes, including those in Aurora, are expected to become hotter and drier as the planet warms, which in turn is expected to increase regional wildfire risk.

4.13.7 Vulnerability

Information for the exposure analyses provided in the sections below was downloaded from the Colorado Forest Atlas in 2021. The distribution of risk areas in the planning area are shown in Figure 4-37 and Figure 4-38.

People

Population could not be examined by WUI area because census block group areas do not coincide with the fire risk areas. Instead, the population vulnerable to wildfire was estimated using the structure count of buildings in the WUI area and applying the census value of 2.84 persons per household for the City of Aurora. As shown in Table 4-57, this analysis estimates that 7.7% of the City's population (29,415) live in areas exposed to wildfire risk. Of those, 12,483 people are at moderate to high wildfire risk.

Table 4-57 City of Aurora Population Within Wildfire Risk Areas

Wildfire Risk Type	Population at Risk	% of Total Population
High Risk	2,562	0.7%
Moderate Risk	9,921	2.6%
Low Risk	4,232	1.1%
Lowest Risk	12,699	3.3%
Total	**29,415**	**7.7%**

Source: Adams County, Arapahoe County, and Douglas County Assessor's Offices, COWRAP

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated

by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Wildfire can also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Property

Property damage from wildfires can be severe and can significantly alter entire communities; however, historically impacts in the City of Aurora have been much more limited. Table 4-58 displays the number of structures in the various wildfire hazard zones within the City and their values, based off 2021 county tax assessor data. 12,020 buildings with a total value of more than $9.7 billion are potentially exposed to wildfire risk,

Table 4-58 City of Aurora Exposure and Value of Structures in Wildfire Risk Areas

Wildfire Risk Type	Improved Parcels	Building Parcels	% of Total Buildings	Improved Value	Content Value	Total Value
High Risk	1,004	1,005	0.8%	$464,993,607	$252,850,564	$717,844,171
Moderate Risk	4,301	4,336	3.6%	$1,516,350,655	$796,152,032	$2,312,502,687
Low Risk	1,617	1,642	1.4%	$777,244,550	$455,300,984	$1,232,545,534
Lowest Risk	4,795	5,037	4.2%	$3,313,725,080	$2,175,846,679	$5,489,571,759
Total	**11,717**	**12,020**	**9.9%**	**$6,072,313,892**	**$3,680,150,258**	**$9,752,464,150**

Source: Adams County, Arapahoe County, and Douglas County Assessor's Offices, COWRAP

Table 4-59 and Table 4-60 show the structure and values in high and moderate wildfire risk areas broken down by type of property. The vast majority of structures in both categories are residential properties.

Table 4-59 City of Aurora Structures in High Wildfire Risk Areas by Property Type

Property Type	Improved Parcels	Building Parcels	Improved Value	Content Value	Total Value
Agriculture	1	1	$3,042	$3,042	$6,084
Commercial	1	1	$1,934,077	$1,934,077	$3,868,154
Exempt	23	23	$36,301,056	$36,301,056	$72,602,112
Residential	943	944	$424,286,086	$212,143,043	$636,429,129
Vacant Land	36	36	$2,469,346	$2,469,346	$4,938,692
Total	**1,004**	**1,005**	**$464,993,607**	**$252,850,564**	**$717,844,171**

Source: Adams County, Arapahoe County, and Douglas County Assessor's Offices, COWRAP

Table 4-60 City of Aurora Structures in Moderate Wildfire Risk Areas by Property Type

Property Type	Improved Parcels	Building Parcels	Improved Value	Content Value	Total Value
Agriculture	8	10	$422,752	$422,752	$845,504

Property Type	Improved Parcels	Building Parcels	Improved Value	Content Value	Total Value
Commercial	12	23	$17,139,725	$17,139,725	$34,279,450
Exempt	25	47	$24,547,711	$24,547,711	$49,095,422
Residential	3,737	3,737	$1,440,397,247	$720,198,624	$2,160,595,871
Vacant Land	519	519	$33,843,220	$33,843,220	$67,686,440
Total	**4,301**	**4,336**	**$1,516,350,655**	**$796,152,032**	**$2,312,502,687**

Source: Adams County, Arapahoe County, and Douglas County Assessor's Offices, COWRAP

Critical Facilities and Infrastructure

Wildfires frequently damage community infrastructure, including roadways, communication networks and facilities, power lines, and water distribution systems. Efforts to restore roadways include the costs of maintenance and damage assessment teams, field data collection, and replacement or repair costs. Direct impacts to municipal water supply may occur through contamination of ash and debris during the fire, destruction of aboveground distribution lines, and soil erosion or debris deposits into waterways after the fire. Utilities and communications repairs are also necessary for equipment damaged by a fire. This includes power lines, transformers, cell phone towers, and phone lines.

Table 4-61 identifies critical facilities exposed to the wildfire hazard in the City broken down by Lifeline categories. Of the 1,396 critical assets identified in Section 4.2, 166 (123%) are in areas at risk of wildfire. Communications sites make up the largest category, followed by transportation, and hazardous materials sites. Of those facilities, 33 are at moderate to high risk. Table 4-62 looks specifically at those 33 facilities, breaking them down by sub-category.

Table 4-61 City of Aurora Critical Facilities and Infrastructure in Wildfire Risk Areas

	High	Moderate	Low	Lowest	Total
Communications	1	12	6	73	**92**
Energy		2	1	1	**4**
Food, Water, Shelter		1		1	**2**
Hazardous Materials	2	7	4	12	**25**
Health and Medical			1	3	**4**
Safety and Security		5	3	9	**17**
Transportation		6	5	11	**22**

	High	Moderate	Low	Lowest	Total
Total	**3**	**33**	**19**	**113**	**166**

Source: Adams County, Arapahoe County, and Douglas County Assessor's Offices, HIFLD

Table 4-62 Critical Facilities at High to Moderate Wildfire Risk by Facility Type

Wildfire	FEMA Lifeline	Critical Facility Type	Count
High	Communications	Land Mobile Towers	1
	Hazardous Materials	Tier II	2
		Total	**3**
Moderate	Communications	Land Mobile Towers	7
		Microwave Towers	5
	Energy	Power Plant	2
	Food, Water, Shelter	Religious Institution	1
	Hazardous Materials	RMP	1
		Tier II	6
	Safety and Security	Fire Station	1
		Police	1
		School	3
	Transportation	Bridge - Good Condition	2
		Bridge - Fair Condition	4
		Total	**33**

Source: Adams County, Arapahoe County, and Douglas County Assessor's Offices, HIFLD

Government Services

Historically, wildfires in Aurora have had minimal impact on delivery of government services. Large fires can affect the availability of resources over an extended response. Power interruption may occur if facilities are not adequately equipped with backup generation.

Economy

Economic impacts of wildfires in Aurora have historically been limited. In addition to the losses described above, large fires can also force business closures, and impact recreation and tourism areas. The economic cost of fighting wildfires is also significant.

Historic, Cultural and Natural Resources

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts, such as damage to fisheries, soil erosion, and spread of invasive plant species.

Many ecosystems are adapted to historical patterns of fire occurrence. These patterns, called "fire regimes," include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

4.13.8 Development Trends

Characteristic of the Colorado Front Range, the City of Aurora has experienced rapid growth for the past ten years as people move to the Denver Metropolitan Area. Much of this growth has occurred in the WUI, where developing lands are adjacent to undeveloped land. While the risk of wildfire on undeveloped land is generally understood, much of the adjacent developing land is equally at risk. As development in WUI areas continues to increase, the risk to lives, property, and resources correspondingly increases.

4.13.9 Risk Summary

- The overall significance of this hazard to the City is Low.
- The City averages 48 wildfires a year, but the vast majority of those are minor incidents with minimal impacts. Approximately 2 wildfires per year result in significant property damage or injuries.
- 29,415 people live in areas potentially exposed to wildfire risk, however most of those are in relatively low risk areas.
- Future growth into interface areas could increase wildfire risk.
- Climate change could increase both the likelihood and severity of wildfires.

4.14 Winter Storm

Hazard	Location	Probability of Future Occurrence	Potential Severity/Magnitude	Overall Significance
Winter Storm	Extensive	Highly Likely	Limited	High

4.14.1 Description

Winter storms can include heavy snow, ice, and blizzard conditions. Winter storms are a yearly occurrence in Colorado and are not always considered a disaster or hazard. For the purposes of this plan, severe winter storms are those which produce heavy snow, significant ice accumulation, or prolonged blizzard conditions. Disasters occur when severe storms impact the operations of the affected community by damaging property, stalling the delivery of critical services, or causing injuries or deaths among the population.

DEFINITIONS

Freezing Rain—Rain that occurs when the temperature is below the freezing point. The rain freezes on impact, resulting in a layer of glaze ice up to an inch thick. In a severe ice storm, an evergreen tree 60 feet high and 30 feet wide can be burdened with up to 6 tons of ice, creating a threat to power and telephone lines, and transportation routes.

Severe Local Storm—Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Winter Storm—A storm having significant snowfall, ice, or freezing rain; the quantity of precipitation varies by elevation.

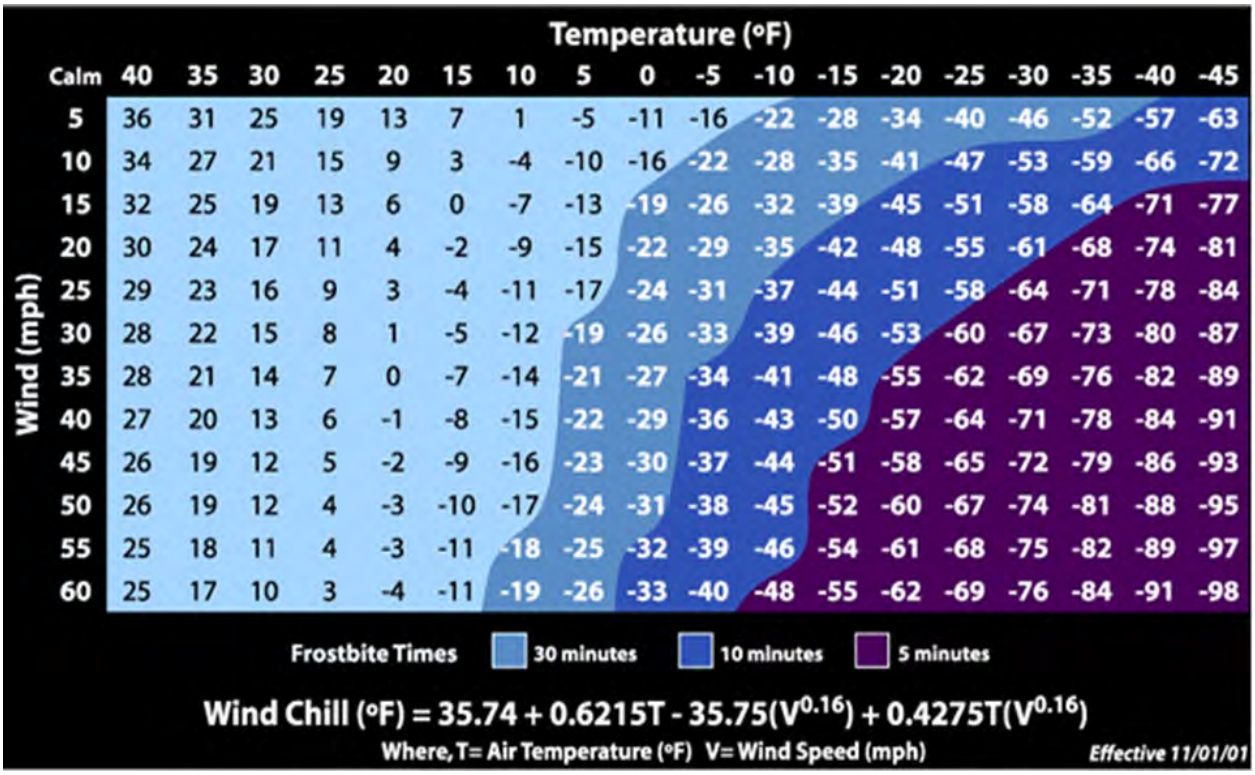
Heavy snow can immobilize a region, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damage can be repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result in injuries and deaths.

Winter storms in the City of Aurora, including strong winds and blizzard conditions, can create life threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter weather include hypothermia and the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can also impact budgets significantly. Heavy snowfall during winter can also lead to flooding during the spring if the area snowpack melts too quickly.

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities.

In 2001, the NWS implemented an updated wind chill temperature index (see Figure 4-40). This index describes the relative discomfort or danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-40 National Weather Service Wind Chill Chart



Source: NWS, www.nws.noaa.gov/om/windchill/index.shtml

A wind chill watch is issued by the NWS when wind chill warning criteria are possible in the next 12 to 36 hours. A wind chill warning is issued for wind chills of at least -25 degrees on the plains and -35 degrees in the mountains and foothills.

4.14.2 Past Events

Table 4-63 lists the City of Aurora severe winter weather events recorded by the National Centers for Environmental Information (NCEI) database from 1996 to 2020. Locations for these records are limited to four zones defined by the NCEI: (1) North Douglas County Below 6000 feet/Denver/West Adams and Arapahoe Counties/East Broomfield County, (2) Denver Metropolitan Area, (3) Central and East Adams and Arapahoe Counties, and (4) Denver Metropolitan Area/East Jefferson/West Adams/Denver/West Arapahoe/North Douglas. The table shows blizzards, extreme cold/wind chill, heavy snow, winter storms, and winter weather events. None of these events resulted in recorded damage to property or crops, injuries, and deaths except for a blizzard that occurred on March 17, 2003, in the North Douglas County Below 6000 feet/Denver/West Adams and Arapahoe Counties/ East Broomfield County zone. This blizzard resulted in two injuries and estimated property damages of $15.5 million.

Table 4-63 Severe Winter Storm Events in Aurora, 1996-2020

Year	Blizzard	Extreme Cold/ Wind Chill	Heavy Snow	Winter Storm	Winter Weather	Total
1996	1		6	1		8
1997	1		5	3		9
1998			2	1		3
1999			4	1		5
2000			2			2
2001	2		5	1		8
2002			2	1		3
2003	1		1			2
2004	1			4		5
2005	1			3		4
2006	2		1	2		5
2007	2			2	1	5
2008				1	2	3
2009	1			7	2	10
2010				2	2	4
2011		1		2	4	7
2012				1	3	4
2013	3			2	2	7
2014				2	3	5
2015	1			3	4	8
2016	1		1	3		5
2017	1			2	1	4
2018				1	1	2
2019	2			2	9	13
2020			1	1	6	8
Total	**20**	**1**	**30**	**48**	**40**	**139**

Source: NCEI

Several significant winter weather events recorded by NCEI which have impacted Aurora include:

- October 1997 – An October blizzard dumped over 31" of snow in the region, leaving 4,000 travelers stranded at the Denver International Airport (DIA). A state of emergency was declared for Colorado.
- December 9, 1998 – Extreme cold temperatures across the region led to power outages, cracked water pipes, and a number of deaths and injuries. Temperatures dipped below 0°F, with a low of -19°F for six consecutive days.
- April 2001 – Severe spring snow, high winds and ice led to snapped power poles and downed power lines. Many residents and businesses were left without power. DIA lost power over two consecutive weekends.
- March 17, 2003 – Largest snowstorm in the Denver Metro region since 1946. The three-day snowfall accumulation measured on March 20th, 2003 remains the most extreme in Arapahoe County to date, coming in at 46.3".
- December 20-29, 2006 – Extreme cold temperatures and multiple snowstorms created ice build-up on local streets. Over 20" of snow accumulated and led to the closure of the airport, grocery stores, and the US mail service at the height of holiday travel. A state-wide disaster was declared. The snowfall

on December 21st, 2016 remains the most extreme one-day snowfall in Arapahoe County to date with an accumulation of 35".

- March 30, 2009 - A band of heavy snow, induced by a strong upper level jetstream. The snow was heaviest on the east side of the Denver metro area where storm totals ranged from 2" to 5". The combination of reduced visibilities and snow packed roadways resulted in multiple accidents during the morning rush hour including an 18-car pileup, a school bus crash and at least three fatalities.
- March 1, 2014 - A band of heavy snow, produced around one inch in less than 30 minutes, contributed to a chain of accidents in the northbound lanes of Interstate 25. The combination of excessive speed and very poor driving conditions led the chain reaction; it involved 104 vehicles and resulted in one death along with 30 injuries. The interstate was closed for approximately five hours.
- March 2019 – A rapidly intensifying storm system or bomb cyclone brought hurricane strength winds to the northeast plains of Colorado, along with moderate to heavy snowfall. Peak wind gusts ranged from 60 to 80 mph. Widespread outages, multi-vehicle accidents and road closures prompted the governor to declare a state of emergency which activated the Colorado National Guard to assist state and local authorities in rescuing hundreds of stranded motorists. Arapahoe County, along with many other counties, issued a disaster declaration. Nearly 1,400 flights in and out of Denver International Airport were canceled due to the blizzard. The number of people who lost power during the storm totaled 445,000. At least 33 public school districts were closed on the 13 and 14th. Warming centers and shelters opened area wide.
- March 2021 – The fourth largest snowstorm in Denver's history moved through the metro area on March 13-14, 2021, dropping 27.1" at DIA. Approximately 25,000 people lost power across Colorado and Wyoming. The number of stranded motorists needing rescue/recovery put a significant strain on responders. Total response and recovery costs for the City of Aurora were over $800,000.

4.14.3 Location

The location rating for winter storms in Aurora is **extensive**.

Winter storms are a yearly feature of the Colorado climate and may occur across all of the City of Aurora. Generally, severe winter storm events are considered regional, which implies the storms impact multiple counties simultaneously, often for extended time periods. At the municipal level, the entire City is potentially exposed to winter storms, and most major storms impact the entire City.

4.14.4 Magnitude and Severity

The magnitude and severity of winter storms is considered **limited**.

The damages caused by severe winter storms and blizzards vary and are dependent on several factors: the duration of the storm; the geographic extent; the time of year; meteorological factors such as wind, moisture content of the snow, ground and air temperatures; and the advance warning of the storm. Impacts from the storm dictate the magnitude of the event, emphasizing that how much snow falls may not always directly correlate to how bad the storm is. Damaged power lines and dangerous or impassable roadways may impede the delivery of critical services such as medical and emergency assistance, the delivery of food, supplies, and medications, or even the provision of basic utilities such as heat and running water. When events happen with a long warning time, it is possible to mitigate the effects of insufficient supply levels or to pre-test emergency generators, which may prevent some of the previously described impacts from occurring. Unanticipated storms increase the number of people stranded, both in cars and at public locations, which may increase the number of injuries and deaths attributed to the event (often caused by exposure) and place uneven and unanticipated strains on public sheltering capacities. The weight of the snow, driven by the water content of the fall, increases the potential for damages caused to structures and trees. Lighter snow caused by extreme cold increases the damages caused to livestock, agriculture, and landscaping due to freezing conditions. Winter storms which go through periods of thaw and freeze prolong dangerous icy conditions, increasing the likelihood of frozen and damaged water pipes, impassable or dangerous roadways, damaged communication lines, or more extensive damages to

infrastructure and structures caused by seeping water freezing under roofs, porches, patios, inside sidings, or causing damage to vehicles.

According to the events on record from the NCEI database, winter storms rarely cause significant damage, death, or injury in Aurora. There has been only one event which resulted in significant recorded property damages in the region. This would indicate that potential damages and casualties would be negligible. However, given the possibility for widespread utility outages, possibly for multiple days, and for the possibility of stranded travelers who could become victims of exposure, the magnitude should be considered limited.

4.14.5 Probability of Future Occurrence

The probability rating for winter storms is **highly likely**.

Winter storms are a yearly feature in Colorado, often occurring multiple times each winter, and thus are considered a seasonal feature. Meteorologists can often predict the likelihood of a severe winter storm in the City of Aurora. When forecasts are available, they can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time.

According to the NCEI database, there have been 139 catalogued events over a 24-year period, or approximately six events per year. This indicates that the probability of a severe winter storm occurring in any given year is almost certain. This corresponds to a probability of future occurrences rating of highly likely.

4.14.6 Climate Change Considerations

Climate change has the potential to exacerbate the severity and intensity of winter storms, including potential heavy amounts of snow. A warming climate may also result in warmer winters, the benefits of which may include lower winter heating demand, less cold stress on humans and animals, and a longer growing season. However, these benefits are expected to be offset by the negative consequences of warmer summer temperatures.

4.14.7 Vulnerability

Population

Stranded motorists have historically been the largest category of people impacted by winter storms, often requiring rescues.

Vulnerable populations include the elderly, low-income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during severe winter weather events and could suffer more secondary effects of the hazard. Those traveling through the city and commuters who are caught in storms may be particularly vulnerable.

Property

High snow loads can cause damage to buildings and roofs. Most property damages with winter storms are related to the heavy snow loads and vehicle accidents. Older buildings are more at risk, as are buildings with large flat rooftops (often found in public buildings such as schools). Vulnerability is influenced both by architecture and type of construction material and should be assessed on a building-by-building basis.

Critical Facilities and Infrastructure

Roads are especially susceptible to the effects of a severe winter storm, which can temporarily hinder transportation and require resources for snow removal. As noted under the people section, heavy snow accumulation may also lead to downed power lines not only causing disruption to customers but also have potentially negative impacts on critical facilities in the city which may have cascading impacts on the local governments' ability to operate.

Severe windstorms, downed trees, and ice can create serious impacts on power and aboveground communication lines. Freezing of power and communication lines can cause them to break, disrupting electricity and communication. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

Government Services

During winter storm events the public will expect notifications as early as possible and to be updated frequently as events unfold. The local government agencies will enact winter weather operations such as extensive plowing operations and the opening of warming shelters. First responders and rescue personnel will perform missions throughout the weather event to ensure safety of the public and continuation of crucial services. Depending on the severity of the event, the ability to accomplish each of these functions successfully could be hindered.

Economy

Closure of major transportation routes during severe winter storms could temporarily isolate parts of Aurora. Depending on the length of the closure it could also hinder the local economy by disrupting tourism, as well as the potential impacts to shipping delays from the closure of major interstates. Snow removal costs can also impact budgets significantly.

The City of Aurora's Local Energy Assurance Plan identifies several capabilities and actions which have been taken to minimize the impacts of power losses to critical facilities and establish power redundancy, such as an inventory of generators. However, power outages may still impact the private sector, leading to business closures as was seen in the 2019 Bomb Cyclone event with impacts lasting for multiple days in some areas. This can hinder residents from conducting normal business and getting to and from their place of work. As with extreme temperatures and wind/hail, Xcel estimates that outages cost the utility approximately $50,000 per 20,000 people affected. This cost could balloon in the event of a widespread or extended power outage in the city.

Historic, Cultural, and Natural Resources

Winter storms can cause significant environmental impacts. High winds and heavy accumulations of ice during storms can damage vegetation and bring down trees and tree limbs. Severe cold and sudden changes in temperature can also damage or kill vegetation and crops. Secondary impacts, such as flooding from rapidly melting snow after a storm, can overwhelm both natural and constructed drainage systems. Additionally, the storms may result in closed highways and blocked roads. It is not unusual for motorists and residents to become stranded. Late season heavy snows will typically cause some plant and crop damage.

4.14.8 Development Trends

All future development will be exposed to severe winter storms but impacts to structures are expected to be minor. The vulnerability of community assets to severe winter storms is increasing through time as more people live or work in the City. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The City of Aurora has adopted the International Building Code. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in the city's general plans also address many of the secondary impacts of the

severe weather hazard (for example, flooding). With these tools, the City of Aurora is well equipped to deal with future growth and the associated impacts of severe winter weather.

Public education efforts may help minimize the risks to future populations by increasing knowledge of appropriate mitigation behaviors, clothing, sheltering capacities, and decision making regarding snow totals, icy roads, driving conditions, and outdoor activities (all of which are contributors to decreased public safety during severe winter storms.) New establishments or increased populations who are particularly vulnerable to severe winter storms (such as those with health concerns or those who live in areas that may be isolated for extended periods of time due to the hazard) should be encouraged to maintain at least a 72-hour self-sufficiency as recommended by FEMA. Encouraging contingency planning for businesses may help alleviate future economic losses caused by such hazards while simultaneously limiting the population exposed to the hazards during commuting or commerce-driven activities.

4.14.9 Risk Summary

- The overall significance of this hazard to the City is High.
- Winter storms of varying severity can be expected to impact the planning area annually.
- Winter storms are typically regional events, and future events can be expected to impact the entire City simultaneously.
- Winter storms have not historically caused significant damage or casualties in Aurora, however the potential for these issues exists.
- There is a significant risk for vehicle accidents and stranded motorists, who may be unprepared to protect themselves from exposure, during winter storms.
- The largest impacts typically involve utility and transportation disruptions.
- Private businesses and residences may not have adequate access to safe sources of backup power in the event of a prolonged utility outage.
- Future efforts should be made to identify populations at risk and determine special needs during winter storm events.

5 Mitigation Strategy

DMA Requirement §201.6(c)(3):
[The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools. This section shall include: *(i) A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.* *(ii)A section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.* *(iii) An action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.*

Hazard Mitigation Plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). In support of the guiding principle established in Section 1.2.1, the HMPC developed a set of goals and measurable objectives for this plan, based on data from the preliminary risk assessment and the results of the public involvement strategy. The guiding principle, goals, objectives, and mitigation actions in this plan all support each other. Goals were selected to support the guiding principle. Objectives were selected that met multiple goals. Mitigation actions were prioritized based on the action meeting multiple objectives and priority hazards.

5.1 Goals and Objectives

Goals are defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard for implementation, that is, implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that the goals are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable. Mitigation Actions are specific actions that help achieve goals and objectives.

To facilitate the goals update of this plan HMPC members were provided a breakdown of the list of goals from the 2016 City of Aurora Hazard Mitigation Plan, along with goals and objectives from a number of related plans, including the 2018 State of Colorado Hazard Mitigation Plan. This review was conducted to ensure the plan's mitigation strategy reflected current policies and priorities, updated risk assessment information, and was integrated with existing plans and policies. They were told that they could use, combine, or revise the statements provided or develop new ones, keeping the risk assessment in mind. The HMPC felt the goals were still valid and did not need any changes. Two new objectives were added (1.5 and 1.6), and a few other objectives were modified to better reflect current priorities.

The following are the mitigation goals for this plan:

- **Goal 1:** Protect people, property, critical facilities, and natural resources from natural hazards through mitigation planning and activities.
- **Goal 2:** Increase public awareness, preparedness, and education about localized natural hazards and actions that can be taken to reduce their impacts.
- **Goal 3:** Establish and maintain relationships that strengthen hazard communication and coordination efforts with public agencies, non-governmental organizations (NGOs), businesses, and citizens.
- **Goal 4:** Coordinate and integrate natural hazard mitigation with city planning, engineering, and development activities.
- **Goal 5:** Maintain the momentum of hazard mitigation planning and preparedness efforts in Aurora.

The objectives are used to help establish priorities and support the agreed upon goals. The objectives are as follows:

- Objectives in support of Goal 1:
  - Objective 1.1: Identify properties, critical facilities, and natural resources that could be adversely impacted by natural hazards.
  - Objective 1.2: Develop plans to address the varying responses and activities required to address the impacts associated with natural hazards.
  - Objective 1.3: Identify individuals and populations who are at high risk to hazardous events.
  - Objective 1.4: Ensure items in Aurora Water's risk and resiliency project continue to be resolved within budgetary framework and document is updated dynamically and certified with EPA every 5 years.
  - Objective 1.5: Continue relationships with surrounding populations to develop procedures for evacuation, education, shelter in place.
- Objectives in support of Goal 2:
  - Objective 2.1: Implement a natural hazards public awareness campaign.
  - Objective 2.2: Assist local businesses and organizations with disaster and emergency preparedness.
  - Objective 2.3: Partner with external stakeholder public information programs to create integrated education and messaging systems.
  - Objective 2.4: Investigate funding capabilities to conduct a needs assessment for implementing additional emergency operations plans and services in areas at high risk and implement as appropriate.
  - Objective 2.5: Expand preparedness efforts for large and small breed animals.
- Objectives in support of Goal 3:
  - Objective 3.1: Develop an outreach strategy to discuss hazard communication and coordination efforts with local community groups.
  - Objective 3.2: Promote city employee and community participation with external partner preparedness programs.
  - Objective 3.3: Identify existing capabilities and resources within the community and create appropriate intergovernmental agreements (IGAs) with partners to enable access during incident response.
  - Objective 3.4: Coordinate preparedness and response planning efforts with external critical infrastructure partners.
  - Objective 3.5: Maintain and expand upon animal preparedness and response efforts.
- Objectives in support of Goal 4:
  - Objective 4.1: In future planning and development efforts, utilize lessons learned from the impacts of previous natural hazards and from the hazard mitigation facilities that performed well.

  - Objective 4.2: Maintain processes for soliciting input from citizens and external partners.
  - Objective 4.3: Consider the structural integrity of new and existing infrastructure in regard to their ability to withstand the impacts of natural hazards.
  - Objective 4.4: Identify, evaluate and implement hazard mitigation projects using a holistic method that utilizes financial resources in a manner that generates the greatest long-term value and highest degree of hazard mitigation relative to the cost.
  - Objective 4.5: Integrate the current HMP goals, objectives, or any other relevant content with appropriate City of Aurora plans and studies as they are created or updated.
- Objectives in support of Goal 5:
  - Objective 5.1: Continually contribute to and maintain data inventories of Aurora's natural hazard events and their characteristics to evaluate and report trends and to determine potential hazard mitigation actions for future Hazard Mitigation Plan updates.

5.2 Progress on Previous Mitigation Actions

The City of Aurora has been successful in implementing actions identified in the 2016 Plan. The 2016 mitigation strategy contained a total of 52 mitigation actions, six of which were identified as having been completed. These actions show good progress towards Goals 1, 4, and 5 as listed above. An additional four actions were deleted as being no longer relevant. These completed and deleted actions are shown in Table 5-1.

Table 5-1 2016 Mitigation Actions Completed or Deleted

2016 #	Mitigation Action Title	Hazard	Notes
7	Establish Contact List of HOAs, NGOs, and Registered Neighboring Systems.	All	Completed; list is updated annually.
22	Alameda Avenue Storm Crossing.	Flood	Completed
24	Baranmor Ditch Reaches 4/5 & 6.	Flood	Completed
29	Lower Westerly Creek Flood Control Improvements.	Flood	Completed
40	Emergency Shelter for Animals.	All	Completed; a trailer is located at north satellite for emergency sheltering
41	Maintain Equipment for Temporary Animal Sheltering.	All	Completed; This equipment is in the grant funded trailer at north satellite.
4	Inform Businesses and Organizations on Location of Essential Information.	All	Deleted
21	Train on Radio Interoperability.	All	Deleted – no longer needed
42	Animal Mortality Management and Zoonosis Surveillance.	All	Deleted; Not a need for Animal Services going forward
47	Assist Owners and Facilities to Develop Animal Emergency Response and Evacuation Plans.	All	Deleted; Little to no interest from horse owners or corporate run kennels in the area.

While only six actions were reported as having been fully completed, considerable progress has been made on other actions. Of the 43 actions carried over into the 2021 Plan, 38 were reported as being in progress or are already being implemented on an annual basis.

Some of the challenges of implementation of projects included:

- Lack of funding, including ability to provide matching funds.

- Difficulty passing benefit cost analysis required for certain FEMA grants.
- Conflicting priorities, and intervention of major hazard events

5.2.1 Continued Compliance with NFIP

Recognizing the importance of the National Flood Insurance Program (NFIP) in mitigating flood losses, an emphasis will be placed on continued compliance with the NFIP. As an NFIP participant, the City has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance. The City will also continue to participate in the Community Rating System (CRS) to go above and beyond the minimum requirements of the NFIP.

5.3 Identification and Prioritization of Mitigation Actions

In order to identify and select mitigation measures to support the mitigation goals, each hazard identified in Section 4.1: Identifying Hazards was evaluated in regard to the various options for mitigation. Hazards that pose a significant threat to the community were considered the priority in the development of hazard specific mitigation measures.

The HMPC considered the following categories of mitigation actions, as defined in FEMA's 2013 Local Mitigation Planning Handbook:

- **Plans and regulations:** These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.
- **Structure and infrastructure projects:** These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- **Natural systems protection:** These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.
- **Education and awareness:** These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them.

The HMPC also considered the following categories as defined in the Community Rating System:

- Prevention: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- Property protection: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- Structural: Actions that involve the construction of structures to reduce the impact of a hazard.
- Natural resource protection: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- Emergency services: Actions that protect people and property during and immediately after a disaster or hazard event.
- Public information/education and awareness: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

At planning meeting #3, the HMPC was provided with handouts describing the categories and listing examples of potential mitigation actions for each category, as well as for the identified hazards. FEMA's 2013 document Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards was referenced and made available for reference, along with FEMA's 2020 Mitigation Action Portfolio. Attendees were then asked to submit mitigation action ideas via an online poll. Action submissions included details describing how the actions will be implemented and administered, to include cost estimates, potential funding

sources, and estimated timeline for completion. Each action was required to be tied to one or more of the goals and objectives.

Actions were compared against identified hazards to ensure that the plan contains a comprehensive range of mitigation actions and projects for each of the highest risk hazards. An emphasis on new and existing buildings and infrastructure was stressed. While the HMPC focused primarily on those hazards identified as posing the highest risk to the jurisdiction, mitigation actions were also suggested for some low priority hazards.

Similarly, while the primary focus was on developing mitigation actions in the categories described above, some actions were proposed that do not fall into one of the above categories and which may be better defined as planning or preparedness actions. Some of these actions were nonetheless included in the plan, as the jurisdiction felt they were important actions to reduce losses from future disasters even if they do not meet the strict definition of mitigation.

5.3.1 Prioritization Process

Once the new mitigation actions were identified, the HMPC members were provided with several sets of decision-making tools, including FEMA's recommended criteria, STAPLE/E (which considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits).

- **Social:** Does the measure treat people fairly?
- **Technical:** Will it work? (Does it solve the problem? Is it feasible?)
- **Administrative:** Is there capacity to implement and manage the project?
- **Political:** Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support the project?
- **Legal:** Does your organization have the authority to implement? Is it legal? Are there liability implications?
- **Economic:** Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?
- **Environmental:** Does it comply with environmental regulations or have adverse environmental impacts?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining project priority – the 'economic' factor of STAPLE/E. Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does the action protect lives?
- Does the action address hazards or areas with the highest risk?
- Does the action protect critical facilities, infrastructure or community assets?
- Does the action meet multiple objectives (Multiple Objective Management)?

The above criteria were used to prioritize actions in an iterative process over the course of the plan update process. At the start of the process, participants were asked to validate or update the priorities of their continuing actions from the 2016 Plan. When submitting new mitigation actions, HMPC members were asked to prioritize those as well. Finally, once all new and continuing actions had been collated into a draft mitigation strategy, participants were asked to verify or update the priorities of each action.

5.4 Mitigation Action Plan

This section outlines the development of the final updated mitigation action plan. The action plan consists of the specific projects, or actions, designed to meet the plan's goals. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

As noted above, 52 mitigation actions were included in the 2016 Plan. Of those, six were reported as having been completed and three were determined to be no longer relevant and were deleted. (See Table 5-1.) The remaining 43 actions were carried over into the 2016 Plan, along with eight new actions.

The 2021 City of Aurora mitigation action plan lists the actions developed and prioritized as described above, to include continuing actions from the 2016 Plan. The action plan details how the City will reduce the vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. The action plan summarizes who is responsible for implementing each of the prioritized actions as well as when and how the actions will be implemented. All actions are tied to specific goals and objectives to ensure alignment with the Plan's overall mitigation strategy. Additionally, projects were tied to specific infrastructure Lifeline categories, to better align with the latest FEMA guidance and grant requirements. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

Many of these mitigation actions are intended to reduce impacts to existing development. In addition, actions are identified to reduce impacts to future development. These actions include those that promote wise development and hazard avoidance, such as building code, mapping, and zoning improvements, and continued enforcement of floodplain development regulations. Actions that protect critical infrastructure note which lifeline category is protected using the following abbreviations:

- COM: Communications
- ENG: Energy
- FWS: Food, Water, Sheltering
- HAZ: Hazardous Waste
- H&M: Health & Medical
- S&S: Safety & Security
- TRN: Transportation

The City of Aurora's mitigation actions are listed in Table 5-2, which includes information on the mitigation actions, lead and supporting agencies, estimated cost, potential funding sources, and estimated timeline.

The parameters for the timeline are as follows:

- Short Term = to be completed in 1 to 5 years
- Long Term = to be completed in greater than 5 years
- Ongoing = currently being funded and implemented under existing programs.

The estimated cost ranges were as follows:

- Low = less than $10,000
- Medium = more than $10,000 and less than $100,000
- High = more than $100,000

The status of actions carried over from the 2016 Plan were reported as follows:

- Not Started – Work has not begun
- In Progress – Work has begun but not completed
- Annual Implementation – Ongoing with no specific end date

Following Table 5-2, Table 5-3 lists a crosswalk of mitigation actions against the hazards they address.

Table 5-2 City of Aurora Mitigation Action Plan

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
1	**Expand Emergency Assistance to High Risk Individuals and Populations.** Investigate opportunities to expand emergency services to high risk individuals, such as the homeless, elderly, disabled and oxygen- dependent people.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1; Lifelines	OEM, Fire, Police	Low; Other potential funding	High	Short Term	In Progress; Better define goals and objectives associated with this action item.
2	**Develop and Enhance Early Warning Response.** Develop new and enhance existing early warning response systems and plans.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2,3; Lifelines	IT, OEM, Housing and Community Services	Medium; Grant funding to update sirens. General fund - salary employee to update plans	High	Ongoing	In Progress; Finalize FEMA COG application and implementation of IPAWS. Develop IPAWS plan and policy.
3	**Educate Citizens on Hazard Notification Systems.** Educate citizens on the Everbridge Reverse Notification System and the outdoor warning sirens used to warn residents and visitors of natural disasters.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2; Lifelines	OEM, All City Depts	Low; General Fund, Salary Employees	High	Short Term	Annual Implementation; Ongoing community education and outreach. Implementation of Engage Aurora for community engagement. Collaborating with communications department with social media outreach and education.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
4	**Partner with Existing Programs to Enhance Multi- lingual and Culturally Appropriate Messaging for Hazard Mitigation Outreach Improvements**. Partner with existing immigrant and refugee programs for multi-lingual and culturally appropriate messaging and work with city departments and commissions to translate applicable material.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2,3,4; Lifelines	OEM, All City Depts	Medium; General Fund: Salaried Employees	Medium	Short Term	In Progress; Partnering with existing immigrant and refugee programs is an ongoing whole community project for OEM.
5	**Distribute Hazard Information via Social Media, Traditional Media, and Existing Interfaces.** Utilize social media, traditional media, and existing interfaces with the public (libraries, recreation facilities, city events, etc.) to distribute appropriate and timely seasonal hazard information.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2,3; Lifelines	OEM	Low; General Fund: Salaried Employees	High	Short Term	In Progress; Ongoing whole community education and outreach information distribution.
6	**Meet with Community Groups to Identify High Risk Areas.** Meet with local community groups on a yearly basis over the next five years to identify high risk areas.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2,3,4; Lifelines	OEM	Low; General Fund: Salaried Employees	Medium	Short Term	In Progress; Ongoing with risk assessment process and Engage Aurora platform.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
7	**Engage Outside Organizations in Disaster Exercises.** Engage other public agencies (local, county, state, and federal), community organization and citizens in disaster response planning and exercises.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2,3,4; Lifelines	OEM	Low; General Fund: Salaried Employee	High	Ongoing	Annual Implementation; Accomplished annually with monthly EOC trainings and an annual EOC functional exercise
8	**Create MOUs with Partners for Resources**. Create MOUs with applicable partners for assistance with obtaining potable water, food, and clothing during and after an incident.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,3; Lifelines	OEM	Low; General Fund: Salary employee	High	Short Term	Annual Implementation; MOUs are no longer accepted within the city. IGAs only. OEM will re-word the title and description. An MOU or IGA is not needed. However, conversations and planning should be ongoing.
9	**Meet with Health and Medical Facilities.** Schedule meetings with health and medical facilities identified as critical infrastructure in order to coordinate and/or de-conflict planning efforts.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3; Lifelines	OEM	Low; General Fund: Salary Employee	High	Ongoing	Annual Implementation; Ongoing through HealthCare Coalition and other regional committees

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
10	**Meet with Businesses Identified as Critical Infrastructure.** Schedule meetings with large private businesses identified as critical infrastructure in order to coordinate and/or de-conflict planning efforts.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3; Lifelines	OEM	Low; General Fund	High	Ongoing	Annual Implementation
11	**Meet with Local Jurisdictions Who Own Critical Infrastructure.** Schedule meetings with local jurisdictions who own critical infrastructure facilities within the City of Aurora in order to coordinate and/or de-conflict planning efforts.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3; Lifelines	OEM	Low; General Fund: Salaried Employee	High	Short Term	Annual Implementation. Working to identify infrastructure interdependencies.
12	**Develop Robust LEPC.** Continue to develop a robust LEPC including public and private partners to better identify and plan for potential complicating incidents that might occur during a natural disaster.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3,4,5; Lifelines 5.1	OEM	Low; General Fund: Salary Employee	High	Ongoing	Annual Implementation.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
13	**Investigate and Create a System to Inform Building and Zoning Process.** Investigate and create a system with the city planning and zoning department that includes utilizing hazard maps and GIS to better inform the building and zoning process. System must integrate land, water use, risks, and hazards.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,4,5; Lifelines	Planning	Medium; General Fund: Salaried Employee and Potential for Grant Funding	Medium	Short Term	In Progress. We incorporate new data all the time and with climate change, will need to stay on top of any change in course.
14	**Coordinate with Citizens and Partners on Land and Community Development Projects.** Coordinate with citizens and appropriate external partners on land and community development projects.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,3,4; Lifelines	Planning	Low; General Fund	Medium	Short Term	In Progress. We incorporate new data all the time and with climate change, will need to stay on top of any change in course.
15	**Coordinate with the Tri-County Health Department.** Coordinate with the Tri-County Health Department on mitigation and response efforts related to public health threats.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,3,4; Lifelines 3.3,3.4,4.2	OEM	Low; General Fund: Salaried Employee	High	Ongoing	Annual Implementation.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
16	**Encourage Construction Techniques that Minimize Risk from Hazards.** Encourage the use of building materials and construction techniques that are more resilient to natural disasters and can minimize the risk to public property.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 4; Lifelines	Planning, Water, Public Works	Low; Potential for grant funding or will need to be a budgeted project	Low	Ongoing	Not Started; AW Engineering/Stormwater Principal to work with building department and other city departments to brainstorm techniques and their implementation
17	**Create an Inventory of Impacts and Potential Mitigation Projects.** Use data collected from previous and future natural hazard events to create an inventory of impacts and potential mitigation projects.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 5; Lifelines	OEM	Low; General Fund: Salaried Employee	High	Ongoing	In Progress; OEM has developed GIS mapping tools and story maps for previous and future natural hazard event mitigation and planning
18	**Comprehensive List of Critical Infrastructure and Corresponding Mitigation Actions.** Develop an inventory of the city's critical infrastructure and create mitigation actions to protect them from the hazards they are at risk to.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,4,5; Lifelines	OEM	Low; General Fund: Salaried Employee	High	Ongoing	In Progress; UASI Critical Infrastructure Inventory and Mapping Project. Critical Infrastructure Risk Management Framework as defined in the National Infrastructure Protection Plan (NIPP) to identify fixed assets and physical facilities that contribute to critical functionality in the NCR
19	**Analyze the Safety of Existing High Risk Dams and Levees, Prioritize and Implement Projects to Strengthen Them.**	Dam/Levee; Erosion	Goals 1,4; Lifelines	Water	High; FEMA, State of Colorado	High	Ongoing	In Progress; Recertification was completed in 2018, AW Engineering/Stormwater Principal to review existing

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
	Analyze the safety of existing high risk dams and levees. The Sand Creek Levee must be recertified by 2020, efforts related to the recertification will begin in 2017. Identify, prioritize, and implement actions to strengthen high risk dams and levees to protect the public.							information and identify actions to further strengthen dams & levees.
20	**Easterly Creek Outfall Systems Improvements.** Acquire land for, design, and construct proposed detention ponds (Chesapeake Townhomes, E. 1st Ave, and Havana Park). Design and construct proposed storm sewer improvements and porous landscape detention in Del Mar Parkway medians.	Erosion; Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund, MHFD Cost-share	Medium	Ongoing	In Progress. Detention pond has been completed at E. 1st Ave, and Havana Park is currently under design.
21	**Create and Implement Additional Emergency Alert and Evacuation Plans for Dam and Levee Failures.** Create and implement additional emergency alert and evacuation plans in areas vulnerable to dam and levee failures.	Dam/Levee; Flood	Goals 2,3; Lifelines	Water, OEM	Medium; FEMA, State of Colorado	High	Long-Term	In Progress; AW Engineering/Stormwater Principal to lead this effort
22	**First Creek Ponds 8154 & 8700.** Acquire land for, design, and construct detention ponds within the City of Aurora annexed property (Picadilly Road near E 48th Avenue to areas south of I-70 up to E Alameda Avenue and Monaghan Road). Project implementation to be determined by rate of development.	Erosion; Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund, Cost-share with MHFD (project management)	Medium	Ongoing	In Progress.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
23	**Fitzsimons Peoria Drainage Improvements.** City of Aurora will reevaluate alternatives and continue to seek funding opportunities to execute the project. If and when funding is acquired and an alternative is selected, the project would be executed through Aurora Water Capital Projects.	Erosion; Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund	High	Long Term	In Progress. Design has been completed, and construction is on-going.
24	**Peninsula Townhomes (East and West Tollgate Creeks MDP Reach EG1 Improvements).** Alternative 3 addresses severe incising and removes properties from the floodplain by providing a naturalized channel. Preserve existing stream corridor and naturalized channelization improvements with grade control structures.	Erosion; Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund, MHFD Cost-share	High	Short Term	In Progress. Construction is complete, 404 permit monitoring is on-going
25	**Create Data Collection System to Identify, Assess, and Prioritize Hazard Mitigation Actions.** Develop a system for documenting information collected and observed during and after a natural hazard event, including photographs, witness accounts, information from emergency responders, and flood debris lines, and impacts to people and property. Identify hazard mitigation facilities that performed well during past hazardous events and according to which shortfalls need to be addressed first, prioritize these facilities in future planning	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,4,5; Lifelines	Water, OEM, Public Works, Planning	Medium; FEMA State of Colorado	High	Ongoing	In Progress; OEM developed a debris management plan and debris tool using ESRI mapping. This plan and tool meet many of the description objectives.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
	and development related mitigation actions.							
26	**Sand Creek Right Bank Tributaries Outfall Systems Improvements.** This planning study is underway in the Alternatives Analysis Phase. The alternatives will be considered and a selected alternative will be taken to conceptual design. Elements of the conceptual design will be prioritized and implemented according to the Aurora Stormwater Master Plan initiative.	Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund, MHFD Cost-share	Medium	Long Term	In Progress.
27	**Second Creek Pond S-215.** Acquire land for, design, and construct proposed detention pond.	Erosion; Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund, possible Cost-share with MHFD and Adams County	Medium	Long Term	Not Started; Will be constructed by private developers.
28	**Second Creek Pond S-219.** Acquire land for, design, and construct proposed detention pond.	Erosion; Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund, possible Cost-share with MHFD and Adams County	Medium	Long Term	Not Started; Due to changes in master plans, may not be built. Other facilities will be created to serve the same purpose.
29	**Stormwater conveyance system asset assessment.** The assessment program for CMP pipe has been completed. The first phase of the RCP pipe and manhole assessment started in 2015. Several additional phases of RCP assessment will be required to complete an assessment of all RCP pipe.	Flood	Goals 4; Lifelines	Water	High; Aurora Water	High	Ongoing	In Progress; Currently Working on CMP repair task 6, the first phase of RCP study was completed and determined that we didn't need to move forward with additional phases. Coordination with AW Planning Services to develop Asset management ranking

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
								system to identify assets in need of rehab/replacement.
30	**MHFD Planning Study Requests and Rehabilitate Urban Engineered Waterways.** The stormwater drainage basins that Aurora is most interested in studying are submitted to MHFD on an annual basis for a five-year planning horizon. MHFD prioritizes studies considering other jurisdictions' requests and implements approximately 1-2 plans involving Aurora annually. Engineered channels will be rehabilitated to increase flood storage and erosion control to reduce damage to property and habitat.	Erosion; Flood; Subsidence	Goals 1,3,4,5; Lifelines	Water, Public Works, Parks, MHFD	High; Capital Improvements Operations and Planning Fund, MHFD Cost-share, other municipalities' cost-share	High	Ongoing	In Progress. There are currently nine active planning studies in various phases.
31	**Ukraine and Easter Intersection Improvements.** Design effort to identify corrective action and remain in compliance with approved drainage reports.	Flood	Goals 1,4,5; Lifelines	Water, Public Works	High; Public Works for Design, Aurora Water for construction	High	Short Term	In Progress; Update to current drainage criteria manual to apply current industry standards to new drainage designs and stormwater management. AW Engineering/ Stormwater Principal to lead this effort to identify any underperforming private and public facilities for corrective action.
32	**Westerly Creek Master Drainageway Improvements.** Acquire land, design, and construct proposed detention ponds (Peoria Hills, Baseball Pond, Canterbury Park, Mississippi, and Cemetery	Erosion; Flood	Goals 1,4,5; Lifelines	Water	High; Capital Improvement Fund, MHFD Cost-share	High	Long Term	In Progress. Storm improvements in Kenton and at Canterbury Park are under design and will be starting construction later this year.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
	Pond). Design and construct proposed storm sewer improvements (numerous).							
33	**Include HMP Components in City Plans and Codes, Including Updated Floodplain Maps and Overlays.** Work with the consultant team for Aurora's 2016 Comprehensive Plan Update to ensure that hazard mitigation topics are included in the scope for the public outreach process and plan development for all relevant plan elements. Obtain updated FEMA floodplain map (updated version typically located on .side). Identify, classify, and map critical facilities and vulnerable populations; and develop map in ArcGIS. Floodplain overlay will appear in public draft of zoning code update. The content of Chapter 70 will be incorporated in 146-2-8 and the flood related definitions incorporated into 146-6.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,4,5; Lifelines	Planning, OEM	Low; General Fund	High	Ongoing	In Progress; Floodplain mapping in the City's GIS is kept current by pulling data directly from FEMA's NFHL server. MFHD is doing some work in identifying critical facilities. Calibre is their consultant. AW Engineering will reach out to the Comprehensive Plan City lead and their consultant team to further identify tasks and responsible party.
34	**Develop Plan for Animal Shelter Evacuation.** Develop and test animal shelter evacuation, temporary shelter, and shelter in place plans.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,3; Lifelines	Animal Services	Low; North Central Region Animal Emergency Committee, Denver UASI Grant	Low	Short Term	Not Started; We will need to work with Arapahoe County and their progress on this measure.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
35	**Utilize Capabilities to Supplement Alert Systems for Dam and Levee Failures.** Utilize prediction and forecasting capabilities to supplement the alert system for areas vulnerable to dam and levee failures.	Dam/Levee	Goals 1,2; Lifelines	Water, OEM	Medium; FEMA State of Colorado, MHFD	Medium	Ongoing	In Progress. AW Engineering/Stormwater Principal to lead this effort in coordination with City staff and MHFD
36	**Distribute Companion Animal Disaster Preparedness Brochures.** Distribute companion animal disaster preparedness brochures with every new animal adoption.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2,3; Lifelines	Animal Services	Low; Brochures free to NCR agencies	Low	Ongoing	In Progress; Working on pamphlet suitable to be passed out with adoption material
37	**Develop Community Animal Response Team.** Develop a local Community Animal Response Team and educate citizens on how they can participate.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 2,3,4; Lifelines	Animal Services	Low; General Fund	Low	Short Term	Not Started; We have not seen the required interest in this yet. We are going to try with Adams and Arapahoe to pool residents.
38	**Determine Accurate Companion Animal Population.** Increase licensing compliance and conduct door-to-door canvassing in order to determine an accurate companion animal population.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind;	Goals 1,2,3; Lifelines	Animal Services	Medium; General Fund	Medium	Ongoing	Not Started; We would like to start an ongoing licensing campaign. Although door to door is not feasible.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
		Subsidence; Tornado; Wildfire; Winter Storms						
39	**Continue Participation in the NCR Animal Emergency Committee.** Continue to participate in the NCR Animal Emergency Committee.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3,4; Lifelines	Animal Services	Low; General Fund	Low	Ongoing	Annual Implementation. Meetings and communication are ongoing.
40	**Continue to Participate in MDSA and CFAWA.** Continue to participate in MDSA and the CFAWA.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3,4; Lifelines	Animal Services	Low; General Fund	Medium	Ongoing	Annual Implementation. Meetings and communication are ongoing.
41	**Deploy Animal Shelter Employees.** Increase response capacity by allowing Animal Protection Officers to deploy with partner agencies when needed.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,3; Lifelines	Animal Services	Low; General Fund	Medium	Long-term	In Progress.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
42	**Evaluate the need for and install new rainfall and stream flow monitoring gauges.** Identify locations where new rainfall and stream gauges are required and coordinate installation activities with MHFD.	Flood	Goals 3,5; Lifelines	Water	Medium; Aurora Water	Medium	Ongoing	In Progress; AW Engineering/Stormwater Principal to lead this effort in coordination with City staff and MHFD
43	**Drought Action Team.** This Team of representatives from Aurora Water conservation, engineering, water resources, finance and executive staff, will meet as needed to implement the City's Water Management Plan; review history of actions taken during drought seasons; review agreements in place or needed; and coordinate with outlying utilities to start putting together a utility wide response/action plan to ensure communications are equal for all customers.	Drought	Goals 1,2,3,4; Lifelines COM, FWS, H&M, S&S	Water; Utilities across the state of Colorado and downstream partners	Less than $10,000; Department budget	High	June 2021	New in 2021. Team has started meeting and several sub committees have formed to manage smaller topics.
44	**Develop a web-based living Hazard Mitigation Plan.** Develop a web-based living Hazard Mitigation Plan to create a more interactive and visually appealing understanding of Hazard Identification, Risk and Mitigation. And to visually understand mitigation investments and actions.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3,4,5; Lifelines COM, ENG, FWS, HAZ, H&M, S&S, TRN	OEM, IT, GIS, Planning, Water	Less than $10,000; Grants, General Fund	Medium	2023	New in 2021.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
45	**Public Information and Warning Evaluation.** Aurora has a variety of capabilities to provide public information and warning. However, having so many tools can make it challenging to keep up with them all and ensure they are working properly. Tornado sirens require a large upgrade and new sirens are not being installed in new development areas. CodeRed can be used for public warning but consistent messaging is still a challenge with that particular system. Templated messaging has been created with a plan but is not often used. IPAWS will soon be another tool and also will require awareness and training. Public Information and Warning can greatly reduce risk for a wide variety of population groups. Messaging does need to be coordinated, prompt, reliable and actionable to the whole community to reduce this risk.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3,4,5; Lifelines COM, ENG, FWS, HAZ, H&M, S&S, TRN	OEM, Communications, PIOs, Planning, City Management	$10,000 - $100,000; General fund	High	2022	New in 2021.
46	**Flood Warning System Assessment Project.** An assessment to determine current flood warning detection systems in the city and if there is a need to invest in this capability.	Flood	Goals 1,2,3,4,5; Lifelines COM, ENG, S&S, TRN	OEM, Water, MHFD, Dispatch, Communications, Fire, Police	Less than $10,000; General Fund	Medium	2022	New in 2021.
47	**Alternative Paving Materials to accelerate snow melt.** Conduct a study to explore the use of alternative paving materials to accelerate the snowmelt on streets	Winter Storms	Goals 1,4,5; Lifelines FWS, S&S, TRN	Public Works; Planning	More than $1,000,000; CIP, Grants, BRIC	Medium	2030	New in 2021.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
	and sidewalks to reduce the need for snow plowing. Study will investigate various types of permeable materials, expected costs, ease of installation, material performance, absorption rates, and long-term maintenance requirements.							
48	**Information Tracking.** Follow formalized data driven ESRI Hubsite for natural hazard-based incidents to identify repetitive loss locations or hazards. Use this information to inform the creation and implementation of future mitigation actions.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Flood; Landslide; Hail; Lightning; Severe Wind; Subsidence; Tornado; Wildfire; Winter Storms	Goals 1,2,3,4,5; Lifelines COM, ENG, FWS, HAZ, H&M, S&S, TRN	OEM; Fire, Police, IT, GIS, Dispatch, GIS	$10,000 - $100,000; General fund	High	2022	New in 2021.
49	**Critical infrastructure mapping.** Map critical infrastructure to better understand the interrelationships among components of infrastructure and support the Risk Assessment section of the HMP.	Dam/Levee; Drought; Earthquake; Extreme Heat; Flood; Hail; Lightning; Severe Wind; Tornado; Wildfire; Winter Storms	Goals 1,2,3,4,5; Lifelines COM, ENG, FWS, H&M, S&S, TRN	OEM; IT, GIS, Planning	Less than $10,000; General Fund	High	2022	New in 2021.
50	**Aurora Community Wildfire Protection Plan.** Reduce Wildland Urban Interface (WUI) and/or fast-moving Brush/Light Fuels Fire issues in City of Aurora. Aurora City has significant areas of WUI that if a severe fire event occurred then a potential mass casualty incident could occur as well as millions of dollars in residential	Wildfire; Erosion	Goals 1,2,3,4,5; Lifelines ENG, FWS, H&M, S&S	Fire; Parks, Water	$10,000 - $100,000; City Budget and/or grants. Potential assistance form Insurance and/or utility companies.	High	2024	New in 2021.

#	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
	structures and infrastructure could be damaged and/or destroyed. Mitigating the hazards of light fuels near structures would significantly limit the severity of WUI impact. Lives lost and/or severe injury would be reduced as well as millions of dollars saved.							
51	**Aurora Fluvial Mitigation Projects and Planning.** Aurora recognizes fluvial hazards and desires to assess the hazards of erosion, sediment, deposition, and other dynamic river processes, by identifying them, mapping and planning for these natural hazards. Aurora has begun taken the proper steps toward identifying this need for mitigation with a recent study of the Sand Creek corridor and outlining recommended mitigation strategies.	Dam/Levee; Drought; Earthquake; Erosion; Expansive Soils; Extreme Heat; Severe Wind; Subsidence; Winter Storms	Goals 1,2,3,4,5; Lifelines FWS, S&S, TRN	Aurora Water, Planning	$10,000 - $100,000; City Budget, General Fund, Dept fund, and/or grants.	High	2030	New in 2021. Recent studies and mapping of fluvial hazard zones are being evaluated and incorporated into local planning. Work on the highest risk areas in the Sand Creek corridor could be anticipated to start in the next 5 years.

Table 5-3 Mitigation Actions by Hazard Addressed

Action #	Dam/Levee	Drought	Earthquake	Erosion	Expansive Soils	Extreme Heat	Flood	Hail	Landslide	Lightning	Severe Wind	Subsidence	Tornado	Wildfire	Winter Storms
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
19	X			X											
20				X			X								
21	X						X								
22				X			X								
23				X			X								
24				X			X								
25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
26							X								
27				X			X								
28				X			X								
29							X								
30				X			X					X			
31							X								
32				X			X								
33	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
34	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
35	X														
36	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
37	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
38	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
39	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
41	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
42							X								
43		X													
44	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
45	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
46							X								
47															X
48	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
49	X	X	X			X	X	X		X	X		X	X	X
50				X										X	
51	X	X	X	X	X	X					X	X			X

6 Plan Implementation and Maintenance

DMA Requirement §201.6(c)(4)(ii):
[The plan shall include] a plan maintenance process that includes: *(i) A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.* *(ii)A process by which local governments incorporate the requirements of the mitigation plan into other planning process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.* (iii) *Discussion on how the community will continue public participation in the plan maintenance process.*

This section describes how the City of Aurora Mitigation Strategy will be implemented and how the overall Hazard Mitigation Plan will be evaluated and enhanced over time. This includes an overview of the strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, evaluating, and updating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how the City will ensure continued public involvement in mitigation planning.

6.1 Implementation

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile actions, the City will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

Implementation will be accomplished by adhering to the schedules identified for each mitigation action in Table 5-2 in Chapter 5 Mitigation Strategy, and through pervasive efforts to network and highlight the multi-objective, win-win benefits of each project to the community and its stakeholders. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. Implementation will be accomplished through the routine actions of monitoring agendas, as well as attending meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneously to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the costlier recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements, should grants be pursued; this will help ensure the City is in a position to capitalize on the opportunity when funding becomes available. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

6.1.1 Implementation and Maintenance of the 2016 Plan

As detailed in Section 5.2, the City has made considerable progress on the implementation of the plan, and on decreasing the City's vulnerability to hazards. The 2016 Plan included a process for implementation and maintenance of the plan, which was generally followed. The 2016 Plan recommended that the HMPC meet annually to review progress on mitigation actions, assess how effective those actions have been in mitigating losses, and how well the Plan's goals and objectives are being met. The HMPC would also monitor how elements of this Plan were being incorporated in into other planning mechanisms. Due to limited resources and conflicting priorities, this did not happen. While the HMPC did not meet formally during the past five years, there were a number of conversations and meetings with individual departments to gather status information on projects.

The status of mitigation actions and success stories are captured in Chapter 5.

6.1.2 Role of the HMPC in Implementation and Maintenance

With adoption of this plan, City staff will be tasked with plan implementation and maintenance. This will be accomplished by keeping the HMPC active throughout the lifecycle of the plan. The HMPC will:

- Act as a forum for hazard mitigation issues,
- Disseminate hazard mitigation ideas and activities to all participants,
- Pursue the implementation of high-priority, low/no-cost recommended actions,
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters,
- Maintain a monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists,
- Monitor and assist in implementation and update of this plan,
- Report on plan progress and recommended changes to City Council and other partners, and
- Inform and solicit input from the public.

Other duties include reviewing and promoting mitigation proposals, providing technical assistance in implementing mitigation codes and ordinances, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the City website, in the local newspaper, and on social media.

6.2 Plan Maintenance

The City of Aurora Hazard Mitigation Plan is a living document that may be adjusted or updated as conditions change, actions progress, or new information becomes available. This section describes the method and schedule the City will follow for monitoring, evaluating, and updating the Plan over the next five years.

6.2.1 Monitoring

Monitoring refers to tracking the implementation of the plan over time. The Aurora Office of Emergency Management (OEM) will be responsible for reaching out to lead and supporting agencies identified in the Mitigation Actions table for status on those mitigation actions. OEM will also coordinate with HMPC members at least annually to identify and track any significant changes in their agencies' mitigation efforts. A sample meeting agenda and progress report are included as Appendix H.

Aurora OEM will use the following process to track progress, note changes in vulnerabilities, and consider changes in priorities as a result of project implementation:

- A representative from the responsible entity identified in each mitigation action will be responsible for tracking and reporting to the HMPC when project status changes. The representative will provide input on whether the project as implemented meets the defined goals and objectives and is likely to be successful in reducing vulnerabilities.
- If the project does not meet identified goals and objectives, the HMPC may select alternative projects for implementation.
- Projects that were not ranked high priority but were identified as potential mitigation strategies will be reviewed periodically to determine feasibility of future implementation.
- New mitigation projects identified will require an individual assigned to be responsible for defining the project scope, implementing the project, monitoring success of the project.
- Mitigation activities not identified as actions in this plan will also be tracked to ensure a comprehensive hazard mitigation program, and to assist with future updates.

Mitigation action #54 in Table 5-2 proposes to develop a web-based living Hazard Mitigation Plan. In addition to enhancing public awareness of and information on hazard mitigation, this platform can also be used to monitor and track the progress of mitigation actions.

6.2.2 Evaluation

Evaluating refers to assessing the effectiveness of the plan at achieving its stated purpose and goals. Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan, such as:

- Decreased vulnerability because of implementing recommended actions,
- Increased vulnerability because of failed or ineffective mitigation actions, and/or
- Increased vulnerability because of new development (and/or annexation).

The HMP will meet annually to evaluate the implementation of the plan and consider any changes in priorities that may be warranted. Aurora OEM will coordinate with all participating agencies to facilitate an effective maintenance and implementation process. Completed projects will be evaluated to determine how they have reduced vulnerability. Changes will be made to the plan to accommodate for projects that have failed or are not considered feasible after a review for their consistency with established criteria, the time frame, priorities, and/or funding resources.

6.2.3 Updates

The Aurora Hazard Mitigation Plan will be reviewed and revised at least once every five years in accordance with the DMA 2000 requirements and latest FEMA and DHSEM hazard mitigation planning guidance. Updates to this plan will consider:

- Has the nature or magnitude of hazards affecting the City changed?
- Are there new hazards that have the potential to impact the City?
- Have growth and development changed the City’s vulnerabilities?
- Do the identified goals and actions still address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional local resources be committed to address identified hazards?
- The updated plan will document success stories where mitigation efforts have proven effective, as well as areas where mitigation actions were not effective, and will include re-adoption by all participating entities following DHSEM/FEMA approval.

6.3 Incorporation into Other Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is the incorporation of hazard data and mitigation plan principles and recommendations into other plans and mechanisms. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. The mitigation plan can be considered as the hub of a wheel with spokes radiating out to other related planning mechanisms that will build from the information and recommendations contained herein. Properly implemented, the HMP should serve as one of the foundational documents of the City's emergency management programs, since everything emergency management does should relate back in one way or another to the hazards the jurisdiction faces.

As stated in Section 6.1 above, implementation through existing plans and/or programs is recommended wherever possible. Based on this Plan's capability assessment and progress made on mitigation actions noted in Chapter 5, the City continues to implement policies and programs to reduce losses to life and property from natural and human-caused hazards. The HMPC will be responsible for integrating the data, goals and objectives, and other elements of this Plan into other plans, as appropriate.

The following sections provide some guidance on how the City may use the updated HMP to inform and improve other plans, procedures, and programs.

6.3.1 Comprehensive Plans

Integrating hazard mitigation into the jurisdiction's comprehensive or general plan is considered a best practice by both FEMA and the American Planning Association. The City's comprehensive plan, Aurora Places, was last updated in 2018 and includes mentions of flood and erosion hazards but does not address citywide hazards in a comprehensive manner. Aurora OEM will work with the City Planning Department to ensure that hazards data and mitigation goals and objectives inform the next Comprehensive Plan update.

6.3.2 Threat and Hazard Identification and Risk Assessment (THIRA)

The City of Aurora has used the North-Central All-Hazards Region (NCR) Threat and Hazard Identification and Risk Assessment (THIRA) in its Emergency Operations Plan for evaluating current risks and threats to the City. As the City has expanded, it has become necessary to perform an analysis focused on the City specifically. A Natural Hazards Mitigation Plan has already been written. A separate threat assessment for human caused threats must be conducted. A methodology to perform this assessment and clearly quantify the severity of risks has been identified and created. A numerical formula was created to evaluate risk using the worst plausible scenarios to evaluate the effect on the city. This risk assessment followed the Aurora Places comprehensive plan and divided the City into logical geographic areas rather than making blanket statements across the entire City. The draft has been developed; risk analysis and threat scoring are being evaluated by City leadership through a series of workshops to finalize the THIRA.

CPG201 "Threat and Hazard Identification and Risk Assessment (THIRA) establishes Step 1 as "Identify the Threats and Hazards of Concern" and lists HIRAs and HMPs as possible sources of threat/hazard information. The criteria for selecting which Threats/Hazards are "of concern" are defined as:

- Factor #1: Likelihood of a Threat or Hazard Affecting a Community
- Factor #2: The Impacts of a Threat or Hazard

Each hazard profiled in the HIRA (Section 4) contains a section analyzing the probability of future events, which provides a data-driven answer to Factor #1. Similarly, the vulnerability assessment section of the hazard profiles address what impacts can realistically be expected from both routine and extreme events of each hazard, which specifically addresses Factor #2.

Step 2 of CPG 201 is to "Give the Threats and Hazards Context" by creating a scenario for each hazard of concern, with specifics like time of day, area, and magnitude of the event, which are then used to establish capability targets for each of the 32 core capabilities. All the hazards profiled in the HIRA contain detailed information to ensure the hazard scenarios are plausible. For some hazards, such as flood or earthquake, detailed Hazus modeling runs have been done that can easily be incorporated as THIRA scenarios. Other hazards include details on the most extreme historical events on record that can quickly be updated to modern scenarios.

6.3.3 Response Plans

The City of Aurora Emergency Operations Plan (EOP) was last updated in 2017 and is currently under revision and being updated to a Comprehensive Emergency Management Plan (CEMP). While the CEMP is an all hazards document, it also contains hazard-specific information and concerns. The CEMP references the HMP and the top natural hazards therein. Incident-specific annexes are under development, including a winter storm plan. Hazard information from this HMP update will be incorporated into the CEMP as appropriate.

Several other operational or functional response plans are also influenced by information contained in the HMP. These plans include but are not limited to:

- **Damage Assessment Plan:** A review of the vulnerability and estimated losses detailed in the hazard profiles can help identify what areas to initially prioritize following a hazard event. Similarly, a review of Section 4.2 Asset Summary can help identify what critical facilities need to be assessed following a hazard event.
- **Debris Management Plan:** HAZUS runs conducted for earthquake and flood scenarios include an estimate of how many tons of debris would likely be generated by those scenarios. These estimates can be used as bounding limits for how much and what type of debris generation is likely to be required, as well as what areas are most likely to see heavy debris generations.
- **Evacuation & Sheltering Plan:** A review of the vulnerability and estimated losses detailed in the hazard profiles can help identify what areas are more likely to need evacuation in different hazard scenarios. The Community Profile in Section 2 can help identify not only how many people would potentially be impacted by disasters, but how many are likely to need assistance with transportation, special medical or sheltering needs, etc. This review can also help evaluate the impacts of multiple or cascading hazards, so that evacuees are not relocated into an area that puts them at risk from other hazards.

6.3.4 Recovery Plan

The City of Aurora Disaster Recovery Plan was last updated in 2017, and references hazard mitigation in several places, to include the use of 406 funds under FEMA's Public Assistance program.

The risk and vulnerability data in the HMP should help inform the pre- and post-disaster recovery planning process, especially by ensuring that the recovery elements of those plans fully consider the dangers posed by other hazards, rather than focusing exclusively on the most recent hazard event. The HMP in turn will be revisited during recovery to help identify opportunities to incorporate mitigation in the recovery and rebuilding process, including maximizing FEMA PA and HMGP funding where applicable.

The FEMA publication "Pre-Disaster Recovery Planning Guide for State Governments" notes:

"…much of the research involved in the development of mitigation plans can be used to inform the pre-disaster recovery planning effort.

"The pre-disaster recovery planning process will benefit from and build upon hazard mitigation as:

- The mitigation planning process identifies local hazards, risks, exposures, and vulnerabilities;
- Implementation of mitigation policies and strategies will reduce the likelihood or degree of disaster-related damage, decreasing demand on resources post-disaster;
- The process will identify potential solutions to future anticipated community problems; and
- Mitigation activities will increase public awareness of the need for disaster preparedness.

"Pre-disaster recovery planning efforts also increase resilience by:

- Establishing partnerships, organizational structures, communication resources, and access to resources that promote a more rapid and inclusive recovery process;
- Describing how hazard mitigation will underlie all considerations for reinvestment;
- Laying out a process for implementation of activities that will increase resilience; and
- Increasing awareness of resilience as an important consideration in all community activities."

6.3.5 Continuity of Operations Plans (COOP) /Business Impact Analysis (BIA)

All departments and agencies of City of Aurora government are required to maintain a Continuity Of Operations Plan (COOP) that details that agency's critical functions and how they will protect those functions in order to continue to provide essential services during a disaster or interruption. By defining and describing the hazards facing the City, including frequency and severity, the HIRA informs agency COOP plans by giving context to what types of disasters of interruptions are most likely to occur. Critical facilities and assets located in hazard areas in Section 4.2 should be prioritized for COOP planning.

6.3.6 Training and Exercise Plan

Training on hazard mitigation principles and procedures should be included in the City's training and exercise planning. Any training and exercise needs identified in the Capabilities Assessment (Section 3.7) and Mitigation Strategy (Section 5) should also be included in the City's training and exercise planning.

6.3.7 Public Awareness and Education Programs

The City's ongoing public education and outreach efforts should reflect the hazards and vulnerabilities described in this Plan. In addition to preparing for disasters, public education should include ways in which the public can reduce their vulnerability to natural and human caused hazards. Furthermore, mitigation activities and success stories should be communicated to the public to show the benefits of effective mitigation planning.

6.3.8 Critical Infrastructure Protection Plan

Critical facilities and assets identified in Section 4.2 should be included in Critical Infrastructure Protection Planning (CIPP), with prioritization given to assets located in hazard-prone areas. Hazardous materials facilities in particular should be viewed both as critical assets in need of protection, and as potential hazards in their own right.

6.3.9 Capital Improvements Plan

Many of the mitigation actions listed in the Mitigation Strategy (Section 6.4.2) came from the City's Capital Improvements Plan, and thus have already been identified for funding. Other high-dollar actions listed or identified in the future can also be added to the Capital Improvements Plan to ensure that hazard mitigation projects continue to receive funding. The prioritization of actions listed in Table 6-4, while not binding on capital improvement planning, can be used to inform the prioritization of those actions. Even projects for which the City intends to seek grant funding may also need to be addressed in the Capital Improvements Plan, given that most mitigation grants require significant local matching funds.

6.4 Continued Public Involvement

Continued public involvement is also imperative to the overall success of the Plan's implementation. This updated HMP will be posted on the City's website for reference and can be used to help inform the City's ongoing public education and outreach program, such as the completion of mitigation actions that reduce the community's vulnerability, can be shared with the public through forums like the Local Emergency Planning Committee (LEPC), public meetings, public preparedness and resilience trainings, and through social media. This helps keep the concept of hazard mitigation alive and helps show the public that their government officials are working to keep them safe.

The update process provides an opportunity to publicize success stories from the Plan implementation and seek additional public comment. When the HMPC reconvenes for the five-year plan update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. The plan maintenance and update process will include continued public and stakeholder involvement and input through participation in designated committee meetings, surveys, web postings, and press releases to local media.

APPENDIX A: PLAN ADOPTION AND APPROVAL

PLACEHOLDER

Hazard Mitigation Plan Adoption Sample Resolution

Resolution # _____

Adopting the City of Aurora
Hazard Mitigation Plan 2021

Whereas, *(name of community) recognizes the threat that natural hazards pose to people and property within our community; and*

Whereas, *undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and*

Whereas, *an adopted Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and*

Whereas, *(name of community) resides within the Planning Area, and fully participated in the mitigation planning process to prepare this Hazard Mitigation Plan; and*

Whereas, *the Colorado Division of Homeland Security and Emergency Management and Federal Emergency Management Agency, Region VIII officials have reviewed the City of Aurora Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body; and*

Now, therefore, be it resolved, *that the (name of board or council), hereby adopts the City of Aurora Hazard Mitigation Plan, as an official plan; and*

Be it further resolved, *City of Aurora Emergency Management will submit this Adoption Resolution to the Colorado Division of Homeland Security and Emergency Management and Federal Emergency Management Agency, Region VIII officials to enable the Plan's final approval.*

Passed: (date)

_____

Certifying Official

APPENDIX B: HAZARD MITIGATION PLANNING COMMITTEE

HMPC Steering Committee Membership

Jurisdiction/Agency	Name	Title	Meeting #1	Meeting #2	Meeting #3
City of Aurora					
Aurora Fire Rescue	Allen Robnett	Commander Office of the Chief	Y	Y	
Aurora Fire Rescue	Eric Franks	Special Ops and Special Projects Battalion Chief	Y		
Aurora Water	Marena Lertch	Support Services Manager	Y	Y	
Aurora Water	Sean Lieske	Environmental Services Manager	Y		
Aurora Water	Swirvine Nyirenda	Water Planning Services Manager	Y		Y
Aurora IT	Ryan Witsel	GIS Analyst	Y		
Aurora Planning & Development Services	Karen Hancock	Principal Planner	Y	Y	Y
Aurora Building Division	Mike Dean	Manager Fire/Life Safety	Y		
Aurora Building Division	William Polk	Fire/Life Safety	Y	Y	
Aurora IT	Bill Keever	GIS Manager	Y	Y	
Aurora Office of Emergency Management	Brandon Lenderink	Emergency Management Specialist	Y	Y	Y
Aurora Office of Emergency Management	James Swart			Y	Y
Aurora Office of Emergency Management	Mathew Chapman			Y	Y
Aurora Oil & Gas Division	Jeffrey S Moore	Manager	Y	Y	
Aurora Parks, Recreation, and Open Space Department	Brent Delehoy	Superintendent	Y	Y	
Aurora Public Works	Craig Pearl	Senior Engineer - Floodplain Administrator	Y	Y	Y
Aurora Public Works	Lynne Center	Deputy Director - Operations	Y	Y	Y
Aurora Communications & Marketing	Michael Bryant	Public Relations Manager	Y	Y	
Public Safety Communications	Kacey Leyba	Operations Manager	Y		Y
Aurora Fleet Maintenance	John Kebba	Fleet Coordinator		Y	Y

Jurisdiction/Agency	Name	Title	Meeting #1	Meeting #2	Meeting #3
Aurora Library and Cultural Services	Phillip Challis	Operations Manager			Y
Aurora Water	Steve Sciba	Deputy Director - Operations			Y
Partners/Stakeholders					
Adams County Emergency Management	Ron Sigman	Emergency Manager	Y		
Colorado Division of Homeland Security and Emergency Management	Mark Thompson	State Hazard Mitigation Officer		Y	Y
Colorado Division of Water Resources	Jim Kirch	Dam Safety Engineer	Y		
Mile High Flood District	Kevin Stewart	Flood Warning Services Manager	Y		
National Weather Service - Boulder	Greg Hanson		Y		
Tri-County Health Dept	Omar Awan	EPR Planner III		Y	
Tri-County Health Dept	Caitlin Gappa				Y
Tri-County Health Dept	Sara Garrington		Y		
Xcel Energy	Deb Watts	Emergency Management Liaison		Y	Y
Xcel Energy	Tom Henley	Area Manager		Y	
	Steven Wright		Y		

City of Aurora Hazard Mitigation Plan Update
Kick Off Meeting Agenda

Date: Wednesday, December 9, 2020 **Time:** 1:00 - 3:00 pm MDT

Project: City of Aurora Hazard Mitigation Plan Update

Subject/Purpose

The purpose of the meeting is to initiate the process for updating the City's Hazard Mitigation Plan (HMP), introduce the Disaster Mitigation Act of 2000, and summarize the hazard mitigation planning process. The HMP is intended to identify hazards, assets at risk, and ways to reduce impacts through long-term sustainable mitigation projects.

Attendees: Hazard Mitigation Planning Committee and Stakeholders

1. Introductions
2. Hazard Mitigation Overview
3. Mitigation Planning Process and Requirements
4. Overview of 2016 Hazard Mitigation Plan
5. Coordination with Other Agencies, Related Planning Efforts, & Recent Studies
6. Planning for Public Involvement
7. Project Schedule and Next Steps
8. Questions

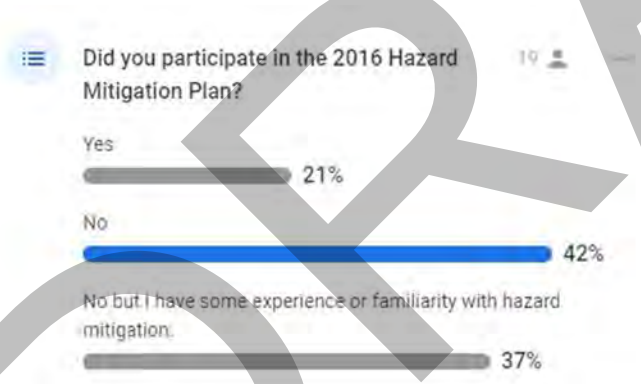
City of Aurora
Hazard Mitigation Plan 2021 Update

Kick-Off Webinar Summary
1 pm-2:30 pm
December 9, 2020

Introductions and Opening Remarks

This document summarizes the kickoff webinar for the City of Aurora Hazard Mitigation Plan (HMP) update for 2021. The webinar was facilitated by Wood Environment & Infrastructure Solutions, Inc. (Wood), the consulting firm hired to facilitate the planning process and develop the updated plan. This type of meeting is ideally conducted in-person, however in this instance the meeting was done in a webinar format in order to comply with social distancing requirements as a result of the COVID-19 pandemic. Jeff Brislawn, HMEM Program Lead at Wood, began the meeting with introductions, filling in for Scott Field who is the Project Manager for this plan update. Twenty-three persons attended the webinar representing a mix of City departments, participating jurisdictions, and stakeholders. The key discussion is summarized below; additional details can be found in the meeting PowerPoint presentation and webinar recording.

Jeff started the meeting with an online poll question asking how many attendees participated in the 2016 Hazard Mitigation Plan. The results of the poll are shown below.



Following the poll question just introduced the Wood team and asked attendees to place their name, title and department in the chat to serve as the record of attendance for the meeting. Following introductions Jeff discussed the agenda items; the key discussion is summarized below, and additional details are within the meeting PowerPoint presentation.

Hazard Mitigation Overview

Mark Thompson (DHSEM) presented PowerPoint slides that outlined what hazard mitigation is and why mitigation it is important. Mark explained hazard mitigation should be an ongoing effort integrated into both day-to-day operations and long-term planning. He noted that FEMA is only concerned with natural

hazards being profiled within these plans but explained this does not preclude communities from including manmade hazards, which could help in having a one stop plan for all types of hazards that pose a risk to the community. Mark continued by explaining a hazard mitigation plan is not a regulatory document and is not a set-in-stone commitment of resources. The overall purpose of a local hazard mitigation plan is to prevent knowable hazards from having an impact on the community.

Mark stated there are two main types of benefits a community gains from having a FEMA approved hazard mitigation plan (HMP); (1) bringing people together in the community; (2) having an HMP approved by FEMA makes a community eligible for FEMA grants (Pre-Disaster Mitigation, Flood Mitigation Assistance, Hazard Mitigation Grant Program-Post-Disaster). He noted that any funding requests from FEMA needs to be based on the hazards and mitigation strategy in the HMP. He added that information from the hazard mitigation plan, specifically the vulnerability assessment and mitigation strategy, can be used in other hazard related plans such as community wildfire protection plans.

FEMA will only fund mitigation projects that will reduce future demand for and the costs of disaster response and recovery such as retrofitting a critical facility, enforcing building codes, land use planning, or removing a structure from a hazard area. Mitigation funding cannot be used for response actions such as purchasing of vehicles for fire or police departments. Mark continued by briefly reviewing the benefit cost relationship of mitigation projects. He shared statistics from the 2019 National Institute of Building Science Report which showed that mitigation grants funded through select federal government agencies, on average, can save the nation $6 in future disaster costs for every $1 spent on hazard mitigation. Since 2011, Colorado has had 145 projects awarded FEMA funding for mitigation projects.

Mark continued his presentation by going over some of the planning requirements for the plan. Specifically highlighting the requirement for a participating jurisdiction to be part of an approved plan. In order for the local jurisdiction to be considered a "participating" jurisdiction they cannot simply adopt the plan but have to also assess their unique risks and identify specific mitigation actions for their community. Mark finished his presentation with asking the HMPC if they have any questions.

Hazard Mitigation Planning Process and Requirements

Jeff continued the meeting with the specific planning requirements the City will have to meet in order to have a FEMA approved plan. Jeff reviewed the Disaster Mitigation Act (DMA) of 2000 Requirements and explained that the City of Aurora Hazard Mitigation Plan (HMP) will be updated in accordance with these requirements. The planning process involves a 4 Phase approach with 9 tasks per FEMA guidance updated in 2013. The kickoff meeting is the first step in the process and also covers tasks 1-3 (Determine the planning area and resources; Build the planning team; Create an outreach strategy).

Role of the Hazard Mitigation Planning Committee (HMPC)

The first step in getting organized is to determine the hazard mitigation planning committee members, which has already started with those in attendance at the kickoff meeting. Jeff presented a slide with a summary of those invited to be on the committee.

Jeff emphasized that local input, and participation from the city, special districts, and stakeholders is required for full approval from FEMA. Participation includes the following:

- Attend meetings and participate in the planning process
- Provide requested information to update or develop jurisdictional information
- Review drafts and provide comments
- Identify mitigation projects specific to jurisdiction, provide status
- Assist with and participate in the public input process
- Coordinate formal adoption

Stakeholders include other local, state and federal agencies with a stake in hazard mitigation in the City or may include academic institutions and local business and industry. State and federal stakeholder may include the CO DHSEM, CO Division of Water Resources, CDOT, CO State Patrol, U.S. Forest Service, CO State Forest Service, CO Geological Survey, CO Parks and Wildlife, Colorado Water Conservation Board, USGS, FEMA Region VIII, US EPA, and National Weather Service. Neighboring counties were also notified about the update and will be given an opportunity to provide input into the process. Stakeholders have various options and levels of participation including:

- Attend HMPC meetings or stay in loop via email list
- Provide data/information
- Partner on mitigation efforts
- Review draft plan

Plan Update Requirements, Key Elements and Schedule

Aspects of the planning process include:

- Re-convene HMPC
- Review and Analyze each section
- Update risk assessment, noting changes
- Note changes in risk exposure due to successful mitigation projects or development/annexation
- Revisit goals
- Identify completed, deleted, deferred actions
- Plan maintenance review/changes

An important requirement of the hazard mitigation planning process is involving the public in the process. FEMA requires the HMPC provide two opportunities for public involvement. FEMA does not prescribe how to involve the public, but Wood recommends this take place during the drafting stage and once more prior to plan approval. There are several advantages to involving the public including developing solutions that fit local needs better, strengthening local support for the plan and ensuring a fair process in the development of the plan. Jeff acknowledged that it can be challenging to get the public to attend meetings and shared that Wood has had success with using online surveys to receive good feedback. It is also recommended to "piggyback" public meeting with other related meetings.

Another requirement of the plan update process is performing a community capability assessment. This is an assessment of the communities existing plans, regulations, fiscal abilities, administrative and technical abilities. Identifying fiscal abilities early on is important because FEMA requires a 25% match of local funds.

Early identification will help to understand potential funding sources now that could be used to possibly match the federal funds.

Conducting a risk assessment is a key aspect of a hazard mitigation plan and involves two components; hazard identification (what can happen here) and the vulnerability assessment (what will be affected). The HMP update will be based on existing documents and studies, with the City of Aurora Hazard Mitigation Plan (2016) providing the baseline for identified hazards and the groundwork for goals, policies and actions for hazard mitigation.

The HMP will be updated over the next six months, with at least two more meetings with the Hazard Mitigation Planning Committee. Wood will be updating the Hazard Identification and Risk Assessment (HIRA) in the next couple of months, with input from the HMPC. Four drafts of the HMP will be created: the first for review by HMPC committee, a second for public review, a third for State review, and a fourth for FEMA review. The first draft for HMPC review is targeted for March 2021, a public review draft in April followed by a review by Colorado DHSEM in April/May and then tentatively approved by FEMA in July/August 2021.

Review of Identified Hazards

Based on hazards from the 2016 City HMP, the list of potential hazards was reviewed. Jeff showed a slide that listed the hazards in the 2016 HMP.

- Dam/Levee Failure
- Drought
- Earthquake
- Erosion and Deposition
- Expansive Soils
- Extreme Heat
- Flood
- Hail
- Landslide/Mud/Debris Flow, Rockfall
- Lightning
- Severe Wind
- Subsidence
- Tornado
- Wildfire
- Winter Storm

The group thought that the original list of hazards was still valid. Jeff noted that every hazard profiled must have at least one mitigation action identified and will need at least one new action added to the updated plan.

Jeff asked the group to review the list of hazards and comment on how they could be enhanced or updated with:

- Historic incidents
- Incident logs

- Public perception
- Scientific studies
- Other plans and reports (e.g., flood and drainage studies, CWPPs, Internet databases)
- Recent disasters

Coordinating with Other Agencies\Related Planning Efforts\Recent Studies

A discussion on recent studies of hazards in other documents and reports followed the identified hazards discussion. Opportunities for coordinating and cross-referencing the HMP were discussed. Recent studies and related planning efforts included:

- Flood Mitigation Master Plans
- Stormwater Plans
- Watershed or river restoration plans
- Drought plans
- Capital Improvement Plans
- Comprehensive Plan Update

There was discussion that the City's recently updated comprehensive plan, Aurora Places, would be a valuable reference. Karen Hancock, with City of Aurora Planning and Development Services, provided a link to the plan. was in need of updating and if that could be combined into the planning process for the HMP update.

Planning for Public Involvement

Jeff noted that a Public survey will be developed to gather input from the public on hazard concerns and mitigation ideas. Advertisement of public survey will be through public information channels, official websites, social media, email blasts etc. He asked for opportunities for outreach at scheduled public meetings or events. Michael Bryant, with City of Aurora Communications, announced that the city would be rolling out a new public engagement platform in the next month or two called Bang the Table.

Initial Information Needs and Next steps

Jeff discussed a slide with initial information needs and next steps. Jeff encouraged the group to send by email information on:

- Review existing hazard mitigation plans
- Recent hazard events (since 2016) – damages, incident logs, damage assessments, etc.
- Growth and development trends
- Recent updated plans and policies

Where available online, Wood will try to obtain the updated plans previously noted. Jeff encouraged the group to send other information that might not be readily accessible online.

A Google Share Drive will be set up for the project to share large documents.

A GIS needs list was provided to the City to assist with data collection, which is already in progress. Wood will begin work in the Hazard Identification and Risk Assessment update and develop a public survey that can be used online.

The next HMPC meeting will be in January following the update of the Hazard Identification and Risk Assessment section of the plan. The specific date will be shared when available.

The webinar chat log is attached to this meeting summary.

Adjourn

The meeting adjourned at 2:40 pm.

Jeff.brislawn@woodplc.com
303-742-5315
2000 S. Colorado Blvd Denver, CO 80222

City of Aurora Hazard Mitigation Plan 2021 Update

Kickoff Webinar Chat Log

[12/9 1:00 PM] Lenderink, Brandon added Johnson, Christopher A to the meeting.
[12/9 1:01 PM] Unknown User Lenderink, Brandon added Dean, Mike to the meeting.

[12/9 1:01 PM] Brislawn, Jeff P
Hi folks we'll get started shortly. Please type in name, title and dept/agency in the chat.

[12/9 1:02 PM] Unknown User Lenderink, Brandon added Sara Garrington to the meeting.

[12/9 1:05 PM] Lieske, Sean
Sean Lieske - Environmental Services Manager, Aurora Water

[12/9 1:05 PM] Watts, Deb S (Guest)
Deb Watts, Emergency Management Liaison,at Xcel Energy.

[12/9 1:05 PM] Dean, Mike
Mike Dean, Manager Fire/Life Safety, Building Division.

[12/9 1:05 PM] Perl, Craig
Craig Perl - Public Works - Senior Engineer - Floodplain Administrator

[12/9 1:05 PM] Robnett, Allen
Allen Robnett Commander Office of the Chief Aurora Fire Rescue

[12/9 1:05 PM] Center, Lynne
Lynne Center - Deputy Director Operations - Public Works

[12/9 1:05 PM] Delehoy, Brent
Brent Delehoy, Superintendent, PROS

[12/9 1:06 PM] Jim Kirch - CO Dam Safety (Guest)
Jim Kirch, CO DWR Dam Safety Engineer

[12/9 1:06 PM] Nyirenda, Swirvine
Swirvine Nyirenda, Water Planning Services Manager

[12/9 1:06 PM] Eric Franks - Aurora Fire Rescue (Guest)
Eric Franks, Aurora Fire Rescue, Special Ops and Special Projects Battalion Chief. Operations division.

[12/9 1:06 PM] Kevin Stewart
Kevin Stewart, Mile High Flood District, Flood Warning Services Manager

[12/9 1:06 PM] Polk, William
Fire/Life Safety, Building Division.

[12/9 1:08 PM] Sara Garrington (Guest)
Sara Garrington, TCHD

[12/9 1:10 PM] Keever, William

Bill Keever, GIS Manager, Aurora IT

[12/9 1:12 PM] Lenderink, Brandon
Brandon Lenderink, Aurora Office of Emergency Management

[12/9 1:12 PM] Lertch, Marena
Marena Lertch, Manager Support Services, Aurora Water

[12/9 1:19 PM] Dean, Mike
Congratulations on your new job Chris. We all miss you here at the COA.

[12/9 1:24 PM] Unknown User Lenderink, Brandon added Jim Kirch - CO Dam Safety (Guest) to the meeting.

[12/9 1:40 PM] Moore, Jeffrey
You also have the Oil & Gas Division.

[12/9 2:02 PM] Unknown User Lenderink, Brandon added Ron Sigman (Guest) to the meeting.

[12/9 2:03 PM] Ron Sigman (Guest)
Ron Sigman-Adams County Emergency Manager

[12/9 2:07 PM] Hancock, Karen
Link to Aurora Places:

[12/9 2:07 PM] Hancock, Karen
https://www.auroragov.org/UserFiles/Servers/Server_1881137/Image/Business%20Services/Planning/Aurora%20Places/Aurora%20Places%20Comp%20Plan%20Adopted%202018%20MQ%20-%20Bookmarked.pdf

[12/9 2:08 PM] Carr, Amy
Thanks for sharing!

[12/9 2:18 PM] Keever, William
< 1% of Aurora population is in Doug Co

[12/9 2:24 PM] Hancock, Karen
Communications should message and advertise

[12/9 2:25 PM] Bryant, Michael
We are rolling out a new public engagement platform in the next month or two, which can be utilized, at least for the draft review stage.
Edited

[12/9 2:25 PM] Ron Sigman (Guest)
I have to leave for a 2:30 meet but am familiar with this presentation so should be up to speed. Thanks for the invite.

[12/9 2:27 PM] Mark Thompson (Guest)
Thanks Jeff!

[12/9 2:33 PM] Center, Lynne
Ron Forrest should be included to represent Fleet Services. Fleet is part of Public Works but should be listed and engaged separately.

[12/9 2:35 PM] Johnson, Christopher A
It looks like Hancock, Karen has her hand raised

[12/9 2:35 PM] Keever, William
Here's the public engagement platform being implemented... https://www.bangthetable.com/

[12/9 2:36 PM] Hancock, Karen
thank you!

[12/9 2:37 PM] Lieske, Sean
Thanks for providing this update.

[12/9 2:37 PM] Mark Thompson (Guest)
Thanks again!

[12/9 2:37 PM] Keever, William
thanks

Meeting ended 1h 48m 12/9 2:40 PM

Meeting Recorded by: Lenderink, Brandon

City of Aurora
Hazard Mitigation Plan Update
Risk Assessment Webinar Agenda

Date: Wednesday, February 17, 2021
1:00 – 3:00 pm MST

Meeting at: Microsoft Teams meeting
Click here to join the meeting
+1 281-810-1627 United States, Houston (Toll)
(866) 670-1764 United States (Toll-free)
Conference ID: 516 045 006#

Subject/Purpose

This is the second planning team meeting for the 2021 update of the City of Aurora Hazard Mitigation Plan. This meeting will focus on identifying the hazards that have potential to impact the City and quantifying their possible impacts. The risk assessment is the fundamental building block of mitigation planning. We'll take a three-part approach to developing a risk assessment: hazard identification, vulnerability assessment, and capability assessment. All planning team members are encouraged to attend. The meeting will be delivered as a webinar due to the COVID-19 pandemic and social distancing requirements.

Attendees: Hazard Mitigation Planning Committee, Stakeholders and Consultant Team

1. Introductions
2. Review of the Hazard Mitigation Planning Process
3. Update on Public Engagement
4. Hazard Identification and Risk Assessment (HIRA) update
5. Review of Mitigation Goals
6. Next Steps
7. Questions and answers

City of Aurora
Hazard Mitigation Plan 2021 Update

Risk Assessment Meeting Summary
February 17, 2021, 1:00 – 3:00 PM

Introductions and Opening Remarks

This document summarizes the risk assessment meeting held for the City of Aurora Hazard Mitigation Plan (HMP) 2021update. The virtual meeting was conducted by Wood Environment & Infrastructure Solutions, Inc. (Wood), the consultant firm hired to facilitate the planning process and develop the updated plan. This type of meeting is ideally conducted in-person, however the meeting was held virtually to comply with social distancing requirements as a result of the COVID-19 pandemic. Scott Field, Project Manager at Wood, began the meeting with introductions. 23 individuals attended the webinar representing a mix of the consultant team, city department representatives, and various stakeholders.

The key discussion is summarized below, and the webinar chat log is attached at the end. Additional details can be found in the meeting PowerPoint presentation and webinar recording.

Review of the Hazard Mitigation Planning Process

Following introductions, Scott Field reviewed the planning process being followed and discussed the project status and progress made thus far. Highlights include:

- Kickoff meeting December 9, 2020
- GIS analysis and map updates
- Risk assessment update in progress
- Plan Update Guide sent out 1/27 – please return by 3/1
- 2016 Action Status Tracker sent out 1/27 – please return by 3/1

Update on Public Involvement Activities/public meeting.

Michael Bryant, Manager of Aurora's Public Relations, Communications and Marketing Department shared information on the new Engage Aurora website, which the City will use to advertise the plan update process and receive public input on hazards. The site will include a public survey on hazards and mitigation activities.

Risk Assessment Presentation and Discussion

The general risk assessment requirements were outlined before turning to a detailed discussion of each hazard. Highlights were presented on each hazard included in the updated risk assessment chapter of the plan. Refer to the PowerPoint presentation for specific details on each hazard. Highlights of the discussion are noted by hazard in the table below.

Hazard or Topic	Meeting Discussion and Problem Statements
Dam or Levee Failure/Incident	• Mark Thompson - Definitions of significant vs high hazard dam ratings. • Brandon Lenderink – Discussion on inundation information for Aurora Reservoir. • Marena Lertch – Will look into gathering further inundation information for Aurora Reservoir. • Mack Chambers – Looking into zooming map out to account for dams outside of the area and impacts. • Mack Chambers - Look into spillway information and data from Cherry Creek. • Brandon Lenderink – Will Parcel Analysis Summary and Lifeline information be broken down.
Drought	• Mark Thompson, CDHSEM – Drought is one of the hazards that may see the biggest profile changes as you integrate the lifelines. • Karen Hancock – Stated that there is growing research to suggest Colorado's "drought" may be actually our new climate, as the state becomes more arid.
Extreme Heat	• Amy mentioned how this can be often interrelated with Drought. Discussed the impacts of Urban Heat Island effect.
Flood	• No comments
Tornado	• No comments
Severe Wind	• No comments
Hail	• Brandon Lenderink – is there any data on uninsured damages? • Bill Keever – The city has roof permit info by address points from 2000-2020, could be used to indicate where roofs have needed replacement/repair.
Winter Storm	• Brandon – the 2019 bomb cyclone had big impacts on the city.
Wildfire	• Discussion between Scott and Brandon about AFD wildfire data.
Earthquake	• Brandon had a comment on the image shown for the Peak Ground Acceleration across Colorado, thinking it showed the epicenter for the Aurora scenario near Grand Junction. Chris explained that map illustrated PGA, not a specific scenario.
Earthquake	• No Comments
Soil Hazards	• No Comments

Jeffrey Moore, Manager of Aurora's Oil and Gas Division asked if potential risk to oil and gas operations would fit into the hazards here. Mack Chambers stated that Wood currently did not have oil and gas in the critical facilities data but could look at it during analysis. Jeffrey stated he could assist with providing data.

Scott also presented information from the CDC's Social Vulnerability Index specific to Aurora and showed some maps created by the Wood team. Karen Hancock with Aurora Planning & Development Services voiced concern about the validity of the CDC data, stating that some of the areas shown with high vulnerability are more affluent neighborhoods or largely commercial or industrial in their nature. Wood would prefer to use City social vulnerability data if it exists, so Karen offered to provide that data.

Review of Mitigation Goals

Scott gave a brief overview of the mitigation goals, objectives, and actions, from the 2016 plan. Chris Johnson with Wood PLC provided the link to a survey for participants to provide input on verifying or revising the goals and objectives: https://bit.ly/3u4uy74

It was requested that this be completed by March 1st.

Next Steps

The project schedule was reviewed:

Project Milestone	Anticipated Timeline
• Updated HIRA	March
• HMPC Meeting #3	March
• HMPC Review Draft	April
• Public Review Draft	April/May
• CO DHSEM Review	May
• Final Plan for FEMA Review (estimated)	June
• FEMA Review (estimated)	June-July
• Final Approved HMP for local adoption	July/August

Initial information needs and next steps were discussed. Wood has sent a Plan Update Guide requesting input on:

- Recent hazard events (since 2016)
- Growth and development trends
- Recent updated plans and policies
- Status of mitigation actions from the 2016 HMP

The plan update guide and goals and objectives survey must both be completed by March 1st.

Adjourn

The meeting adjourned at 3:05 pm

City of Aurora Hazard Mitigation Plan 2021 Update

Meeting 2 Chat Log

[2/17 12:52 pm] Lenderink, Brandon added Field, Scott to the meeting.
[2/17 12:52 pm] Lenderink, Brandon added Carr, Amy to the meeting.
[2/17 12:52 pm] Lenderink, Brandon added Delehoy, Brent to the meeting.
[2/17 12:52 pm] Lenderink, Brandon added Johnson, Christopher A to the meeting.
[12/9 1:01 PM] Unknown User Lenderink, Brandon added Dean, Mike to the meeting.
[12:58 PM] Unknown User Lenderink, Brandon added Chapman, Matthew to the meeting.
[12:58 PM] Unknown User Lenderink, Brandon added Wright, Steven to the meeting.
[12:58 PM] Unknown User Lenderink, Brandon added Hancock, Karen to the meeting.
[12:58 PM] Unknown User Lenderink, Brandon added Omar Awan (Guest) to the meeting.
[12:59 PM] Unknown User Lenderink, Brandon added Kebba, John to the meeting.
[12:59 PM] Unknown User Lenderink, Brandon added Moore, Jeffrey to the meeting.
[12:59 PM] Unknown User Lenderink, Brandon added Perl, Craig to the meeting.
[1:00 PM] Unknown User Lenderink, Brandon added Robnett, Allen to the meeting.
[1:00 PM] Unknown User Lenderink, Brandon added Swart, James to the meeting.
[1:00 PM] Unknown User Lenderink, Brandon added Center, Lynne to the meeting.
[1:01 PM] Unknown User Lenderink, Brandon added Lertch, Marena to the meeting.
[1:01 PM] Unknown User Lenderink, Brandon added Brislawn, Jeff P to the meeting.
[1:01 PM] Unknown User Lenderink, Brandon added Henley, Tom (Guest) to the meeting.
[1:01 PM] Unknown User Lenderink, Brandon added Chambers, Mack to the meeting.
[1:02 PM] Unknown User Lenderink, Brandon added Polk, William to the meeting.
[1:02 PM] Unknown User Lenderink, Brandon added Keever, William to the meeting.

[1:04 PM] Hancock, Karen
Karen Hancock, Principal Planner/Environmental, City of Aurora

[1:04 PM] Lenderink, Brandon
I was just typing that! Thanks Scott

[1:04 PM] Moore, Jeffrey
Jeffrey S. Moore, Manager, Oil & Gas Division, City of Aurora

[1:04 PM] Perl, Craig
Craig Perl, Public Works, Senior Engineer-Floodplain Administrator

[1:04 PM] Omar Awan (Guest)
Omar Awan, EPR Planner III, TCHD

[1:04 PM] Lenderink, Brandon
Brandon Lenderink, Aurora Office of Emergency Management

[1:04 PM] Lertch, Marena
Marena Lertch, Manager Support Services at Aurora Water--also Aurora Water Emergency Manager

[1:04 PM] Chapman, Matthew
Matt Chapman-City of Aurora OEM

[1:04 PM] Delehoy, Brent
Pros

[1:04 PM] Brislawn, Jeff P
Jeff Brislawn, Hazard Mitigation Lead, Wood

[1:04 PM] Robnett, Allen
Allen Robnett AFR

[1:05 PM] Delehoy, Brent
Brent Delehoy Parks

[1:05 PM] Swart, James (Guest)
Jesse Swart - City of Aurora OEM

[1:05 PM] Kebba, John
John Kebba City of Aurora

[1:05 PM] Henley, Tom (Guest)
Tom Henley, Area Manager, Xcel Energy

[1:05 PM] Center, Lynne
Lynne Center, Deputy Director Public Works Operations, City of Aurora

[1:09 PM] Lenderink, Brandon
You should all have both those docs in an email sent on 2/4/21 as well.

[1:09 PM] Unknown User Lenderink, Brandon added Jim Kirch - CO DWR (Guest) to the meeting.
[1:17 PM] Unknown User Lenderink, Brandon added markw.thompson to the meeting.

[2:07 PM] Perl, Craig
Does engageaurora.org ahve multilingual capabilities?
(1 liked)

[2:08 PM] Keever, William
Is this built with the "Bang the Table" platform?
Edited

[2:18 PM] Bryant, Michael
Keever, William Yes. We have branded it locally as Engage Aurora.
(1 liked)

[2:18 PM] Lertch, Marena
My bid-anonymous,
(1 liked)

[2:19 PM] Lertch, Marena
yes on both Michael
(1 liked)

[2:21 PM] Bryant, Michael
Perl, Craig We have the ability to add a Google translate button to the page, which has its limitations on accuracy. Otherwise, it basically involves setting up a secondary project page with its own translation.
(1 liked)

[2:23 PM] Keever, William
we have roof permit data if interested by address points

[2:26 PM] Perl, Craig
Picture is all recent transplants from TX!

[2:49 PM] Robnett, Allen
i have to get to another meeting
(1 liked)

[2:50 PM] Lenderink, Brandon
Keever, William Did we miss your ?

[2:54 PM] Johnson, Christopher A
https://bit.ly/3u4uy74
Fill | City of Aurora Hazard Mitigation Goals & Objectives 2021 Update
FEMA requires that mitigation plans establish "mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." Goals are general guidelines that explain what the communi...
bit.ly

[2:54 PM] Moore, Jeffrey
Link says i don't have permission.

[2:55 PM] Lertch, Marena
same-no permission

[2:55 PM] Lertch, Marena
all good!

Meeting ended 2h 12m 3:05 PM

Respondent

1 Anonymous

36:28
Time to complete

1. Goal 1: Protect people, property, critical facilities, and natural resources from natural hazards through mitigation planning and activities.

• Objective 1.1: Identify properties, critical facilities, and natural resources that could be adversely impacted by natural hazards.
• Objective 1.2: Develop plans to address the varying responses and activities required to address the impacts associated with natural hazards.
• Objective 1.3: Identify individuals and populations who are at high risk to hazardous events.
• Objective 1.4: Integrate large and small breed animals as at risk populations to consider in the hazard mitigation plan.

I think these are all still appropriate.

2. Goal 2: Increase public awareness, preparedness, and education about localized natural hazards and actions that can be taken to reduce their impacts.

• Objective 2.1: Implement a natural hazards public awareness campaign.
• Objective 2.2: Assist local businesses and organizations with disaster and emergency preparedness.
• Objective 2.3: Partner with external stakeholder public information programs to create integrated education and messaging systems.
• Objective 2.4: Investigate funding capabilities to conduct a needs assessment for implementing additional emergency operations plans and services in areas at high risk and implement as appropriate.
• Objective 2.5: Expand preparedness efforts for large and small breed animals.

I think these are all still appropriate.

3. Goal 3: Establish and maintain relationships that strengthen hazard communication and coordination efforts with public agencies, non-governmental organizations (NGOs), businesses, and citizens.

• Objective 3.1: Develop an outreach strategy to discuss hazard communication and coordination efforts with local community groups.
• Objective 3.2: Promote city employee and community participation with external partner preparedness programs.
• Objective 3.3: Identify existing capabilities and resources within the community and create appropriate memorandums of understanding (MOU) or agreements with partners to enable

access during incident response.
• Objective 3.4: Coordinate preparedness and response planning efforts with external critical infrastructure partners.
• Objective 3.5: Maintain and expand upon animal preparedness and response efforts with local jurisdictions.

I think these are all still appropriate.

4. Goal 4: Coordinate and integrate natural hazard mitigation with city planning, engineering, and development activities.

• Objective 4.1: In future planning and development efforts, utilize lessons learned from the impacts of previous natural hazards and from the hazard mitigation facilities that performed well.
• Objective 4.2: Maintain processes for soliciting input from citizens and external partners.
• Objective 4.3: Consider the structural integrity of new and existing infrastructure in regards to their ability to withstand the impacts of natural hazards.
• Objective 4.4: Identify, evaluate and implement hazard mitigation projects using a holistic method that utilizes financial resources in a manner that generates the greatest long-term value and highest degree of hazard mitigation relative to the cost.
• Objective 4.5: Integrate the current HMP goals, objectives, or any other relevant content with appropriate City of Aurora plans and studies as they are created or updated.

I think these are all still appropriate.

5. Goal 5: Maintain the momentum of hazard mitigation planning and preparedness efforts in Aurora.

• Objective 5.1: Continually contribute to and maintain data inventories of Aurora's natural hazard events and their characteristics to evaluate and report trends and to determine potential hazard mitigation actions for future Hazard Mitigation Plan updates.

No other comments.

6. Your Name

Jeffrey Moore

7. Your Department / Agency

Oil & Gas Division

Respondent

2 Anonymous

07:33
Time to complete

1. Goal 1: Protect people, property, critical facilities, and natural resources from natural hazards through mitigation planning and activities.

• Objective 1.1: Identify properties, critical facilities, and natural resources that could be adversely impacted by natural hazards.
• Objective 1.2: Develop plans to address the varying responses and activities required to address the impacts associated with natural hazards.
• Objective 1.3: Identify individuals and populations who are at high risk to hazardous events.
• Objective 1.4: Integrate large and small breed animals as at risk populations to consider in the hazard mitigation plan.

utah park, Expo Park

2. Goal 2: Increase public awareness, preparedness, and education about localized natural hazards and actions that can be taken to reduce their impacts.

• Objective 2.1: Implement a natural hazards public awareness campaign.
• Objective 2.2: Assist local businesses and organizations with disaster and emergency preparedness.
• Objective 2.3: Partner with external stakeholder public information programs to create integrated education and messaging systems.
• Objective 2.4: Investigate funding capabilities to conduct a needs assessment for implementing additional emergency operations plans and services in areas at high risk and implement as appropriate.
• Objective 2.5: Expand preparedness efforts for large and small breed animals.

Send out facebook post to avoid areas

3. Goal 3: Establish and maintain relationships that strengthen hazard communication and coordination efforts with public agencies, non-governmental organizations (NGOs), businesses, and citizens.

• Objective 3.1: Develop an outreach strategy to discuss hazard communication and coordination efforts with local community groups.
• Objective 3.2: Promote city employee and community participation with external partner preparedness programs.
• Objective 3.3: Identify existing capabilities and resources within the community and create appropriate memorandums of understanding (MOU) or agreements with partners to enable

access during incident response.
• Objective 3.4: Coordinate preparedness and response planning efforts with external critical infrastructure partners.
• Objective 3.5: Maintain and expand upon animal preparedness and response efforts with local jurisdictions.

Post signs in area

4. Goal 4: Coordinate and integrate natural hazard mitigation with city planning, engineering, and development activities.

• Objective 4.1: In future planning and development efforts, utilize lessons learned from the impacts of previous natural hazards and from the hazard mitigation facilities that performed well.
• Objective 4.2: Maintain processes for soliciting input from citizens and external partners.
• Objective 4.3: Consider the structural integrity of new and existing infrastructure in regards to their ability to withstand the impacts of natural hazards.
• Objective 4.4: Identify, evaluate and implement hazard mitigation projects using a holistic method that utilizes financial resources in a manner that generates the greatest long-term value and highest degree of hazard mitigation relative to the cost.
• Objective 4.5: Integrate the current HMP goals, objectives, or any other relevant content with appropriate City of Aurora plans and studies as they are created or updated.

Have a site on sharepoint

5. Goal 5: Maintain the momentum of hazard mitigation planning and preparedness efforts in Aurora.

• Objective 5.1: Continually contribute to and maintain data inventories of Aurora's natural hazard events and their characteristics to evaluate and report trends and to determine potential hazard mitigation actions for future Hazard Mitigation Plan updates.

6. Your Name

Brent Delehoy

7. Your Department / Agency

Pros

Respondent

3 Anonymous

17:54
Time to complete

1. Goal 1: Protect people, property, critical facilities, and natural resources from natural hazards through mitigation planning and activities.

• Objective 1.1: Identify properties, critical facilities, and natural resources that could be adversely impacted by natural hazards.
• Objective 1.2: Develop plans to address the varying responses and activities required to address the impacts associated with natural hazards.
• Objective 1.3: Identify individuals and populations who are at high risk to hazardous events.
• Objective 1.4: Integrate large and small breed animals as at risk populations to consider in the hazard mitigation plan.

Not sure of the overall risk Aurora has with small and large breed animal populations and if that needs to be considered in the HMP update.

2. Goal 2: Increase public awareness, preparedness, and education about localized natural hazards and actions that can be taken to reduce their impacts.

• Objective 2.1: Implement a natural hazards public awareness campaign.
• Objective 2.2: Assist local businesses and organizations with disaster and emergency preparedness.
• Objective 2.3: Partner with external stakeholder public information programs to create integrated education and messaging systems.
• Objective 2.4: Investigate funding capabilities to conduct a needs assessment for implementing additional emergency operations plans and services in areas at high risk and implement as appropriate.
• Objective 2.5: Expand preparedness efforts for large and small breed animals.

I'm unaware if Animal Care services is continuing the work regarding animal preparedness and if their is a need to continue this objective. Potentially remove.

3. Goal 3: Establish and maintain relationships that strengthen hazard communication and coordination efforts with public agencies, non-governmental organizations (NGOs), businesses, and citizens.

• Objective 3.1: Develop an outreach strategy to discuss hazard communication and coordination efforts with local community groups.
• Objective 3.2: Promote city employee and community participation with external partner preparedness programs.

• Objective 3.3: Identify existing capabilities and resources within the community and create appropriate memorandums of understanding (MOU) or agreements with partners to enable access during incident response.
• Objective 3.4: Coordinate preparedness and response planning efforts with external critical infrastructure partners.
• Objective 3.5: Maintain and expand upon animal preparedness and response efforts with local jurisdictions.

The city no longer does MOUs and does only IGAs. Change to IGAs Identify existing capabilities and resources within the community and create appropriate IGAs or agreements with partners to enable access during incident response as applicable. Need to get an update on the animal related objectives

4. Goal 4: Coordinate and integrate natural hazard mitigation with city planning, engineering, and development activities.

• Objective 4.1: In future planning and development efforts, utilize lessons learned from the impacts of previous natural hazards and from the hazard mitigation facilities that performed well.
• Objective 4.2: Maintain processes for soliciting input from citizens and external partners.
• Objective 4.3: Consider the structural integrity of new and existing infrastructure in regards to their ability to withstand the impacts of natural hazards.
• Objective 4.4: Identify, evaluate and implement hazard mitigation projects using a holistic method that utilizes financial resources in a manner that generates the greatest long-term value and highest degree of hazard mitigation relative to the cost.
• Objective 4.5: Integrate the current HMP goals, objectives, or any other relevant content with appropriate City of Aurora plans and studies as they are created or updated.

5. Goal 5: Maintain the momentum of hazard mitigation planning and preparedness efforts in Aurora.

• Objective 5.1: Continually contribute to and maintain data inventories of Aurora's natural hazard events and their characteristics to evaluate and report trends and to determine potential hazard mitigation actions for future Hazard Mitigation Plan updates.

6. Your Name

Brandon Lenderink

7. Your Department / Agency

Office of Emergency Management

Respondent

4 Anonymous

05:13
Time to complete

1. Goal 1: Protect people, property, critical facilities, and natural resources from natural hazards through mitigation planning and activities.

• Objective 1.1: Identify properties, critical facilities, and natural resources that could be adversely impacted by natural hazards.
• Objective 1.2: Develop plans to address the varying responses and activities required to address the impacts associated with natural hazards.
• Objective 1.3: Identify individuals and populations who are at high risk to hazardous events.
• Objective 1.4: Integrate large and small breed animals as at risk populations to consider in the hazard mitigation plan.

Ensure items in Aurora Water's risk and resiliency project continue to be resolved within budgetary framework and document is updated dynamically and certified with EPA every 5 years. Continue relationships with surrounding populations to develop procedures for evacuation, education, shelter in place.

2. Goal 2: Increase public awareness, preparedness, and education about localized natural hazards and actions that can be taken to reduce their impacts.

• Objective 2.1: Implement a natural hazards public awareness campaign.
• Objective 2.2: Assist local businesses and organizations with disaster and emergency preparedness.
• Objective 2.3: Partner with external stakeholder public information programs to create integrated education and messaging systems.
• Objective 2.4: Investigate funding capabilities to conduct a needs assessment for implementing additional emergency operations plans and services in areas at high risk and implement as appropriate.
• Objective 2.5: Expand preparedness efforts for large and small breed animals.

Appropriate

3. Goal 3: Establish and maintain relationships that strengthen hazard communication and coordination efforts with public agencies, non-governmental organizations (NGOs), businesses, and citizens.

• Objective 3.1: Develop an outreach strategy to discuss hazard communication and coordination efforts with local community groups.
• Objective 3.2: Promote city employee and community participation with external partner

preparedness programs.
• Objective 3.3: Identify existing capabilities and resources within the community and create appropriate memorandums of understanding (MOU) or agreements with partners to enable access during incident response.
• Objective 3.4: Coordinate preparedness and response planning efforts with external critical infrastructure partners.
• Objective 3.5: Maintain and expand upon animal preparedness and response efforts with local jurisdictions.

Exercise more frequently and with all levels of employees as well as external partners.

4. Goal 4: Coordinate and integrate natural hazard mitigation with city planning, engineering, and development activities.

• Objective 4.1: In future planning and development efforts, utilize lessons learned from the impacts of previous natural hazards and from the hazard mitigation facilities that performed well.
• Objective 4.2: Maintain processes for soliciting input from citizens and external partners.
• Objective 4.3: Consider the structural integrity of new and existing infrastructure in regards to their ability to withstand the impacts of natural hazards.
• Objective 4.4: Identify, evaluate and implement hazard mitigation projects using a holistic method that utilizes financial resources in a manner that generates the greatest long-term value and highest degree of hazard mitigation relative to the cost.
• Objective 4.5: Integrate the current HMP goals, objectives, or any other relevant content with appropriate City of Aurora plans and studies as they are created or updated.

Appropriate as written

5. Goal 5: Maintain the momentum of hazard mitigation planning and preparedness efforts in Aurora.

• Objective 5.1: Continually contribute to and maintain data inventories of Aurora's natural hazard events and their characteristics to evaluate and report trends and to determine potential hazard mitigation actions for future Hazard Mitigation Plan updates.

Appropriate as written

6. Your Name

Marena Lertch

7. Your Department / Agency

Aurora Water

City of Aurora
Hazard Mitigation Plan Update
Mitigation Strategy Meeting Agenda

Date: Thursday, March 18, 2021
9:00 – 11:00 am MST

Meeting at: Microsoft Teams meeting
Click here to join the meeting
+1 281-810-1627 United States, Houston (Toll)
(866) 670-1764 United States (Toll-free)
Conference ID: 852 308 533#

Subject/Purpose

This meeting will focus on updating the plan's mitigation strategy, including the plan's goals and objectives, actions undertaken since the last plan update, and identifying new mitigation activities. All participating jurisdictions and planning team members are encouraged to attend. The meeting will be conducted virtually due to the COVID-19 pandemic and social distancing requirements.

Attendees: Hazard Mitigation Planning Committee, Stakeholders and Consultant Team

1. Introductions
2. Review of the Planning Process and Progress to Date
3. Update Mitigation Goals & Objectives
4. Review of progress on Mitigation Actions from 2016 Plan
5. Review of Mitigation Action Categories
6. Development of New Mitigation Actions
7. Next steps
8. Questions and Answers

City of Aurora
Hazard Mitigation Plan 2021 Update

Mitigation Strategy Meeting Summary
March 18, 2021, 9:00 – 11:00 AM

Introductions and Opening Remarks
This document summarizes the mitigation strategy meeting held for the City of Aurora Hazard Mitigation Plan (HMP) 2021 update. The virtual meeting was conducted by Wood Environment & Infrastructure Solutions, Inc. (Wood), the consultant firm hired to facilitate the planning process and develop the updated plan. The meeting was held virtually to comply with social distancing requirements as a result of the COVID-19 pandemic. Scott Field, project manager at Wood, kicked off the virtual meeting and thanked everyone for their participation. 20 individuals attended the meeting representing a mix of city department representatives, various stakeholders, and the consultant team. In lieu of lengthy introductions, participants were asked to type their name, agency, & title into the meeting chat log.

The key discussion is summarized below, and the webinar chat log is attached at the end. Additional details can be found in the meeting PowerPoint presentation and webinar recording

Review of the Planning Process and Progress to Date
The FEMA planning process steps were recapped; we are currently wrapping up the Risk Assessment process and beginning the mitigation strategy portion. This meeting addressed mitigation strategizing and goal review/development aspects.

The progress on the plan update process to date was reviewed. Highlights include:
- Kickoff meeting held December 9th
- Risk Assessment meeting held February 17th
- Plan Update Guides completed
- 2016 Action Status Tracker collected
- HIRA Update Ongoing

Preliminary results of the public survey were reviewed; the full survey results will be provided to the planning team once the survey closes.

Mitigation Goals and Objectives
The goals from the 2016 Hazard Mitigation Plan were revisited, and results from a survey conducted after Meeting #2 were discussed. Goals and objectives are more general and broad guidelines while actions are specific and project-driven. Projects submitted for grant funding will need to tie back to goals and objectives in the HMP.

The 2021 Jefferson County Hazard Mitigation Plan goals and objectives are as follows. There were no proposed revisions to the goals from 2016. Changes to objectives and additional objectives added for 2021 are underlined.

Goals:

- Goal 1: Protect people, property, critical facilities, and natural resources from natural hazards through mitigation planning and activities.
- Goal 2: Increase public awareness, preparedness, and education about localized natural hazards and actions that can be taken to reduce their impacts.
- Goal 3: Establish and maintain relationships that strengthen hazard communication and coordination efforts with public agencies, non-governmental organizations (NGOs), businesses, and citizens.
- Goal 4: Coordinate and integrate natural hazard mitigation with city planning, engineering, and development activities.
- Goal 5: Maintain the momentum of hazard mitigation planning and preparedness efforts in Aurora.

Objectives:

1) Goal 1 Objectives:
   a) Objective 1.1: Identify properties, critical facilities, and natural resources that could be adversely impacted by natural hazards.
   b) Objective 1.2: Develop plans to address the varying responses and activities required to address the impacts associated with natural hazards.
   c) Objective 1.3: Identify individuals and populations who are at high risk to hazardous events.
   d) Objective 1.4: Integrate large and small breed animals as at-risk populations to consider in the hazard mitigation plan.
   e) Objective 1.5: Ensure items in Aurora Water's risk and resiliency project continue to be resolved within budgetary framework and document is updated dynamically and certified with EPA every 5 years.
   f) Objective 1.6: Continue relationships with surrounding populations to develop procedures for evacuation, education, shelter in place.
2) Goal 2 Objectives:
   a) Objective 2.1: Implement a natural hazards public awareness campaign.
   b) Objective 2.2: Assist local businesses and organizations with disaster and emergency preparedness.
   c) Objective 2.3: Partner with external stakeholder public information programs to create integrated education and messaging systems.
   d) Objective 2.4: Investigate funding capabilities to conduct a needs assessment for implementing additional emergency operations plans and services in areas at high risk and implement as appropriate.
   e) Objective 2.5: Expand preparedness efforts for large and small breed animals.
3) Goal 3 Objectives:
   a) Objective 3.1: Develop an outreach strategy to discuss hazard communication and coordination efforts with local community groups.
   b) Objective 3.2: Promote city employee and community participation with external partner preparedness programs.
   c) Objective 3.3: Identify existing capabilities and resources within the community and create appropriate ~~memorandums of understanding (MOU) or~~ intergovernmental agreements (IGAs) with partners to enable access during incident response.

   d) Objective 3.4: Coordinate preparedness and response planning efforts with external critical infrastructure partners.
   e) Objective 3.5: Maintain and expand upon animal preparedness and response efforts with local jurisdictions
4) Goal 4 Objectives:
   a) Objective 4.1: In future planning and development efforts, utilize lessons learned from the impacts of previous natural hazards and from the hazard mitigation facilities that performed well.
   b) Objective 4.2: Maintain processes for soliciting input from citizens and external partners.
   c) Objective 4.3: Consider the structural integrity of new and existing infrastructure in regards to their ability to withstand the impacts of natural hazards.
   d) Objective 4.4: Identify, evaluate and implement hazard mitigation projects using a holistic method that utilizes financial resources in a manner that generates the greatest long-term value and highest degree of hazard mitigation relative to the cost.
   e) Objective 4.5: Integrate the current HMP goals, objectives, or any other relevant content with appropriate City of Aurora plans and studies as they are created or updated.
5) Goal 5 Objectives:
   a) Objective 5.1: Continually contribute to and maintain data inventories of Aurora's natural hazard events and their characteristics to evaluate and report trends and to determine potential hazard mitigation actions for future Hazard Mitigation Plan updates.

For each of the goals and objectives, Scott highlighted any proposed changes and additions and led a discussion with the committee members. There was discussion about the integration of FEMA Lifelines into Goal 1. There was also discussion amongst the committee about the addition of concepts involving "whole community" and "resiliency" into the goals.

Review of Progress on Existing Mitigation Actions

Prior to the webinar, a Mitigation Action Tracker was sent to the HMPC requesting status updates on the jurisdictions' 2016 mitigation actions. The Tracker was emailed again following the webinar to fill in some of the missing statuses. The mitigation action statuses are categorized as one of the following: Completed, Annual Implementation, In Progress, Not Started and Deleted.

Some examples of "Deleted" actions may be due to lack of project applicability over time, or even inability to complete a project in an area where the community does not have control/jurisdiction (e.g. state owned vs. federal land). Annual Implementation are actions that a jurisdiction is conducting on an ongoing basis, but which the jurisdiction wants to continue forward into the updated plan to maintain visibility on the action.

Mitigation Actions

Amy Carr lead a discussion on the Mitigation Actions portion of the plan. One way to think of mitigation actions is the four A's:

- Altering a hazard,
- Averting a hazard,
- Avoiding a hazard,
- Adapting to a hazard

FEMA suggests these four categories for mitigation actions:

- Plans and Regulations,
- Structure and Infrastructure Projects,
- Education and Awareness, and
- Natural Systems Protection.

The Community Rating System was also discussed, which includes the following six categories:

- Prevention
- Structural projects
- Public information
- Natural resource protection
- Property protection
- Emergency services

Resources for more details on mitigation action types, categories, and example projects were provided, including a short discussion on climate change and adaptation considerations. Example hazard-specific mitigation projects were discussed including FEMA funding-eligible projects for winter weather, flood, and other hazards.

Response activities such as vehicle purchases are not considered mitigation actions and will not count towards meeting the plan requirements, but can be included at the jurisdiction's discretion as long as there are enough "good" mitigation actions to meet the requirement.

Developing New Mitigation Actions

The City is required to develop at least one new action for the 2021 plan update. Ideally, the City should develop additional actions that address all the hazards addressed in the plan, or at least the High significance hazards. Because the City participates in the National Flood Insurance Program (NFIP), they will need to have a mitigation action addressing continued NFIP compliance.

The following are resources with ideas and examples of mitigation actions and implementation:

- FEMA's 'Mitigation Action Portfolio' Publication: https://www.fema.gov/sites/default/files/2020-08/fema_mitigation-action-portfolio-support-document_08-01-2020_0.pdf
- DOLA 'Planning for Hazard' Guide: https://planningforhazards.com/home

A link to the New Mitigation Action Survey was shared during the meeting and emailed after. Each HMPC member was asked to fill out the survey with at least one mitigation action by March 31st.

New Mitigation Actions Survey: http://bit.ly/3lhDeTq

Next Steps

The project schedule was reviewed:

Project Milestone	**Anticipated Timeline**
Updated HIRA	March 2021
HMPC Review Draft	April 2021
Public Review Draft	May 2021
CO DHSEM Review	May 2021
Final Plan for FEMA Review (estimated)	June 2021

- FEMA Review (estimated) June-July 2021
- Final Approved HMP for local adoption July /August 2021

Adjourn

The meeting adjourned at 10:57 am

City of Aurora Hazard Mitigation Plan 2021 Update

Meeting 3 Chat Log

[3/18 9:00 AM] Unknown User Johnson, Christopher A was invited to the meeting.
[3/18 9:00 AM] Unknown User Brislawn, Jeff P was invited to the meeting.
[3/18 9:01 AM] Unknown User Henley, Tom was invited to the meeting.
[3/18 9:02 AM] Unknown User "Caitlin Gappa (Guest)" was invited to the meeting.

[3/18 9:06 AM] markw.thompson (Guest)
Mark Thompson, CO DHSEM

[3/18 9:06 AM] "Caitlin Gappa (Guest)"
Caitlin Gappa, Tri-County Health Department

[3/18 9:06 AM] Chapman, Matthew
Matt Chapman-Aurora OEM

[3/18 9:06 AM] Hancock, Karen
Karen Hancock, Principal Planner/Environmental, City of Aurora Planning & Development Services Dept

[3/18 9:06 AM] Brislawn, Jeff P (Guest)
Jeff Brislawn, Hazard Mitigation Lead, Wood

[3/18 9:06 AM] Center, Lynne
Lynne Center Deputy Director Public Works Operations City of Aurora

[3/18 9:06 AM] Challis, Phillip (Guest)
Phillip Challis / Operations Manager - Libraries & Cultural Services

[3/18 9:06 AM] Leyba, Kacey
Kacey Leyba, Operations Manager, Aurora Public Safety Communications

[3/18 9:06 AM] Kebba, John
John Kebba Fleet Coordinator City of Aurora Fleet Maintenance
Edited

[3/18 9:06 AM] Perl, Craig
Craig Perl, Aurora Public Works, Senior Engineer - Floodplain Administrator

[3/18 9:07 AM] Nyirenda, Swirvine
Swirvine Nyirenda, Aurora Water, Planning Services Manager

[3/18 9:09 AM] Sciba, Steven
Steve Sciba-Aurora Water, Deputy Director of Operations

[3/18 9:11 AM] Swart, James
Jesse Swart - Aurora OEM

[3/18 9:19 AM] Unknown User "Treste Huse, NWS Boulder (Guest)" was invited to the meeting.

[3/18 9:29 AM] Lenderink, Brandon
Incorporate risk reduction principles into policy documents and initiatives. Good example from Larimar

[3/18 9:33 AM] markw.thompson (Guest)
(yes)

[3/18 9:40 AM] Perl, Craig
So not a Snowcat???

[3/18 9:40 AM] markw.thompson (Guest)
Definitely not a snowcat.

[3/18 9:41 AM] Lenderink, Brandon
That's exactly what I sent Matt. I would argue that all day long

[3/18 9:42 AM] Swart, James
would closing roads prone to blizzard hazards be more of mitigation?

[3/18 9:43 AM] Field, Scott
It could be planning or it could be considered mitigation, depending on teh details.

[3/18 9:43 AM] markw.thompson (Guest)
The actions that count towards the planning requirements have to be strictly mitigation- long term risk reduction. However, there's value in having some response/preparedness actions that are important to a community. A snowcat would be an example of the latter.

[3/18 9:44 AM] Perl, Craig
Kidding about the snowcat, but maybe we can look at systems to alter/minimize the impact of snow drifts in known problem areas, such as snow fences.
(3 liked)

[3/18 10:19 AM] Johnson, Christopher A
Microsoft Forms (office.com)
Microsoft Forms
Easily create surveys, quizzes, and polls.
forms.office.com

[3/18 10:21 AM] markw.thompson (Guest)
Project scoping/design is OK.

[3/18 10:24 AM] markw.thompson (Guest)
Reliability or redundancy?

[3/18 10:29 AM] Sciba, Steven
BRB...

[3/18 10:29 AM] markw.thompson (Guest)
I have to jump off but appreciate the chance to participate. Looking forward to the rest of the process.

[3/18 10:30 AM] Field, Scott
Thanks mark

[3/18 10:34 AM] Brislawn, Jeff P (Guest)
Karen related to your post on erosion buffers, Wood helped the CWCB with a model fluvial hazard zone model ordinance. FYI here is the link: https://www.coloradofhz.com/resources

[3/18 10:43 AM] Kebba, John
I believe Englewood/Littleton wastewater treatment plant is or was using the gas by product as a fuel.
(1 liked)

[3/18 10:45 AM] Brislawn, Jeff P (Guest)
Linking to projects in existing plans such as stormwater master plans is acceptable also.

[3/18 10:45 AM] Hancock, Karen
fluvial haz zones are going to be sensitive since some of them are already entitled for other land uses. more to come...

[3/18 10:45 AM] Delehoy, Brent
Brent Delehoy, Pros

[3/18 10:49 AM] Chambers, Mack
Hancock, Karen do you know of any developed Fluvial GIS data for the city?

[3/18 10:50 AM] Hancock, Karen
not that I can provide to outside parties without permission. Aurora Water is the keeper.

[3/18 10:51 AM] Chapman, Matthew
I have to drop off the call. Thanks everyone!

[3/18 10:52 AM] Chambers, Mack
Thank you Karen

[3/18 10:52 AM] Polk, William
Will Polk

[3/18 10:53 AM] Polk, William
Will Polk Building Div Fire Life Safety Group
(1 liked)

[3/18 10:45 AM] Brislawn, Jeff P (Guest)
Linking to projects in existing plans such as stormwater master plans is acceptable also.

[3/18 10:45 AM] Hancock, Karen
fluvial haz zones are going to be sensitive since some of them are already entitled for other land uses. more to come...

[3/18 10:45 AM] Delehoy, Brent
Brent Delehoy, Pros

[3/18 10:49 AM] Chambers, Mack
Hancock, Karen do you know of any developed Fluvial GIS data for the city?

[3/18 10:50 AM] Hancock, Karen
not that I can provide to outside parties without permission. Aurora Water is the keeper.

[3/18 10:51 AM] Chapman, Matthew
I have to drop off the call. Thanks everyone!

[3/18 10:52 AM] Chambers, Mack
Thank you Karen

[3/18 10:52 AM] Polk, William

Will Polk

[3/18 10:53 AM] Polk, William
Will Polk Building Div Fire Life Safety Group
(1 liked)

Meeting ended 2h 5m 3/18 10:57 AM
1h 55m
Meeting Recorded by: Lenderink, Brandon

Mitigation Action Selection and Prioritization Criteria

Does the proposed action protect lives or vulnerable populations?

Does the proposed action address hazards or areas with the highest risk?

Does the proposed action protect critical facilities, infrastructure, or community assets?

Does the proposed action meet multiple objectives (multi-objective management)?

STAPLE/E

Developed by FEMA, this method of applying evaluation criteria enables the planning team to consider in a systematic way the social, technical, administrative, political, legal, economic, and environmental opportunities and constraints of implementing a particular mitigation action. For each action, the HMPC should ask, and consider the answers to, the following questions:

Social

Does the measure treat people fairly (different groups, different generations)? Does it consider social equity, disadvantaged communities, or vulnerable populations?

Technical

Will it work? (Does it solve the problem? Is it feasible?)

Administrative

Is there capacity to implement and manage project?

Political

Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support it?

Legal

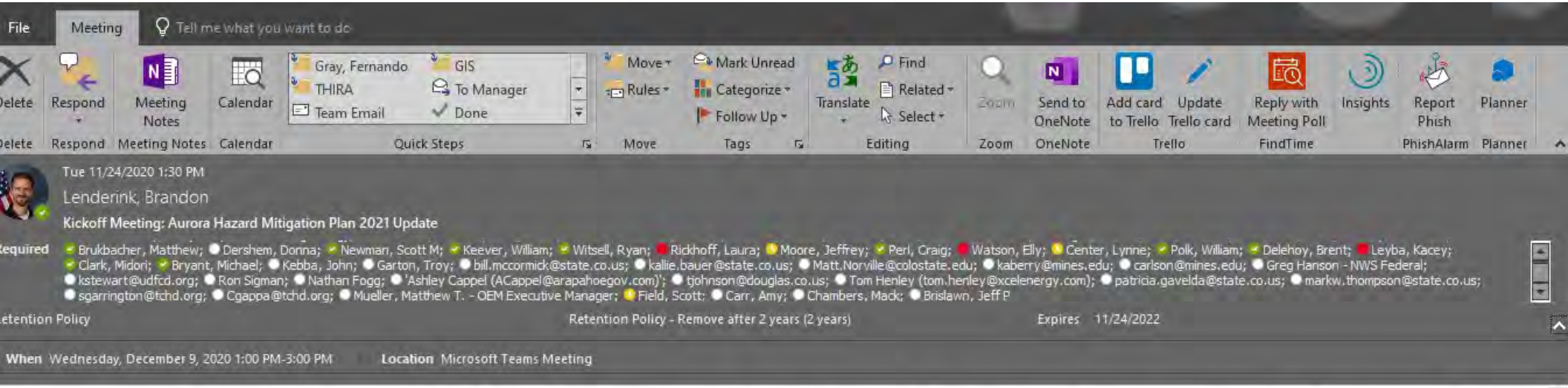
Does your organization have the authority to implement? Is it legal? Are there liability implications?

Economic

Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?

Environmental

Does it comply with environmental regulations or have adverse environmental impacts?



This meeting will kick-off the 2021 update process for the City of Aurora's Hazard Mitigation Plan. This plan analyses the City's risk to natural and human-caused hazards and lays out a strategy and specific action to reduce those risks. The plan is required to be updated every five years in order to maintain eligibility for mitigation grant funds.

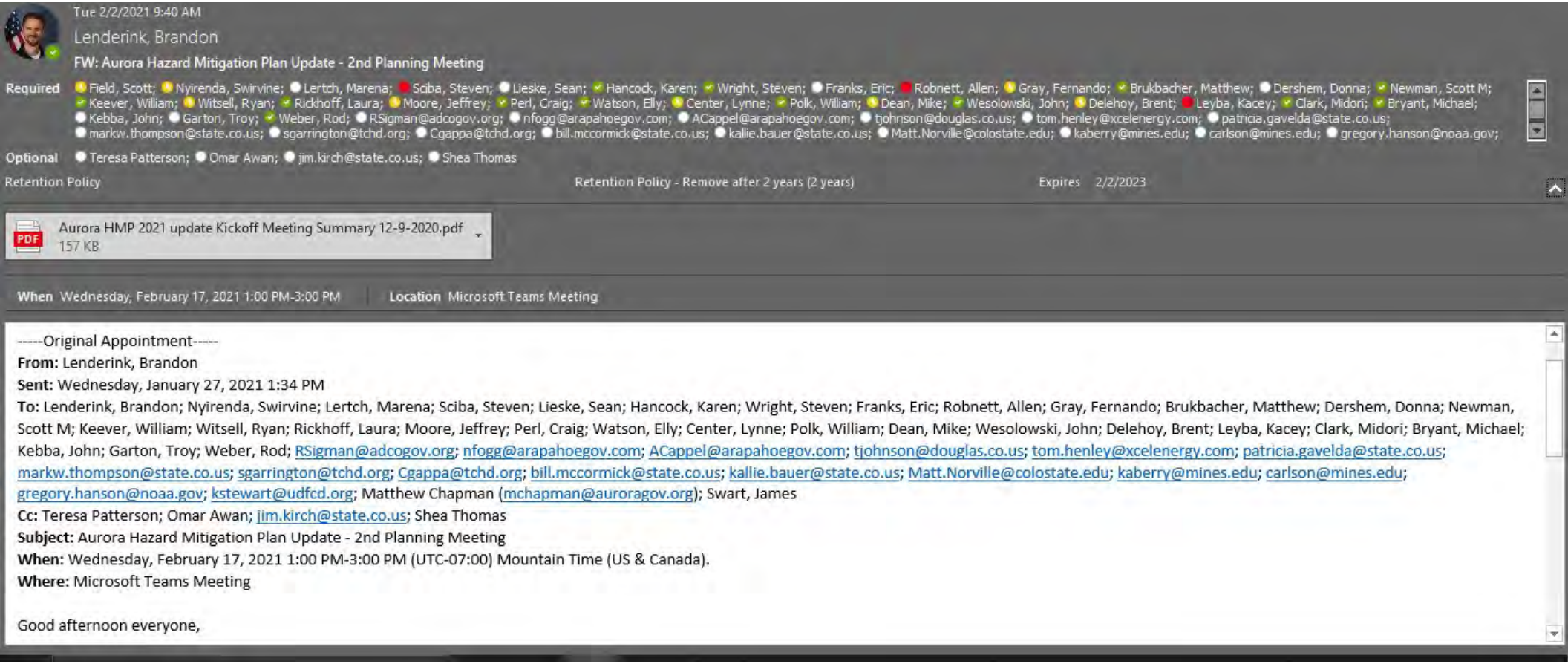
We will introduce the project team and our consultants, outline the planning process, collect information, plan for public outreach, and answer any questions you may have. We know there's a lot going on right now, but we hope you'll be able to join us.

Microsoft Teams meeting

Join on your computer or mobile app
Click here to join the meeting

City of Aurora, Colorado

Learn More | Meeting options



Tue 2/2/2021 9:40 AM

Lenderink, Brandon

FW: Aurora Hazard Mitigation Plan Update - 2nd Planning Meeting

Required Field, Scott; Nyirenda, Swirvine; Lertch, Marena; Sciba, Steven; Lieske, Sean; Hancock, Karen; Wright, Steven; Franks, Eric; Robnett, Allen; Gray, Fernando; Brukbacher, Matthew; Dershem, Donna; Newman, Scott M; Keever, William; Witsell, Ryan; Rickhoff, Laura; Moore, Jeffrey; Perl, Craig; Watson, Elly; Center, Lynne; Polk, William; Dean, Mike; Wesolowski, John; Delehoy, Brent; Leyba, Kacey; Clark, Midori; Bryant, Michael; Kebba, John; Garton, Troy; Weber, Rod; RSigman@adcogov.org; nfogg@arapahoegov.com; ACappel@arapahoegov.com; tjohnson@douglas.co.us; tom.henley@xcelenergy.com; patricia.gavelda@state.co.us; markw.thompson@state.co.us; sgarrington@tchd.org; Cgappa@tchd.org; bill.mccormick@state.co.us; kallie.bauer@state.co.us; Matt.Norville@colostate.edu; kaberry@mines.edu; carlson@mines.edu; gregory.hanson@noaa.gov;

Optional Teresa Patterson; Omar Awan; jim.kirch@state.co.us; Shea Thomas

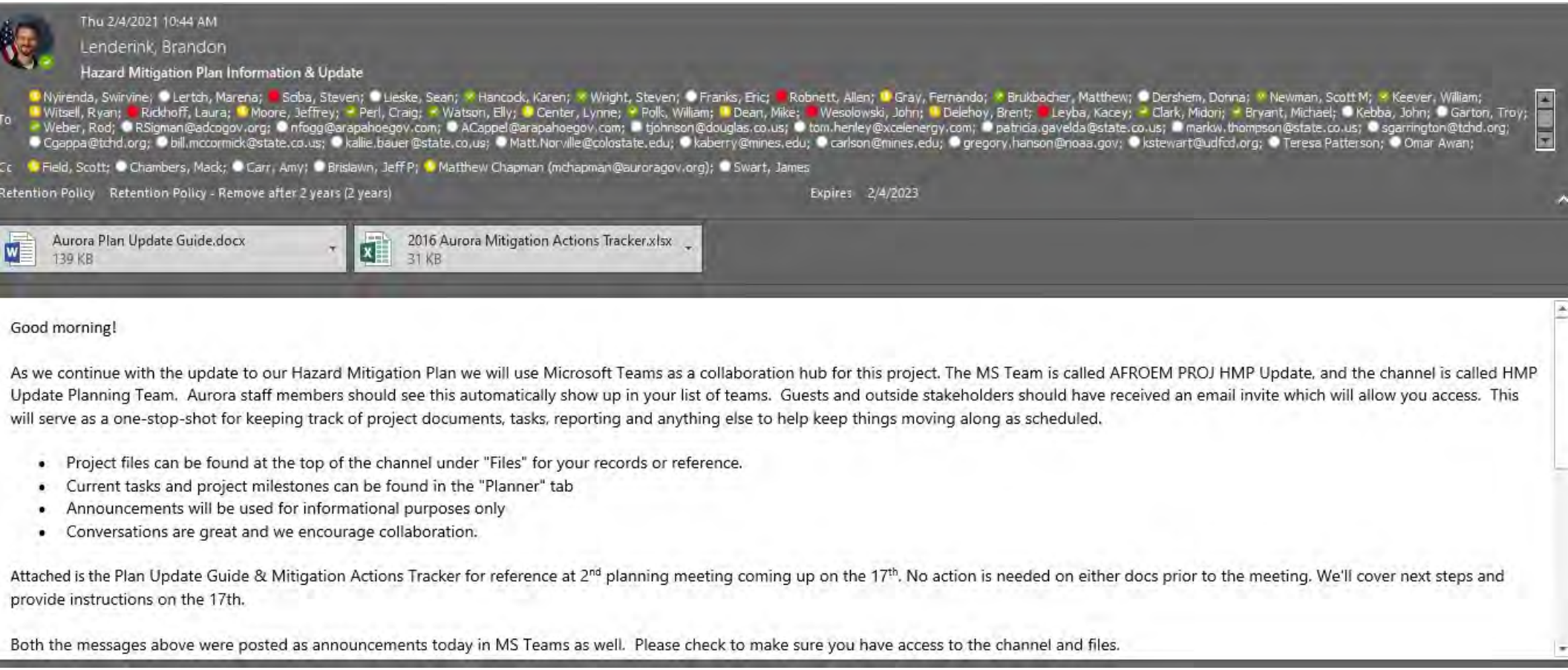
Retention Policy — Retention Policy - Remove after 2 years (2 years) — Expires 2/2/2023

Aurora HMP 2021 update Kickoff Meeting Summary 12-9-2020.pdf
157 KB

When Wednesday, February 17, 2021 1:00 PM-3:00 PM | **Location** Microsoft Teams Meeting

-----Original Appointment-----
From: Lenderink, Brandon
Sent: Wednesday, January 27, 2021 1:34 PM
To: Lenderink, Brandon; Nyirenda, Swirvine; Lertch, Marena; Sciba, Steven; Lieske, Sean; Hancock, Karen; Wright, Steven; Franks, Eric; Robnett, Allen; Gray, Fernando; Brukbacher, Matthew; Dershem, Donna; Newman, Scott M; Keever, William; Witsell, Ryan; Rickhoff, Laura; Moore, Jeffrey; Perl, Craig; Watson, Elly; Center, Lynne; Polk, William; Dean, Mike; Wesolowski, John; Delehoy, Brent; Leyba, Kacey; Clark, Midori; Bryant, Michael; Kebba, John; Garton, Troy; Weber, Rod; RSigman@adcogov.org; nfogg@arapahoegov.com; ACappel@arapahoegov.com; tjohnson@douglas.co.us; tom.henley@xcelenergy.com; patricia.gavelda@state.co.us; markw.thompson@state.co.us; sgarrington@tchd.org; Cgappa@tchd.org; bill.mccormick@state.co.us; kallie.bauer@state.co.us; Matt.Norville@colostate.edu; kaberry@mines.edu; carlson@mines.edu; gregory.hanson@noaa.gov; kstewart@udfcd.org; Matthew Chapman (mchapman@auroragov.org); Swart, James
Cc: Teresa Patterson; Omar Awan; jim.kirch@state.co.us; Shea Thomas
Subject: Aurora Hazard Mitigation Plan Update - 2nd Planning Meeting
When: Wednesday, February 17, 2021 1:00 PM-3:00 PM (UTC-07:00) Mountain Time (US & Canada).
Where: Microsoft Teams Meeting

Good afternoon everyone,



Good morning!

As we continue with the update to our Hazard Mitigation Plan we will use Microsoft Teams as a collaboration hub for this project. The MS Team is called AFROEM PROJ HMP Update, and the channel is called HMP Update Planning Team. Aurora staff members should see this automatically show up in your list of teams. Guests and outside stakeholders should have received an email invite which will allow you access. This will serve as a one-stop-shot for keeping track of project documents, tasks, reporting and anything else to help keep things moving along as scheduled.

- Project files can be found at the top of the channel under "Files" for your records or reference.
- Current tasks and project milestones can be found in the "Planner" tab
- Announcements will be used for informational purposes only
- Conversations are great and we encourage collaboration.

Attached is the Plan Update Guide & Mitigation Actions Tracker for reference at 2nd planning meeting coming up on the 17th. No action is needed on either docs prior to the meeting. We'll cover next steps and provide instructions on the 17th.

Both the messages above were posted as announcements today in MS Teams as well. Please check to make sure you have access to the channel and files.

Tue 3/2/2021 2:28 PM

Lenderink, Brandon

3rd Planning Meeting - HMP Mitigation Action Strategy Meeting

Required Nyirenda, Swirvine; Lertch, Marena; Sciba, Steven; Hancock, Karen; Wright, Steven; Franks, Eric; Robnett, Allen; Gray, Fernando; Brukbacher, Matthew; Dershem, Donna; Newman, Scott M; Keever, William; Witsell, Ryan; Rickhoff, Laura; Moore, Jeffrey; Perl, Craig; Watson, Elly; Center, Lynne; Polk, William; Dean, Mike; Wesolowski, John; Delehoy, Brent; Leyba, Kacey; Clark, Midori; Bryant, Michael; Kebba, John; Garton, Troy; Weber, Rod; RSigman@adcogov.org; nfogg@arapahoegov.com; ACappel@arapahoegov.com; tjohnson@douglas.co.us; tom.henley@xcelenergy.com; patricia.gavelda@state.co.us; markw.thompson@state.co.us; sgarrington@tchd.org; Cgappa@tchd.org; bill.mccormick@state.co.us; kallie.bauer@state.co.us; Matt.Norville@colostate.edu; kaberry@mines.edu; carlson@mines.edu; gregory.hanson@noaa.gov; kstewart@udfcd.org;

Retention Policy — Retention Policy - Remove after 2 years (2 years) — Expires 3/2/2023

When Thursday, March 18, 2021 9:00 AM-11:00 AM **Location** Microsoft Teams Meeting

Please join us for our next Hazard Mitigation Plan Update meeting. We will be reviewing our Plan goals, objectives and mitigation actions for the 2021 Hazard Mitigation Plan.

Microsoft Teams meeting

Join on your computer or mobile app

Click here to join the meeting

City of Aurora, Colorado

Learn More | Meeting options


HMP Update Planning...
Posts
2 more
Team
19 Guests
HMP Update - 2nd Planing Meeting Info
2nd Planning Meeting set for 2/17/21
HMP Update Planning Team AFROEM PROJ HMP Update
This is the second planning team meeting for the 2021 update of the City of Aurora Hazard Mitigation Plan. It is scheduled for Wednesday, February 17th 1:00-3:00 pm. This meeting will focus on identifying the hazards that have potential to impact the City and quantifying their possible impacts. The risk assessment is the fundamental building block of mitigation planning. We'll take a three-part approach to developing a risk assessment: hazard identification, vulnerability assessment, and capability assessment. All planning team members are encouraged to attend.
Attached is the Plan Update Guide & Mitigation Actions Tracker for reference. No action is needed on either docs prior to the meeting. We'll cover next steps and provide instructions on the 17th.
See less
New conversation

Aurora, Colorado City Hall

Yesterday at 7:26 AM ·

In this week's This Is Aurora city newsletter, get ready for Global Fest, enjoy a summer concert on the lawn, provide feedback on a draft Hazard Mitigation Plan, and more. View the newsletter at conta.cc/3iVKjtu, and sign up to receive it every week in your email inbox at AuroraGov.org/NewsletterSignup.

MYEMAIL.CONSTANTCONTACT.COM

This Is Aurora - City Newsletter - Aug. 19, 2021

Explore the world at Global Fest, provide feedback on city's Hazard...

3

Aurora Fire Rescue
in 1 hr ·

Here is your chance to provide input on the city's Hazard Mitigation Plan Update! Please consider participating before the March 31st deadline.

https://engageaurora.org/hazardmitigation

ENGAGEAURORA.ORG

Hazard Mitigation Plan Update

The city of Aurora is revising its 2016 Hazard Mitigation Plan to lessen the long-term risk to people and property from natural hazards. Mitigation measures reduce personal loss, save

Boost Post

Like Comment Share

Aurora Now - August 25, 2021

Share

It's a colorful celebration of Aurora's diverse cultures through music, dance and food. AuroraTV takes a look back at Global Fest 2021. Plus, an update on our city's new Immigrant Integration Plan from our Office of International and Immigrant Affairs; how to take part in Aurora's upcoming, virtual Career Expo, including a chance to work at AuroraTV and why now is a great time to adopt a dog from our Aurora Animal Shelter. Those stories and much more this week on Aurora Now.

Series: Aurora Now
Posted: 8/25/2021
Category: News
Producer: AuroraTV Staff

Related Videos

Aurora Now - August 25, 2021
Category: News

Aurora Now - August 18, 2021
Category: News

Aurora Now - August 11, 2021
Category: News

Aurora Now August 4, 2021
Category: News

Aurora Now - July 28, 2021
Category: News

Show more

Aurora, Colorado City Hall

@auroragov

- Home
- Posts
- Newsletter Sign-up
- Reviews
- Videos
- Live
- Photos
- About
- Community
- Events

Create a Page

Every Friday, Aurora Mayor Mike Coffman and host Wendy Brockman welcome questions from the public and discuss different topics on city efforts and issues affecting our...

Posts

Aurora, Colorado City Hall

15 hrs ·

There's just one week left to provide input on the city's Hazard Mitigation Plan Update. Take a brief survey or help map out potential natural hazards for the city to consider in its update.
https://engageaurora.org/hazardmitigation

ENGAGEAURORA.ORG

Hazard Mitigation Plan Update

The city of Aurora is revising its 2016 Hazard Mitigation Plan to lessen...

1

Like Comment Share

Hazard Mitigation Plan Update

The city of Aurora is revising its 2016 Hazard Mitigation Plan to lessen the long-term risk to people and property from natural hazards. Mitigation measures reduce personal loss, save lives and reduce the cost of responding to and recovering from disasters. The plan guides decision makers in committing city resources and integrates with existing building and zoning regulations, long-range planning efforts and environmental stewardship.

The updated plan is also required by the Federal Emergency Management Agency for local jurisdictions to be eligible for disaster mitigation funding. The plan includes rating the risks associated with hazards in the city of Aurora, and how the city plans to address or lessen potential impacts of identified hazards.

The city wants public input and feedback both during the planning process and on the final draft. The final draft is now available. View the plan and provide feedback at https://virtual.woodplc.com/VirtualSpace/147208.

View the final draft and provide feedback

REGISTER to get involved!

STAY INFORMED

Subscribe for project updates

Your email address...

SUBSCRIBE

9 members of your community are following this project

Aurora, Colorado City Hall
@auroragov

- Home
- Posts
- Newsletter Sign-up
- Reviews
- Videos
- Live
- Photos
- About
- Community
- Events

Create a Page

Like Share ···

Posts

Aurora, Colorado City Hall
2 hrs ·

The city's This is Aurora city newsletter for March 4, 2021, is now available to read at https://conta.cc/3sPsdeW .

Help the city identify and plan for potential hazards

The city of Aurora is updating its Local Hazard Mitigation Plan and needs your input. We want to know what natural and human-caused hazards you're aware of, such as flooding or wildfires, so the city can better prepare for potential disasters.

1

Like Comment Share

This is Aurora

City Newsletter

March 4, 2021

Help the city identify and plan for potential hazards

The city of Aurora is updating its Local Hazard Mitigation Plan and needs your input. We want to know what natural and human-caused hazards you're aware of, such as flooding or wildfires, so the city can better prepare for potential disasters.

The plan, which was last updated in 2016, includes rating the risks associated with hazards in the city of Aurora, and how the city plans to address or lessen potential impacts of identified hazards. The updated plan is also required by the Federal Emergency Management Agency for local jurisdictions to be eligible for disaster mitigation funding.

As part of the city's new Engage Aurora platform, there is a public survey as well as other opportunities for feedback, including a map where you can identify hazard areas, and a place for you to ask your questions about the plan. The survey should take only a few minutes to complete. The survey is open through March 31, and will guide the final draft of the plan update, which will be made available for public review in late spring or early summer.

To provide your feedback, go to EngageAurora.org/HazardMitigation.

City of Aurora, CO @AuroraGov · Aug 18

Help Aurora prepare for and protect our community from natural hazards. The City of Aurora Hazard Mitigation Plan is updated every five years. The draft plan is open for public review and comment until Sept. 3. Learn more and comment on the draft plan at virtual.woodplc.com/VirtualSpace/1....

2 1

This is Aurora

City Newsletter

Aug. 19, 2021

Explore the world with Global Fest - a virtual celebration - at 11 a.m. Aug. 21

Join us at 11 a.m. Saturday, Aug. 21, for Global Fest, Aurora's annual celebration of international cultures and traditions.

Global Fest will be a virtual event in 2021, airing live on AuroraTV.org and the city's Facebook page. From the International Fashion Show and the Parade of Nations, to performances representing cultures from around the world, Global Fest is a recognition of Aurora's diversity and how it makes the community stronger.

The performance lineup includes the Philippine-American Society of Colorado, Amigos de Mexico, Nyadak Pal (South Sudanese traditional dance), and Nguyen Lion Dance. Forty-seven countries are represented in this year's Parade of Nations, and cultural attire from 10 countries will be featured in the International Fashion Show. Throughout the event, local international restaurants will be featuring demonstrations of their food.

Learn more at AuroraGlobalFest.org.

Provide feedback by Sept. 3 on Hazard Mitigation Plan

Help Aurora prepare for and protect our community from natural hazards! The City of Aurora Hazard Mitigation Plan is updated every five years and includes new information on hazards, vulnerabilities, assets at risk, and ways to reduce impacts through long-term hazard mitigation projects. Public input on the plan is an important step to make sure the plan is as accurate and effective as possible. The draft plan is open for public review and comment until Sept. 3.

Review the draft plan

ID	Start time	Completion time	Email	Name	Select affiliation (select one):	Please provide comments regarding the draft update of the 2021 City of Aurora Hazard Mitigation Plan here:	What zip code do you reside in?	Please provide your contact information (Name and email address) in case we have any further questions
1	8/20/21 10:02:16	8/20/21 10:03:22	anonymous		Member of the Public	This is a horrible waste of taxpayer money. They website is not inclusive to non technical taxpayers.	80015	

Aurora Hazard Mitigation Plan Update Public Input Survey

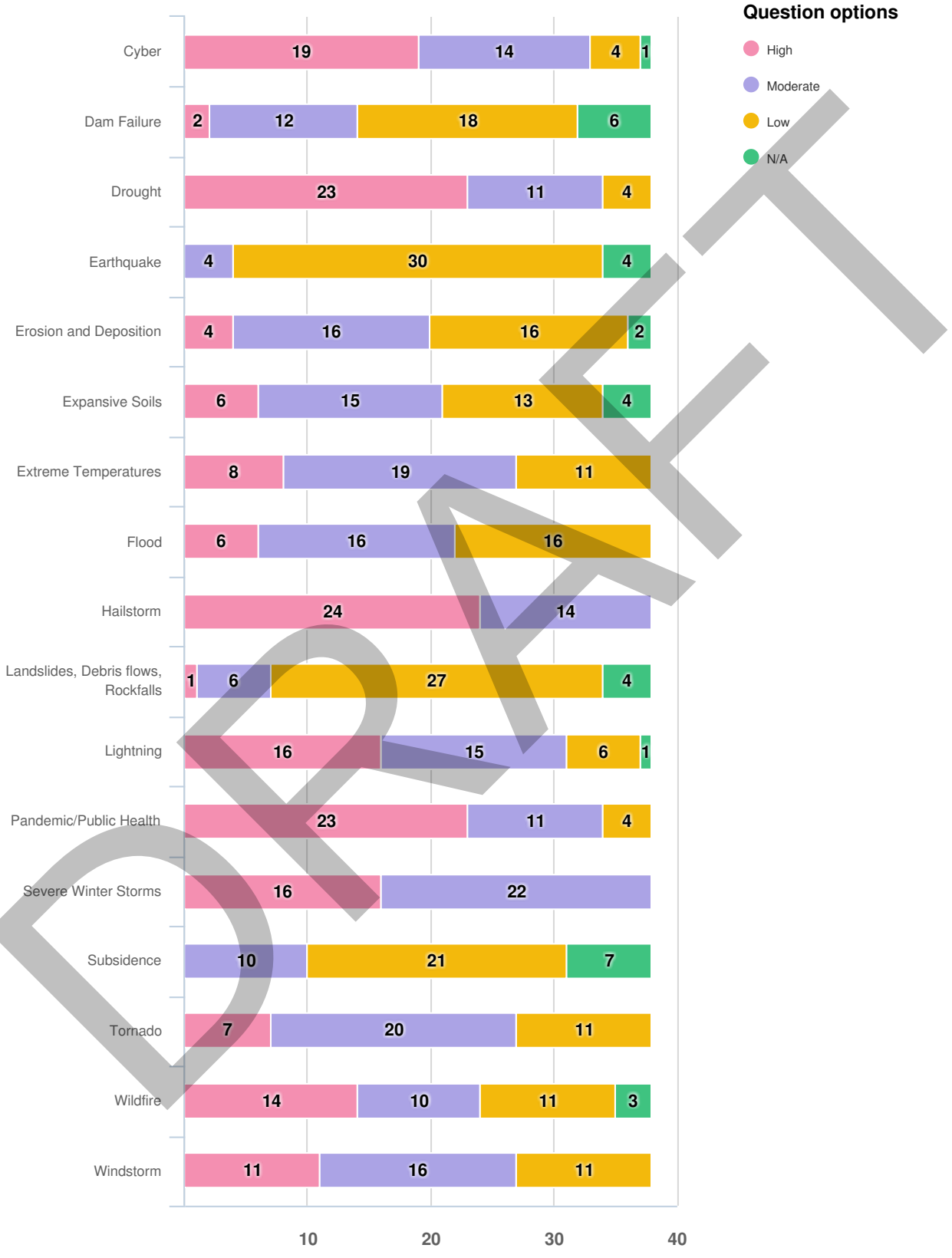
SURVEY RESPONSE REPORT
08 February 2021 - 09 March 2021

PROJECT NAME:
Hazard Mitigation Plan Update

BANG THE TABLE engagementHQ

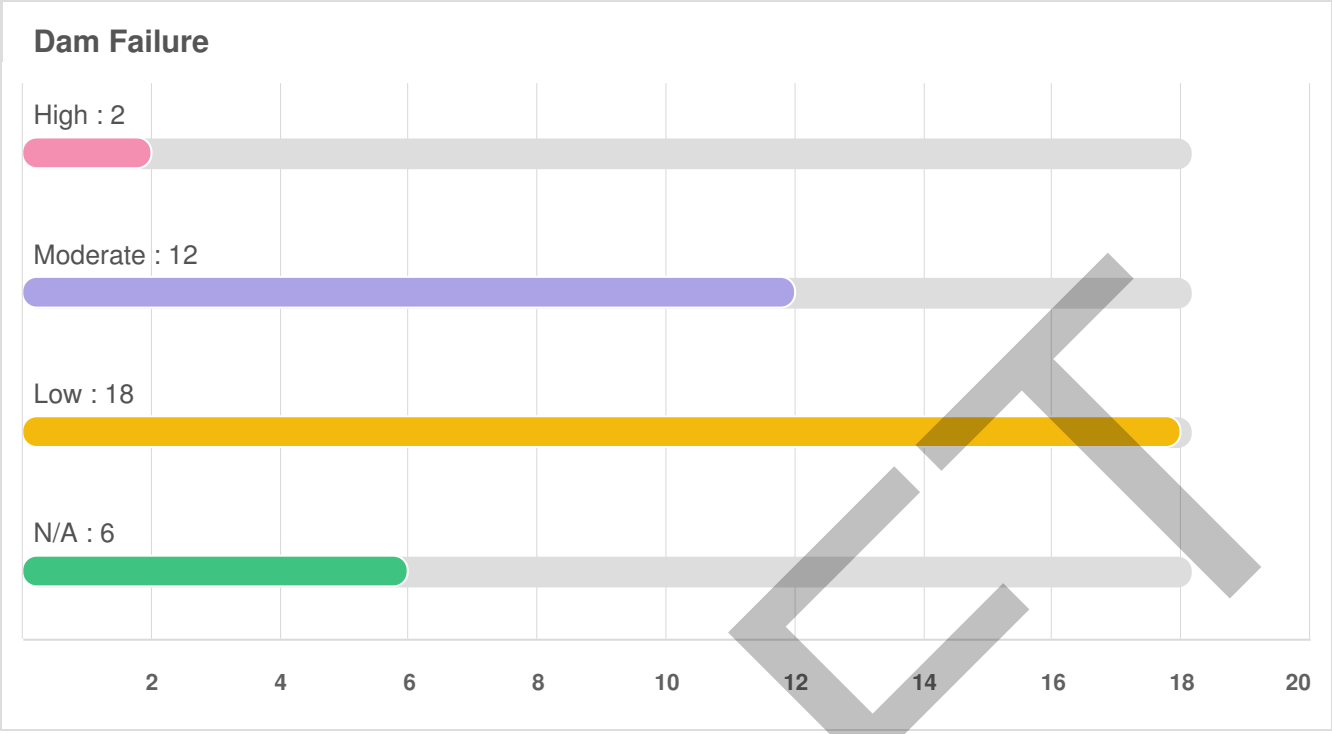
SURVEY QUESTIONS

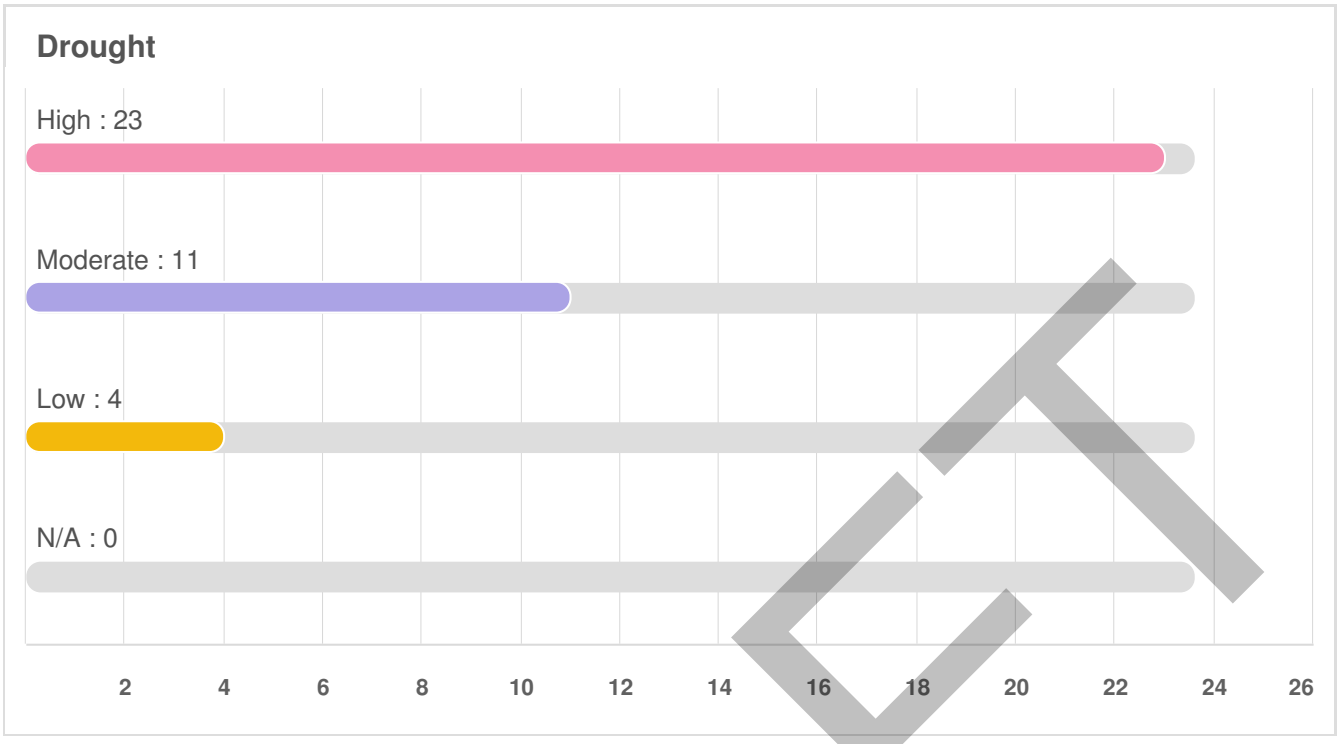
Q1 The hazards addressed in the Hazard Mitigation Plan update are listed below. Please indicate the level of significance in A...

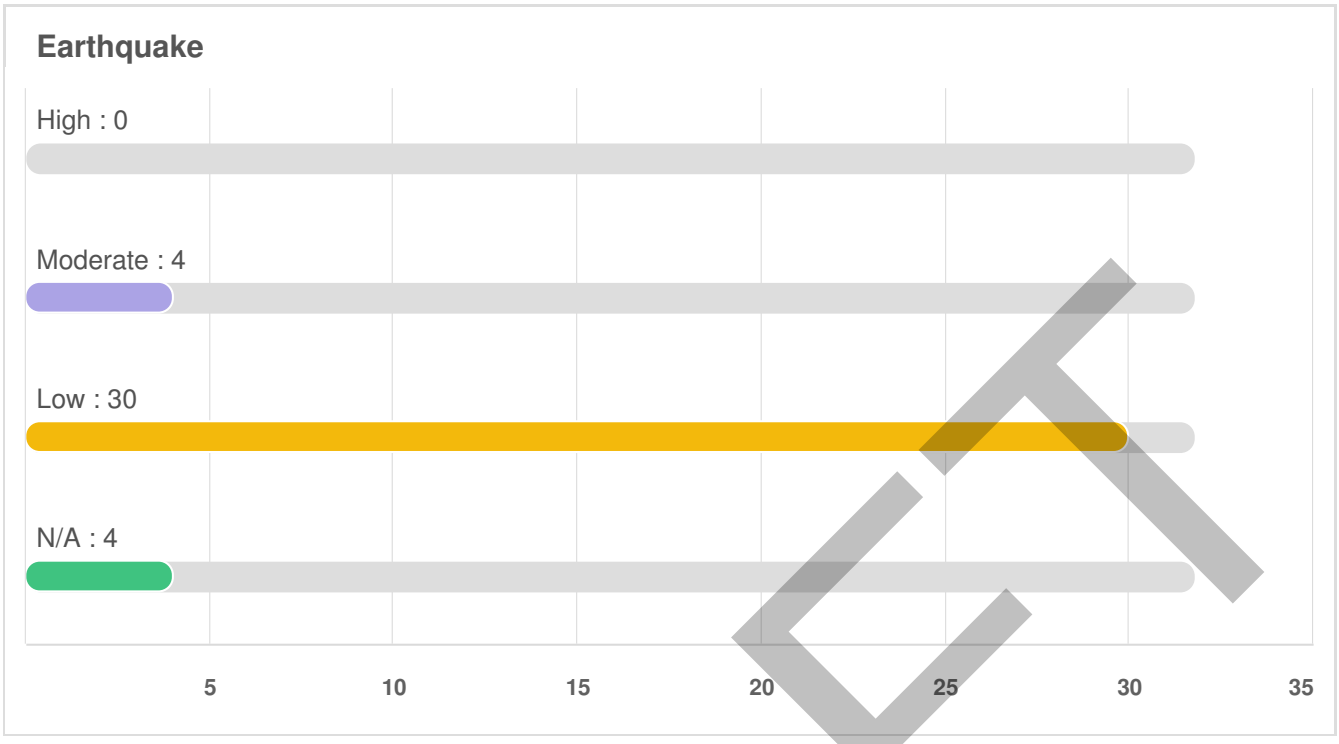


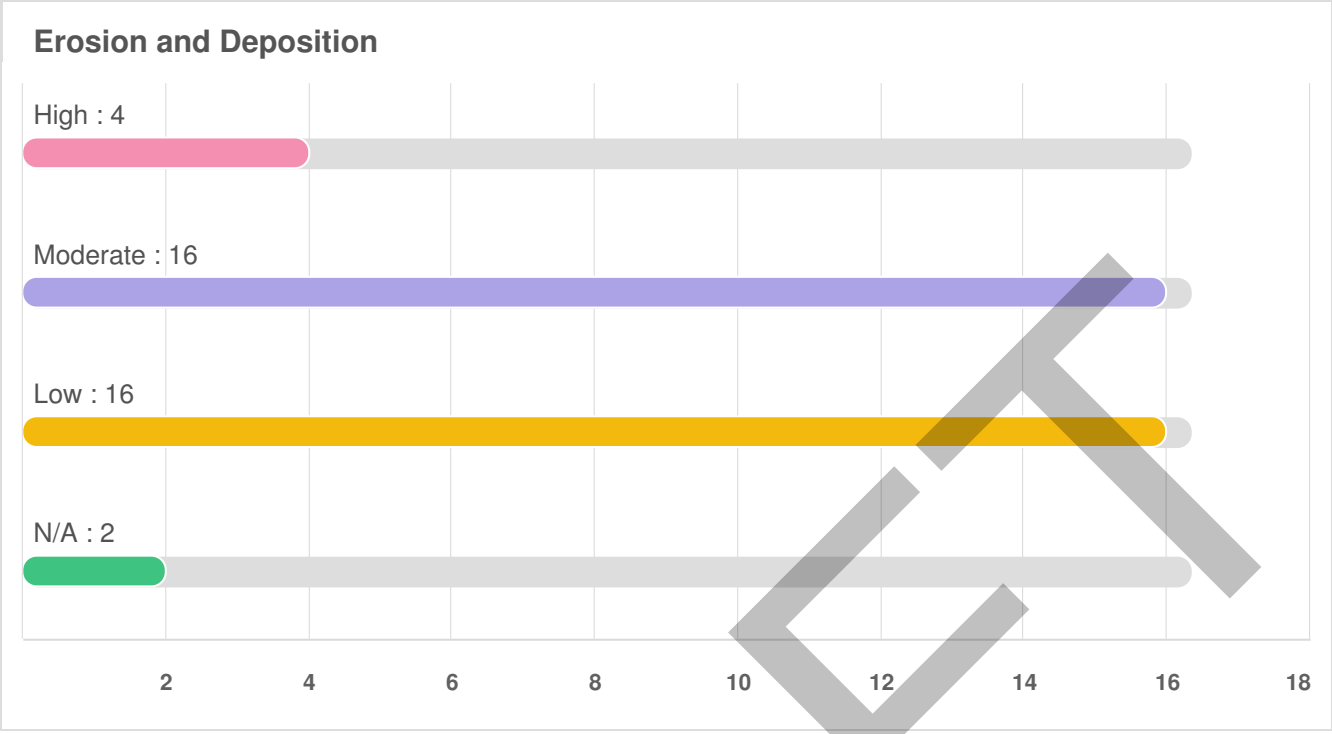
Mandatory Question (38 response(s))
Question type: Likert Question

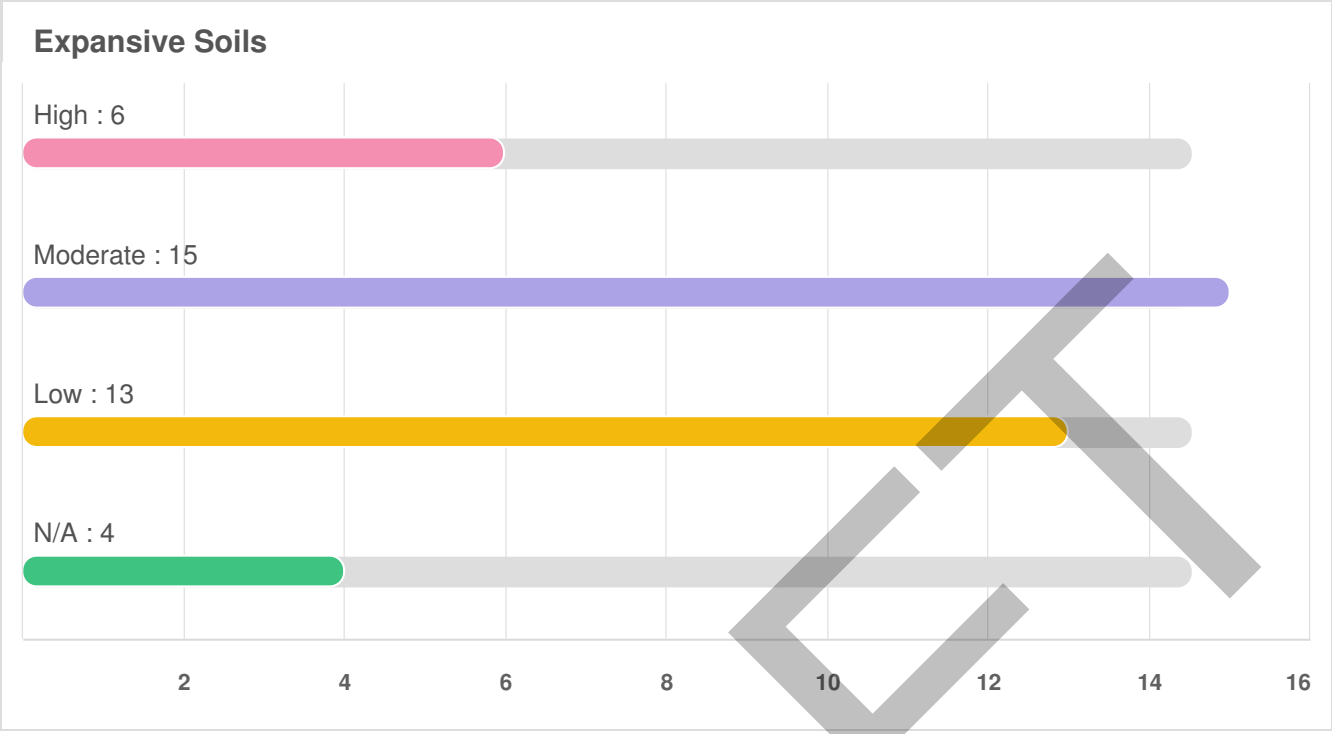
Q1 **The hazards addressed in the Hazard Mitigation Plan update are listed below. Please indicate the level of significance in A...**

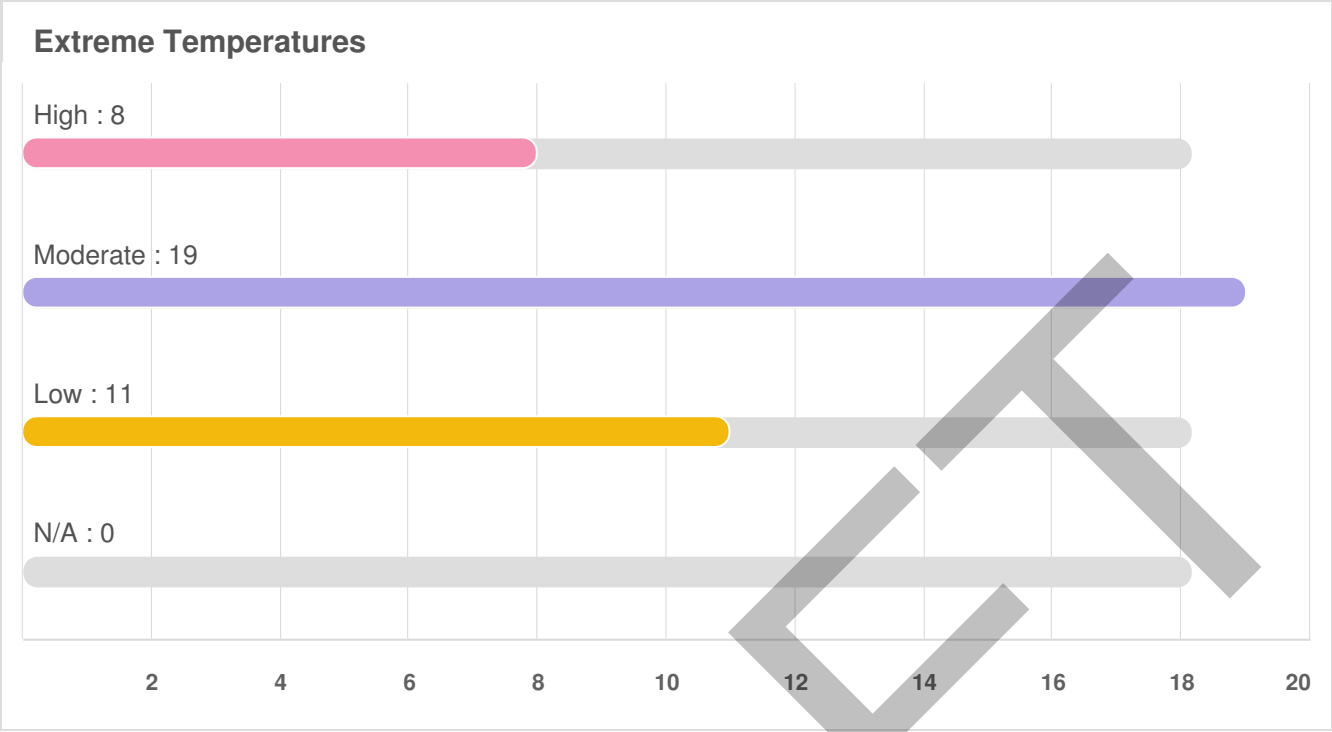


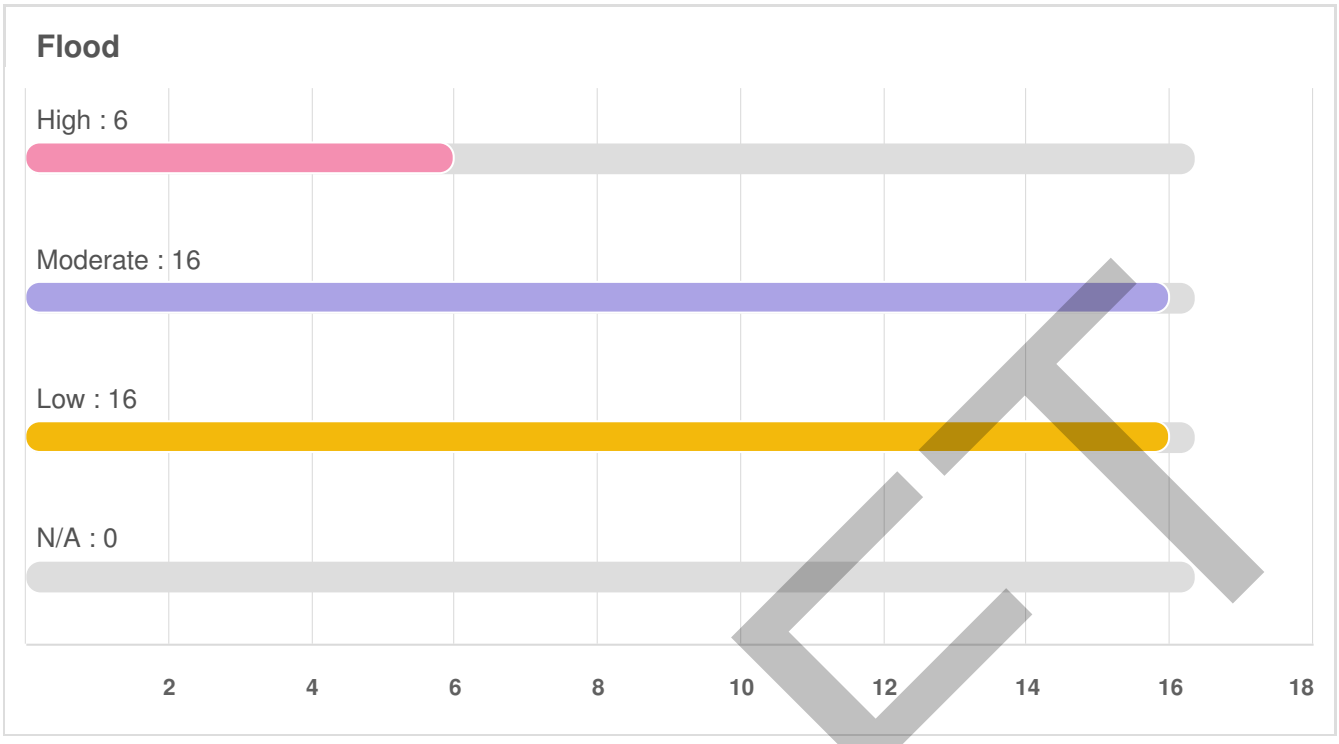

Drought
High : 23
Moderate : 11
Low : 4
N/A : 0
2
4
6
8
10
12
14
16
18
20
22
24
26

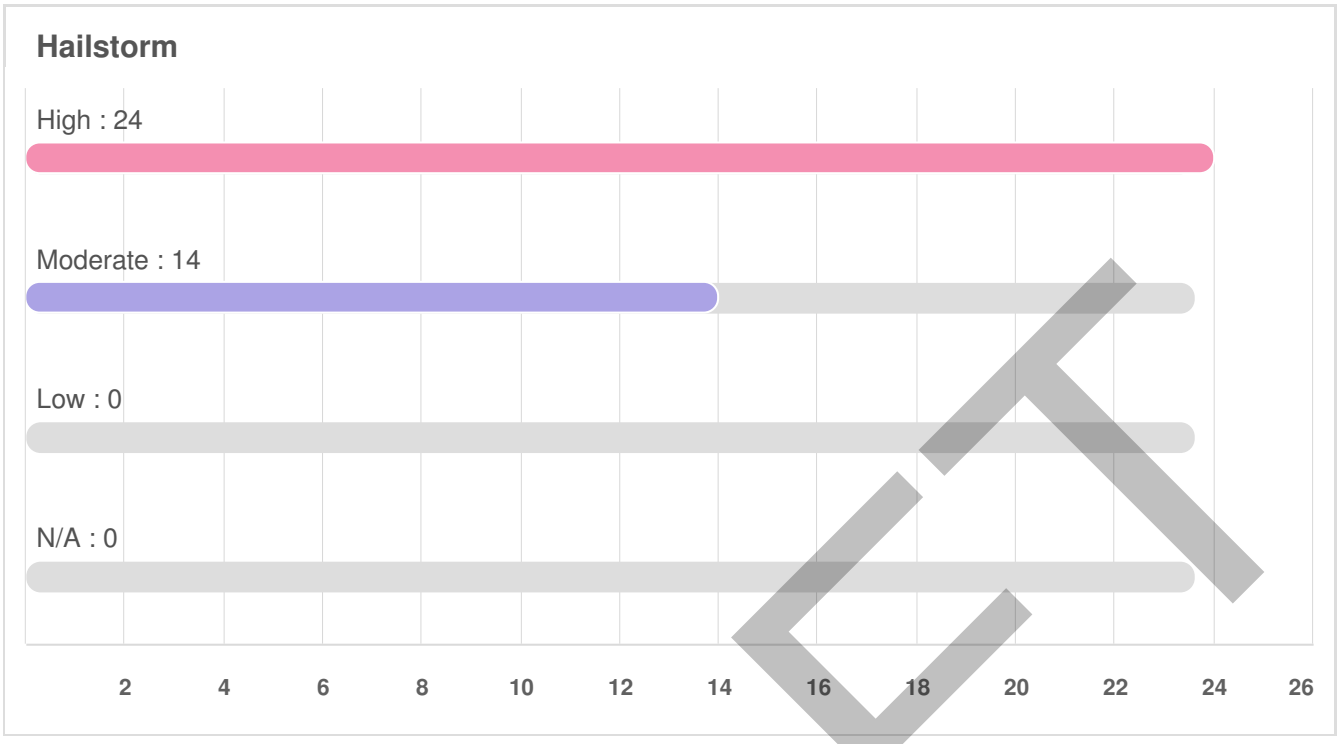


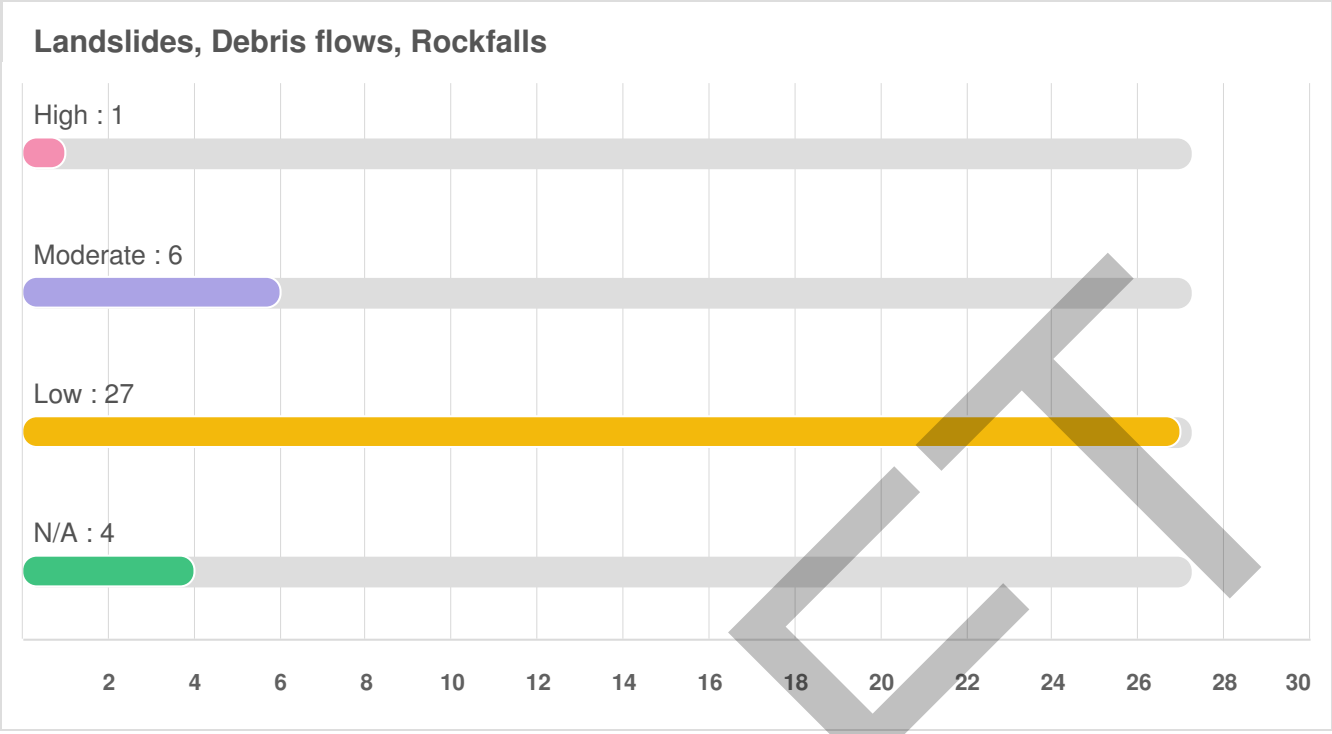

Erosion and Deposition
High : 4
Moderate : 16
Low : 16
N/A : 2
2
4
6
8
10
12
14
16
18

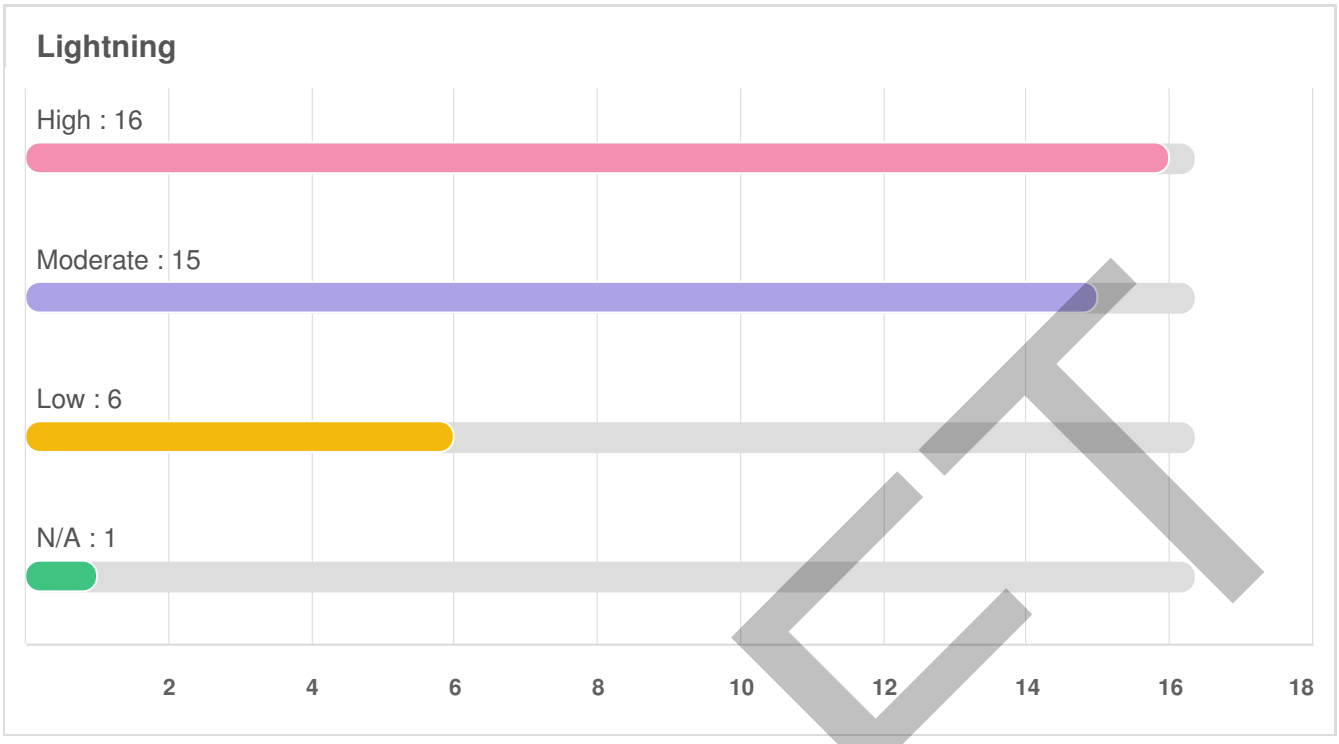


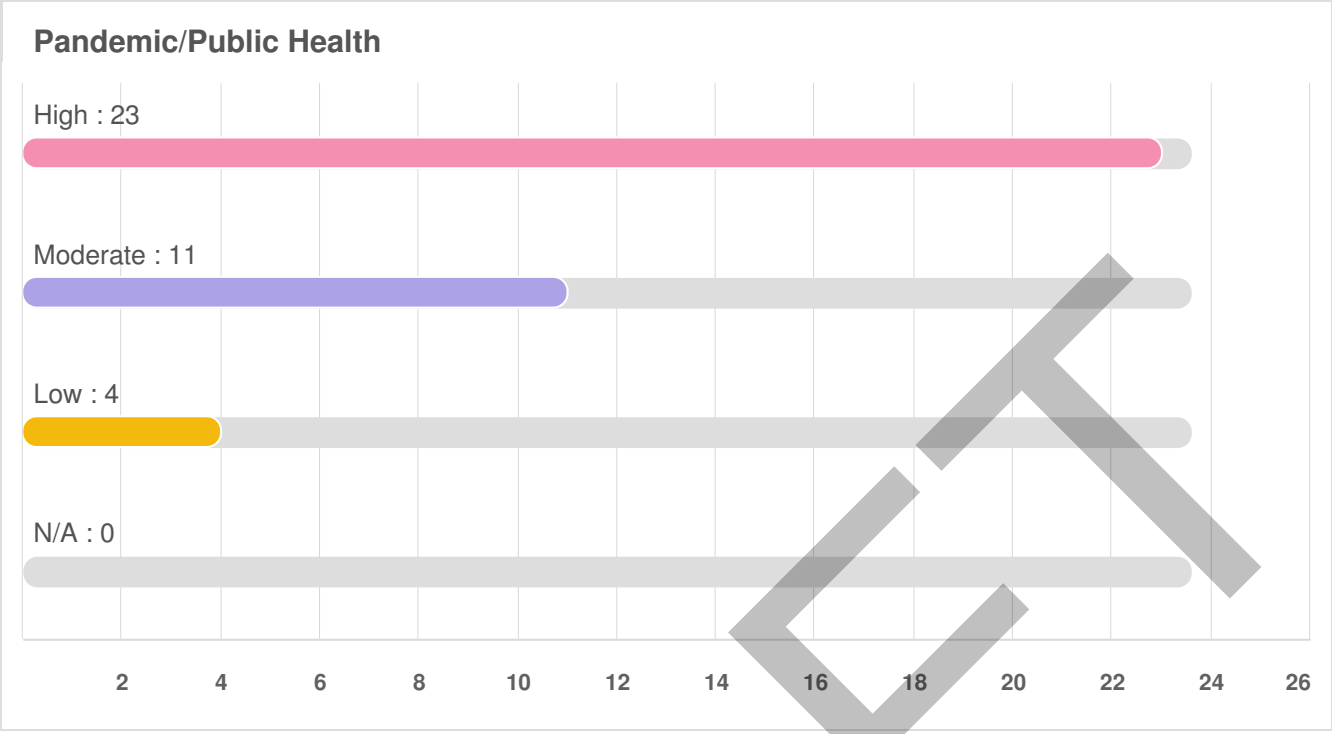

Extreme Temperatures
High : 8
Moderate : 19
Low : 11
N/A : 0
2
4
6
8
10
12
14
16
18
20

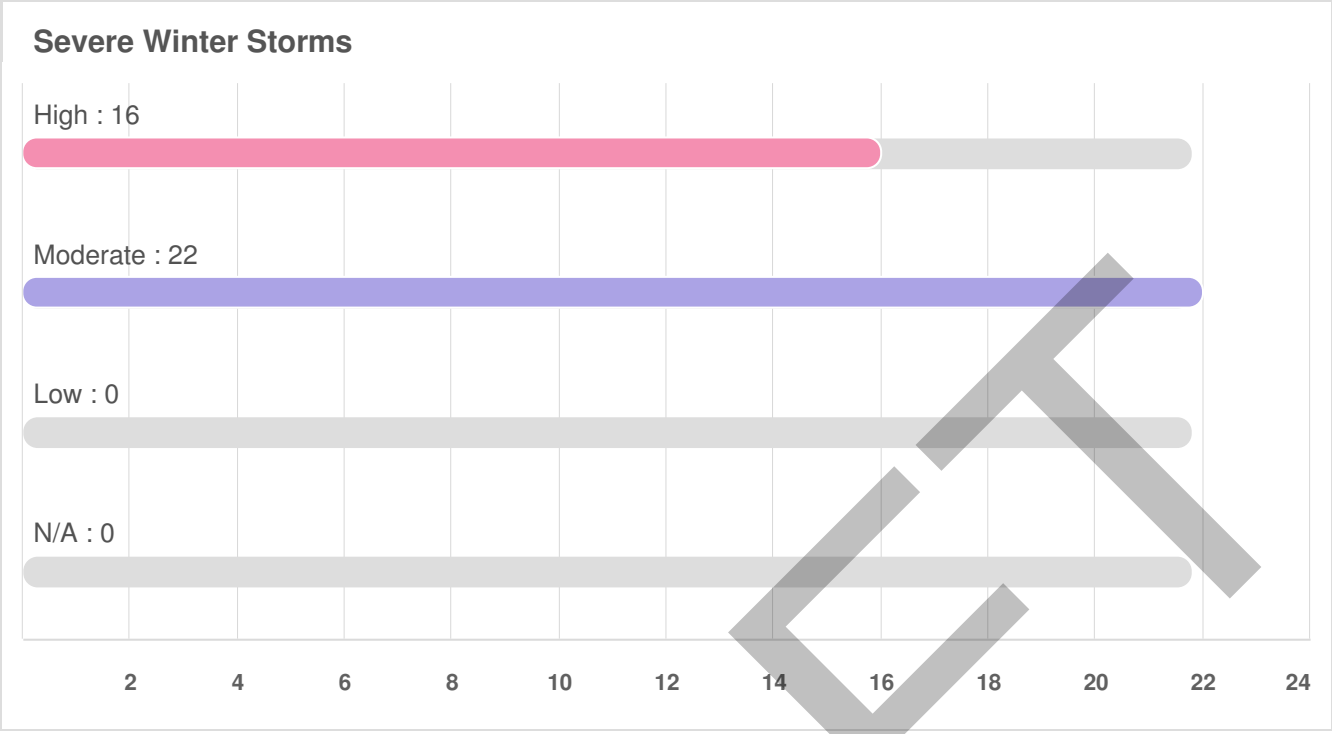


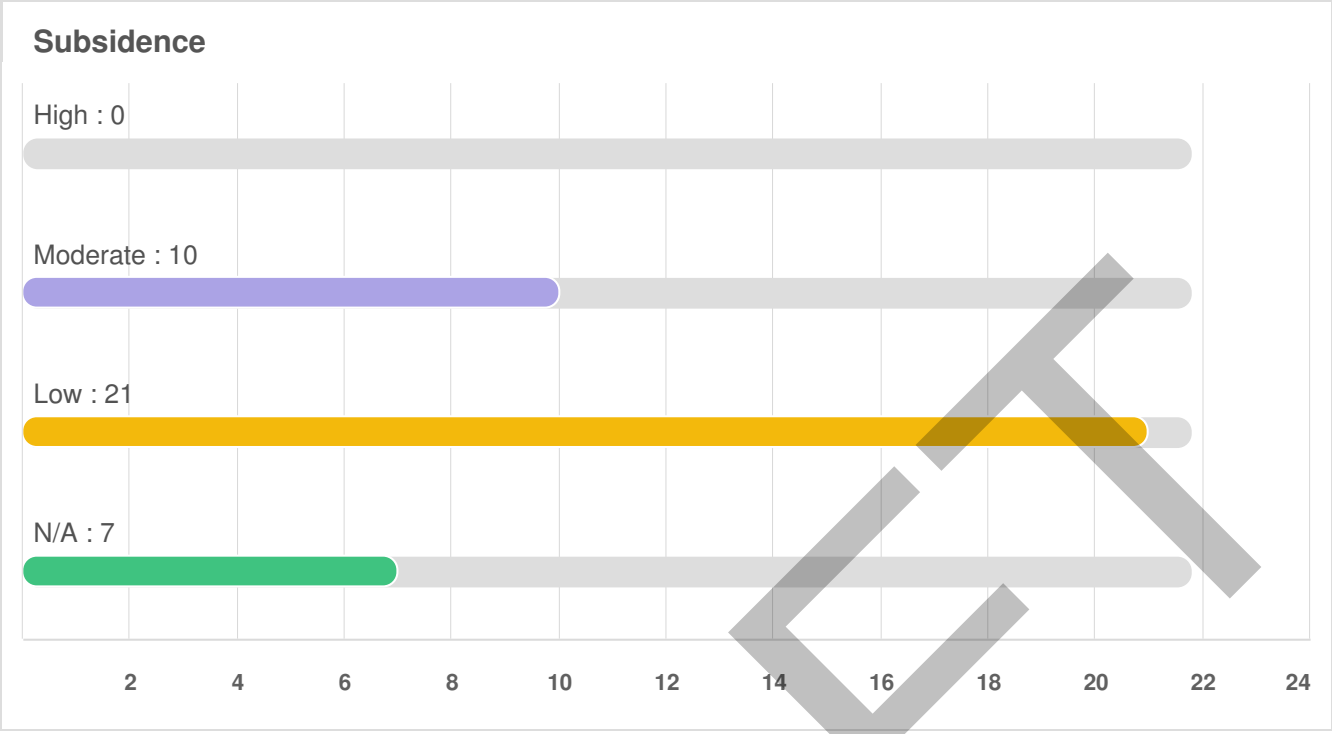

Hailstorm
High : 24
Moderate : 14
Low : 0
N/A : 0
2
4
6
8
10
12
14
16
18
20
22
24
26

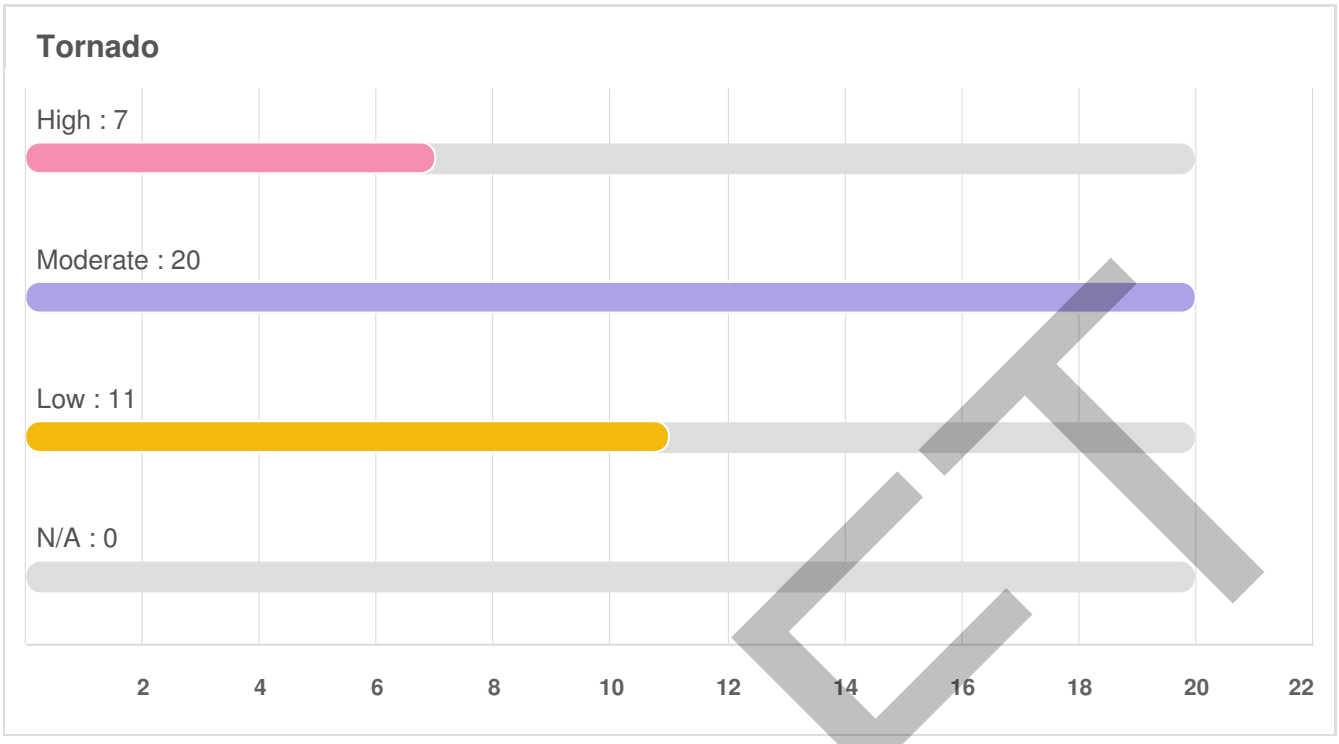

Landslides, Debris flows, Rockfalls
High : 1
Moderate : 6
Low : 27
N/A : 4
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30

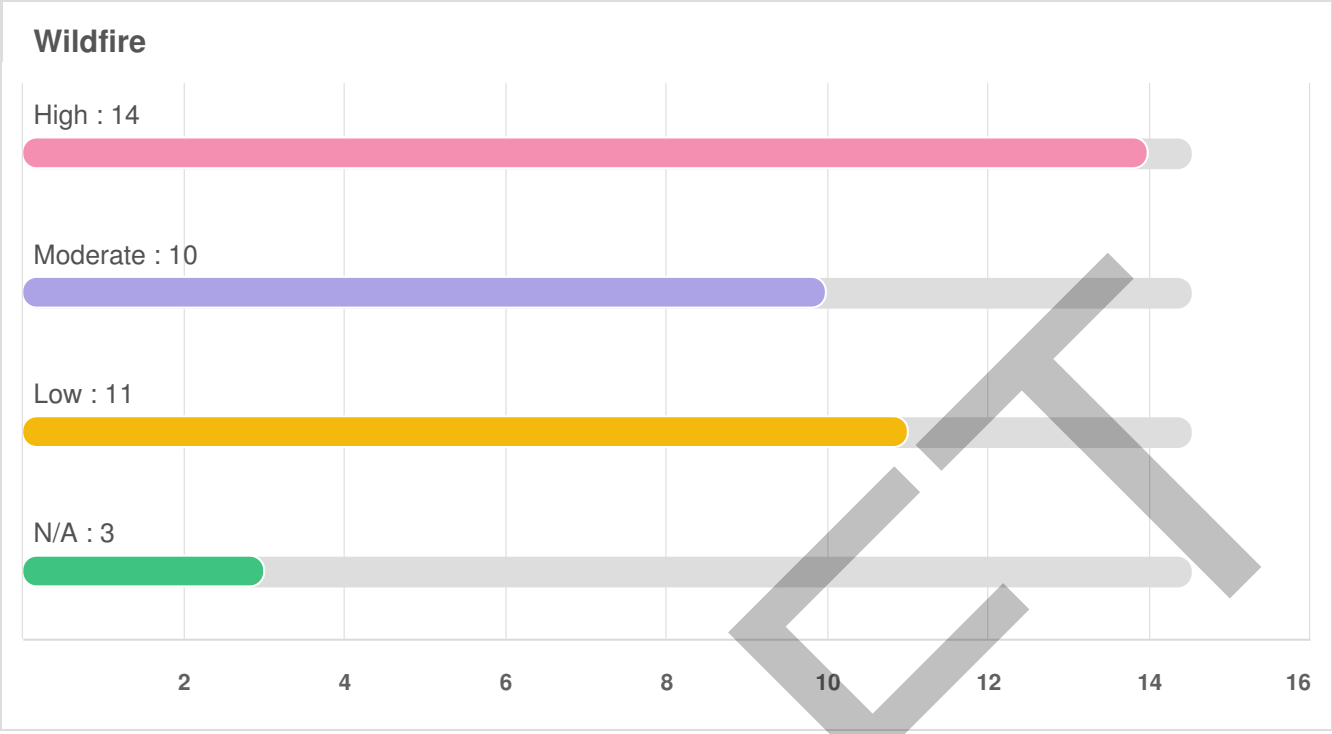


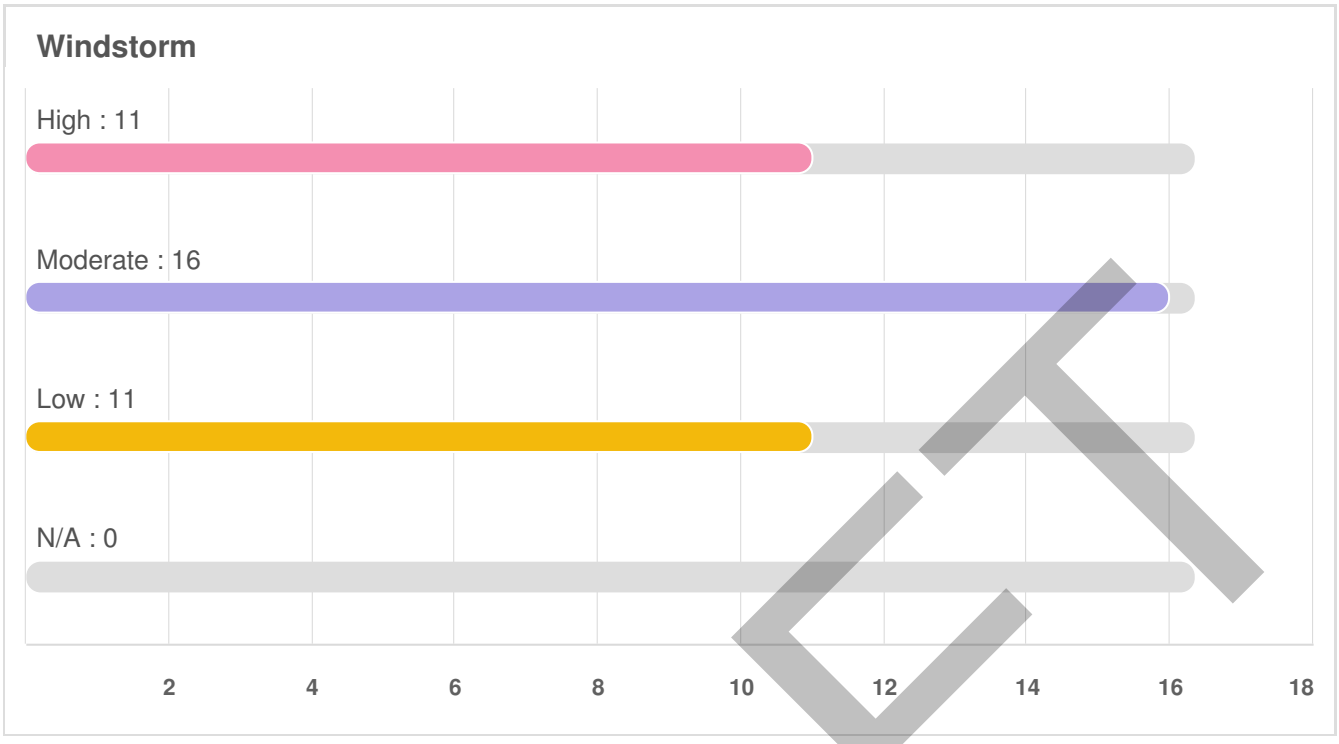

Pandemic/Public Health
High : 23
Moderate : 11
Low : 4
N/A : 0
2
4
6
8
10
12
14
16
18
20
22
24
26


Severe Winter Storms
High : 16
Moderate : 22
Low : 0
N/A : 0
2
4
6
8
10
12
14
16
18
20
22
24

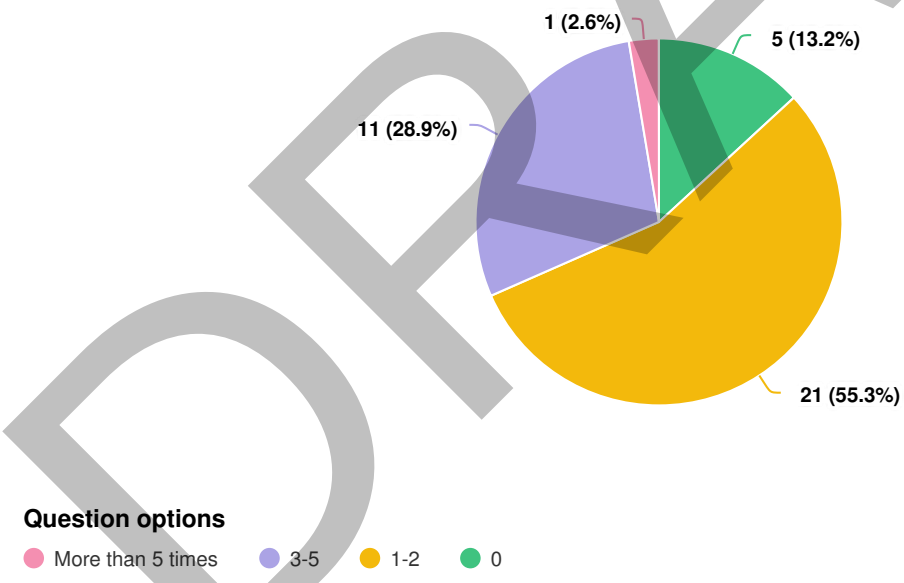

Subsidence
High : 0
Moderate : 10
Low : 21
N/A : 7
2
4
6
8
10
12
14
16
18
20
22
24







Q2 How many times has a natural hazard disrupted your daily life in the last five years?



Mandatory Question (38 response(s))
Question type: Radio Button Question

Q3 Do you have information on specific hazard issues/problem areas that you would like the planning committee to consider?

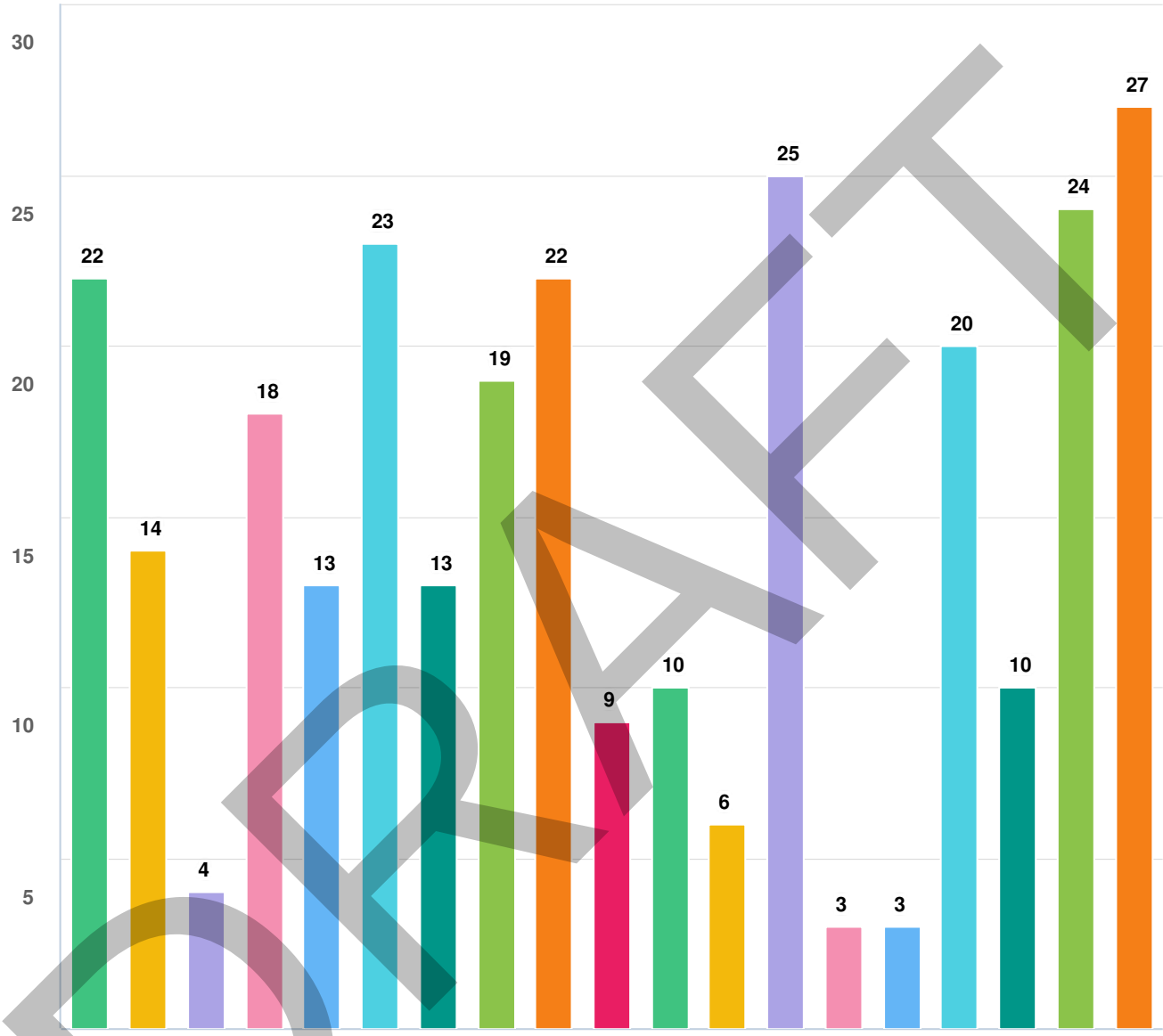
Anonymous 2/17/2021 09:32 PM	I'd explore giving council members could have the option of formally filling the comms/outreach role, defined the plan, full-time and with a full-time salary for the duration of the emergency. As I recall, FEMA Cat B would cover the differential cost for at least the first 90 days of a declared disaster.
Anonymous 2/18/2021 09:54 AM	Mass evacuations are complex and require interagency plans and annual on the ground drills to maintain preparedness. Only a few hurricane prone areas are skilled at this. In the event of a terrorist attack with a dirty bomb or other metro area mass evacuation scenario, clogged freeways and unnecessary death would result. Please consider adding this to the planning effort.
MyAur0ra1961 2/18/2021 12:15 PM	Highly concerned about the hazardous waste from homeless individuals living along Tollgate/Sand Creek.
Anonymous 2/19/2021 12:39 PM	Yes, we don't need masks. People will get sick. They pass it on. We need a paid sick leave plan that is mandatory for companies so people will actually stay home, as well as a punity plan for people who won't stay home when ill. We need to repair roads AND parking lots. Don't leave the responsibility on property owners! If someone mentions a pothole in a parking lot and the property manager says they can't do it for 2 weeks, send someone out there the next day to fix it, even if it's just filling it with gravel! Start putting harsher punishment on jaywalking. People don't always see someone running across the road in the evening when it's dark, or even during the day when they are using muscle memory to drive their route. We should always watch the road, but sometimes our mind decides it's going to put us on muscle memory mode so we can continue to think about tasks we need to complete or people we are going to speak to. For events like hailstorms, places like car sales lots and shopping centers should consider putting up canopys or a covering over the parking areas. This may also reduce the threat of tornadoes within the cities and will help with weather issues like snow, rain, and wind, as people who don't like to shop during inclement weather will be drawn to places that have that protection from the elements. Bottom line is, there are always creative ways to fix issues, but we need to open the state back up so we don't go bankrupt. We need to fight this illness the way they did back when they didn't have PPE. Living in fear isn't really living. It's just surviving.
Anonymous 2/19/2021 03:36 PM	Cyber outages like we just experienced. Civil unrest
Anonymous 2/19/2021 05:44 PM	DROUGHT: main impact of climate crisis in Rocky Mt region expected to be long term severe drought. Conserving water and industrial use of water that irredemiably destroys water must be seriously re thought and incorporated in Aurora's planning (such as the large quantity of water used to extinction in

	fracking , creating wastewater which is so toxic it must be permanently sequestered and removed from the hydrologic cycle) . Water is necessary for all life and is our most precious resource. Given long term drought projections, we must protect it better now, with ordinances that protect Aurora's water security (total water supplies) and ensure that Aurora's aquifers are not additionally contaminated by industrial processes, industrial waste, etc. Selling Aurora's water to oil and gas companies for fracking and ultimate removal from the hydrologic cycle creates short term financial gain but will result in catastrophic long term water shortage. SPECIAL HAZARDS AREAS: such as Lowry Landfill, Buckley Garrison and other Dept of Defence toxic waste sites, and the various landfills are currently not protected from industrial disruption through seismic, explosive, and other industrial processes (such as those used in fracking for oil and gas), and they MUST be, since the primary goal of these sites is to avoid disruption and contaminant leaching through the soils or groundwater, into acquifers, etc. Given that fracking uses multiple radial arms (extending approximately 2 miles from well site), there must be special city rules prohibiting frack wells and frack arms within some scientifically derived distance that a geological and hydrogeological specialty team that specializes in seismic impacts can certify as ensuring that each site will be safe from disruption.
Anonymous 2/20/2021 10:57 AM	1) Drought and the weather events associated with climate changes. 2) Industrial use of water for manufacturing and -especially fracking- must be restricted or ended altogether. Much of that water cannot be reclaimed for domestic use. It is not enough to ask the public to cut back on watering lawns or turn off the tap when brushing their teeth to address this excessive water permitted for oil and gas industry especially when Colorado is facing water shortages for years to come.
velma366 2/20/2021 12:12 PM	n/a
Anonymous 2/20/2021 02:25 PM	Flooding
Anonymous 3/03/2021 05:48 PM	Snow removal on local streets when there will be consistently cold temperatures. Driving on ice is very dangerous.
BobGaiser 3/04/2021 09:12 AM	landfill
Anonymous 3/04/2021 03:20 PM	Making sure that public grassy areas are trimmed down for wildfire (green belts , undeveloped lots). Install more warning systems for severe weather events (tornadoes, hailstorms, etc). I live in area and cannot hear the warning system very well.
Anonymous 3/05/2021 05:50 PM	brush and wildfires during dry months

Anonymous 3/08/2021 10:11 AM	Evacuation route markings to help people find optimal routes to safety.
Anonymous 3/08/2021 12:56 PM	With so many new housing developments that change the landscapes and natural drainage of above ground and below ground water - storm and residential runoff - a concern might be where and how water flows from newer areas to long-established areas (developments) without causing undue damage. I know the City of Aurora has developed and is implementing the 100-year flood control. This may not address the storm water and residential water flows completely. It is easy to see, especially during and after significant rain/snow fall that water collects on streets and sometimes create large icy roadways and may collect in older established residential communities. This may be considered an issue addressed.
Anonymous 3/09/2021 03:44 PM	Better communication around improper disposal of cigarette butts as they cause wildfires.

Optional question (16 response(s), 22 skipped)
Question type: Essay Question

Q4 **The following types of mitigation actions may be considered in Aurora. Please indicate the types of mitigation actions that you think should have the highest priority in the Aurora Hazard Mitigation Plan.**



Question options

- Public Health Incident Preparedness
- Improve Reliability of Communications Systems
- Dam Safety
- Evacuation Route Development
- Floodprone Property Buyout
- Landslide/Rockfall Mitigation
- Water Conservation
- Education and Discounts on Flood Insurance
- Stream Restoration
- Forest Health/Watershed Protection
- Stormwater Drainage Improvements
- Public Education/Awareness
- Planning/Zoning
- Generators for Critical Facilities
- Critical Facilities Projection
- Continued Participation in the National Flood Insurance Program. The National Flood Insurance Program is managed by FEMA and enables homeowners, business owners and renters in participating communities to purchase federally backed flood insurance.
- Assistance with Defensible Space
- Wildfire Fuels Treatment projects (i.e. mechanical, prescribed burning, thinning, etc.)
- Indoor/Outdoor Warning systems

Mandatory Question (38 response(s))
Question type: Checkbox Question

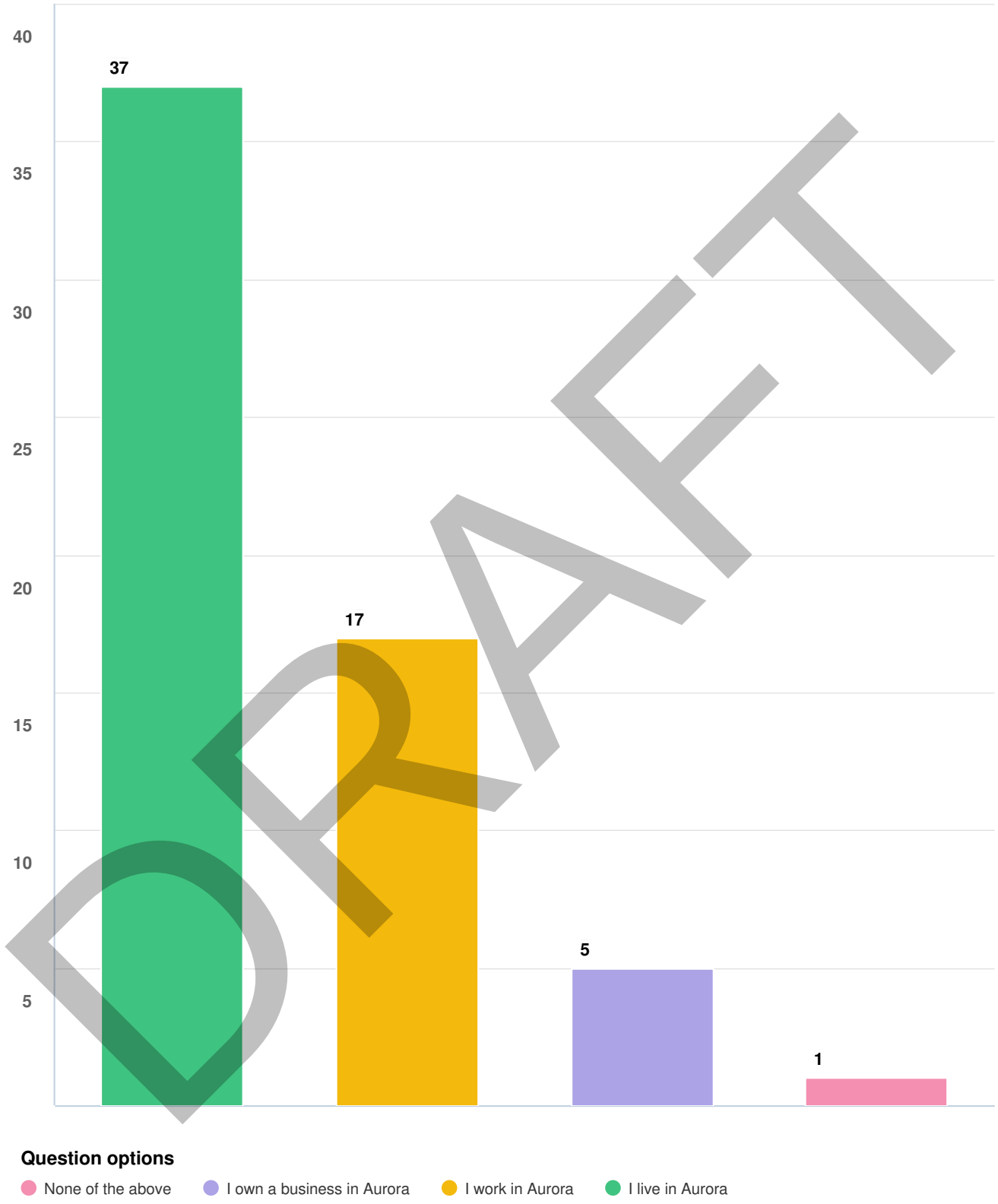
Q5 Please comment on any other pre-disaster mitigation actions that the planning committee should consider for reducing future losses caused by disasters

Anonymous 2/18/2021 09:54 AM	Plan and publicize evacuation centers, such as school gymnasiums. During a crisis is too late to make these arrangements.
MyAur0ra1961 2/18/2021 12:15 PM	Hire additional Code Enforcement Officers to ensure properties are not storing garbage/non-working vehicles/pollutants on their property. Enforce the current laws.
Anonymous 2/18/2021 02:40 PM	Investing in cyberattack protection especially for our power grid and other utilities.
Anonymous 2/19/2021 03:36 PM	IT infrastructure robustness - plan for a failure.
Anonymous 2/19/2021 05:44 PM	The public alarm system in Aurora should be more informative to the public as to type of disaster, level of threat and immediacy of actions that need to be taken. The tonal system that is often sounded, apparently when tornados have been sighted,needs to be accompanied by a verbal message that provides intelligible information.
Anonymous 2/20/2021 10:57 AM	Protection of the aquifers is vital for use in agriculture and domestic well water. Draining down of this water supply is dangerous for those reasons and more. Allowing drain-down for industrial and fracking use will deplete this long depended on water source and further, contamination of the aquifers from chemical runoff (super-fund sites) and inadequate disposal of chemicals used in manufacturing - will not allow for a dependable clean supply into the near future. Legislation is necessary to protect our deep water sources.
velma366 2/20/2021 12:12 PM	n/a
Anonymous 3/04/2021 08:45 AM	Expand Gun Club Road between Quincy and Alexander. The old two lane road is a hazard daily and would be critical if a major emergency occurred in SE Aurora.
Anonymous 3/04/2021 03:20 PM	Better communication across all mediums.
Anonymous 3/08/2021 09:36 AM	I have never heard emergency sirens. Where we lived in Texas, I could hear them inside my home and inside my office at work. They were also tested EVERY month to insure they continued to work. I think y'all need to put up a lot more sirens to cover the city AND start monthly testing. Ours were always

	the first Wednesday of every month.
Anonymous 3/08/2021 12:56 PM	Because of our dry climate and on-going threat of droughts, it is possible that our communities are more prone to fires than we realize.

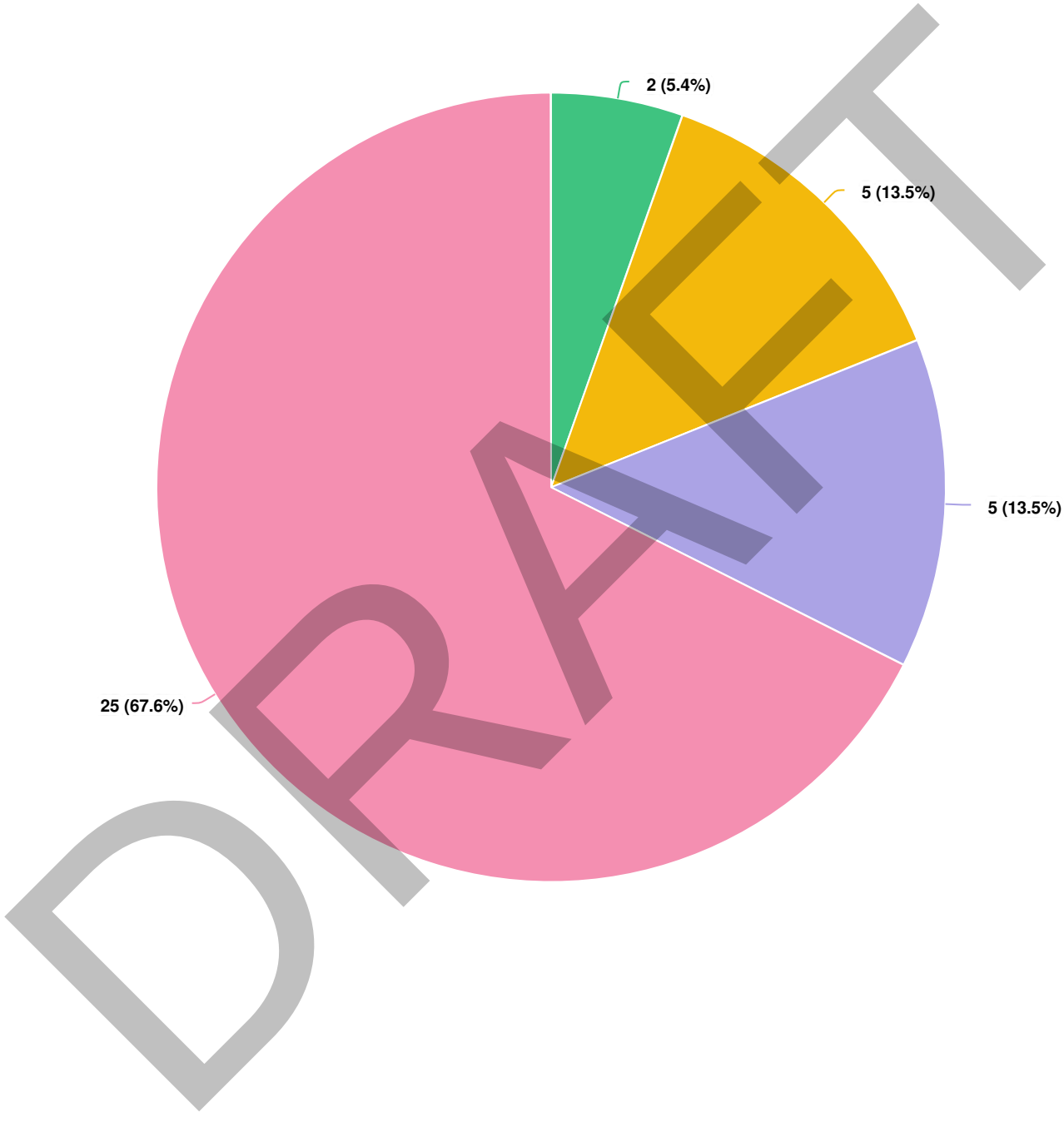
Optional question (11 response(s), 27 skipped)
Question type: Essay Question

Q6 Please check all that apply



Mandatory Question (38 response(s))
Question type: Checkbox Question

Q7 How long have you lived/worked/owned a business in Aurora?



Optional question (37 response(s), 1 skipped)
Question type: Dropdown Question

Q8 What is your ZIP code?

Anonymous 2/17/2021 09:32 PM	80016
Devilcat 2/18/2021 09:02 AM	80014
Anonymous 2/18/2021 09:54 AM	80020
lcoppedge 2/18/2021 10:21 AM	80014
MyAur0ra1961 2/18/2021 12:15 PM	80011
Anonymous 2/18/2021 02:40 PM	80013
Nicheortiz 2/18/2021 06:38 PM	80011
shillelagh 2/19/2021 11:10 AM	80015
Anonymous 2/19/2021 12:39 PM	80013
Davemedic 2/19/2021 03:19 PM	80016
Anonymous 2/19/2021 03:36 PM	80012
Anonymous 2/19/2021 05:44 PM	80012
Anonymous 2/20/2021 09:58 AM	80017
Anonymous 2/20/2021 10:57 AM	80018

velma366 2/20/2021 12:12 PM	80010
Anonymous 2/20/2021 02:25 PM	80011
Anonymous 3/03/2021 05:48 PM	80016
BryonTaylor 3/03/2021 07:45 PM	80013
Anonymous 3/04/2021 07:09 AM	80014
Anonymous 3/04/2021 07:26 AM	80013
Anonymous 3/04/2021 07:48 AM	80013
Anonymous 3/04/2021 08:45 AM	80016
BobGaiser 3/04/2021 09:12 AM	80018
Anonymous 3/04/2021 12:34 PM	80015
Anonymous 3/04/2021 03:20 PM	80017
Anonymous 3/05/2021 10:45 AM	80017
Anonymous 3/05/2021 05:50 PM	80012
Anonymous 3/06/2021 02:27 PM	80013
Anonymous 3/07/2021 11:16 AM	80011

Anonymous 3/08/2021 09:36 AM	80013
Anonymous 3/08/2021 09:40 AM	80015
Anonymous 3/08/2021 09:42 AM	80018
Anonymous 3/08/2021 10:11 AM	80013
Anonymous 3/08/2021 12:56 PM	80013
Anonymous 3/08/2021 06:38 PM	80011
Anonymous 3/09/2021 07:08 AM	80016
Anonymous 3/09/2021 08:21 AM	80013
Anonymous 3/09/2021 03:44 PM	80014

Mandatory Question (38 response(s))
Question type: Number Question

APPENDIX E: MITIGATION ACTION ALTERNATIVES

Example Mitigation Actions by FEMA categories with Hazards Identified in the City of Aurora Hazard Mitigation Plan Update 2021

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Drought	Weather Extremes (hail, lightning, temps,)	Wind/ Tornado	Wildland Fires	Severe Winter Storm
PREVENTION								
Building codes and enforcement		■	■	■	■	■	■	■
Comprehensive Watershed Tax		■						
Density controls	■	■	■				■	
Design review standards		■	■	■		■	■	
Easements		■	■				■	
Environmental review standards		■	■				■	
Floodplain development regulations	■	■	■					
Hazard mapping	■	■	■				■	
Floodplain zoning	■	■	■					
Forest fire fuel reduction			■				■	
Housing/landlord codes			■	■	■			
Slide-prone area/grading/hillside development regulations							■	
Manufactured home guidelines/regulations		■			■	■		
Minimize hazardous materials waste generation			■					
Multi-Jurisdiction Cooperation within watershed	■	■		■				
Open space preservation	■	■					■	
Performance standards	■	■		■	■	■	■	■
Periodically contain/remove wastes for disposal			■					
Pesticide/herbicide management regulations			■					
Special use permits	■	■	■				■	
Stormwater management regulations		■	■					
Subdivision and development regulations	■	■	■	■		■	■	
Surge protectors and lightning protection					■			
Tree Management				■	■	■	■	■
Transfer of development rights		■					■	
Utility location			■		■	■		■

APPENDIX E: MITIGATION ACTION ALTERNATIVES

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Drought	Weather Extremes (hail, lightning, temps,)	Wind/ Tornado	Wildland Fires	Severe Winter Storm
PROPERTY PROTECTION								
Acquisition of hazard prone structures	■	■					■	
Facility inspections/reporting	■	■	■					
Construction of barriers around structures	■	■	■					
Elevation of structures	■	■						
Relocation out of hazard areas	■	■	■				■	
Structural retrofits (e.g., reinforcement, floodproofing, bracing, etc.)		■	■	■	■	■	■	■
PUBLIC EDUCATION AND AWARENESS						■		
Debris Control		■				■		
Flood Insurance	■	■						
Hazard information centers	■	■	■	■	■	■	■	■
Public education and outreach programs	■	■	■	■	■	■	■	■
Real estate disclosure	■	■	■		■		■	■
Crop Insurance				■	■			
Lightning detectors in public areas					■			
NATURAL RESOURCE PROTECTION								
Best Management Practices (BMPs)		■	■	■	■		■	
Forest and vegetation management	■	■		■	■		■	■
Hydrological Monitoring	■	■	■	■	■			
Sediment and erosion control regulations	■	■	■	■				
Stream corridor restoration		■						
Stream dumping regulations		■	■					
Urban forestry and landscape management		■		■	■		■	■
Wetlands development regulations		■	■				■	

APPENDIX E: MITIGATION ACTION ALTERNATIVES

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Drought	Weather Extremes (hail, lightning, temps,)	Wind/ Tornado	Wildland Fires	Severe Winter Storm
EMERGENCY SERVICES								
Critical facilities protection	■	■	■	■	■	■	■	■
Emergency response services	■	■	■		■	■	■	■
Facility employee safety training programs	■	■	■		■	■	■	■
Hazard threat recognition	■	■	■	■	■	■	■	■
Hazard warning systems (community sirens, NOAA weather radio)	■	■	■		■	■	■	■
Health and safety maintenance	■	■	■	■	■	■	■	■
Post-disaster mitigation	■	■	■	■	■	■	■	■
Evacuation planning	■	■	■				■	
Hazard threat recognition	■	■	■	■	■	■	■	■
STRUCTURAL PROJECTS								
Channel maintenance		■						
Dams/reservoirs (including maintenance)	■	■						
Isolate hazardous materials waste storage sties			■					
Levees and floodwalls (including maintenance)		■						
Safe room/shelter					■	■		■
Secondary containment system			■					
Site reclamation/restoration/revegetation		■	■	■				
Snow fences								■
Water supply augmentation				■	■			

References

Adams County Assessor's Office

Arapahoe County Assessor Office

Aurora Economic Development Council. https://www.auroraedc.com/.

Beaufort Wind Scale. National Oceanographic and Atmospheric Association, http://www.spc.noaa.gov/faq/tornado/beaufort.html

Center for Climate and Energy Solutions. No date. Website accessed April 2014, http://www.c2es.org/science-impacts/basics/faqs/tornadoes.

City of Aurora. www.auroragov.org.

City of Aurora. 2018. Who Is Aurora? Demographic Report. https://www.auroragov.org/cms/One.aspx?portalId=16242704&pageId=16535137.

Colorado CDLE. 2020. Colorado Department of Labor and Employment.

Colorado Department of Local Affairs. www.dola.colorado.gov

Colorado Department of Transportation.

Colorado Division of Homeland Security and Emergency Management. https://dhsem.colorado.gov/

Colorado Department of Natural Resources – Dam Safety Division. https://dwr.colorado.gov/services/dam-safety

Colorado Division of Reclamation, Mining, and Safety. https://drms.colorado.gov/

Colorado Earthquake Hazards – Colorado Earthquake Mitigation Council 2008. http://www.dola.state.co.us/dem/public_information/earthquake.htm

Colorado Geological Survey. http://geosurvey.state.co.us

Colorado Geological Survey Earthquake Report. http://www.dola.state.co.us/dem/mitigation/plan_2007/Earthquake%20Evaluation%20Report.pdf

Colorado Geological Survey Department of Natural Resources, A Guide to Swelling Soils for Colorado Homebuyers and Homeowners. (Denver, Colorado.) 1997. p 15-16.

Colorado Health Information Dataset. www.cdphe.state.co.us/cohid

Colorado Landslide Hazard Mitigation Plan (2002). http://dola.colorado.gov/dem/mitigation/plan_2007/2002 Landslide Update.pdf

Colorado Enhanced State Hazard Mitigation Plan (2018). https://mars.colorado.gov/mitigation/enhanced-state-hazard-mitigation-plan-e-shmp

Colorado Parks and Wildlife. https://cpw.state.co.us/

Colorado State Demography Office. https://demography.dola.colorado.gov/

Colorado State Forest Service – Colorado Forest Atlas. https://csfs.colostate.edu/wildfire-mitigation/colorado-forest-atlas/

Colorado State Forest Service. http:// forestry.state.co.us

Colorado Water Conservation Board. http://cwcb.state.co.us

Community Rating System. www.fema.gov/business/nfip/crs.shtm

Colorado Division of Water Resources, Office of the State Engineer. 2013. 27th Annual Report on Dam Safety. Available on-line at http://water.state.co.us/DWRIPub/DWR%20Annual%20Reports/27th_Annual_Report_on_Dam_Safety_WY10-12.pdf.

Colorado Water Conservation Board. Colorado Drought Mitigation and Response Plan (2018). https://drought.unl.edu/archive/plans/Drought/state/CO_2018.pdf

Denver Regional Council on Governments. www.drcog.org

Denver Regional Council on Governments Natural Hazard Mitigation Plan. www.drcog.org/index.cfm?page=NaturalHazardMitigation89

Directory of Colorado State Register Properties. www.coloradohistory-oahp.org/programareas/register/1503/

Disaster Declarations for States and Counties. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

Douglas County Assessor's Office

Enhanced Fujita Scale. National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/ef-scale.html

FEMA 2010. http://www.fema.gov. Website accessed 2009, 2010, 2011.

FEMA. 2001. Understanding Your Risks; Identifying Hazards and Determining your Risks. FEMA (386- 2). August 2001.

FEMA. 2002. Getting Started; Building support for Mitigation Planning; FEMA (386-1). September 2002.

FEMA. 2003. Developing the Mitigation Plan; Identifying Mitigation Actions and Implementing Strategies. FEMA (386-3). April 2003

FEMA. 2004. Using HAZUS-MH for Risk Assessment, How to Guide, FEMA (433). August 2004

FEMA. 2007. FEMA, National Flood Insurance Program, Community Rating System; CRS Coordinator's Manual FIA-15/2007 OMB No. 1660-0022

Intergovernmental Panel on Climate Change – Climate Change and Land Report. https://www.ipcc.ch/site/assets/uploads/2019/11/SRCCL-Full-Report-Compiled-191128.pdf

McKee, Thomas B, Nolan J. Doesken, John Kleist, Catherine J. Shier and William P. Stanton. 2000. A History of Drought in Colorado: Lessons learned and what lies ahead. No. 9 – Second Edition. Colorado State University.

Mile High Flood District. https://mhfd.org/

National Bridge Inventory. www.nationalbridges.com

National Centers for Environmental Information. https://www.ncdc.noaa.gov/stormevents/

National Drought Mitigation Center. www.drought.unl.edu

National Environmental Policy Act. www.epa.gov/compliance/nepa

National Fire Danger Rating System. www.wrh.noaa.gov/sew/fire/olm/nfdrs.html

National Flood Insurance Program. www.fema.gov/business/nfip

National Institute of Building Science Multi-Hazard Mitigation Council, 2011

National Lightning Safety Institute. www.lightningsafety.com

National Oceanic and Atmospheric Agency. www.noaa.gov

National Performance of Dams Program. http://npdp.stanford.edu

National Register of Historic Places. www.nps.gov/history/nr

National Weather Association (NWA) Online Glossary. http://www.weather.gov/glossary/

National Weather Service. www.nws.noaa.gov

National Weather Service Pueblo Lightning Page. http://www.crh.noaa.gov/pub/?n=ltg.php

Rocky Mountain Insurance Information Association. www.rmiaa.org

United States Army Corps of Engineers. www.usace.army.mil

United States Bureau of Labor Statistics. www.bls.gov/

U.S. Centers for Disease Control and Prevention. Social Vulnerability Index. https://svi.cdc.gov.

U.S. Census. 2019. ACS 2015-2019 5-year data estimates. https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2019/

United States Department of Agriculture. www.usda.gov

United States Department of Health and Human Services. https://empowermap.hhs.gov/

United States Drought Monitor. https://droughtmonitor.unl.edu/

United States Fish and Wildlife Service. www.fws.gov

U.S. Fish and Wildlife Service Mountain-Prairie Region. http://www.fws.gov/mountain-prairie/co.html

United States Forest Service. www.usfs.gov

United States Geological Survey. www.usgs.gov

U.S. Global Change Research Program. Fourth National Climate Assessment. https://nca2018.globalchange.gov/.

U.S. Seasonal Drought Outlook (housed by the Climate Prediction Center). www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html

University of Colorado at Boulder ATOC Weather Lab. http://foehn.colorado.edu/weather

University of Nebraska Lincoln – National Drought Mitigation Center. https://droughtreporter.unl.edu/map/

USGS Earthquake Hazards Program http://earthquake.usgs.gov/regional/states/colorado/hazards.php

Western Regional Climate Center. https://wrcc.dri.edu/.

Xcel Energy. www.xcelenergy.com

APPENDIX G: ACRONYMS AND DEFINITIONS

ACRONYMS

%g	Percentage of gravity
°C	Degrees Celsius
°F	Degrees Fahrenheit
ACS	American Community Survey
AHMAC	All-Hazard Mitigation Advisory Committee
ASC	Active Stream Corridor
BCA	Benefit-Cost Analysis
BCC	Board of County Commissioners
BCEGS	Building Code Effectiveness Grading Schedule
BLM	Bureau of Land Management
BRIC	Building Resilient Infrastructure and Communities
CAIC	Colorado Avalanche Information Center
CDC	Centers for Disease Control and Prevention
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health & Environment
CEMP	Aurora Comprehensive Emergency Management Plan
CERC	Crisis and Emergency Risk Communication
CERT	Community Emergency Response Team
CFR	Code of Federal Regulations
CGS	Colorado Geological Survey
CIP	Capital Improvement Plan
CIPP	Critical Infrastructure Protection Planning
CIS	Community Information System
CISA	Cyber & Infrastructure Security Agency
COOP	Continuity of Operations Plan
COVID-19	Coronavirus Disease 2019
COWRAP	Colorado Wildfire Risk Assessment Portal
CPA	Community Planning Areas
CPG	Comprehensive Preparedness Guide
CRS	Community Rating System
CSAS	Center for Snow and Avalanche Studies
CSFS	Colorado State Forest Service

CWCB	Colorado Water Conservation Board
CWPP	Community Wildfire Protection Plan
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Maps
DHS	U.S. Department of Homeland Security
DHSEM	Division of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act
DMV	Department of Motor Vehicles
DNR	Colorado Department of Natural Resources
DOLA	Colorado Department of Local Affairs
DOT	U.S. Department of Transportation
DR	(Major) Disaster Declaration
DRCOG	Denver Regional Council of Governments
DSB	Colorado Dam Safety Branch
DWR	Colorado Department of Water Resources
EAP	Emergency Action Plan
ECOS	Environmental Conservation Online System
EDC	Aurora Economic Development Council
EHD	Environmental Health Department
EF	Enhanced Fujita
EM	Emergency Declarations
EMPG	Emergency Management Performance Grant
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
ERC	Energy Release Component
ESA	Endangered Species Act
FACE	Future Avoided Cost Explorer
FBI	Federal Bureau of Investigation
FBFM	Flood Boundary and Floodway Map
FEMA	Federal Emergency Management Agency
FHZ	Fluvial Hazard Zone
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flooding Mitigation Assistance
FM	Fire Management Declaration

FPD	Fire Protection District
GIS	Geographic Information System
HAZMAT	Hazardous Materials
Hazus-MH	Hazards, United States-Multi Hazard
HIFLD	Homeland Infrastructure Foundation-Level Data
HHPD	High Hazard Potential Dam
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HMPC	Hazard Mitigation Planning Committee
HIRA	Hazard Identification and Risk Assessment
HUD	Housing and Urban Development
HPL	High Potential Loss
IBC	International Building Code
ICC	International Code Council
IPP	Integrated Preparedness Plan
ISO	Insurance Services Office
JCOS	Jefferson County Open Space
LAL	Lightning Activity Level
LEPC	Local Emergency Planning Committee
LHMP	Local Hazard Mitigation Plan
MGWRS	USGS Mountain Ground Water Resources Study
MHFD	Mile High Flood District
MMI	Modified Mercalli Scale
Mph	Miles per Hour
NASA	National Aeronautics and Space Administration
NCEI	National Centers for Environmental Information
NDMC	National Drought Mitigation Center
NFDRS	National Fire Danger Rating System
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NEHRP	National Earthquake Hazard Reduction Program
NEPA	National Environmental Policy Act
NID	National Inventory of Dams
NIMS	National Incident Management System

NOAA	National Oceanic and Atmospheric Administration
NRC	U.S. Coast Guard's National Response Center
NRCS	Natural Resource Conservation Service
NRP	Natural Resource Protection
NWS	National Weather Service
OEM	Office of Emergency Management
OIT	Office of Information Technology (State of Colorado)
ORM	Colorado Office of Risk Management
OSHA	Occupational Safety and Health Administration
PDI	Palmer Drought Index
PDM	Pre-Disaster Mitigation
PDS	Palmer Drought Severity Index
PGA	Peak Ground Acceleration
PIF	Pandemic Intervals Framework
PMRS	Precipitation Runoff Modeling System
PPE	Personal Protective Equipment
RMIIA	Rocky Mountain Insurance Information Association
RMP	Risk Management Plan
SBA	Small Business Administration
SCADA	Supervisory Control and Data Acquisition
SCENIC	Southwest Climate and Environmental Information Collaborative
SFHA	Special Flood Hazard Area
SP	Standard Precipitation Index
SRL	Severe Repetitive Loss Properties
TCHD	Tri-County Health Department
THIRA	Threat and Hazard Identification and Risk Assessment
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFW	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WHO	World Health Organization
WRCC	Western Regional Climate Center
WUI	Wildland Urban Interface

DEFINITIONS

100-Year Flood: The term "100-year flood" can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1% chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1% annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program (NFIP).

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1% chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the NFIP are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit/cost analysis of proposed mitigation measures, benefits are limited to specific, measurable risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water reactive materials.
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events.
- Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.
- Government facilities.

Dam: Any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris Flow: Dense mixtures of water-saturated debris that move down-valley; looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

Debris Slide: Debris slides consist of unconsolidated rock or soil that has moved rapidly down slope. They occur on slopes greater than 65%.

Disaster Mitigation Act of 2000 (DMA): The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) were established.

Drainage Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause

of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Fire Behavior: Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency: Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's FIRM. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A FIRM identifies most, but not necessarily all, of a community's floodplain as the SFHA.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1% chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita Scale of Tornado Intensity: Tornado wind speeds are sometimes estimated on the basis of wind speed and damage sustained using the Fujita Scale. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour [mph]) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people or cause property damage.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (HAZUS-MH) Loss Estimation Program: HAZUS-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The HAZUS-MH software program assesses risk in a quantitative manner to estimate damages and losses associated with natural hazards. HAZUS-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. HAZUS-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide: Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed by lightning each year (see http://www.fema.gov/hazard/thunderstorms/thunder.shtm).

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Initiatives (or Mitigation Actions): Mitigation initiatives are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00; or
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Sinkhole: A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Special Flood Hazard Area: The base floodplain delineated on a FIRM. The SFHA is mapped as a Zone A in riverine situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33%.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire: Wildfire refers to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

APPENDIX H: EXAMPLE PROGRESS MEETING AGENDA AND REPORT

City of Aurora Hazard Mitigation Plan
Annual Progress Meeting Agenda

1. **Discussion on hazard events and impacts that occurred during the performance period**
2. **Review of progress on mitigation action implementation**
3. **Discussion on success stories**
4. **Recommendations for new actions/projects**
5. **Review of funding options and grant opportunities**
6. **Review of changes in plan maintenance or implementation**
7. **Review of continuing public involvement**

APPENDIX H: EXAMPLE PROGRESS MEETING AGENDA AND REPORT

City of Aurora Hazard Mitigation Plan
Annual Progress Report Template

Reporting Period:

Background: The City of Aurora developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the City of Aurora organized resources, assessed risks from natural hazards within the county, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, Aurora maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed online at:

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2021, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before _____, 2026. The *City of Aurora Hazard Mitigation Plan* has targeted 51 hazard mitigation initiatives to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

__ out of __ initiatives (__%) reported ongoing action toward completion.

__ out of __ initiatives (__%) were reported as being complete.

__ out of __ initiatives (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the *City of Aurora Hazard Mitigation Plan*. The objective is to ensure that there is a continuing and responsive planning process that will keep the hazard mitigation plan dynamic and responsive to the needs and capabilities of the partner jurisdictions. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area
- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement

The Hazard Mitigation Planning Committee: The Hazard Mitigation Planning Committee (HMPC), made up of planning partners and stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on _____, 202_. It was determined through the plan's development process that the HMPC would remain in service to oversee maintenance of the plan. At a minimum, the HMPC will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the HMPC membership present at the meeting is as indicated in Table 1.

TABLE 1. HMPC COMMITTEE MEMBERS PRESENT		
Name	**Title**	**Department/Agency**

Natural Hazard Events within the Planning Area: During the reporting period, there were _____ natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

_____

_____

_____

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each initiative. Reviewers of this report should refer to the *City of Aurora Hazard Mitigation Plan* Table 5-2 for more detailed descriptions of each initiative and the prioritization process.

Address the following in the "status" column of the following table:

Was any element of the initiative carried out during the reporting period?

If no action was completed, why?

Is the timeline for implementation for the initiative still appropriate?

If the initiative was completed, does it need to be changed or removed from the action plan?

TABLE 2.
ACTION PLAN MATRIX

Action No.	Title	Action Taken? (Yes or No)	Timeline	Priority	Status	Status (√, O, X)
1	**Expand Emergency Assistance to High Risk Individuals and Populations.** Investigate opportunities to expand emergency services to high risk individuals, such as the homeless, elderly, disabled and oxygen- dependent people.					
2	**Develop and Enhance Early Warning Response.** Develop new and enhance existing early warning response systems and plans.					
3	**Educate Citizens on Hazard Notification Systems.** Educate citizens on the Everbridge Reverse Notification System and the outdoor warning sirens used to warn residents and visitors of natural disasters.					
4	**Partner with Existing Programs to Enhance Multi- lingual and Culturally Appropriate Messaging for Hazard Mitigation Outreach Improvements.** Partner with existing immigrant and refugee programs for multi-lingual and culturally appropriate messaging and work with city departments and commissions to translate applicable material.					
5	**Distribute Hazard Information via Social Media, Traditional Media, and Existing Interfaces**. Utilize social media, traditional media, and existing interfaces with the public (libraries, recreation facilities, city events, etc.) to distribute appropriate and timely seasonal hazard information.					
6	**Meet with Community Groups to Identify High Risk Areas.** Meet with local community groups on a yearly basis over the next five years to identify high risk areas.					
7	**Engage Outside Organizations in Disaster Exercises.** Engage other public agencies (local, county, state, and federal), community organization and citizens in disaster response planning and exercises.					

TABLE 2. ACTION PLAN MATRIX						
Action No.	**Title**	**Action Taken? (Yes or No)**	**Timeline**	**Priority**	**Status**	**Status (√, O, X)**
8	**Create MOUs with Partners for Resources.** Create MOUs with applicable partners for assistance with obtaining potable water, food, and clothing during and after an incident.					
9	**Meet with Health and Medical Facilities.** Schedule meetings with health and medical facilities identified as critical infrastructure in order to coordinate and/or de-conflict planning efforts.					
10	**Meet with Businesses Identified as Critical Infrastructure.** Schedule meetings with large private businesses identified as critical infrastructure in order to coordinate and/or de-conflict planning efforts.					
11	**Meet with Local Jurisdictions Who Own Critical Infrastructure.** Schedule meetings with local jurisdictions who own critical infrastructure facilities within the City of Aurora in order to coordinate and/or de-conflict planning efforts.					
12	**Develop Robust LEPC.** Continue to develop a robust LEPC including public and private partners to better identify and plan for potential complicating incidents that might occur during a natural disaster.					
13	**Investigate and Create a System to Inform Building and Zoning Process**. Investigate and create a system with the city planning and zoning department that includes utilizing hazard maps and GIS to better inform the building and zoning process. System must integrate land, water use, risks, and hazards.					
14	**Coordinate with Citizens and Partners on Land and Community Development Projects.** Coordinate with citizens and appropriate external partners on land and community development projects.					
15	**Coordinate with the Tri-County Health Department**. Coordinate with the Tri-County					

TABLE 2. ACTION PLAN MATRIX						
Action No.	**Title**	**Action Taken? (Yes or No)**	**Timeline**	**Priority**	**Status**	**Status (√, O, X)**
	Health Department on mitigation and response efforts related to public health threats.					
16	**Encourage Construction Techniques that Minimize Risk from Hazards.** Encourage the use of building materials and construction techniques that are more resilient to natural disasters and can minimize the risk to public property.					
17	**Create an Inventory of Impacts and Potential Mitigation Projects.** Use data collected from previous and future natural hazard events to create an inventory of impacts and potential mitigation projects.					
18	**Comprehensive List of Critical Infrastructure and Corresponding Mitigation Actions.** Develop an inventory of the city's critical infrastructure and create mitigation actions to protect them from the hazards they are at risk to.					
19	**Analyze the Safety of Existing High Risk Dams and Levees, Prioritize and Implement Projects to Strengthen Them.** Analyze the safety of existing high risk dams and levees. The Sand Creek Levee must be recertified by 2020, efforts related to the recertification will begin in 2017. Identify, prioritize, and implement actions to strengthen high risk dams and levees to protect the public.					
20	**Easterly Creek Outfall Systems Improvements.** Acquire land for, design, and construct proposed detention ponds (Chesapeake Townhomes, E. 1st Ave, and Havana Park). Design and construct proposed storm sewer improvements and porous landscape detention in Del Mar Parkway medians.					
21	**Create and Implement Additional Emergency Alert and Evacuation Plans for Dam and Levee Failures.** Create and implement additional emergency alert and evacuation plans in areas vulnerable to dam and levee failures.					

TABLE 2. ACTION PLAN MATRIX						
Action No.	**Title**	**Action Taken? (Yes or No)**	**Timeline**	**Priority**	**Status**	**Status (√, O, X)**
22	**First Creek Ponds 8154 & 8700.** Acquire land for, design, and construct detention ponds within the City of Aurora annexed property (Picadilly Road near E 48th Avenue to areas south of I-70 up to E Alameda Avenue and Monaghan Road). Project implementation to be determined by rate of development.					
23	**Fitzsimons Peoria Drainage Improvements.** City of Aurora will reevaluate alternatives and continue to seek funding opportunities to execute the project. If and when funding is acquired and an alternative is selected, the project would be executed through Aurora Water Capital Projects.					
24	**Peninsula Townhomes (East and West Tollgate Creeks MDP Reach EG1 Improvements).** Alternative 3 addresses severe incising and removes properties from the floodplain by providing a naturalized channel. Preserve existing stream corridor and naturalized channelization improvements with grade control structures.					
25	**Create Data Collection System to Identify, Assess, and Prioritize Hazard Mitigation Actions.** Develop a system for documenting information collected and observed during and after a natural hazard event, including photographs, witness accounts, information from emergency responders, and flood debris lines, and impacts to people and property. Identify hazard mitigation facilities that performed well during past hazardous events and according to which shortfalls need to be addressed first, prioritize these facilities in future planning and development related mitigation actions.					
26	**Sand Creek Right Bank Tributaries Outfall Systems Improvements.** This planning study is underway in the Alternatives Analysis Phase. The alternatives will be considered and a selected					

TABLE 2. ACTION PLAN MATRIX						
Action No.	**Title**	**Action Taken? (Yes or No)**	**Timeline**	**Priority**	**Status**	**Status (√, O, X)**
	alternative will be taken to conceptual design. Elements of the conceptual design will be prioritized and implemented according to the Aurora Stormwater Master Plan initiative.					
27	**Second Creek Pond S-215.** Acquire land for, design, and construct proposed detention pond.					
28	**Second Creek Pond S-219.** Acquire land for, design, and construct proposed detention pond.					
29	**Stormwater conveyance system asset assessment.** The assessment program for CMP pipe has been completed. The first phase of the RCP pipe and manhole assessment started in 2015. Several additional phases of RCP assessment will be required to complete an assessment of all RCP pipe.					
30	**MHFD Planning Study Requests and Rehabilitate Urban Engineered Waterways.** The stormwater drainage basins that Aurora is most interested in studying are submitted to MHFD on an annual basis for a five-year planning horizon. MHFD prioritizes studies considering other jurisdictions' requests and implements approximately 1-2 plans involving Aurora annually. Engineered channels will be rehabilitated to increase flood storage and erosion control to reduce damage to property and habitat.					
31	**Ukraine and Easter Intersection Improvements.** Design effort to identify corrective action and remain in compliance with approved drainage reports.					
32	**Westerly Creek Master Drainageway Improvements.** Acquire land, design, and construct proposed detention ponds (Peoria Hills, Baseball Pond, Canterbury Park, Mississippi, and Cemetery Pond). Design and construct proposed storm sewer improvements (numerous).					

TABLE 2. ACTION PLAN MATRIX						
Action No.	**Title**	**Action Taken? (Yes or No)**	**Timeline**	**Priority**	**Status**	**Status (√, O, X)**
33	**Include HMP Components in City Plans and Codes, Including Updated Floodplain Maps and Overlays.** Work with the consultant team for Aurora's 2016 Comprehensive Plan Update to ensure that hazard mitigation topics are included in the scope for the public outreach process and plan development for all relevant plan elements. Obtain updated FEMA floodplain map (updated version typically located on .side). Identify, classify, and map critical facilities and vulnerable populations; and develop map in ArcGIS. Floodplain overlay will appear in public draft of zoning code update. The content of Chapter 70 will be incorporated in 146-2-8 and the flood related definitions incorporated into 146-6.					
34	**Develop Plan for Animal Shelter Evacuation.** Develop and test animal shelter evacuation, temporary shelter, and shelter in place plans.					
35	**Utilize Capabilities to Supplement Alert Systems for Dam and Levee Failures.** Utilize prediction and forecasting capabilities to supplement the alert system for areas vulnerable to dam and levee failures.					
36	**Distribute Companion Animal Disaster Preparedness Brochures.** Distribute companion animal disaster preparedness brochures with every new animal adoption.					
37	**Develop Community Animal Response Team.** Develop a local Community Animal Response Team and educate citizens on how they can participate.					
38	**Determine Accurate Companion Animal Population.** Increase licensing compliance and conduct door-to-door canvassing in order to determine an accurate companion animal population.					

TABLE 2. ACTION PLAN MATRIX						
Action No.	**Title**	**Action Taken? (Yes or No)**	**Timeline**	**Priority**	**Status**	**Status (√, O, X)**
39	**Continue Participation in the NCR Animal Emergency Committee.** Continue to participate in the NCR Animal Emergency Committee.					
40	**Continue to Participate in MDSA and CFAWA.** Continue to participate in MDSA and the CFAWA.					
41	**Deploy Animal Shelter Employees.** Increase response capacity by allowing Animal Protection Officers to deploy with partner agencies when needed.					
42	**Evaluate the need for and install new rainfall and stream flow monitoring gauges.** Identify locations where new rainfall and stream gauges are required and coordinate installation activities with MHFD.					
43	**Drought Action Team.** This Team of representatives from Aurora Water conservation, engineering, water resources, finance and executive staff, will meet as needed to implement the City's Water Management Plan; review history of actions taken during drought seasons; review agreements in place or needed; and coordinate with outlying utilities to start putting together a utility wide response/action plan to ensure communications are equal for all customers.					
44	**Develop a web-based living Hazard Mitigation Plan.** Develop a web-based living Hazard Mitigation Plan to create a more interactive and visually appealing understanding of Hazard Identification, Risk and Mitigation. And to visually understand mitigation investments and actions.					
45	**Public Information and Warning Evaluation.** Aurora has a variety of capabilities to provide public information and warning. However, having so many tools can make it challenging to keep up with them all and ensure they are working properly. Tornado sirens require a large upgrade and new sirens are not being installed in new development					

TABLE 2. ACTION PLAN MATRIX						
Action No.	**Title**	**Action Taken? (Yes or No)**	**Timeline**	**Priority**	**Status**	**Status (√, O, X)**
	areas. CodeRed can be used for public warning but consistent messaging is still a challenge with that particular system. Templated messaging has been created with a plan but is not often used. IPAWS will soon be another tool and also will require awareness and training. Public Information and Warning can greatly reduce risk for a wide variety of population groups. Messaging does need to be coordinated, prompt, reliable and actionable to the whole community to reduce this risk.					
46	**Flood Warning System Assessment Project.** An assessment to determine current flood warning detection systems in the city and if there is a need to invest in this capability.					
47	**Alternative Paving Materials to accelerate snow melt.** Conduct a study to explore the use of alternative paving materials to accelerate the snowmelt on streets and sidewalks to reduce the need for snow plowing. Study will investigate various types of permeable materials, expected costs, ease of installation, material performance, absorption rates, and long-term maintenance requirements.					
48	**Information Tracking.** Follow formalized data driven ESRI Hubsite for natural hazard-based incidents to identify repetitive loss locations or hazards. Use this information to inform the creation and implementation of future mitigation actions.					
49	**Critical infrastructure mapping.** Map critical infrastructure to better understand the interrelationships among components of infrastructure and support the Risk Assessment section of the HMP.					
50	**Aurora Community Wildfire Protection Plan.** Reduce Wildland Urban Interface (WUI) and/or fast-moving Brush/Light Fuels Fire issues in City of Aurora. Aurora City has significant areas of					

TABLE 2.
ACTION PLAN MATRIX

Action No.	Title	Action Taken? (Yes or No)	Timeline	Priority	Status	Status (√, O, X)
	WUI that if a severe fire event occurred then a potential mass casualty incident could occur as well as millions of dollars in residential structures and infrastructure could be damaged and/or destroyed. Mitigating the hazards of light fuels near structures would significantly limit the severity of WUI impact. Lives lost and/or severe injury would be reduced as well as millions of dollars saved.					
51	**Aurora Fluvial Mitigation Projects and Planning.** Aurora recognizes fluvial hazards and desires to assess the hazards of erosion, sediment, deposition, and other dynamic river processes, by identifying them, mapping and planning for these natural hazards. Aurora has begun taken the proper steps toward identifying this need for mitigation with a recent study of the Sand Creek corridor and outlining recommended mitigation strategies.					

Completion status legend:
✓= Project Completed
O = Action ongoing toward completion
X = No progress at this time

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Planning Committee, the following recommendations will be noted for future updates or revisions to the plan:

_____

_____

_____

_____

_____

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the governing boards of all planning partners and to local media outlets and the report is posted on the City of Aurora Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*

Insert Contact Info Here

City of Aurora
Hazard Mitigation Plan Update
2021

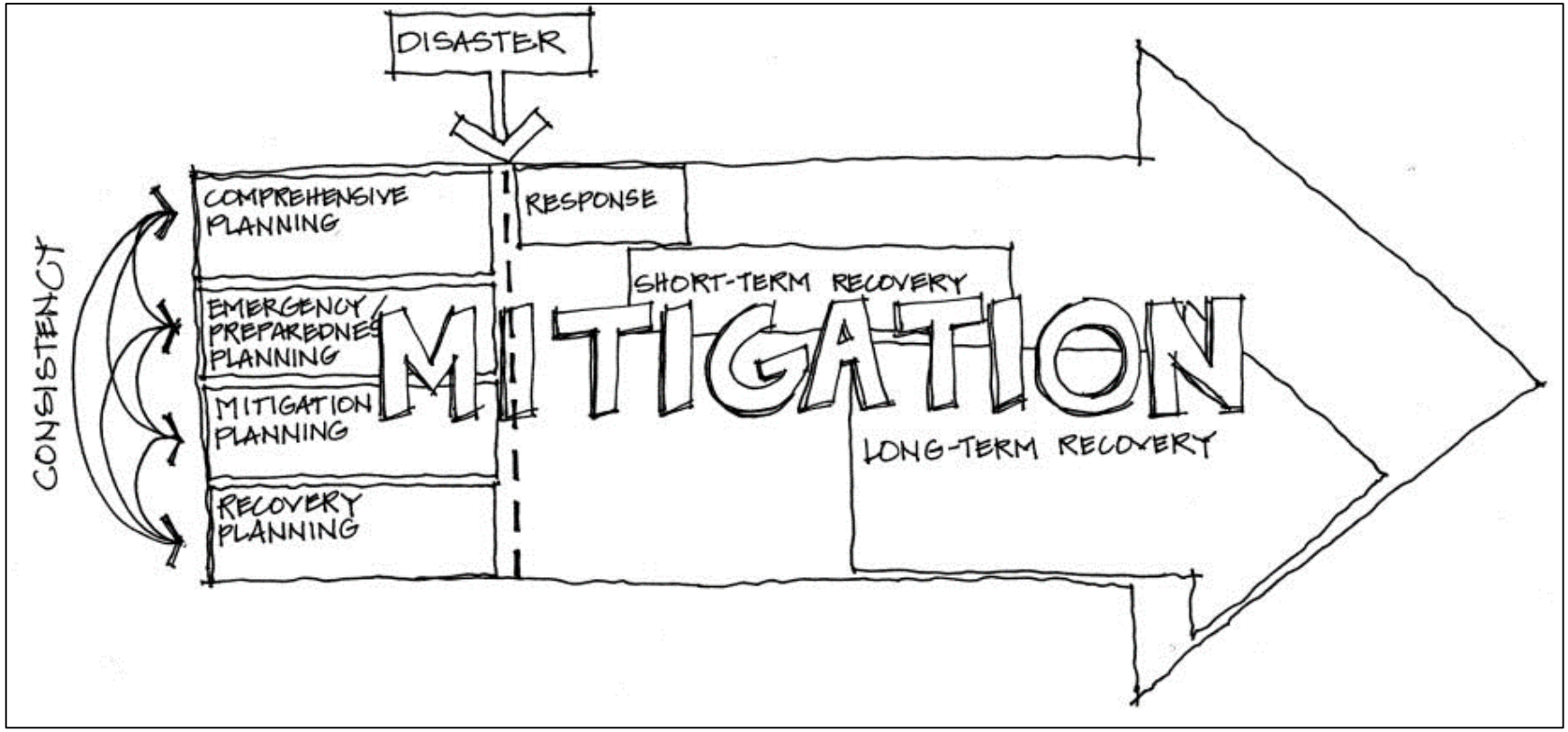
Matt Chapman
Office of Emergency Management

Hazard Mitigation Plan Update

Purpose of the Plan

- Identifies and provides an analysis of the natural hazards that may impact Aurora.
- Required for eligibility to apply for mitigation grant programs.
- City Staff collaboration across departments and multiple plans to identify and prioritize mitigation projects.
- Compliance with local, state and federal requirements.
  - Laws and Authorities
  - Funding

Hazard Mitigation Plan Update



Source: Masterson et al, 2014; Modified from Schwab, 1998; Lindell, Prater, and Perry, 2007

Hazard Mitigation Plan Update

Hazard Mitigation Assistance (HMA) Grants

- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA) $160 Million
- Building Resilient Infrastructure and Communities (BRIC) $1 Billion

Also:

- Rehabilitation of High Hazard Potential Dams (HHPD) grant program.

Hazard Mitigation Plan Update

Community Rating System

- Voluntary program
- Recognizes activities above and beyond the minimum requirements of the NFIP
- Provides discounts on flood insurance premiums

Goals:

- Reduce flood damage to insurable property,
- Strengthen and support the insurance aspects of the NFIP
- Encourage a comprehensive approach to floodplain management

CRS Credits for Activity 510 Floodplain Management Planning can be achieved in the development or update of LHMP

City of Aurora is currently Class 7 (15% discount)

Hazard Mitigation Plan Update

Colorado Project Awards through FEMA Hazard Mitigation Assistance Program					
	Wildfire Mitigation/Fuels Reduction	**Flood Reduction/ Drainage Improvements/ Property Acquisition**	**Landslide/ Slope Stabilization/ Property Acquisition**	**Planning Grants (including Advance Assistance)**	**Other Projects: Generators, 5% Projects, Appraisals, Preparedness, Warning**
Obligated Projects	23	34	6	50	32
FEMA Grant Fund	HMGP, PDM	HMGP, PDM, FMA	HMGP, PDM	HMGP, PDM, FMA	HMGP
Project Costs	$12,470,757.66	$116,361,804.61	$15,292,225.61	$3,979,303.15	$4,265,228.01
Total FEMA Funding and Local Match (2011-Present) = $152,369,319.04 (Total Projects: 145)					
Each project must be linked to the HMP's Goals & Objectives					
2018 Pending Awards		**1 $1,100,000.00**			

Hazard Mitigation Plan Update

Every dollar spent on mitigation saves three to six dollars in disaster response and recovery costs!

Hazard Mitigation Plan Update

History and Timeline of the Plan

- 2005 Denver Regional Council of Governments Plan
- 2014 Aurora recommended to create an individual plan
- 2016 First City of Aurora Hazard Mitigation Plan adopted
- 2021 Revision and adoption of updated Hazard Mitigation Plan

Hazard Mitigation Plan Update

Internal City Planning Integration

- Comprehensive Plan
- Zoning Ordinance
- Growth Management
- Floodplain, Stormwater, Wildfire Ordinance
- Building Code
- Erosion and Sediment Control
- Site Plan Reviews
- Capital Improvement Plan
- Economic Development Plan
- Transportation Plans
- Emergency Operations Plan
- Local Energy Assurance Plan
- Flood Insurance and Engineering Studies
- Multiple State and County Plans

Hazard Mitigation Plan Update

Coordination With Other Stakeholders

- State, Federal, Regional, Local Businesses
- CDOT
- DIA
- DRCOG
- RTD
- DOLA
- CO Geological Survey
- Colorado Water Conservation Board
- FEMA Region VIII
- Adams, Arapahoe, Douglas and Denver

Hazard Mitigation Plan Update

10 Step Planning Process

1) Organize the Planning Effort
2) Involve the Public
3) Coordinate with Other Departments and Agencies
4) Identify the Hazards
5) Assess the Risks
6) Set Goals
7) Review Possible Activities
8) Draft an Action Plan
9) Adopt the Plan
10) Implement, Evaluate, and Revise the Plan

Hazard Mitigation Plan Update

Steps to Approval:

- Internal review
- Public review
- State Division of Homeland Security and Emergency Management (DHSEM) review
- FEMA review
- Formal adoption
- Final FEMA approval

Questions?

RESOLUTION NO. R2021- ____

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF AURORA, COLORADO, ADOPTING THE 2021 CITY OF AURORA HAZARD MITIGATION PLAN

WHEREAS, the City provides emergency services to the citizens of the City of Aurora, Colorado, including police and fire emergency response; and

WHEREAS, the City Council desires to ensure that the basic government functions of maintaining the public peace, health, and safety are provided during any disaster that may occur within the City; and

WHEREAS, the Office of Emergency Management is responsible for coordinating disaster planning and ensuring the readiness and use of all available resources during a disaster within the City; and

WHEREAS, in 2016, the City of Aurora Hazard Mitigation Plan was developed to focus on the goals and objectives and the natural hazards pertaining only to the City of Aurora; and

WHEREAS, the 2021 City of Aurora Hazard Mitigation Plan (HMP) is a comprehensive review and update of each section of the 2016 HMP and includes an assessment of the progress in evaluating, monitoring, and implementing the mitigation strategy outlined in the 2016 HMP; and

WHEREAS, the Federal Emergency Management Agency (FEMA) requires that hazard mitigation plans be updated every five years for the jurisdiction to be eligible for federal mitigation assistance.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF AURORA, COLORADO, THAT:

Section 1. The City Council of the City of Aurora, Colorado hereby adopts the 2021 City of Aurora Hazard Mitigation Plan.

Section 2. All resolutions or parts of resolutions of the City in conflict herewith are hereby rescinded.

RESOLVED AND PASSED this _____ day of _____. 2021.

_____
MIKE COFFMAN, Mayor

ATTEST:

_____
KADEE RODRIGUEZ, City Clerk

APPROVED AS TO FORM:

_____
ANGELA L. GARCIA, Senior Assistant City Attorney

CITY OF AURORA
Council Agenda Commentary

Item Title: Fleet Replacement Schedule
Item Initiator: Deputy Chief Rodney Weber, Aurora Fire Rescue
Staff Source/Legal Source: Deputy Chief Rodney Weber / Angela Garcia, Senior Assistant City Attorney
Outside Speaker: N/A
Council Goal: 2012: 1.0--Assure a safe community for people

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

.

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☐ Approve Item and Move Forward to Study Session

☐ Approve Item as proposed at Study Session

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☒ Information Only

☐ Approve Item with Waiver of Reconsideration
Reason for waiver is described in the Item Details field.

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: Public Safety, Courts & Civil Service

Policy Committee Date: 11/9/2021

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval

☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation

☐ Recommendation Report Attached

☐ Minutes Attached

☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

N/A

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

Fire Apparatus Replacement Scheduled discussion. Discuss old replacement schedule to new replacement schedule. Provide Engine, Ladder, and Specialty Unit statistics.

QUESTIONS FOR COUNCIL

N/A

LEGAL COMMENTS

This item is informational only. There is no formal council action necessary.
The City Manager shall be responsible to the Council for the proper administration of all affairs of the city placed in his charge and, to that end, shall have the power and duty to make written or verbal reports at any time concerning the affairs of the City. (City Charter, Art. 7-4(e)) (Garcia)

PUBLIC FINANCIAL IMPACT

☐ YES ☒ NO

If yes, explain: N/A

PRIVATE FISCAL IMPACT

☒ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A

AFR FLEET REPLACEMENT SCHEDULE

HISTORY

- In 2017 AFR was struggling to keep the minimum amount of apparatus available for use.
- System that assigned points to a vehicle based upon mileage, age, and cost of use. Once a vehicle met a certain amount of points (15), it was replaced.
- The replacement process in use during created many challenges
  - Poor design standards
    - No measures in place to objectively evaluate performance
    - No standardization
    - Antiquated Design/Build process
  - Aged Apparatus
    - Noncompliance with industry accepted standards
    - Equipment had significantly surpassed their useful life
    - Lack of modern safety and operational features

BACKGROUND

- Poor Maintenance Standards
  - Inadequate preventative maintenance schedules/standards
  - Minimum amount of training
  - Long lead times for parts and repairs
- No Collaboration with Stakeholders
  - End user had little input
  - No accountability with vendors
  - Lack of oversight for the process
- This replacement process led to excessive repair costs paired with budget overruns, excessive out of service times, and an overall reduction to AFR's service delivery model to the community
- In 2018, AFR, City Management, Finance, and Fleet Maintenance collaborated to create a new process for replacement.

AREAS OF FOCUS

- A fiscally responsible, defensible framework that allows the City of Aurora to have a standardized approach to developing specifications and subsequently purchasing apparatus
  - Adherence to common industry accepted standards (NFPA, EVT, etc.)
  - A standardized prototype/specification for fire apparatus
  - Performance based standards for evaluating the fire apparatus's performance and features
  - Adherence with deadlines (ACLC funding, letter of intent, prebuild, final sign off, etc…)
  - Ensure all legal/contractual/procurement language protects the City
  - Modernize the fleet
  - Increase operator/occupant safety and reduce injuries and collisions
  - Reduce overall operating costs

PROCESS IMPROVEMENT HIGHLIGHTS

- Replaced the point system with a time-based system
  - Engines and Ladders replaced at 8 years
  - Specialty units are replaced at 10 years
  - Consistent, data driven approach, 2 Engines and 1 Ladder or Specialty Unit (rotated every other year) replaced a year
- Collaboration of stakeholders
  - Formation of several applicable committees involving all stakeholders
  - Enhancement of the role of the Fleet Liaison
  - Participation of key stakeholders into all aspects of the process
- Apparatus assignment rotation
  - High volume stations will receive newer apparatus and their apparatus will be rotated to lower volume stations
  - Apparatus will reach reserve status while they still have operational life
- Updated maintenance standards
  - New, more aggressive preventative maintenance schedule
  - Increased continuing education and training for all stakeholders
  - Performance based measures enacted to evaluate all aspects of the

PROGRESS REPORT

- Age of apparatus is decreasing
  - Front line engines reduced 20.5%, average age 9.7 years, Goal: approx. 4-5 years
  - Front line ladders reduced 24.4%, average age is 10.88 years, Goal: approx. 4-5 years
  - Average age of reserve apparatus is still approximately 19 years, This will improve as the replacement schedule achieves full implementation
- Operational costs are decreasing, Operational efficiencies are increasing
  - Newer apparatus cost less to maintain
    - Average cost to repair a front line Engine has been reduced 32% since 2018
    - Average cost to repair a front line Ladder has been reduced 56% since 2018
  - Better design process equates to an apparatus that can consistently perform in AFR's service delivery model
  - Standardization allows for more focused and attainable training, better parts inventory management, ease of operation, and timely appropriate repair of apparatus
  - Aggressive preventative maintenance addresses problems earlier and in a less costly manner
  - Less down time equates to an increased overall unit reliability
  - Collisions and injuries related to the apparatus are decreasing

OUTLOOK

- Time
  - 3-5 more years to fully realize all of the benefits
    - Almost all of the original apparatus will have been replaced
    - Robust fully equipped reserve apparatus
  - Enough empirical data will have been collected to responsibly implement changes
    - Collision review board
    - Apparatus design and equipment committees
    - Pricing/negotiation strategies on new purchases
    - Risk Management (NFPA compliancy, EVT tech, etc…)
  - Increased reliability and lower cost of operation
- Needs
  - Commitment to remain engaged in the process
    - Continued funding
    - Built in escalator to account for inflation and price increases year to year
    - Development of a fiscally responsible metric to increase the number of units purchased as the Fleet grows
    - Pricing and negotiations strategies
    - Ensuring the City of Aurora is protected through proper language in contracts
    - Maintain accountability of the vendors

QUESTIONS?

CITY OF AURORA
Council Agenda Commentary

Item Title: 2021 Public Safety, Courts and Civil Service Agenda Item Review
Item Initiator: Danelle Carrel, Committee Liaison
Staff Source/Legal Source: Jason Batchelor, Deputy City Manager
Outside Speaker: N/A
Council Goal: 2012: 1.0--Assure a safe community for people

COUNCIL MEETING DATES:

Study Session: N/A

Regular Meeting: N/A

ITEM DETAILS:

- Agenda long title
- Waiver of reconsideration requested, and if so, why
- Sponsor name
- Staff source name and title / Legal source name and title
- Outside speaker name and organization
- Estimated Presentation/discussion time

Information Only

ACTIONS(S) PROPOSED ***(Check all appropriate actions)***

☐ Approve Item and Move Forward to Study Session

☐ Approve Item as proposed at Study Session

☐ Approve Item and Move Forward to Regular Meeting

☐ Approve Item as proposed at Regular Meeting

☒ Information Only

☐ Approve Item with Waiver of Reconsideration
Reason for waiver is described in the Item Details field.

PREVIOUS ACTIONS OR REVIEWS:

Policy Committee Name: N/A

Policy Committee Date: N/A

Action Taken/Follow-up: ***(Check all that apply)***

☐ Recommends Approval ☐ Does Not Recommend Approval

☐ Forwarded Without Recommendation ☐ Recommendation Report Attached

☐ Minutes Attached ☐ Minutes Not Available

HISTORY ***(Dates reviewed by City council, Policy Committees, Boards and Commissions, or Staff. Summarize pertinent comments. ATTACH MINUTES OF COUNCIL MEETINGS, POLICY COMMITTEES AND BOARDS AND COMMISSIONS.)***

N/A

ITEM SUMMARY ***(Brief description of item, discussion, key points, recommendations, etc.)***

Recap of the 2021 agenda items presented to the Public Safety, Courts and Civil Service Committee.

QUESTIONS FOR COUNCIL

Information Only.

LEGAL COMMENTS

The corporate authority and all legislative authority of the city shall be vested in the council, as the governing body of the city. The council shall have and shall exercise the powers, privileges and duties granted and conferred by the state constitution, statute or city Charter. (Section 2-32 of the City Code). (Platt)

PUBLIC FINANCIAL IMPACT

☐ YES ☒ NO

If yes, explain: N/A

PRIVATE FISCAL IMPACT

☒ Not Applicable ☐ Significant ☐ Nominal

If Significant or Nominal, explain: N/A

Public Safety, Courts and Civil Service Committee
2021 Agenda Items

Item	Timing	Requested By	Staff Source	Status
2020 Crime Updates - Preliminary	January	Gruber	Parker	Done / Info Only
Police Community Resources Manager	January	Gruber	McDonald	Done / Info Only
2020 Policy Committee Agenda Review	January		Batchelor	Done / Info Only
2021 Policy Committee Workplan	January		Batchelor	Done / Info Only
PulsePoint	January	David Patterson (Falck)	Batchelor	Done / Info Only
APD Crime Updates	February	Gruber	Parker	Done / Info Only
NLADA Assessment Overview of Public Defender	February	D. Wilson	D. Wilson	Done / Info Only
Traffic Updates	February	Gruber	Hanifin	Done / Info Only
Separation Stats and Exit Interviews Follow-up (2/1000 mandate)	February	Gardner/Berzins	PD/FR/HR	Done / Info Only
AFR 2020 Review / Activity Metrics	February	Batchelor	Gray	Done / Info Only
RTD IGA	March	Platt	Lesnansky	Approved for SS
March 2021 Crime Stats	March	Gruber	Parker	Done / Info Only
Motor Vehicle Thefts Update	March	Gruber	Brown	Done / Info Only
Comprehensive Emergency Management Plan	March	Gray	Chapman	Approved for SS
Car seat and Smoke Alarm Installation Program	March	Gray	Stowell	Done / Info Only
RAVEN IGA	April	Platt	Gaskill	Approved for SS
April Crime Stat and Initiatives Report	April	Gruber	Parker	Done / Info Only
Gang Robbery Investigations Team (GRIT) / Gang Initiatives / Discussion	April	Gruber	Lawson, Prosser, Poppe, DA Kellner	Done / Info Only
Jonathan Smith Report Analysis and Planned Actions (AFR)	April	Gruber	Gray	Done / Info Only
AFR Special Operations	April	Gray	Gray	Done / Info Only
CU Anschutz and APD IGA	May	Platt	Wilson	Approved for SS
Vehicular Public Nuisances Ordinance	May	Bergan	Hanifin/Koumantaki	Approved for SS
May Crime Stats, Initiatives and Officer Retention Report	May	Gruber	Parker	Done / Info Only
Jonathan Smith Report Analysis and Planned Actions (APD)	May	Gruber	V. Wilson	Done / Info Only
Municipal Court Overview	May	DeBoyes, Heckman, Day	DeBoyes, Heckman, Day	Done / Info Only
2021 Fireworks	May	Berzins	Hills	Done / Info Only
June Crime and Attrition Stats	June	Gruber	Parker/Schneebeck	Done / Info Only
Camping Ban - Public Health and Safety discussion	June	Gruber	Coffman	Done / Info Only
Critical Incident Stress	June	Gray	Andersen	Done / Info Only

Update on Cardiac Arrest Registry to Enhance Survival	June	Gray	Weber	Done / Info Only
K9 Audit	June	Twombly	Crawford	Done / Info Only
July Crime and Attrition Stats	July	Gruber	Parker/Schneebeck	Done / Info Only
July AFR Response Times including Mapping Tech and Heat Maps	July	Gruber	Gray	Done / Info Only
PREP Program	July	McDonald	McDonald	Done / Approved
Domestic Violence Unit and Program Update	July	Heckman	Heckman / Alscher	Done / Info Only
Data Driven Safety Enhancements (to include cancer in fire service)	July	Gray	Andersen	Done / Info Only
PD Attrition and Crime Updates	August	Gruber	Parker	Done / Info Only
AFR Attrition Data	August	Gruber	Wasserburger	Done / Info Only
Aurora 9-1-1 Update/Overview	August	Buneta	Buneta	Done / Info Only
AFR Recruiting Strategy	August	Gray	Stowell	Done / Info Only
Armed Forces Treatment Court Update	August	Day	Day	Done / Info Only
AMC 134-38 Resolution/Ordinance	September		Delena/Platt	Approved for SS
Armed Forces Treatment Court Supporters Acknowledgement	September	Gruber	A. Garcia	Approved for SS
PD Crime and Attrition Data	September	Gruber	Parker/Schneebeck	Done / Info Only
AFR Attrition Data	September	Gruber	Wasserburger	Done / Info Only
Community Health Program Update	September	Gray	Stowell/Hardi	Done / Info Only
NLADA Assessment Report of Aurora Public Defender's Office	September	D. Wilson	D. Wilson	Done / Info Only
Updates on Police Hiring and Discipline Process	September	Gardner	Batchelor	Done / Info Only
AFR IFC Code 2021 Adoption	October	Gray	Hills	Approved for SS
AFR Regional Fire Code Board of Appeals IGA	October	Gray	Hills	Approved for SS
PD Crime and Attrition Data	October	Gruber	Parker/Schneebeck	Done / Info Only
AFR Attrition Data	October	Gruber	Wasserburger	Done / Info Only
2021 Judicial Performance Commission	October	DeBoyes	DeBoyes	Done / Info Only
AFR Auto/Mutual Aid Procedures	October	Berzins	Robnett	Done / Info Only
APD Mutual Aid Process and Procedures	October	Berzins	Parker	Done / Info Only
Peace Officers Behavioral Health Support & Community Partnerships Program (Grant)	November		Sherbondy	Pending SS consideration
PD Crime and Attrition Data	November	Gruber	Parker/Schneebeck	Pending
AFR Attrition Data	November	Gruber	Wasserburger	Pending
Office of Independent Monitor Update	November		Venegas	Pending
Technology Analysis for E-Discovery	November	Gruber	S. Newman	Pending
Hazard Mitigation Plan	November		Gray	Pending
Fleet Replacement Plan	November	Gray	Gray	Pending
2021 Recap	November		Batchelor	Pending