
Flood Mitigation Task Force
Draft Report to City Council
May 10, 2016

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I. Executive Summary-DRAFT

[Executive Summary still in draft form / to be finalized by FMTF.]

II. Background

The Flood Mitigation Task Force was created by the Austin City Council by Resolution 20150604-044 on June 4, 2015. City Council and the Mayor each appointed two individuals to serve on the Task Force, which convened its first meeting on Sept. 22, 2015. At the general meeting the Task Force heard public testimony about flooding and received information by Watershed Protection Department staff regarding flood basics, flood problems and solutions, the buyout programs, variances, funding sources, drainage utility fee structure, CodeNext, standard and green infrastructure, the structure and inner-workings of the operations and maintenance department, the Watershed Protection Department Master Plan, the Onion Creek preliminary study, flood response resources and public care facilities and schools flood analysis.

Three working groups were formed to focus on different areas of the council resolution: Capital Improvement Projects, Operations & Maintenance, and Buyouts. Each group met more than a dozen times during the 9 months and after receiving more detailed information from staff and outside information, the groups considered and discussed what they had learned. Each group drafted a report which included their observations and recommendations. (See Appendix for each working group report).

During the Task Forces timeframe, the City of Austin held a Special Called Meeting on Sunday, November 8, 2015, 2:00 pm to receive public comment in response to a flooding event that occurred on Friday, October 30, 2015.

Community members, a majority of which came from the Upper and Lower Onion Creek areas which have been were impacted by the flood events, voiced their concerns to the Mayor and City Council. During the 4 ½ hour meeting, 31 people signed up to express their emotions about flooding events effecting their lives.

The agenda, minutes and video recording can be found here: http://austintexas.gov/department/city-council/2015/20151108-spec.htm.

The final report includes the full list of recommendations approved by the entire Task Force. It then also includes the initial recommendations and background compiled by each Working Group. Note that some recommendations made at the Working Group level were not agreed upon by the full Task Force, but those recommendations are intact in the Working Group reports.

III. Recommendations by Resolution Sections – from Resolution No. 20150604-044

1. 1a - Overall Flood Mitigation and Preparedness strategies

Recommendations:

1. Adopt a city wide prioritization policy based on loss of life, general health and safety, property damage, and/or other criteria to prepare for and mitigate flooding. All subsequent policy and budget decisions should be evaluated through this framework.
    a. Develop a plan to repair and replace the highly critical local drainage systems within 5 years. If necessary, issue debt instruments every five years until the major local flood mitigation CIPs are completed.
    b. Develop a schedule to perform routine maintenance, inspections, and repairs to all storm water infrastructure (such as pond, pipes, inlets, and open waterways) on a minimum 5-year cycle.
    c. Create a proactive approach to repair and maintain drainage systems in desirable development areas and neighborhoods with storm drainage systems constructed before the Drainage Criteria Manual was adopted in 1977.
2. Conduct a financial and organizational audit of the Watershed Protection Department, (WPD) to evaluate staffing resource allocations, program effectiveness, and successful implementation of master plan goals and objectives. Conduct the audit on a regular basis, i.e. every 5 years.
3. Evaluate whether WPD should be moved to the City's "Infrastructure Services" service group of departments to better reflect WPD's as an infrastructure rather than the "Development Services" service group.
4. Consider continuation/permanence of FMTF with oversight of WPD, including follow-through on this report and further address certain parts of the resolution, and provide for continued citizen engagement.
5. Develop a more balanced approach for allocating the Drainage Utility Funds (DUF) between the various watershed protection missions to better support CIP and O&M needs.
6. Review and update the Watershed Protection Master Plan on a 5 year basis and tie-in program performance measures with the plan.
7. Set goals to reduce the number of habitable structures at risk of flooding based on all mitigation solutions and tools, e.g., retention and detention ponds; street gutters, drainage pipes; flood walls; individual floodproofing such as garden walls, elevation, and individual property floodwalls; and maintenance of closed and open waterways.
8. Review and revise the prioritization methods used to address problem flooding, combining multiple approaches that would include risk and event-based, as well as individual property damage and clustered property damage.

9. Conduct a third-party evaluation of the effectiveness and accountability of the Regional Stormwater Management Program (RSMP) to mitigate flooding and consider whether revisions and expansion of the program should be made.
10. Establish a comprehensive asset management plan allowing for better short and long-term planning of maintenance and capital improvement costs and needs.
11. Investigate and consider additional detention methodologies used by other jurisdictions.
12. Complete local flood modeling to have known local flood areas modeled by the end of Fiscal Year 2019.
13. Gather community input early in the project development in a flood plain regarding strategies to be examined; allowing the public to see the results, costs, and benefits for the alternatives studied.
14. Ensure a system and process exists such that the Development Services Department's "One Stop Shop" can easily determine if new development, or redevelopment, is in or near any known flood problem areas. Advise applicant, staff, and the Neighborhood Plan Contact Team (NPCT) of this data during the building and/or site plan review, and include this data in the Development Viewer.
15. Where creek and channel conveyance can be impeded by vegetative growth or debris:
    a. Maintenance should include cleaning under bridges and around culverts, removing fallen trees that can act as debris dams, and obvious obstacles that could cause increased water surface elevation.
    b. If little to no maintenance is/will be performed on a creek(s), WPD should ensure that assumptions in the models account for higher roughness factors.
    c. Add personnel and/or employ contractors to remove vegetation and debris.
16. City should stage personnel and assets around the city to improve response time to flooding and be more proactive in preventative maintenance.
17. Continue to update FEWS equipment and software due to the reliance of many departments, the Emergency Operations Center (EOC), and the general public that rely on this system.
18. Coordinate with the US Geological Survey to add more flood-hardened rain and flood stage gauges for better flood forecasting.

2. 1b – Flood plain variances and flood buyout policy

I. FLOODPLAIN VARIANCES

A floodplain variance is an exception to the standard development regulations for properties within the floodplain. There is a standard process for granting administrative variances by the Watershed Protection Department Director, when a development meets all of the administrative variance criteria. When a project does not conform to the requirements for an administrative variance, the Austin City Council may take action to grant a floodplain variance to the property owner/developer.

It is important to note that there are other types of variances to environmental and drainage regulations which may be granted (e.g., variances to impervious cover limitations, variances to

detention and/or water quality requirements). The request for a floodplain variance should not be conflated with these other types of variances. For example, a property can be within the allowable impervious cover limits and still require a floodplain variance in order to get a development permit to remodel a bathroom, to build a second story, or to add a carport.

On average, there are 3 administrative variances are granted per year (based on 2004-2015), and there is an average of 6 requests per year to Council to grant floodplain variances (based on 1995-2015).

Floodplain Variances Recommendations:

1. Continue current floodplain policy as it relates to FEMA National Flood Insurance Program and Community Rating System to help reduce flood hazard insurance rates for all homeowners and property owners.

2. Continue the current floodplain policies, except as modified below, while allowing a variance process for many of the existing homes to remain or be modified in a reasonably safe manner and without damage to others.

    a. Require public notice for Council floodplain variances. Notice should be given to Neighborhood Groups as well as potentially-affected property owners.

    b. Expand the requirements of the City Code section of the floodplain management regulations that explains floodplain variances (Chapter 25-12-3 Appendix G, Sections G105) to include additional information commonly discussed at past floodplain variance hearings as defined in the Buyouts Work Group report.

3. Implement additional flood mitigation requirements if development or redevelopment is allowed in a floodplain such as:

    a. education for safe evacuation and safely sheltering in place.

    b. disclosure by seller/owner (or their representative) and education for buyer/renter of property that has been granted a floodplain variance that may constitute a health and safety risk.

II. FLOOD BUYOUT POLICY

Buyouts are just one type of flood mitigation tool that can be used to reduce the risks to human health and safety as well as to property. This mitigation tool serves as a method of last resort for responsible communities to support their citizens, when other structural or maintenance solutions are infeasible, ineffective, or have a disproportionately high in cost relative to the benefits they would achieve.

The most reliable way to ensure that people do not flood is to keep them as far away from the hazard as possible; however, in an urban area it would be a gross oversimplification of an extremely complex reality to adopt a management strategy of only removing development from flood-prone areas. All of the available flood mitigation tools need to be considered when selecting the

appropriate solution, and the Watershed Protection Department does consider and utilize the entire range of tools, including regional detention ponds, storm sewer improvements, and flood tunnels.

In order to grapple with the question of buyouts, the buyout/variance subcommittee of the Flood Mitigation Task Force has focused on three primary areas:

I. Examination of the Lower Onion Creek Buyout Program;
II. Examination of project prioritization approaches; and,
III. Examination of the acquisition process.

The Lower Onion Creek Buyout Program is an extremely important focal point for Austin citizens and the City Council alike, and it serves both as an exercise in contrast and as a springboard for understanding the core elements that might form a general (city-wide) buyout policy, if one were to be adopted.

Prioritization is the first key step in the process of developing flood mitigation solutions. The Watershed Protection Department has developed a consistent and sophisticated process for prioritization, based on the philosophy that the highest risk problems should be addressed first.

Acquisition of property, along with relocation support, is at the heart of executing a buyout program. The City of Austin has significant flexibility in the acquisition process when the buyout program is voluntary (i.e. optional for property owners to sell). There are more prescriptive processes that have been established when using the powers of eminent domain. However, even when eminent domain is used there may be flexibility: constraints stem from the regulatory requirements (federal, state, and city) associated with the funding source (e.g., requirement to use specific provisions of the Uniform Relocation Act for federal funding from U.S. Army Corps of Engineers buyout program).

Flood Buyout Policy – General Recommendations:

4. A buyout program has shown to be a viable mitigation tool and it should remain a strategy, although not the first option.

    a. Where buyouts have been identified as the optimal flood mitigation solution, expedite implementation of funding buyout programs.

    b. Continue the buyout program as primarily a voluntary program (i.e. optional for property owners to sell) except where there is a demonstrable threat to life and safety, or where Eminent Domain is a condition of funding.

    c. Evaluate the efficiencies of the buyout program experiences by citizens, including staff and contractor performance. Conduct a post-buyout evaluation to ensure that important lessons can be captured and integrated into future processes.

    d. Plan for a sustainable buyout program through consistent annual funding and ongoing focused evaluation and re-evaluation of flood risk.

5. Initiate Upper Onion Creek buyout program with initial focus on those homes that were substantially damaged in the 2013 and 2015 floods.

6. Develop a program of voluntary buyouts by citizen request.

7. Evaluate the potential need for buyouts or other costly flood mitigation before annexing any property.

8. Continue to evaluate the potential to implement flood mitigation solutions (such as detention ponds) on land that has been purchased via a mitigation buyout.

9. Ensure that all property purchased for flood mitigation buyouts not be put to any use that is contrary to mitigating flooding.

10. Ensure that property owners fully understand the program due to the complexity of the process.

11. Assist property owners in understanding the consequences of not participating in a voluntary buyout program (e.g., increase in insurance rates, health and safety concerns, neighborhood character, etc.).

Flood Buyout Policy – Lower Onion Creek (LOC) Buyout Project (855 properties in the program):

12. Expedite the remaining LOC buyouts to finish by end of 2016, and expedite the existing Williamson Creek buyout program.

13. Evaluate the LOC outreach program and determine if there are improvements that can be made for the current and future buyouts.

14. Develop a plan for eventually buying the LOC properties at risk, even if the current owner does not yet want to sell.

Flood Buyout Policy – Prioritization:

15. Develop a program for purchasing structures that have been catastrophically flooded by a rainfall event including:

    a. Develop a method for prioritizing individual flooded properties.

    b. Develop a funding program.

16. Develop a method for prioritizing individual/isolated properties which are at risk of flooding (i.e. those that meet specific thresholds of risk such as 10-year flood depth and which are not part of a cluster).

17. Consider whether other risk parameters should be incorporated into prioritization (and perhaps drainage design standards) such as watershed size, history of watershed experiencing high-magnitude events, and other factors.

Flood Buyout Policy – Acquisition:

18. Adopt a consistent policy to be used across all buyout programs (both voluntary/optional for property owner and eminent domain acquisitions) so that all buyout program participants have access to equitable benefits.

3. 1.c Structure and use of the adopted drainage utility charge

Background

The Drainage Utility Fee (DUF) is a fairly young construct, having been used in Texas for less than 20 years. The current structure of the fee is based perceived use of the stormwater system and the ratio of pervious to impervious cover. While the recent updating of the DUF attempts to address certain elements of inequality, the underlying construct is incomplete; stormwater drainage is inherently non-voluntary, meaning the individual property owner has little control over the problem, and the stormwater system is highly interdependent. Every single property effects stormwater runoff on the surrounding properties, but does so in a complex way, making analysis difficult.

The biggest challenge to reducing the potential for loss of life and property damage is funding to implement the necessary capital improvement projects (CIPs). The Watershed Protection Department has a great deal of information regarding where current flooding is located, what causes it, and what can be done to mitigate damages. With an estimated cost of between 2-4 billion dollars to address the creek and local flooding problems and only a portion of the DUF being spent on project development and implementation, it will take an estimated 80 to 100 years to address known issues.

The DUF alone is not sufficient to fund major CIPs within a reasonable time frame. However, it is important to maintain the fee to ensure adequate funding exists for staff, planning, maintenance, and smaller-scaled projects. It should be noted that the Flood Mitigation Task Force heard from numerous citizens who expressed concern regarding the current formula for calculating the DUF and the process through which the new ordinance and formulas were developed. Task Force members understand the City was revising the DUF based on a court order and recognize that the schedule to adopt the revisions was hamstrung by the fiscal calendar; however, now that the deadline time-crunch has passed, the City should reopen public discussions to address citizen concerns such as using the percentage of impervious cover as a multiplier, including roof over hangs in the calculation, and addressing the perceived lack of a responsive public process when crafting the amended DUF.

Operations and Maintenance (O&M) funding is entirely made up of a distribution from the funding collected through the DUF. O&M receives approximately 40% of the dollars collected. As a practical matter, the DUF cannot be relied on for solving Austin's flood problems. The DUF's present revenues are insufficient to cover all of the needed O&M expenses, and yet a large portion of the Fund is directed to purposes other than O&M. Increasing the DUF to cover the necessary O&M

costs is problematic; as a regressive and inequitable fee, owners in the lower income tiers are already struggling with payments.

All flood mitigation projects evolve through a methodical process beginning with identification, moving through the evaluation of suitable solutions, and finishing with its implementation. Buyouts are one of many possible mitigation solutions that may be selected after careful prioritization and evaluation. Ideally, structures where buyout is the optimal mitigation solution should be purchased before they experience flooding. However, since this is not always feasible (due to funding and programmatic constraints), a program should be put in place to quickly assess whether a flooded structure is a suitable candidate for a buyout so that a voluntary buyout process may be initiated by staff following a flood event.

Looking at the City's stormwater system funding of capital improvement projects, operations and maintenance, and other specific, strategic programs designed to address flooding issues, it is very hard to picture the current DUF adequately meeting the high level of service expected by residents. Given the many constraints, more attention needs to be given toward finding innovative funding solutions, keeping the DUF equitable and affordable, and addressing current impediments to making current flood mitigation funding go farther to address citizen's needs. It may be time for thinking about the DUF in a new perspective, one where the fee is treated in a manner similar to roadways and other public infrastructure rather than electric or water utility rates; the latter being based on volume of use that is controllable by the property owner. Doing this may result in a more logical and equitably apportioned fee structure.

Recommendations

1. Analyze the current allocation of the DUF to make sure funding matches the City wide priorities mentioned in section 1a, recommendation 1.
    a. Direct more funding toward flood mitigation solutions, operations, and maintenance costs.
    b. Reduce the allocations to interdivisional transfers.
    c. Continue the analysis to allocate funding toward the most critical needs.
2. Continue to gather through an established public process input on the newly adopted Drainage Utility Fee for future amendments.
    a. Allow for more citizen input to address concerns regarding the equity of the current fee’s structure.
    b. Explore and consider other factors, for example, the percentage of impervious cover as a multiplier and roof overhangs and their factoring into the fee.
3. Consider creating a reserve fund for buyout of properties affected by an extraordinary flood event, or alternatively, approve requests by WPD to perform post-flood recovery buyouts on an as-needed basis
4. Issue a series of debt instruments every five years until the major creek flood mitigation capital improvement projects are completed. Major projects should be designated by those that are too large to have construction completed in one annual funding cycle via the DUF.
5. In relation to section 1a, recommendation 1, flood mitigation is a public safety responsibility and the Council should consider reducing spending on non-essential projects that do not directly

improve public health and safety until the flood mitigation and deferred maintenance activities are caught up to the point where they align with the WPD's asset management program.

6. Primarily direct DUF funding toward flood mitigation projects and operational expenses in keeping with the spirit of the fee's inception (related to section 1a, recommendation 1).

4. 1d. Stormwater management system operation and maintenance costs (O&M), capital costs, city fees, flood insurance, and other identified factors that have impacts to affordability and equity

The Task Force did not look directly at the question regarding how the cost of operations, maintenance, capital projects, city fees, or flood insurance impact affordability and equity; however, we recognize that the cost of making the necessary improvements will require a significant expenditure by the City for the foreseeable future. We also recognize the real and ongoing costs in terms of quality of life, flood damage (existing and potential), and life-safety will continue to effect the City if Austin does not have the fortitude to effectively address flood mitigation. Many of the known problems have been identified for decades (in some cases more than 30 years) and the cost to implement solutions is not going to decrease. Furthermore, previous and current planning policies (via Austin Tomorrow Plan 1979 and Imagine Austin 2012) encourage higher density in older areas of the City (built prior to the 1977 Drainage Criteria Manual DCM.) with undersized existing drainage infrastructure.

While there are widespread creek and local flood problems throughout our community most of them can be associated with pre-1977 development. The districts and neighborhoods impacted by these floods are demographically diverse and, while the brunt of major flooding is felt by the effected residents, the reality is that there is a fiscal cost to the entire city. Those costs include the labor of City personnel and emergency responders, repair and replacement of City infrastructure, and community-wide flood insurance rates. Although the total cost of the 2013 Halloween Flood is still being tallied by City Staff the numbers to date indicate the final number will surpass $150 million dollars.

Because we should be focused on the life-safety aspect of flood mitigation, and because these problems are spread across the City, and because watersheds do not recognize political boundaries, we do not believe that solutions can be, or should be, divvied up by Districts to ensure equitable spending across the City. Instead, and as mentioned in other sections of this report, the Task Force believes that the problems and solutions should be prioritized by risk to human life, risk to critical infrastructure, and risk of potential damage to buildings such that the most dangerous problems are addressed first.

The City Council will need to address the issue of affordability in how the recommendations of this report are implemented, but at the same time Council must recognize that the costs of flood recovery are borne by the entire City and the costs to mitigate should be as well. To

maintain affordability we recognize the full implementation of the Watershed Protection Master Plan will take time but we firmly believe that we cannot wait decades longer to address the critical flood problems facing the City. It may be necessary for City management and Council to make some difficult budgetary decisions regarding the things we want to spend money on as a community versus things we must do to keep our residents safe.

Recommendations:

1. Before increasing fees or calling bond elections, Council should undertake a review of the entire City budget, specifically items related to priorities to keep the citizens of Austin safe, and make difficult decisions about how we prioritize spending and about funding the things we must do to keep our residents safe.
2. Council should consider directing staff to prepare detailed analyses or assessments of potential flood problems and the cost of mitigation in areas identified for annexation to better define anticipated costs in the service plans for these areas.
3. The City should adopt a uniform buyout program so that any buyouts, regardless of the reason, are treated uniformly and fairly.
4. The City should consider forming watershed coalitions, partnerships, or flood control districts in select watersheds (such as Onion Creek) to develop and fund regional flood mitigation strategies. This will encourage comprehensive solutions throughout entire watersheds and spread the financial burden and mitigation responsibilities over a larger geographic area.

5. 1e. Methods and means to provide more public education and outreach to new residents and visitors to raise awareness of flash flooding potential, as well as actions and strategies for the public to remain safe

Even though Austin is known as Flash Flood Alley, the city has largely been spared the scenes of New Orleans during Hurricane Katrina: homeowners being rescued from their roofs by helicopter, drowning of elderly due to lack of bus drivers or buses to evacuate frail residents from nursing homes or the faces of frantic parents trying to reach children at schools cut off by high water.

However, as a result of the October 2013 and 2015 extreme flood events, Southeast Austin and Travis County took the greatest hit in the loss of life and extensive property damage. The Lower Onion Creek flooding claimed eight souls with the youngest being only six months old. In the Memorial Day 2015 flood, somehow a man ended up atop a telephone pole at House Park on Lamar Blvd. escaping a rapidly rising Shoal Creek blocks away. This image as well as one of a man rescued by helicopter from a tree top near upper Onion Creek are a permanent reminder that not everyone in Austin knows the saying “Turn Around Don’t Drown”. To try and prevent the images of New Orleans being repeated here

in Austin, the following education and outreach strategies are recommended for the City of Austin.

General public education is critical to the safety of our population. The City's Early Warning Flood Gauge and Rain Gauge System are a core piece, warning residents of rainfall and the potential for flooding, alerting emergency responders to crisis locations, and warning downstream communities of impending flooding. We understand the City is currently upgrading this system.

Education and outreach needs to move away from the "100-year floodplain" approach and talk to people about the probability of flooding. For example, a 100-year flood has a 26% chance (about 1 in 4 chance) of occurring over a 30-year mortgage. Another way of thinking about it is that there is a 1 in 6 chance of a 100 year flood occurring in 18 years.

Flooding in Austin is not confined to the FEMA-identified floodplains. The massive "water bombs," such as the 14 inches of rain that hit the airport in 2015, can strike anywhere and can cause flooding in any neighborhood overwhelming the storm water system. There is no practical way to build systems that can take on water bomb levels of rainfall.

Early warning systems save lives. Installing an Emergency Siren System similar to one used in Tulsa, OK, would provide residents and visitors with notice of imminent danger. Flood zone signage similar to hurricane zone signage along the Gulf and tsunami signage on the coasts would further enhance flood danger awareness. Information on emergency tool kits if surrounded by rising waters (access to the attic, breaking through the roof) pending rescue by first responders is critical for survival. Assistance with Emergency Preparedness Plans empowers communities. With the proper development and implementation of these resources the COA should minimize the potential of its residents or visitors being unaware of pending flood dangers.

The Flood Early Warning System (FEWS) is critical to public safety and should continue to be well maintained, expanded to cover more creeks, and updated as technology evolves. The FEWS program is funded under the O&M budget with a current funding level of $1.4 million a year. Floodplain modeling is allotted $0.5 million. The FEWS program currently contains approximately 100 gauges, including gauges maintained by the COA and US Geological Survey (USGS). Gauges must be Flood Hardened

With the substantial growth seen in the Austin Metro Area in recent years, strategically locating additional flood hardened gauges to provide more data points for better flood modeling is crucial to saving lives at the beginning and during extreme flood events.

Educating the public on available early warning systems is critical. The Integrated Public Alert Warning System (IPAWS) provides public safety officials with an effective way to alert and warn the public about serious emergencies using the Emergency Alert System (EAS), Wireless Emergency Alerts (WEA), the National Oceanic and Atmospheric (NOAA) Weather Radio, and other public alerting systems from a single interface.

The Regional Notification System (RNS) is a reverse 911 messaging system for the Council of Governments 10 County Area (Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Llano, Travis and Williamson counties). This System is utilized for warning specific parts of the community, not just the County as a whole. It uses the 911 database (landlines) and allows residents to register their cell phones in order to receive the warnings. https://public.coderedweb.com/cne/en-US/21C524DBEA1F. If residents do not have a landline phone, and they have not registered their cell phones to the RNS they will not receive the warning messages that could be targeted to their specific neighborhood or place of business.

Lastly, concern exists that the WPD's name does not accurately convey the role the Department plays in this critical function to the community. Simple changes could help citizens and taxpayers better understand where these dollars go and why.

Recommendations:

PUBLIC EDUCATION AND OUTREACH

1. Watershed Protection Department shall enhance the current community outreach approach by actively:
   a. Tailoring the current "Flood Safety Resources" warning safety tips to include local information specific to the COA residents (refer to Louisville, KY example: http://www.msdlouky.org/programs/crssite/fpfloodsafety.html).
   b. Providing the information in www.ATXfloods.com in a multilingual format
   c. Educating COA residents on registering their phones and the use of the Integrated Public Alert Warning System (IPAWS) through the COA Office of Homeland Security and Emergency Management.
   d. Educating COA residents on the Regional Notification System (RNS).
   e. Issuing NOAA Radios to residents in floodplains.
   f. Providing information to residents in floodplains on emergency tool kits.
   g. Coordinating with First Responder agencies on public education/awareness on the difference between rescue (water still rising-danger of drowning vs water crested-shelter in place until help arrives), etc.
   h. Effectively communicating the flooding chances residents face beyond the standard 100-year floodplain, including outside the floodplain. Creative ways to do so might include games and other education tools.
   i. Educating the Public about 100-year floodplain terminology.
   j. Establishing and conducting regular flood informational media blitz events with the goal to reinforce emergency flood preparedness throughout the COA.

k. Implementing effective marketing techniques to include communities challenged with Internet connectivity, specifically areas at risk of flooding.
l. Including the Watershed Protection Master Plan "Problem Score" Viewer link as an additional educational/information resource to the COA residents: http://austin.maps.arcgis.com/apps/MapJournal/index.html?appid=d45481abb0804c95a8e6b033188982b9
m. Creating an informational brochure of available alternate Power Source options available to residents (manual backup systems) in flood prone areas that will temporarily support the family's power source needs until electrical service is restored.
n. Creating educational strategies on how residents and business operators can safely shut down utility valves for gas, oil, water and the main electrical supply (use tags on valves so they can be found quickly) AND include instructions that ONLY a professional can turn utilities back on if home and/or business flooded. This is ONLY feasible with advance warning.

2. All school campuses shall ensure each school campus located within a floodplain has an updated Emergency Preparedness Plan in response to flooding incidents each year.
   a. Those plans should be reviewed annually by the Administration in conjunction with campus security staff, teachers, local first responders and the Parent Teacher Association (PTA) and the Campus Advisory Council (CAC) leadership, as applicable. The sample Emergency Preparedness Document (attached) provides the type of information that should be included.
   b. Conduct annual flood response training with students and staff.
   c. Develop parental/custodial outreach and education materials so parents/custodians know what to do in a flooding incident emergency (who to call, where to go, etc.). Share plan with PTA and CAC, to include what the plan of action to inform parents/custodians of students will be (meetings, informational brochure, posters, information translated to other language(s) as needed, etc.). Informational materials must be included with "Back-to-School" Night events as well as in standard information packets for each new parent/custodians and students to all school campuses. All informational materials must be in the recipients' primary language.
3. Agencies and/or businesses with vulnerable populations:
   a. Charter Schools and Child Daycare Facilities should properly register to ensure their respective administration and security personnel, staff and parents are included in the "Emergency Flood Preparedness" list with the Department of Homeland Security and Emergency Management.
   b. Agency and Building Administrators of Nursing Homes and other facilities that house vulnerable populations (disabled, incapacitated, minors, Wards of the State, etc.) shall take the same precautionary prevention, intervention and

response strategies required of the school district. (Refer to SAMPLE Emergency Preparedness Document) On-site backup systems, emergency generators and required supplies (food, water, medications, etc.) must be incorporated into the Emergency Response Plan based on the needs of the population housed at the facility.

4. WPD shall assist in the establishment of an early warning network to communicate current conditions and warnings to local Home Owners Associations (HOAs) and neighborhood associations to help them get the word to residents, especially the elderly and infirm, who may not be aware of the flooding danger or who may need assistance.
5. Specific to floodplain variances, if development or redevelopment is allowed in a floodplain, WPD shall:
   a. *Provide e*ducation for *safe evacuation and* safely sheltering in place and
   b. Require disclosure by seller/owner (or their representative) and education for buyer/renter of property that has been granted a floodplain variance that may constitute a health and safety risk.

ACTION AND STRATEGIES – ALERT AND RESPONSE

6. Watershed Protection Department and the COA incorporate information from the National Water Model needed to enhance the safety of all COA residents.
7. Continue to update FEWS equipment and software due to the reliance of many departments, the Emergency Operations Center (EOC), and the general public that rely on this system.
8. Closer coordination with USGS to add more flood-hardened rain and flood stage gauges for better flood forecasting in order to assist first responders during extreme rain events and for potential evacuations of Austin citizens.
9. Install, inspect, and maintain an Emergency Siren System designed to alert residents and visitors in flood prone areas.
10. COA develop and implement “First Responder” resources needed in response to expanding city boundaries (Refer to Fire Station Map and Response Times Documents).
    a. Fire Stations with adequate staffing and operational support
    b. EMS Stations with adequate staffing and operational support
11. Watershed Protection Department and First Responder Agencies review flooding incidents after 30 days and provide a condensed report to the COA City Council on what worked well and areas needing improvement
12. Watershed Protection Department coordinate with Texas A&M University for emergency veterinary services in response to flood events: http://vetmed.tamu.edu/files/vetmed/vet/texvet-0815-pages-34-35.pdf

ACTION AND STRATEGIES – AWARENESS AND PREPAREDNESS

13. Watershed Protection Department continuously review and update creek and local flood maps on a 3-year cycle and update as necessary.
14. As local flood maps are generated or developed, the Watershed Protection Department should publish and share them online similar to creek floods.
15. Watershed Protection Department shall encourage Agency Heads and Building Administrators of identified structures in the floodplain to coordinate with their local "First Responder" agencies and develop or update the facility's individual Emergency Response Plan to flooding incidents in response to current flood maps.
16. Require "Flood Zone" signage in high-risk flood zones by marking the curbs in the color "BLUE." Informational brochures regarding the meaning of the color on the curbs will be developed and distributed to all utility customers in a multilingual format at least twice a year.
17. Neighborhoods, including camping and lodging areas, with documented creek and local area flooding require signage at all major arterial roads entering the neighborhood to designate area as susceptible to flooding during storms. (Like hurricane zone signage along the Gulf and tsunami signage on the coasts.)
18. Require property owners (or their representative) to notify residents in writing if the leased property is in a floodplain. The written notification shall be in the lessee's primary language. Renter's Insurance information should be included with the application.
19. Intergovernmental Coordination with surrounding counties on floodplain hazards in the area for consistency in the educational message and potential cost savings.
20. Examine renaming WPD to better communicate to Austin citizens the three primary goals of the Department: Water Quality, Erosion Control, and Flood Mitigation.
21. Agencies and business owners/operators located within floodplains install barriers and/or anchor/secure large physical hazards and properly store chemical hazards (toxic, caustic and flammable) at risk of posing a danger, further injury or damage to residents/occupants, including first responders, downstream.
22. For COA residents involved in the Flood Buyout Program, WPD shall ensure that homeowners who choose not to voluntarily sell their home be educated around the implications and consequences.
23. Create a public forum whereby citizens can address the oversight body of the Watershed Protection Department to voice grievances, and seek avenues for navigating the bureaucracy.

6. 1f. Standard and Green infrastructure utilization; impacts, regulations, and management of impervious cover; master planning and studies underway

The following regulatory and planning mechanisms are recommended. These recommendations are intended to be adopted as soon as possible to send a strong message to local residents that the City of Austin takes seriously its responsibility to minimize the risks to public safety posed by flooding.

Planning and Regulatory Recommendations:

1. WPD should engage in a comprehensive planning process regularly (e.g. every five years, perhaps in concert with the Watershed Protection Master Plan) that addresses land use, transportation, utilities, and drainage concerns to map known and potential flood problem areas and determine:
    a. A maximum amount of total impervious cover for flood-prone neighborhoods that must be considered prior to issuing any building permits.
    b. Where onsite detention is required for proposed new and redevelopment.
    c. Where flooding problems remain unresolved, new development or densification is discouraged.
    d. Where, in areas to be annexed, potential flooding concerns and the cost for improvements are identified prior to annexation. For example, staff currently asks residents in an area to be annexed about flooding but examples show that, although none reported flooding, it may just be due to lack of a recent large rain event.
    e. Where flood problems are severe, do not issue permits for new development, redevelopment, infill and auxiliary structures until the flood problems are mitigated or the following conditions apply (no exceptions):
        i. the developer provides a certified engineering study that proves no adverse downstream impact, or
        ii. onsite mitigation is included in the development, or
        iii. downstream infrastructure is improved by the development
2. Strengthen the City of Austin Land Development Code (LDC) regarding flood mitigation requirements for new development and redevelopment.
    a. Known loopholes (as identified by staff) should be eliminated.
    b. Existing code has provisions that would allow for the regulation of redevelopment but this code is not enforced. Identify, clarify and strengthen these provisions and provide a timeline and funding necessary for enforcement.
    c. Determine whether the 1% annual exceedance probability (AEP) event should be replaced by a larger, less frequent event (perhaps only in certain watersheds) or if 'freeboard' requirements should be increased (freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management).
    d. Enforce stormwater discharge limit requirements in the COA LDC and Drainage Criteria Manual, Section 8.1.0., which requires that storm water management for peak rates of runoff shall provide for a temporary storage of stormwater runoff. Runoff is then released at a controlled rate which cannot exceed the capacities of

the existing downstream drainage systems, or the pre-developed peak runoff rate of the site at each discharge point, whichever is less.

e. Require that all new or remodeled commercial and residential structures added to existing lots (e.g. Accessory dwelling units) comply with impervious cover limits.
f. Enforce requirements that all proposed land development projects, whether new or redevelopment, demonstrate no adverse downstream impacts. Onsite (and any necessary offsite) stormwater controls must be modeled to simulate proposed condition discharges and their impact on the city storm drain system, including the receiving waters of each watershed.
g. Require that commercial and residential redevelopment reduce post development peak rates of discharge to match peak rates of discharge for undeveloped conditions instead of existing predevelopment conditions. Undeveloped conditions are assumed to be grassland unless otherwise demonstrated by the applicant.
h. Require that all objects such as, but not limited to, dumpsters and commercial use furniture (benches, picnic tables, etc.) in floodplains be anchored to the ground so as not to block storm drains, bridges and floodways during a flood. Food trailers should be transported offsite prior to flooding. Educate and enforce compliance during annual health inspections or similar routine inspections.

3. Implement City policies, programs, staffing levels, training opportunities and interdepartmental collaboration to enhance flood mitigation and preparedness.
    a. Ensure that Development Review staff is aware of 2013 amendments in the LDC related to Watershed Protection Ordinance (Ordinance No.20131017-046) with special attention to enforcement of Article 4 Section 30-4-151.
    b. Ensure a system and process exists such that the Development Services Department's One Stop Shop can easily check to see if proposed new or redevelopment is in or near any known flood problem areas. Advise applicant, staff, and the Neighborhood Plan Contact Team (NPCT) of this data during the building and/or site plan review, and include this data in the Development Viewer.
    c. Resolve flood-related Code enforcement problems in a timely manner. Immediately remedy problems such as blocked drainage easements that create safety hazards.
    d. If any existing stormwater infrastructure that is designed and/or constructed by entities other than the City of Austin requires corrective measures, those fixes shall be paid for by the responsible developer or contractor.
    e. Implement a rapid licensing/approval process for flood restoration contractors in preparation for future flood events. This will provide assurance to homeowners and businesses that contractors are aware of current city regulations and that liability is assured.
    f. Increase commercial inspection and enforcement efforts to disallow the storage of chemicals and hazardous materials in flood-prone areas. Ensure that inspectors in applicable City programs (e.g. WPD Pollution Prevention and Reduction Program, Code Enforcement, and others) are aware of flood problem areas.

4. Actively seek and participate in Public-Private Partnerships where the City can leverage private development activities to increase investment in new or updated flood mitigation infrastructure.
5. Implement a benefit-cost analysis for CIP projects to determine whether the use of smaller 'design storms' (e.g. less than 100-year flood protection) are more cost effective. This will help determine project viability, make it easier to seek funding, and stretch limited resources.

Green Infrastructure Recommendations

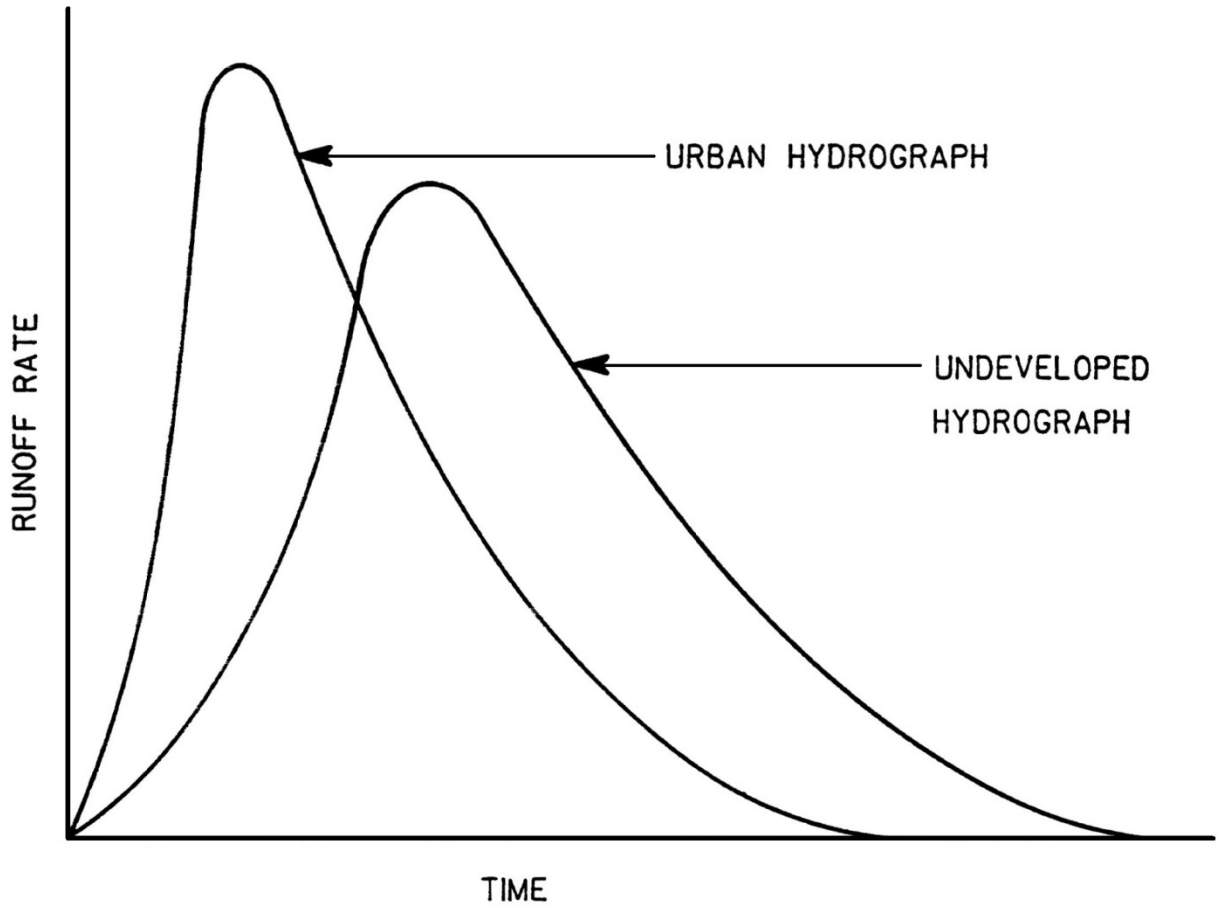
Green infrastructure for stormwater management reduces impacts from built environments using landscape features and engineered systems that mimic natural processes to control the quantity and quality of runoff. Green stormwater infrastructure (GSI) often includes elements such as rainwater harvesting, rain gardens and pervious pavement. These features typically detain small volumes of water and therefore aren't always considered effective flood mitigation measures. However, when implemented on a widespread basis throughout a neighborhood they can provide essential benefits (see the Geosyntec/CoA Brentwood Study). To that end, green infrastructure projects on private land offer a way for community-minded residents to reduce their flood footprint for their own benefit and that of their downstream neighbors.

Recommendations

1. Incentivize onsite retrofit floodwater management measures for private property owners.
   a. Enhance outreach opportunities particularly for those who have suffered losses due to local flooding. Promote in specific neighborhoods (e.g., Brentwood).
   b. WPD should partner with Austin Water Utility's existing Rainwater Harvesting and WaterWise Rainscape rebate programs to:
      i. Enhance program guidance information regarding landscape elements that mitigate local flood impacts.
      ii. Contribute rebate dollars when onsite solutions provide flood detention (e.g. rainwater harvesting volumes over 1,000 gallons).
      iii. Consider increasing the rebate amount for systems that use a smart controller to ensure that detention volume is available when needed.
      iv. Consider rebating professional drainage design guidance where local flooding problems exist.
      v. Consider administrative costs (e.g. operational, maintenance, inspection and enforcement activities) associated with green stormwater infrastructure-related incentives and implement only those program elements that are cost-effective.
2. Consider offering one-time discounts to the City Drainage Fee for flood detention facilities that exceed regulatory requirements (consider location, size/capacity thresholds and possible cap on reduction values).
3. Collaborate in cost-sharing opportunities that integrate green infrastructure and flood detention with other projects, such as:
   a. Other City CIP projects

   b. Public-Private Projects
   c. Interlocal jurisdictions and entities (see Section 4)
4. Integrate green stormwater infrastructure with standard CIP solutions (gray infrastructure) when it can serve a vital role, such as:
   a. to offset potential increases in peak flow created as a result of more efficient drainage conveyance (see figure _I_ below)
   b. redirecting runoff away from structures

Figure _I_ Hydrograph: Urban vs. Undeveloped



7. 2. Identify available funds, including federal, state, and local sources as well as prioritizing future capital investment for flood mitigation and management.

The Watershed Protection Master Plan and on-going planning activities being conducted by the Watershed Department have and continue to identify and define where the creek and local flooding problems are, the root cause of the flooding, and feasible mitigation alternatives to be considered. While the residents of Austin have expressed a strong desire to move faster to implement flood mitigation projects, there remains a need to continue planning and studies necessary to bring future projects to fruition. However, the biggest challenge has always been and will continue to be funding to implement the full scope of the Watershed Protection Master Plan.

Watershed staff provided a summary of Drainage and Watershed Bonds 1975-2015 and reported that the citizens of Austin voted to approve all nine of the bond packages for drainage improvements in this time period with the last being ten years ago in 2006. (See Appendix).

Recommendations:

1. Issue debt consistent with the recommendations in this report.
2. Investigate opportunities for grants or cost sharing with US Geological Survey to install additional flood-hardened rainfall and stage gauges throughout the City.
3. Evaluate and identify opportunities to share costs with private development to upgrade outdated drainage systems.
4. Examine budgetary requests of other City Departments to identify projects less critical to public safety than flood mitigation and reallocate these resources to increase staff and resources of WPD. Council should prioritize capital spending in future budgets to focus spending on mitigating the most critical flood mitigation projects and to fund necessary maintenance operations over spending money on non-critical projects that do not impact public health and safety to reduce the fiscal impact to citizens.
5. Evaluate opportunities to leverage volunteer activities to encourage greater citizen participation in keeping waterways clear. Examples include Keep Austin Beautiful and the Colorado River Alliance. Understanding that the structure may be overly complex, Council should also explore simple straightforward financial incentives to spur citizen engagement, which could occur in the form of a tax credit or similar.
6. Leverage local funding with state and federal programs and funding options where practicable; however, take into considerations potential project delays or additional project needs/spending that may be part of the matching funds. Seek additional sources of funds for acquiring properties such as the Stafford Act's Hazard Mitigation Grant Program (HMGP), the HUD's Community Development Block Grant Program (CDBG),

Flood Mitigation Assistance Program (FMAP), Executive Order 12898 (Environmental Justice) funding (where applicable), and private partnerships.

8. 3. PEER CITIES – Evaluating best practices in peer cities with similar climate and flood issues.

AUSTIN:	**2014 Population**	**912,791**
	Square miles	**271.8**

The following cites have similar climate and flood issues as Austin and have experienced major flood events and implemented flood mitigation solutions that may be of interest and benefit to the City of Austin,

1. **TULSA:**

2014 Population	**399,682**
Square miles	**196.8**

Tulsa has a similar flood history as Austin with frequent flooding, rapid growth and a general denial of the possibility that floods could reoccur until their "year of the floods" in 1974 and 1984 Memorial Day flood, which killed 14, injured 288, damaged or destroyed nearly 7,000 buildings and did $180 million in damages. **Following that flood, Tulsa appears to have taken the initiative to prevent future flooding and relocation of people through a series of policies and ongoing actions.**

Actions taken included:

1. 1984 flood caused relocation of 300 flooded homeowners & a mobile home park and damaged or destroyed 7,000 buildings;
2. Introduced a total capital program for flood control and master drainage plans.
3. **City Commissioners enacted a floodplain building moratorium following the 1976 flood.**
4. Created Dept. of Storm water Management to centralize flood, drainage and storm water programs and funded by the City budget.
5. **Storm water utility fee created to be utilized exclusively for maintenance of storm water detention facilities, stream channels, pumping stations, culverts, ditches and other drainage facilities. The current fee is $5.43 per month, based on cost of clearing 2,650 square feet of property.**
6. **Storm drainage management is now part of the Streets and Storm water Dept.**

7. **After storms & when needed, crews clear the streams and detention sites also utilizing storm water fees.** On average, they clean more than 22 miles of ditches and clear about 5 miles of drainage pipe each year.
8. Phased implementation programs for large capital projects are funded by storm water fees, sales tax revenues or bond issues and utilized for acquisition of lands & construction of large water retention facilities, major drainage basin improvements and other related projects.
9. Building parks in the floodplains, sports fields in storm water detention locations and greenway trails on creek banks.
10. **"In Tulsa, growth is welcomed – so long as it will not flood or cause flooding elsewhere."**
11. Tulsa now has the lowest flood insurance rates in the U.S. (40% discount) due to their initiatives.
12. Tulsa has installed over 80 sirens in the city, each audible up to one mile. They have three types of sounds:
    a. a three-minute "steady" tone to warn of impending tornadoes and of chemical releases.
    b. A three-minute "wavering" tone to warn of nuclear attacks
    c. Three-minute "high-low" tone to warn of impending flooding.

2. EL PASO:

2015 population	**877,248**
Square miles	**256.3**

In 2006, El Paso suffered record flooding which continued over an extended period in late July into early August. Recognizing the magnitude of the task and the logistical difficulties due to it's location on the New Mexico and Mexican borders, and under the sponsorship of Congressman Silvestre Reyes, a Federal Flood Assessment Conference was convened to discuss levels of coordination between federal agencies.

What is relevant here is that El Paso recognized the need to bring all interested parties together to develop a joint solution for their flooding problems. Representatives from El Paso, New Mexico and Mexico joined together.

Included in the conference were:

NOAA, National Weather Service

U.S. Geological Survey

U.S. International Boundary and River Commission

U.S. Army Corps of Engineers

U.S. Bureau of Reclamation

El Paso County Water Improvement District

Elephant Butte (New Mexico) Irrigation District

Department of Homeland Security

Federal Emergency Management Agency

Texas Department of Transportation

U.S. Environmental Protection Agency

Major recommendations made by the Conference included:

1. Clean trash, debris & vegetation & remove sediment from the Rio Grande floodplain/ channel
2. Create a Drainage District
3. Establish an Early Warning System
4. Restore the Rio Grande flood capacity to original design
5. Modify the channel
6. Increase the number of flood gauges
7. Survey the drain system

3. LOUISVILLE:

2015 population	**597,337**
Square miles	**399**

Located on the Ohio River, Louisville is highly susceptible to river flooding as well as flash flooding from interior streams and overloaded storm systems. In 1986, they created a Storm Water Drainage Authority under the Louisville Metropolitan Sewer District. The MSD Floodplain Board is responsible for approving any variance requests via public hearings.

Major improvements they have implemented include:

1. **Their 2016 Drainage Capital Budget is $187 million ($179m existing/ $8.8m new projects) as a part of a long term plan of over $1 billion.**

2. To combat the river flooding, Louisville utilizes floodwalls, levees, major pumping stations, roadway gate closures and sandbag street closures.
3. An outdoor early warning system is in place, in addition to the emergency broadcast system, for impending disasters. The system is tested the second Tuesday of each month. Public education is also in place through classroom and nursing home presentations, utility inserts, booths at area events and brochures to ensure everyone knows what to do in the event of an emergency.
4. For drainage, they have developed a Neighborhood Maintenance Program where they have divided the city into 50 distinct neighborhoods. Service requests and maintenance are grouped by neighborhood and scheduled on a yearly basis.
5. Any development or redevelopment within the floodplain must create detention facilities within the same watershed, either on the same property or an alternate site, if approved.
6. Floodplain permits can be issued for residences if the lowest level of the structure is at least one foot above the 100 year floodplain. Austin requires a minimum of 2 feet above the floodplain.
7. A natural vegetation buffer strip at least 25 ft. wide on each side of the stream bank is also required.

Louisville's flood insurance discount rate is 35%, one of the highest in the country, and well ahead of Austin's current 20% discount.

9. 4. ONION CREEK **RECOMMENDATIONS**

October 30, 2015, marked the latest in a series of flooding disasters that have created serious property damage and loss of life along Onion Creek over the years. Prior to this, there was the Halloween Flood 2013, in which the flood waters reached a record level of 41 feet and, for the first time, severely damaged and destroyed homes in the Upper Onion Creek neighborhood in addition to lower Onion Creek. The 2013 Halloween Flood had destroyed or severely damaged homes in Onion Creek at a total estimated cost of well over $150 million, including some city services. This dollar loss was probably much higher due to the lack of complete data from the city and affected counties.

In response to the 2013 Halloween Flood on Onion Creek, the City Council had passed Resolution 20140515-028 directing the City Manager to, among other things, provide a report to Council regarding the costs associated with the purchase of homes in the Lower Onion Creek floodplain around the William Cannon Drive and Pleasant Valley Road area as well as funding options and an evaluation of the drainage fee.

The 2013 and 2015 floods resulted in a need to redraw the floodplain map, but also to look more closely at possible ways to reduce the impact of future floods and preclude the need for extensive buyouts in the future.

The goal of the current Onion Creek Floodplain and Flood Mitigation Study, in addition to redrawing the floodplain maps, was to eliminate potential inundation of buildings during a 1% annual chance event (ACE). It was determined by the consultants that a 3 to 5 foot reduction in the peak would be needed to achieve the target of reducing flood risk by 30%. The specific focus area of the Study was IH35 to E. Slaughter Lane, known as Upper Onion Creek, but we suggest that attention should continue to be directed to both Upper and Lower Onion Creek.

In reading the Study and the cover letter from Watershed, we feel that a good job has been done by Halff Engineering, but it is still preliminary and needs further work, especially concerning upstream detention and the future issues to be faced if impervious cover controls are not implemented throughout the Onion Creek floodplain. This should be considered a high priority.

Options evaluated in the study for Upper Onion Creek included:

1. Property Buyouts
2. Regional Detention
3. Flood walls
4. Channel Modifications & Clearing
5. Channel Improvements

The Preliminary Study is now complete and has examined the potential viability of temporarily diverting a significant amount of the floodwaters, then releasing them back into the creek once that major crest has fallen. Although the 2013 crest lasted less than one hour, Onion Creek residents and residences suffered extensive damage.

BUYOUTS:

If buyouts were to be viewed as the sole solution for Upper Onion Creek flooding, the Study identified 222 structures within the preliminary floodplain. It was estimated that 147 of these properties would have to be purchased at an estimated cost of $91 million and annual maintenance costs of $23k. It wasn't clear as to what would be done with the purchased property after it is cleared.

It should be noted that this approach would:

1. Not provide assurance against further flooding in Upper or Lower Onion Creek if further impervious cover limits are not introduced concerning development and redevelopment upstream including in Hays County).
2. Potentially damage the viability of the community through reduced property values.
3. Not, by itself, ensure any additional security for properties downstream in Lower Onion Creek.

We feel that selective buyouts should be considered in those areas hit by both the 2013 and 2015 floods, but should be approached with the objective of also improving the

neighborhood and not as a total solution. We recommend the City of Austin should evaluate structures within the 25 year floodplain for possible buyouts.

REGIONAL DETENTION:
Three Centex quarries in Hays County (Centex West, Centex East Offline and Centex East Inline) were identified and studied as possible temporary retention options to hold the water.

Centex West has a capacity of 5,700 acre feet, which was estimated could retain 10% of the targeted reduction, or approximately .5-1.0 feet, of the flooding. The time in which it could be detained was not identified. Estimated cost was $34 m.

Centex East Offline and Centex East Inline were discounted as having multiple constraints and a low viability, but no details were provided in the Report. However, a 2013 Report, also by Halff, and prepared for The Texas Water Development Board and the U.S. Army Corps of Engineers on behalf of Hays County, did identify two additional detention possibilities, Rattlesnake Falls and Dripping Springs, which indicated potential reductions of 4 to 5 feet if all three options (Centex, Rattlesnake and Dripping Springs) were combined.

Limited discussions have taken place with the owners or managers of these facilities to date.

The Bornheim Quarry, owned by the COA, fronts onto Little Bear Creek and was not considered in either Study, even though the creek flows into Onion Creek.

Based on the combination of the two studies, we feel it bears further investigation for combining potential benefits from all of the quarries, including those not identified in this Study, especially in line with the 2013 Hays County Study which indicated potential reductions in the flood levels of 4 to 5 feet in Hays County, though it could be less once joined by Little Bear Creek in Travis County. However, these reductions could possibly be improved by including the Bornheim Quarry, located along Little Bear Creek.

<u>Antioch Recharge Facility</u>:
While not necessarily a part of the Onion Creek Mitigation Study, the Barton Springs Edwards Aquifer Conservation District (BSEACD) is studying ways that some of the detained water in the Centex Quarry might be diverted to the Antioch Recharge Facility, thus helping to recapture the water in the Edwards Aquifer and retain it for future use. This, and other recharge facilities, should be considered as a part of this project

FLOODWALLS: (See attached map)

Floodwalls were identified as one means of eliminating the flood threat for the Upper Onion Creek Community, but would require 6,200 ft of wall along Pinehurst with heights ranging from 7 feet to a maximum 16 feet, in addition to the purchase of about 55 structures and installation of an internal drainage system to drain approximately 110 acres of local runoff.

In the Wild Dunes area, they would need 3,400 feet of wall with a height ranging from 5 to 12 feet. 31 structures would have to be purchased

In both neighborhoods, the wall would need to be relocated as closely as possible to existing structures in order to minimize the height.

Total cost for the Floodwall Option was $80 million with annual O&M costs of $44k. It wasn't clear as to what would be done with the purchased property after it is cleared.

We consider this option to be the most destructive of the options:

1. It would still result in the purchase of 86 properties ,
2. Quality of life and property value could be seriously diminished for those directly behind the walls
3. Overall property values through the Onion Creek neighborhoods and resultant property tax revenues to the COA and Travis County could be greatly reduced.
4. Increased flow downstream could further increase future flood problems and potential buyouts in Lower Onion Creek.

CHANNEL MODIFICATIONS AND CLEARING:

CHANNEL CLEARING: According to the 2016 Study, totally clearing the channels and immediate overbanks can be considered an effective alternative to reducing flood elevations as it allows the water to run more freely and was estimated to decrease the water levels by up to 2.0 feet in the Wild Dunes area. There is also a potential benefit due to a reduction of fire threats in the area with the removal of the dead brush. However, efforts to clear and maintain the "cleared" channel would also potentially impact the riparian corridor along Onion Creek and cost approximately $11.2m with an estimated additional $1m in annual O&M costs as well as increase erosion.

REMOVE CONSTRICTIONS: Selective efforts, such as excavating the channel below the River Plantation Bridge, could provide benefits by increasing the opening and reducing the water elevations in the Wild Dunes area. The result could also be to increase erosion. The impact of this increased flow on Lower Onion Creek must also be evaluated.

CHANNEL BENCHING: This option would result in increased velocity of water flow and could potentially be very erosive.

CHANNEL IMPROVEMENTS: Combining the channel alternatives does offer potential, but should be further evaluated in the final engineering analysis. Regular maintenance would

be required and initial cost is estimated at $74m, but water surface decreases of 1.4 – 2.7 ft in the Pinehurst area and 2.5-4.0 ft in the Wild Dunes area make it worth further investigation and, combined with the quarry alternatives, might achieve the mitigation goal. Once again, water velocity would be increased so the impact on Lower Onion Creek should also be considered.

While these recommendations are directed primarily towards Upper Onion Creek, they are made with the understanding that current efforts to complete the Lower Onion Creek Buyouts will be completed as quickly as possible.

RECOMMENDATIONS:

1. **Specific steps for mediating the flood risk in Onion Creek:**
    a. **Clean and regularly maintain the Creek.**
    b. **Immediately expand the Halff Studies for upstream detention solutions.**
    c. **Organize the Regional Conference to galvanize support and cooperation from all interested parties into an Action Plan.**
    d. **Buyouts are essential for the immediate problems in Lower Onion Creek and there are selected at-risk areas in Upper Onion Creek. Expedite buyouts in those areas if an effective detention solution cannot be readily identified.**
    e. **Channel improvements should be considered, including benching, removing constrictions and channel clearing with consideration to potential erosion issues. Any channel improvement options must consider downstream impacts.**
    f. **A large-scale floodwall option is destructive and should be considered only as a last resort and in specific limited areas. Any floodwall options must consider downstream impacts.**
    g. **Evaluate individual property floodproofing, including elevation of structures and/or individual structure floodwalls ("garden walls").**
2. **Expand and expedite study of the Centex Quarries and all other options upstream, including the Bornheim Quarry, Rattlesnake inline detention alternative, IH 35 inline detention alternative, and Dripping Springs inline detention alternative to further quantify possible approaches and potential detention benefits.**
3. **Immediately reach out to Hays, Travis, Bastrop, and Blanco Counties to jointly address the problem and potential solutions, including contacting Centex, Dripping Springs and Rattlesnake Falls ownership.**
4. **Evaluate the viability and benefit from channeling a portion of the floodwaters into the Antioch Recharge Facility and recapturing it in the Edwards Aquifer.**
5. **Evaluate other potential locations for detention facilities within the Onion Creek area.**
6. **Convene a Regional Conference/ Task Force comprised of all potentially interested parties (local, county, state, federal and private) at the earliest possible date to confirm the findings, identify tasks and funding needed, and establish time frames and objectives. The City of Austin should take the lead on this endeavor.**
7. **Strongly discourage development or redevelopment within the Onion Creek 500 year floodplain until FEMA has reviewed the results of this Study and updated their maps.**

8. **Conduct a third-party evaluation of the effectiveness and accountability of the Regional Stormwater Management Program (RSMP) to mitigate flooding and consider whether revisions and expansion of the program should be made. Create an Onion Creek Flood Control District to manage the Onion Creek Floodplain. Potential partners include BSEACD, Hays County, Travis County and LCRA.**
9. **Appoint representatives from both Lower and Upper Onion Creek to join the Halff Study Team as full members of the ongoing study team to formalize plans and provide community input and support.**
10. **Coordinate area early warning systems with strategically placed flood-hardened gauges to include all streams and creeks feeding into the Onion Creek watershed.**

POTENTIAL FUNDING/ PARTNER RESOURCES:

For any far-reaching solution to be successful in solving the Onion Creek flooding problems, it is essential to form partnerships with the other potential stakeholders. Onion Creek is not just a local Austin problem; it extends upstream into Hays and Blanco Counties and even has an impact downstream as it flows into the Colorado River just above Bastrop.

1. **LCRA**
2. **Texas Water Development Board**
3. **State of Texas**
4. **Hays, Travis & Blanco Counties**
5. **U.S. Army Corps of Engineers**
6. **FEMA**
7. **Creation of Onion Creek Flood Control District**
8. **Bonds**
9. **Barton Springs Edwards Aquifer Conservation District (BSEACD)**
10. **Other potential sources of funding (as referenced in Section 6)**

10. 5. Collaborating with the City's Environmental Commission

The Environmental Commission has oversight of the Watershed Protection Department. On January 13, 2016, members of the Flood Mitigation Task Force briefed the Commission on the progress of the FMTF, with the intent to follow up with the Commission upon completion of the final report.

The FMTF recommendation for the Environment Commission are:

1. When considering acquiring properties for green space or environmental protection, include the benefits of flood mitigation.

2. Ensure the Watershed Protection Department is funded and staffed at a level that ensures the maintenance and upkeep of the open and closed storm water systems to ensure public safety during massive rain events.
3. Review vegetation and riparian policies along open water drainage systems to ensure the policies are benefiting the public and not causing flooding, stoppage or backups of flood water.
4. Create a public forum whereby citizens can address the oversight body of the Watershed Protection Department to voice grievances, and seek avenues for navigating the bureaucracy.
5. Develop a process for tracking and following up on citizens' grievances and concerns. Request an annual report on the status of grievances presented to the Environmental Commission.
6. As the oversight committee of the Watershed Protection Department, review the effectiveness and efficiency of the WPD's performance measures.

11. 6. Collaborating with other jurisdictions and agencies that have interest, expertise, and investment authority regarding flood mitigation potentially impacting areas inside and outside of the City of Austin as well as with work groups or other regional initiatives focused on flood issues and storm water management.

Recommendations:

1. Form a regional council or task force comprised of water management, safety and environmental organizations to look at regional storm water management. There does not appear to be a regional authority or strategy to manage flooding incidents. City of Austin Watershed Protection Master Plan 2015 Update recommends Watershed Protection continue to partner with other jurisdictions to achieve watershed protection goals, but there is no recommendation to partner with other jurisdictions to achieve regional storm water management and flood mitigation strategies.
2. Consider partnering with the following organizations to develop the council or task force.
    - Hays County and its municipalities
    - Travis County and its municipalities
    - Bastrop County and its municipalities
    - Blanco County and its municipalities
    - Williamson County and its municipalities
    - Lower Colorado River Authority
    - Barton Springs/Edwards Aquifer Conservation District
    - Texas Department of Transportation
    - Texas Commission on Environmental Quality
    - Texas Water Development Board
    - Texas Facilities Commission
    - Texas General Land Office
    - Texas Parks and Wildlife
    - Texas Division of Emergency Management

- U.S. Environmental Protection Agency
- NOAA, National Weather Service
- U.S. Geological Survey
- U.S. International Boundary and River Commission
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- Department of Homeland Security
- Federal Emergency Management Agency
- Texas Medical Center – Houston Weather Alert System
- Environmental systems Research Institute @ Pickle Research Campus
- Texas Tech University – TxDOT and hydrology research
- Texas A&M University – flood forecasting
- Rice University – post hurricane flood research
- Texas Floodplain Managers Association (TFMA)
- American Society of Civil Engineers (ASCE) Environmental & Water Resources Institute (EWRI)
- Association of State Flood Plain Managers (ASFPM)
- And other appropriate agencies

3. Form a Regional Flood Control District to focus on flood mitigation and stormwater management, and to fund flood mitigation programs.
4. Investigate flood management programs used by El Paso County Water Improvement District, Elephant Butte (New Mexico) Irrigation District, Tulsa, Oklahoma, City of El Paso, Texas and Louisville, Kentucky. See recommendations in Section 3. Peer Cities.
5. Encourage collaboration with surrounding communities to adopt floodplain and storm drainage policies comparable to the levels of City of Austin.
6. Incorporate information from the National Water Model as needed to enhance the safety of all COA residents.
7. Coordinate with Texas A&M University for emergency veterinary services in response to flood events: http://vetmed.tamu.edu/files/vetmed/vet/texvet-0815-pages-34-35.pdf
8. Coordination with United States Geological Survey (USGS) to add more flood hardened rain and flood stage gauges for better flood forecasting in order to assist first responders during extreme rain events and for potential evacuations of Austin citizens. Investigate opportunities for grants or cost sharing with USGS to install additional flood hardened rainfall and stage gauges through the City.
9. Install, inspect, and maintain an Emergency Siren System designed to alert residents and visitors in flood prone areas.
10. Coordinate a flood warning system to include local news media, NOAA Weather Radios and local wireless phone and pager services. Ensure a contingency plan for massive power failures, lightning strikes, and damaged communication infrastructures.
11. Coordinate with each school campus located within a floodplain to ensure each has an updated Emergency Preparedness Plan in response to flooding incidents each year.

IV. Work Group Scope & Strategies

The FMTF separated into 4 working groups to gather information and carry out the tasks of reviewing the programs and policies of the Watershed Protection Department. Work Groups met independent of each other to meet with individual staff members of the Watershed Protection Department. Following are the three Work Group and their areas of purview.

1. **Capital Improvements Work Group Strategies**: Flood mitigation, flood preparedness, flood buyout policy, capital costs, affordability and equity, green and grey infrastructure, Master Plan, other studies, identify funds and prioritization of CIP, peer city benchmarking.
2. **Operations & Maintenance Work Group Strategies:** Flood mitigation, flood preparedness, floodplain variances, operations & maintenance costs, capital costs, affordability and equity, public education & safety, green and grey infrastructure, Master Plan, other studies, peer city benchmarking.
3. **Buyouts Work Group Strategies:** Flood mitigation, flood preparedness, flood buyout policy, affordability and equity, Master Plan, peer city benchmarking.
4. **Report Writers Group Strategies:** Compile the three Work Group Reports into recommendations by resolution section and prepare an executive summary.

V. Work Group Reports

Capital Improvements Work Group Report (Appendix A)
Buyouts Work Group Report (Appendix B)
Operations & Maintenance Work Group Report (Appendix C)

VI. Citizen Communications

Names of Citizen Communications (Appendix D)

VII. Task Force member names, appointments and committees:

Rose Marie Klee (Mayor) Buyouts Committee, Report Writers
Jeffrey Henke (Mayor) Buyouts
Marvin Chaney (District 1) Operations & Maintenance, Report Writers
Ben Hodges (District 1) Operations & Maintenance
Ana Aguirre (District 2) Capital Improvements, Report Writers
Robert Kibbie (District 2) Buyouts
Kate Mason-Murphy (District 3) Capital Improvements
Richard Maness (District 3)
Rolando Delgado (District 4) Buyouts
Carol Olewin (District 4) Secretary FMTF, Operations & Maintenance, Report Writers
Ken Jacob (District 5) Capital Improvements, Report Writers
Rollin MacRae (District 5) Capital Improvements
Paul Morales (District 6) Operations & Maintenance
Jay Scanlon (District 6) Capital Improvements, Report Writers
Dale Gray (District 7) Vice Chair FMTF, Buyouts
Dorsey Twidwell, Jr, (District 7) Operations & Maintenance
Robert Henneke, (District 8) Capital Improvements, Report Writers
Matthew L Rienstra, (District 8) Chair FMTF
John Gleason (District 9) Capital Improvements, Report Writers
Elloa Mathews (District 9) Capital Improvements
Raymond Canfield (District 10) Capital Improvements
John Pitts, Jr (District 10) Operations & Maintenance, Report Writers

VIII. Watershed Protection Department Comments

Watershed Protection dedicated its staff to providing information and support to the full FMTF as well as to the individual work groups.

Appendix A
Flood Mitigation Task Force
Operations & Maintenance Work Group Recommendations

TOP THEMES

- Drainage Utility Fee Funding and Structure insufficient to cover WPD mission.
- O&M FTE count is insufficient to operate and maintain the existing aging and future annexed drainage system.
- Educating the Public about 100-year flood plain terminology.
- Floodplain variances should be considered on a case-by-case basis.
- Flood Early Warning System critical to life and safety in Austin/Travis County and downstream communities.
- Consider cost of Buyouts vs Infrastructure Development to mitigate flooding.
- Consider continuation/permanence of FMTF with oversight of WPD, including follow-through on this report and further address certain parts of the resolution of resolution, and continued citizen engagement

Overall Flood Mitigation and Preparedness strategies

Staff & Budget

The Watershed Protection Department (WPD) does a tremendous amount of work for the city and it's residents with a relatively small staff and budget.

While our city has grown at a rapid pace, Watershed Operations & Maintenance (O&M) has received no significant budget increases for the past eight (8) years; similarly, full time equivalents (FTE) has been stagnant at 46 people for the past 8 years. Not only does staff have a difficult time keeping up with existing infrastructure needs, the city has grown in geography through annexation over the past years, exacerbating these difficulties.

The O&M department has had difficulty retaining staff due to low wages, long hours during emergency storm events, and commute distance to and from work. With the current wages paid to field staff, it is difficult for staff to afford housing close to the City. In fact, many of the field staff have moved to better paying positions at Austin Energy and Austin Water and in the private sector.

As O&M crews are working to repair aging stormwater infrastructure, if a large storm event is anticipated, crews are pulled off that repair project in anticipation of a flooding event. By moving

field crews to prepare for a large storm event, the repair and maintenance projects are put on hold until the storm event passes.

Strategy

The focus of O&M is to reduce overall costs so that more resources can be directed to flooding problem-areas. Currently, the City operates from a reactive position and is unable to address every complaint/problem. Coverage area, age of the system, limited funding, and staffing resources contribute to the challenges facing the WPD.

As part of a more proactive stance, the City has an opportunity to leverage the tremendous amount of private development currently occurring in Austin, but staff is limited to a single FTE to engage with the development community. Staff has indicated that many private developers are happy to engage on ways they can cover certain upgrades or new drainage infrastructure, but the Department must have the staff to be able to execute on this strategy.

The City does not currently have a program-wide asset management planning tool in use. The WPD is using a software program system for work order maintenance management and a Geographical Information System (GIS) to identify and track stormwater infrastructure. Having a comprehensive asset management plan allows for better short- and long-term planning of maintenance and capital improvement costs and needs. While the WPD has taken incremental steps to attain further integration between their current asset/work order tracking systems and business processes, establishing and implementing an asset management plan will further aid in reducing overall costs to the department and direct future capital investments to meet current and future needs.

Infrastructure

The City's existing stormwater drainage infrastructure is old, unmapped/modeled, and often times is significantly undersized to handle runoff of current and future city development, and O&M is struggling to cover the problems inevitably caused by those facts. While O&M has been granted new mapping tools (e.g. - television cameras) and now replaces aging infrastructure with more sustainable technologies than before (e.g. – pipe lining, suitable pipes, natural stones and permeable groundcover), the sheer size of the problem is massive.

Some key statistics:

- An estimated 257 miles out of 1,100 miles of storm drainpipes are in need of replacement and upgrading.
    - City is currently staffed and funded to clean out only 75,000 feet per year (14.2 miles), signifying only 1.3% of the Closed System Infrastructure is cleaned out in a year. At that rate it will take 75 years to clear and maintain the existing closed storm water systems in Austin.

  - O&M crews currently replace approximately .62 miles/year with the current FTEs. Existing drainage pipes within the City are aging at a rate of approximately 7 miles/year. At that rate, current O&M staff will never catch up to the aging drainage system.
  - Fully replacing the 257 miles within a 5-10 year timeframe is estimated to cost between $162 to $326 million annually.
- The original 2015 Performance Measures projected to install and rehabilitate 1,000 feet of pipeline in the year, but actuals for 2013 were 3,500 feet per year and actuals for 2014 were 3,800 feet per year. Clearly 2015 underestimated the workload of the El Nino weather pattern returning to the Austin area in 2015. FTE's were not increased or adjusted to reflect the increased workload needed to keep up with the actual work.
- O&M has a backlog of over 453 work orders in the Closed Water System, dating back to 2004, a backlog of approximately 100 Open Water/Erosion Systems work orders, dating back 12-15 months, and over 500 Detention/Water Quality Pond work orders, dating back to 2011.
- As O&M falls further behind, existing problems worsen and become more expensive to fix.

Flood Early Warning System (FEWS)

The Flood Early Warning System (FEWS) is critical to public safety and should continue to be well maintained, expanded to cover more creeks, and updated as technology evolves.

The FEWS program is funded under the O&M budget with a current funding level of $1.4 million a year. Floodplain modeling is allotted $0.5 million. The FEWS program currently contains approximately 100 gauges, including gauges maintained by the COA and US Geological Survey (USGS).

With the substantial growth seen in the Austin Metro Area in recent years, strategically locating additional gauges to provide more data points for better flood modeling is crucial to saving lives at the beginning and during extreme flood events.

Recommendations:

- Conduct a financial and organizational audit of the Watershed Protection Department to evaluate staffing resource allocations, program effectiveness, and successful implementation of master plan goals and objectives.
- Update the Drainage Master Plan more frequently and tie-in program performance measures with the plan. Keeping an eye on these metrics will broaden focus on meeting long-range goals and objectives.
- Expand the Regional Stormwater Management Program to cover the entire city so as to aid in the replacement/upgrading of stormwater infrastructure and not only regional detention, and expand these asset management tools into a more robust capital investment planning resource.

- Investigate and review other detention methods other than current drainage criteria methods listed in the Drainage Criteria Method.
- Continue and increase efforts to establish a comprehensive asset management plan for use in short- and long-term capital improvement planning and maintenance.
- Assess whether Watershed Development would be more appropriately under the oversight of the City of Austin Infrastructure Services Deputy City Manager rather than Development Services Deputy City Manager.
- Consider continuation/permanence of FMTF with oversight of WPD, including follow-through on this report and further address certain parts of the resolution of resolution, and continued citizen engagement
- City should consider decentralizing the O&M facilities and consider more regional facilities locations dispersed around the city that can be more reactive to flooding and more proactive in preventative maintenance
- Continued coordination with surrounding Counties, specifically in areas of future annexation where drainage may have been designed to a lower level of service than what would be currently required within the City, areas which set staff back as they work to upgrade the City's overall service.
- Continue to update FEWS equipment and software due to the reliance of many departments, the Emergency Operations Center (EOC), and the general public that rely on this system.
- Closer coordination with USGS to add more rain and flood stage gages for better flood forecasting in order to assist first responders during extreme rain events and for potential evacuations of Austin citizens.

Floodplain variance and flood buyout policies

The City has seven criteria for granting development (variance) within the 100-year floodplain:

1. the finished floor elevation of a proposed building is at least two feet above the 100-year floodplain;
2. normal access to a proposed building is by direct connection with an area above the regulatory flood datum, as prescribed by Chapter 25-12, Article 1 (Building Code);
3. a proposed building complies with the requirements in Chapter 25-12, Article 1, Section 25-12-3 Appendix G (Flood Resistant Construction) and Section 1612 (Flood Loads);
4. development compensates for the floodplain volume displaced by the development;
5. development improves the drainage system by exceeding the requirements of Section 25-7-61 (Criteria for Approval of Development Applications), as demonstrated by a report provided by the applicant and certified by an engineer registered in Texas;
6. the variance is required by unique site conditions; and
7. development permitted by the variance does not result in additional adverse flooding impact on other property.

The current (2015) administrative floodplain variances will impact over 5,000 structures in the City with the new FEMA floodplain maps implemented January 1, 2016. Homeowners within the 100-year floodplain footprint cannot make improvements to their property exceeding 50% of the value of the property without having to meet the administrative floodplain building

requirements. These requirements will significantly impact the practice of building a new structure on 100-year floodplain properties. These building requirements may subject the City to more buyouts at a significant cost.

If an administrative variance is not granted, there is currently no public notification required for the public hearing by Council of the request. To protect the correlative rights of all citizens and stakeholders potentially impacted by changes to drainage patterns by construction, some form of public notice should be required at some point in the variance request process.

Recommendations:

- City should require adherence to the seven evaluation criteria, and should strictly review whether or not a development exacerbates flooding, and the cost/benefit of allowing the development with any potential future flooding scenarios.
- Coordinate with PARD and look for opportunities to purchase lots in the 100-year floodplain to use as open space/neighborhood parks.
- Rather than focusing on buying structures already flooded in the 100 year floodplain, consider purchasing undeveloped land in floodplains to prevent the increase of impervious cover while mitigating future flooding risks.
- Public notice should be required during the variance request process.
- A dramatic curtailment/cessation of granting variances, at least until a time when the city has caught up with current problems.

Structure and use of the adopted drainage utility charge

O&M funding is entirely made up of a distribution from the Drainage Utility Fund (DUF); O&M receives approximately 40% of the dollars collected in the DUF.

As a practical matter, the DUF cannot be relied on for solving Austin's flood problems. Present DUF revenues are insufficient to cover all the needed O&M expenses, and yet a large portion of the DUF is directed to purposes other than O&M. Increasing the DUF to cover the necessary O&M is problematic; as a regressive and inequitable fee, owners in the lower income tiers are already struggling with payments.

The DUF is a fairly young construct, having been used in Texas for less than 20 years. The fee's current structure is based on use of the stormwater system, based on pervious and impervious cover. While the recent updating of the DUF attempts to address certain elements of inequality, the underlying construct is incomplete; stormwater drainage is inherently non-voluntary, meaning the individual property owner has little control over the problem, and the stormwater system is highly interdependent. Every single property effects stormwater runoff on the surrounding properties, but does so in a complex way to make analysis difficult.

Looking at the stormwater system – and funding it's ongoing operations and maintenance – in a manner similar to roadways and other public infrastructure, rather than similar to electric rates

which are based on volume and controllable by the property owner, would result in a more logical and equitably apportioned fee structure.

Recommendations:

- Analyze the current amount of the DUF distributed to O&M and consider increasing the percentage allocated
- Restructure the DUF to more broadly and equitably cover all ratepayers in a manner that considers the non-voluntary nature of the root problem.

Storm water management system operation and maintenance costs (O&M), capital costs, city fees, flood insurance, and other identified factors that have impacts to affordability and equity in anticipation of the 2016-2017 Council budget conversation.

Financial Recommendations:

- Examine cost benefits of moving a portion of the O&M prioritized projects over to CIP to ensure completion in a timely manner. This will reduce critical infrastructure workload from the O&M backlog and allow less-critical projects to be covered by the DUF.
- A CIP to replace large portions of the City's critically old pipe infrastructure.
- Examining new financial sources for large scale infrastructure projects other than the DUF and DUF-backed capital bonds, such as General Obligation Bonds.

Staff Recommendations:

- Adding FTEs and contractors to efficiently maintain the current and future drainage system, including:
    - More staff to evaluate the Public-Private Partnership Opportunities.
    - Evaluate cost benefits of adding an internal design team for closed systems (open systems has two internal design teams).
    - Evaluate cost benefits of adding FTEs and use more contractors/temporary employees during emergencies, so that the current team isn't completely transferred over during emergencies.
    - Evaluate cost benefits of using contractors to repair larger drainage infrastructure and smaller routine maintenance projects to allow City crews to focus on smaller drainage repair projects.
    - Evaluate increased city support of private/volunteer initiatives (including Keep Austin Beautiful and other initiatives) to address clearing of debris and other basic maintenance
- Adding new O&M facilities strategically around the City to dispatch crews more efficiently. Currently, crews are dispatched from one facility located on Hwy 183 in northeast Austin.

- Implementing programs to add moral for field staff crews and increase staff retention.

Methods and means to provide more public education and outreach to new residents and visitors to raise awareness of flash flooding potential, as well as actions and strategies for the public to take to remain safe

General public education is critical to the safety of our population. The City's Early Warning Flood Gauge and Rain Gauge System are a core piece, warning residents of rainfall and the potential for flooding, alerting emergency responders to crisis locations, and warning downstream communities of impending flooding. We understand the City is currently upgrading this system.

Education and outreach needs to move away from the "100-year floodplain" approach and talk to people about the probability of flooding. For example, a 100-year flood has a 26% chance (about 1 in 4 chance) of occurring over a 30-year mortgage. Another way of thinking about it is that there is a 1 in 6 chance of a 100 year flood occurring in 18 years.

Flooding in Austin is not confined to the FEMA-identified floodplains. The massive "water bombs," such as the 14 inches of rain that hit the airport in 2015, can strike anywhere and can cause flooding in any neighborhood overwhelming the stormwater system. There is no practical way to build systems that can take on water bomb levels of rainfall.

Lastly, concern exists that the WPD's name does not accurately convey the role the Department plays in this critical function to the community. Simple changes could help citizens and taxpayers better understand where these dollars go and why.

Recommendations:

- Continued and increased coordination with surrounding Counties on floodplain hazards in our area for consistency in the educational message and potential cost savings.
- Examine renaming WPD to better communicate to Austin citizens the three primary goals of the Department: Water Quality, Erosion Control, and Flood Mitigation.
- Effectively communicate the flooding chances residents face beyond the standard 100 year floodplain, including outside the floodplain. Creative ways to do so might include games and other education tools.

Standard and Green Infrastructure utilization; impacts, regulations, and management of impervious cover; master planning studies underway.

An upgrade of the City's building codes, with tight coordination with WPD and flooding mitigation issues, is critical to the success of the City's overall efforts to stem flooding. We understand CodeNext is closely examining these issues. Further, we commend WPD for its innovation in sustainable, or "green", design, which has demonstrated a higher success rate at mitigating flooding and it's impacts on erosion and water quality.

Recommendations:

- Support current CodeNext recommendations to require mandatory drainage plan review for all building permits both commercial and residential, including infill development, and require builders to include mitigation strategies in their planning.
- Ensure that communication between all City Departments, WPD, Public Works, PARD, and others are clear in regard to current floodplain building requirements.
- Encourage more Public-Private Partnerships, where the City can leverage private development activities to increase investment in new or updated infrastructure.
- Continue to incorporate and encourage sustainable infrastructure design.

Identifying available funds, including federal, state, and local source as well as prioritizing future capital investment for flood mitigation and management.

Recommendations:

- Investigate opportunities for grants or cost sharing with US Geological Survey to install additional rainfall and stage gages through the City.
- Evaluate and identify opportunities to share costs with private development to upgrade outdated drainage systems.
- Recommend implementing a Storm Water Impact Fee assessed on new development to offset increased costs of upgrades and increased maintenance to drainage infrastructure surrounding development.
- Examine budgetary requests of other City Departments to identify projects less critical to public safety than flood mitigation and use these resources to increase staff and resources of WPD.
- Evaluate opportunities to leverage volunteer activities to encourage greater citizen participation in keeping waterways clear. Examples include Keep Austin Beautiful and the Colorado River Alliance. Understanding that the structure may be overly complex, Council should also explore simple straightforward financial incentives to spur citizen engagement, which could occur in the form of a tax credit or similar.

Appendix B
Flood Mitigation Task Force
Capital Improvements Work Group Recommendations

- **Charge and Actions**

The Austin City Council, by Resolution 20150604-044, (date), created the Flood Mitigation Task Force (TF), and charged it with addressing the following issues:

(Insert Resolution)

The Task Force began meeting on September 22, 2015, and met at least monthly since. The TF created several committees to more intensively investigate components of the problem: mitigation, funding, buyouts, policy, and intergovernmental cooperation. The committees have met more frequently, receiving input from City staff and others on various aspects of flooding and its impacts on Austin communities, as well as potential efforts toward reducing those impacts.

Findings and recommendations will be presented in each area of the report, but several overarching conclusions stand out:

- Flooding has been addressed in a reactive, rather than a proactive manner;
- Flood mitigation has been organized on a "squeaky wheel" basis rather than prioritized on a basis of importance;
- Catching up and establishing a flood damage-free status will be costly and will require enacting, funding and enforcing strong and difficult regulations.

Overview

-
- Stream Channel and Floodplain Management

A natural landscape, unaltered by clearing, changes in land uses, construction of impervious cover, and artificially generated discharges, has inherent "water shedding" characteristics. These are determined by soil type, slope, and flow deterrence like vegetation and geological features. On a given landscape, rainfall events differing in amount, intensity and duration will produce predictable flows in the streams draining the area (watershed). Any alteration in any of the characteristics of the landscape will change stream flows. Removal of vegetation, paving of surfaces and clearing or shaping of channels will increase discharges to the stream and intensify flows to downstream areas. These are sometimes countered by constructing detention and retention projects to intercept these flows, or restoration projects to recreate natural function in a damaged area.

Channel management consists of clearing significant obstructions when noted, and stabilization of significant bank erosion situations. The lack of staff to continually monitor channel situations

hinders obstruction removal, and staff "hands-off" approach to active stream management allow some situations to develop to significance when they could be dealt with more easily/cheaply by early intervention. There does not appear to be any stream-by-stream plan to actively manage the fluvial geomorphology of streams to assure stability or avoid problems.

Floodplain management also appears to be a "hands-off" approach, whereby reaction is the preferred approach, with no plan or implementation on a stream-by stream basis. Only when significant problems present themselves are after-the-fact reactions initiated. Projects by other City departments (such as bike highways, recreation, transportation) with destructive elements are routinely approved as "having gone through a process", even when they result in serious adverse impacts to stream stability, erosion and flooding.

This can be attributed to lack of staff/funding, lack of standing for ecological stability in the decision-making process, and an aversion to criticism from taking actions that might not be understood at the political level. In a politically active city like Austin, there is likely to be a strong negative reaction to any management program for streams.

- Drainage Management

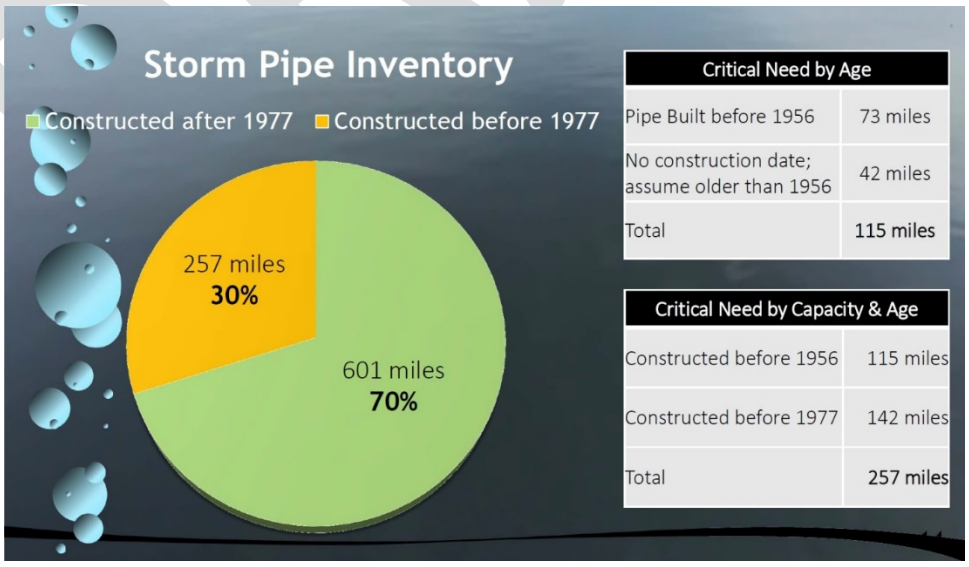
The surface drainage management for the City of Austin consists of designed or ad hoc drainage on the surfaces of streets, in roadside ditches, and across land surfaces; and the designed underground storm drain system which captures surface street drainage and conveys water to the streams by underground pipes. Above a certain quantity of rainfall, each of these is exceeded, causing inundation of streets, yards and even houses. These impacts are greatest in areas of older construction (some over 100 years old), where designs were inadequate, and where infrastructure is failing. Adding to these problems are adjacent subsequently-built-up areas which drain toward these already at-risk areas. To some extent, these problems can be addressed by adding storm drain capacity, but care must be exercised to avoid delivering excess water to already overflowing streams, exacerbating flooding in downstream neighborhoods. Staff indicates that their program includes detention designs to prevent any increase in streamflow, but so few projects are done that it is impossible to evaluate whether this is possible, much less achieved. Funding is at a rate that it would take over 100 years to catch up with the need.

1.0 Review and make recommendations regarding:

1A. Flood Mitigation and Preparedness Strategies.

The basic goals of flood mitigation and preparedness strategies are to identify and quantify known and predicated flood risk; to make the general public, elected officials, and emergency responders aware of the risks and how to respond; and to develop and implement mitigation strategies that reduce the potential of creating new or future problems (regulation) and reduce the potential risk related to existing flood problems. Based on the 2015 update to the Watershed Master Plan, the City has identified all of the known creek flood and local flood areas within the City's full-purpose and extra-territorial-jurisdictions; however, detailed engineering models have not been developed for all of the creeks and most of the local (street and storm drain network) flood problem areas.

The City is able to develop a prioritized list of creek flood mitigation projects based on the risk to life, critical infrastructure, and private property because the majority of the creeks (~75%) have been studied. In contrast, the priority list of local drainage problems is reactive due to the fact that most of the local flood problems are identified through reporting by 311 calls of actual flooding to streets, yards, and structures. This is due in large part to the limits of local flood modeling that existed until recently (two dimensional modeling has made large advances in terms of model availability and cost in recent years) and the fact that it would be difficult and costly to model 100% of the City to determine where local flooding may occur. The Watershed Department has begun developing models of the known local drainage problems and, when complete, will be able to use that information to better inform the prioritization of those projects.



We recognize it may not be a Tier I activity to complete the creek flood models because the majority of the streams have been studied and others may be studied as development occurs;

however, the City should continue to progress towards the goal of having them all completed. Similarly, it may not be realistic to develop city-wide local flood models but Watershed should work to identify potential local flood problem areas using proxy information (such as the age of the neighborhood) and should develop a methodology to prioritize future local flood study areas. The goal is to eventually be able to proactively identify and model potential local flood areas.

Flood mitigation strategies used by the City of Austin include 1) prevention through rules, regulations, and enforcement; 2) structural solutions including flood detention (above ground and underground), channel modification, flow diversion, storm drain upgrades, raising structures, improving low-water crossings, removing structural constrictions, levees, and floodwalls; and 3) property acquisition (buyouts).

Overall mitigation strategies are sound but there is a general consensus that there are opportunities to work more closely with affected parties (such as neighborhoods). Many residents perceive a lack of opportunity to provide input during the Preliminary Engineering Report (PER) phase regarding the potential variations of the stated strategies or combinations of strategies that should be studied for variability. In addition, some of the flooding issues are in watersheds that extend beyond the City's jurisdiction and can only be solved through cooperation with other jurisdictions.

Recommendations:

1. Dedicate resources and funding to complete local flood modeling to allow the program to utilize data to improve prioritization with a goal to have known local flood areas modeled by the end of Fiscal Year 2019.
2. Gather community input early in the PER phase (possibly during the scoping stage) regarding strategies to be examined and be transparent in showing the results, costs, and benefits for the alternatives studied.
3. Ensure a system and process exists such that the One Stop Shop can easily check to determine if new development, or redevelopment, is in or near any known local flood problem areas so this can be taken into consideration during the building and/or site plan review.
4. Commit more resources to creek maintenance, as opposed to creek clearing, in areas where channels do not have sufficient or significant freeboard. Maintenance should include cleaning bridges and culverts, cutting fallen trees that can act as debris dams, and obvious obstacles that could cause increased water surface elevation. If little to no maintenance is/will be performed on a creek(s) then Watershed should ensure that the modeling/engineering assumptions in the models account for the higher roughness factors.
5. Dedicate future resources and funding for additional local flood modeling to allow for a proactive approach and response (rather than reactive) to local flooding problems in desired development areas (such as TODs) and neighborhoods with storm drainage system constructed before the Drainage Criteria Manual was adopted in 1977.

6. Dedicate future resources and funding to complete creek flood modeling for the remaining unstudied creeks (approx. 25% un-modeled) by the end of FY2019 in order to develop floodplain maps and to prevent future issues in those watersheds.
7. The City should adopt a policy to rank and prioritize local flood mitigation capital projects based on the threat to persons and critical infrastructure (including roadways) due to flooding in order to mitigate the highest risk flood problems first.
8. Consider developing a coordination council or Task Force comprised of interested parties (such as Hays County, Travis County, Lower Colorado River Authority, Barton Springs/Edwards Aquifer Conservation District, and the U.S. Army Corps of Engineers) to look at regional / watershed solutions where appropriate (for example Onion Creek Watershed).

1B. Floodplain variances and flood buyout policy:

The City has seven criteria for granting development (variance) within the 100-year floodplain:

I. the finished floor elevation of a proposed building is at least two feet above the 100-year floodplain;
II. normal access to a proposed building is by direct connection with an area above the regulatory flood datum (as prescribed by Chapter 25-12, Article 1 of the Building Code);
III. a proposed building complies with the requirements in Chapter 25-12, Article 1, Section 25-12-3 Appendix G (Flood Resistant Construction) and Section 1612 (Flood Loads);
IV. development compensates for the floodplain volume displaced by the development;
V. development improves the drainage system by exceeding the requirements of Section 25-7-61 (Criteria for Approval of Development Applications), as demonstrated by a report provided by the applicant and certified by an engineer registered in Texas;
VI. the variance is required by unique site conditions; and
VII. development permitted by the variance does not result in additional adverse flooding impact on other property.

The current (2015) administrative floodplain variances will impact over 5,000 structures in the City with the new FEMA floodplain maps implemented January 1, 2016. Were new FEMA maps introduced a/o Jan. 2016? Homeowners within the 100-year floodplain footprint cannot make improvements to their property exceeding 50% of the value of the property without having to meet the administrative floodplain building requirements. These requirements will significantly impact the practice of building a new structure on 100-year floodplain properties. These building requirements may subject the City to more buyouts at a significant cost.

If an administrative variance is not granted, there is currently no public notification required for the public hearing by Council of the request. To protect those potentially impacted by changes to drainage patterns by construction, some form of public notice should be required during the variance request process.

Recommendations:

1. Require strict adherence to the seven evaluation criteria; disallow development that exacerbates flooding.
2. Provide public notification to property owners that may be affected when a flood variance request has been made.
3. Disallow the granting of floodplain variances until mitigation goals have been achieved in flood-prone areas.

We offer the following additional suggestions regarding buyouts:

1. Accelerate buyouts for all affected property owners in Lower Onion Creek (many of whom suffered significant damage or lost their homes in both the 2013 and 2015 floods)
2. Accelerate flood mitigation solutions for Upper Onion Creek (including those described in the Onion Creek Flood Mitigation Feasibility Analysis by Halff in February 2016)
3. The ultimate goal regarding buyouts should be to eliminate the need for this type of mitigation in the future unless there are special circumstances (e.g. an isolated area where only 2 or 3 homes are flooded and it would be cost-prohibitive to initiate major flood mitigation actions)
4. Evaluate the potential to implement flood mitigation solutions (such as detention ponds) on land that has been bought out
5. To speed up the process, investigate the potential for eliminating relocation as a component of the buyout program (only when this approach is acceptable to the homeowner). In such cases, the buyout program needs to make a uniform objective final offer with a firm deadline for acceptance.
6. If buying out most of an area, consider if it makes sense to focus on the whole area to avoid leaving isolated houses. This can eliminate the need to maintain infrastructure and will eliminate the possibility of future flood rescue and flood risk.
7. Proceed with condemnation to remove any remaining properties from harm's way.
8. Develop policy to create a system for tracking homeowners in areas with flooded homes who may be willing to move and sell their house to the City in the future.

1C. Structure and use of the adopted drainage utility charge

The biggest challenge to reducing the potential loss of life and property damage from existing flooding is funding to implement the necessary capital improvement projects. From the information presented to the Flood Mitigation Task Force it is clear that Watershed has a great deal of information regarding where the flooding is, what causes it, and what can be done to mitigate damages. With an estimated cost of between $2 billion and $4 billion dollars to address the creek and local flooding problems and only a portion of the Drainage Utility Fee (DUF) being spent on project development and implementation it will take an estimated 80 to 100 years to address known issues.

The drainage utility fee is not sufficient to fund major CIPs in a reasonable time frame but it is important to maintain the DUF to ensure adequate funding exists for staff, planning, maintenance, and small CIPs.

It should be noted that the Flood Mitigation Task Force heard from numerous citizens who expressed concern regarding the current formula for calculating DUF charges and the process through which the new ordinance and formulas were developed. We understand the City was revising the DUF based on a court order and recognize that the schedule to adopt the revisions was hamstrung by the fiscal calendar; however, now that the deadlines / time crunch have passed the City should reopen public discussions to address citizen concerns such as using the percentage of impervious cover as a multiplier, including roof over hangs, and the perceived lack of a responsive public process.

Before 1977 most neighborhoods in Austin were built with minimally engineered drainage systems such as the one below. The runoff from hundreds of houses, streets and driveways all flowed to the central open ditch visible in the center running north and south between Friar Tuck and Sherwood Lanes in Sherwood Oaks just north of St. Edwards University. (Congress Ave. in the upper right corner)

COA installed a small drain pipe in the ditch in the late '60's and levied a fee on the adjacent homeowner's to pay for the pipe. As upstream development occurred runoff increased and the drain pipe constantly overflowed flooding homes, streets and property. This is the same scenario occurring in most Central Austin neighborhoods built prior to 1977 where density is being incentivized and built with current COA policies.

Recommendations:

1. Issue a series of Certificate of Obligation Bonds every five years until the major creek flood mitigation capital improvement projects are completed. Major projects should be designated by those that are too large to have construction completed in one annual funding cycle via the DUF.
2. Prioritize the local flood mitigation capital improvement projects by areas that have received the most damage (critical infrastructure, buildings, potential loss of life) AND older storm drain systems in greatest need of repair.
3. Implement repairs and replacement of the critical local drainage systems within 5 years – if necessary issue a series of Certificate of Obligation Bonds every five years until the major local flood mitigation capital improvement projects are completed. Major projects should be designated by those that are too large to have construction completed in one annual funding cycle via the DUF.
4. Establish an aggressive timetable for improving/repairing the remainder of the pre-1977 Drainage Criteria Manual storm drain system to replace/repair the aging infrastructure.
5. Prioritize by known or predictable flooding problems and develop a schedule and dedicate resources to perform routine maintenance, inspections, and repairs to all stormwater infrastructure (such as pond, pipes, inlets) on a minimum 5-year cycle.
6. Flood mitigation is a public safety responsibility and the Council should also consider reducing future spending for non-essential projects that do not directly improve public health and safety until the flood mitigation and deferred maintenance activities are caught up to the point where they can be managed with the DUF funding.

1D. Stormwater management system operation and maintenance costs (O&M), capital costs, city fees, flood insurance, and other identified factors that have impacts to affordability and equity

We did not look directly at the question regarding how these items impact affordability and equity but recognize that the cost of making the necessary improvements will require a significant expenditure by the City for the foreseeable future. But we also recognize the real and ongoing costs in terms of quality of life, flood damage, and life-safety will continue to effect the City if Council does not have the fortitude to start addressing flood mitigation in Austin. Many of the known problems have been identified for decades (in some cases more than 30 years) and the cost to implement mitigation is not going down. As well, Council has directed previous and current planning policy via Austin Tomorrow Plan 1979 and Imagine Austin 2012 to encourage higher density in older areas built with the pre-1977 DCM.

While there are widespread creek and local flood problems throughout our community most of them can be associated with pre-1977 development. The districts and neighborhoods impacted by these floods are demographically diverse and while the brunt of major flooding is felt by the effected residents the reality is that there is a fiscal cost to the entire city. Those costs include personnel and emergency responders, repair and replacement of City infrastructure, and community-wide flood insurance rates.

Because we should be focused on the life-safety aspect of flood mitigation, and because these problems are spread across the City, and because watersheds do not recognize political boundaries, we do not believe that solutions can be, or should be, divvied up by Districts to ensure equitable spending by District. Instead, and as mentioned in other sections of this report, we believe that the problems should be prioritized by risk to human life, risk to critical infrastructure, and risk of potential damage to buildings such that the most dangerous problems are addressed first.

The City will need to address the issue of affordability in how the recommendations of this report are implemented, but at the same time Council must recognize that the cost of flood recovery are borne by the entire City and the costs to mitigate should be as well. To maintain affordability we recognize the full implementation of the Drainage Master Plan will take time but we firmly hold that we cannot wait decades longer to address the critical flood problems facing the City. It may be necessary of Council to make some difficult budgetary decisions regarding the things we want to spend money on as a Community versus things we must do to keep our residents safe.

Recommendations:

1. Move away from the “all or nothing” approach to flood mitigation. Rather than pursuing solutions that bring all flooding concerns/areas on par with the current drainage criteria manual use benefit-cost-analysis to determine if using a smaller design storm to implement flood mitigation will result in more cost effective projects

that will be eligible for federal funding and that can stretch the limited resources of the City by reducing or eliminating projects that are not economically feasible to implement.

2. Commit more resources to creek maintenance (as opposed to creek clearing) in areas where channels do not have sufficient or significant freeboard (refer to Section 1A). Low maintenance versus the current policy of no maintenance is a less expensive way to reduce flood damages than implementing large capital improvement projects.
3. Council should prioritize capital spending in future budgets to focus spending on mitigating the most critical flood mitigation projects and to fund necessary maintenance operations over spending money on non-critical projects that do not impact public health and safety to reduce the fiscal impact to citizens.

1E. Methods and means to provide more public education and outreach to new residents and visitors to raise awareness of flash flooding potential, as well as actions and strategies for the public to remain safe

Even though Austin is known as Flash Flood Alley, the city has largely been spared the scenes of New Orleans during Hurricane Katrina: homeowners being rescued from their roofs by helicopter, drowning of elderly due to lack of bus drivers or buses to evacute frail residents from nursing homes or the faces of frantic parents trying to reach children at schools cut off by high water.

However, in the Memorial Day 2015 flood, somehow a man ended up atop a telephone pole at House Park on Lamar Blvd. escaping a rapidly rising Shoal Creek blocks away. This image as well as one of a man rescued by helicopter from a tree top near upper Onion Creek are a permanent reminder that not everyone in Austin knows the saying "Turn Around Don't Drown". To try and prevent the images of New Orleans being repeated here in Austin, the following education and outreach strategies are recommended for the City of Austin.

Recommendations:

24. Watershed Department continuously review and update creek and local flood maps on a 3-year cycle and update as necessary
25. As local flood maps are generated or developed, the Watershed Department should publish and share them online similar to creek floods. Effective marketing techniques should be implemented to include community's challenges with Internet connectivity, specifically areas at risk of flooding.
26. Watershed Department shall encourage Agency Heads and Building Administrators of identified structures in the floodplain to coordinate with their local "First Responder" agencies and develop or update the facility's individual Emergency Response Plan to flooding incidents in response to current flood maps.
27. Require "Flood Zone" signage in flood prone areas by marking the curbs in the color "BLUE" within ___ years. Neighborhoods with documented creek and local area flooding require signage at all major arterial roads entering the neighborhood to designate area as susceptible to flooding during storms. (Like hurricane zone signage along the Gulf and tsunami signage on the coasts.)
28. Require property owners to notify residents in writing if the leased property is in floodplain. The written notification shall be in the leasee's primary language. Renter's Insurance information should be included with the application.
29. COA develop and implement "First Responder" resources needed in response to expanding city boundaries (Refer to Fire Station Map and Response Times Documents)
    i. Fire Stations with adequate staffing and operational support
    ii. EMS Stations with adequate staffing and operational support~

30. Watershed Department and First Responder Agencies review flooding incidents after 30 days and provide a condensed report to the COA City Council on what worked well and areas needing improvement
31. AISD shall ensure each school campus located within a floodplain has an updated Emergency Preparedness Plan in response to flooding incidents each year.
    iii. Those plans should be reviewed annually by the Administration in conjunction with campus security staff, teachers, local first responders and the Parent Teacher Association (PTA) and the Campus Advisory Council (CAC) leadership. The sample Emergency Preparedness Document (attached) provides the type of information that should be included.
    iv. Develop parental/custodial outreach and education materials so parents/custodians know what to do in a flooding incident emergency (who to call, where to go, etc.) Share plan with PTA and CAC, to include what the plan of action to inform parents/custodians of students will be (meetings, informational brochure, posters, information translated to other language(s) as needed, etc…) Informational materials must be included with "Back-to-School" Night events as well as in standard information packets for each new parent/custodians and students to the AISD. All informational materials must be in the recipients' primary language.
32. Conduct annual training with students and staff
    v. Charter Schools and Child Daycare Facilities should properly register to ensure their respective administration and security personnel, staff and parents are included in the "Emergency Flood Preparedness" list with the Watershed Department.
    vi. Agency and Building Administrators of Nursing Homes and other facilities that house vulnerable populations (disabled, incapacitated, minors, Wards of the State, etc…) shall take the same precautionary prevention, intervention and response strategies required of the AISD. (Refer to SAMPLE Emergency Preparedness Document) On-site backup systems, emergency generators and required supplies (food, water, medications, etc…) must be incorporated into the Emergency Response Plan based on the needs of the population housed at the facility.

Additional Thoughts:

1. Creek flooding alarm system with sirens – install, maintain and inspect
2. NOAA Radios issued to residents in the floodplain as well as information on developing a safety plan when trapped in a flood (access to attic; tool kit in attic to break through roof, etc…)
3. Anchor dumpsters
4. Signage clearly visible to visitors camping or lodging in flood plain areas.
5. Utilize the Watershed Department's Flood Safety Resources sheet

6. Media blitz for flood preparedness

1F. Standard and Green infrastructure utilization; impacts, regulations, and management of impervious cover; master planning and studies underway

Following the Memorial Day 1981 flood in which 13 lives were lost in Central Austin, the City of Austin implemented a drainage charge to fund an expanded stormwater management program. Since that fateful year, Austin has spent $65 million on mitigation, less than $2 million per year.

As of 2016, following three major storms in two years that caused flooding citywide, there are currently no plans or projects underway to mitigate the explosive growth Austin has experienced in the Shoal Creek Watershed. This scenario is repeated in other watersheds in Austin with inadequate infrastructure built prior to 1977 when the Drainage Criteria Manual was adopted.

While the Onion Creek and South Lamar studies are underway, the Capital Priorities group recommends the following regulatory and planning mechanisms as requested in Council Resolution 20150604-044. . These recommendations are intended to be adopted as soon as possible prior to the CodeNext process to send a strong message to Austin's residents that the city takes seriously its responsibility to use its regulatory power to minimize the risk to public safety posed by flooding. These recommendations are not intended to replace a structured funding mechanism to address the capital improvements needed to manage the city's number one threat to life and property: flooding.

Planning and Regulatory Recommendations:

6. Amend the Land Development Code to require that all objects such as food trailers, dumpsters and restaurant or other commercial use furniture in floodplains (benches, picnic tables, etc.) be anchored to the ground so as not to block storm drains, bridges and floodways in a flood. Provide for inspection of this with application and annual health or other inspection.
7. Ensure a system and process exists so that the One Stop Shop can easily check to see if new or redevelopment is in or near any known Local Flood problem areas.
8. The city should have a clear policy and sufficient staff to implement identification of code enforcement problems that are not resolved in a timely manner with a clear directive to take the necessary legal steps to immediately remedy problems such as blocked drainage easements that create safety hazards.
9. Staff reports that current code has provisions that would allow for the regulation of redevelopment but this code is not enforced. Identify, clarify

and strengthen these provisions and provide a timeline and funding necessary for enforcement.

10. Staff has identified loopholes in the code that impact flooding. These loopholes should be compiled and a process to eliminate these loopholes be identified through amendments to the LDC prior to the CodeNext report. Staff needs to review to determine if other loopholes exist.
11. Consider a moratorium on construction (new development, redevelopment, infill or auxiliary structures) in areas where known local flood problems exist until the City has mitigated the known problems UNLESS the developer provides an engineering study that proves no adverse downstream impact, onsite mitigation is included in the development, or downstream infrastructure is improved by the development to provide mitigation. This would apply even if the construction is proposed on a lot that is below the allowed maximum impervious cover.
12. Determine whether the 1% AEP event should be replaced by a larger, less frequent event or is freeboard requirements should be increased.
13. Dedicate adequate funding/training time to bring Development Review staff up to speed on 2013 amendments in the LDC related to Resolution No.20131017-046 with special attention to enforcement of Article 4 Section 30-4-151.
14. Dedicate resources and funding to do a more detailed analysis of potential flooding in areas to be annexed so a realistic plan is in place related to the potential need or cost for improvements. For example, the staff currently asks residents in an area to be annexed about flooding but examples show that although none reported flooding, it may just be due to lack of a recent large rain event.
15. Limit stormwater discharges to comply with the COA Land Development Code and DCM, Section 8.1.0: The basic concept of storm water management for peak rates of runoff is to provide for a temporary storage of stormwater runoff. Runoff is then released at a controlled rate which cannot exceed the capacities of the existing downstream drainage systems, or the pre-developed peak runoff rate of the site at each discharge point, whichever is less.
16. Develop an amendment to the LDC to require, or strengthen requirements, that all residential and commercial new and redevelopment verifies no adverse downstream impacts. The proposed on site (and any necessary offsite) stormwater controls must be modeled to simulate proposed condition discharges and their impact on the city storm drain system, including the receiving waters of each watershed.
17. Require corrective measures for any existing stormwater infrastructure designed by and constructed by entities other than the City of Austin be paid for by the responsible developer or contractor.
18. Commercial and residential redevelopment sites must reduce post development peak rates of discharge to match peak rates of discharge for

undeveloped conditions instead of existing predevelopment conditions. Undeveloped conditions are assumed to be grassland unless otherwise demonstrated by the applicant.

19. City of Austin develop a rapid licensing/approval process for flood restoration contractors that can be implemented in the wake of a flood event to provide assurance to homeowners, residents and businesses that these repair contractors are following current city regulations and that liability is assured.
20. At least one time every five years the City should require a coordinated review of planning (land use, transportation, utilities, and drainage) to ensure that we do not continue to encourage development or densification in areas with unresolved flooding.
21. Recommend that the City of Austin adopt construction / building requirements that new construction positively impact flood mitigation, rather than being neutral impact.

Green Infrastructure Recommendations

Austin is well known as a leader for protecting the natural environment. Barton Springs pool is the top tourist draw for the city and protecting it has been at the forefront of many Austinites concerns. Residents who are willing to recycle, compost and carpool want options to lessen runoff from their houses and use the water for their gardens as well as support policies that minimize the urban heat island, encourage bird and bee habitat and not contribute to the need for giant CIP projects that are expensive. To that end, these projects offer a way for self-selecting residents to lessen their flood footprint that can benefit the citizenry as a whole.

5. Incentives for On-site Stormwater Control Measures
    a. Educate on reducing Impervious Cover (basis for new rate structure):
    b. Driveway strips
    c. Permeable pavers
    d. Pervious decks/patios
6. Grants/Rebates
    a. Participate in AWU's existing Rainwater Harvesting and WaterWise Rainscape rebate programs
    b. Expand cost-sharing for detention/WQ retrofits where benefits can be quantified and valued
7. Fee Discounts (if to be considered further):
    a. Only provide fee discounts for SCMs that exceed regulatory requirements – why not do this everywhere a property owner wants to participate?
    b. Apply as part of an area-wide solution (e.g., Brentwood)
    c. Limit participation (cap on value of fee reductions)

    d. Establish SCM size/capacity threshold
8. Operational and Administrative Considerations:
    a. Maintenance / Inspection / Enforcement
    b. Administration and billing – determining eligibility and record-keeping / tracking
9. Cost-of-Service Considerations:
    a. Distributed GSI will not reduce capital costs of drainage systems unless part of an area-wide program (e.g., Brentwood)
    b. Distributed GSI not likely to affect drainage system O&M costs
    c. Added cost-of-service for inspection, enforcement, administration
    d. Cost of discounts passed on to non-participating rate payers
    e. Basis of fee discount (if not supported by reduced cost-of-service)
10. Technical Considerations:
    a. Flood, Water quality, Erosion
    b. Peak flow vs Volume
    c. Regional vs small-scale distributed SCMs (or combination)
11. Regulatory Considerations:
    a. Meet vs Exceed Regulatory requirements
    b. Green Stormwater Infrastructure Working Group / CodeNEXT recommendations
    c. Incentives available to all land uses
    d. Potential Code Change for FY17, if fee discount proposed
12. Benchmarking with Peer Cities:
    a. Most have Combined Sewer Overflow (CSO) problems
    b. San Antonio, Houston, Chicago, New York, Philadelphia, Phoenix, Portland, Seattle, Tucson
13. Roughly half of communities reviewed have credits/incentives:
    a. Development Incentives (e.g., density bonus, landscaping, IC)
    b. Grants / Rebates / Installation financing
    c. Award & Recognition Programs
    d. Drainage Fee Discounts:
        i. Impervious Cover Reduction
        ii. Fixed or Percent Dollar Discount
        iii. Sometimes only to commercial customers
        iv. Inspection / Enforcement on private property is irregular and maintenance is responsibility of property owner

2.0 Identify available funds, including federal, state, and local sources as well as prioritizing future capital investment for flood mitigation and management.

As indicated in other sections of this report, the Drainage Master Plan and on-going planning activities being conducted by the Watershed Department have and continue to identify and define where the creek and local flooding problems are, the root cause of the flooding, and feasible mitigation alternatives to be considered. While the residents of Austin have expressed a strong desire to move faster to implement flood mitigation projects there remains a need to continue planning and studies necessary to bring future projects to fruition. However, the biggest challenge has always been and will continue to be funding to implement the full scope of the Drainage Master Plan.

Watershed staff provided a summary of Drainage and Watershed Bonds 1975-2015 and reported that the citizens of Austin voted to approve all nine of the bond packages for drainage improvements in this time period with the last being ten years ago in 2006. (See addendum for summary).

Recommendations:

1. Council should prioritize capital spending in future budgets to focus spending on mitigating the most critical flood mitigation projects and to fund necessary maintenance operations over spending money on non-critical projects that do not impact public health and safety to reduce the fiscal impact to citizens.
2. Leverage local funding with state and federal programs and funding options where practicable; however, take into considerations potential project delays or additional project needs/spending that may be part of the matching funds.
3. Immediately begin formulating the first in a series of necessary Certificate of Obligation Bond packages to address the highest priority flood mitigation capital improvement projects.
4. Develop a schedule and dedicate resources to perform routine maintenance, inspections, and repairs to all stormwater infrastructure (such as pond, pipes, inlets).

3.0 Best Practices and Peer Cities

- 4.0 Interlocal Collaboration Recommendations (Resolution Item 6)

It is well recognized that flooding does not respect geopolitical boundaries such as county or municipal lines and that watersheds such as Onion Creek exist as a majority outside Austin. It is in the region's interests to pool resources, expertise and other opportunities to collaborate to limit the impact of flooding on the citizens of the region.

Recommendations:

3.1 Consider creating a Flood Control District to include all of the jurisdictional entities in the Onion Creek watershed. The logical organization to manage it would be the Barton Springs Edwards Aquifer Conservation District (BSEACD). A flood control district can be a taxing entity and fund most or the entire project. A further advantage would be the district could encompass multiple counties and thus exercise full control over the floodplain.

3.2 City of Austin Watershed Protection department should expand collaboration with other city and county watershed departments. COA WP should coordinate resources with UT and other higher education institutions.

3.3 Coordinate area early warning systems with strategically placed gauges in to include all streams and creeks feeding into the Onion Creek watershed.

3.4 Convene a flood mitigation coordination conference to align the interests and resources of local, county, state, federal and private resources to evaluate the problems and assist with funding and coordination using the example of El Paso in 2006. (Do we want to link to El Paso study here?)

3.5 Council should request a legal briefing on what role the city can play in advocating for changes outside its jurisdiction in regards to upstream development that threatens the safety of citizens by increasing flooding in Austin (strengthening the County regulatory controls).

- **5.0 Onion Creek Mitigation Study**

October 30, 2015, marked the latest in a series of flooding disasters that have created serious property damage and loss of life along Onion Creek over the years. Prior to this, there was the Halloween Flood 2013, in which the flood waters reached a record level of 41 feet and, for the first time, severely damaged and destroyed _____ homes in the Upper Onion Creek neighborhood in addition to _____ homes in lower Onion Creek at a total cost of _____.

The 2013 Halloween Flood had destroyed or severely damaged _____ in Lower Onion Creek and _____ homes in Upper Onion Creek at a total estimated cost of _____

In response to the 2013 Halloween Flood on Onion Creek, the City Council passed Resolution 20140515-028 directing the City Manager to, among other things, provide a report to Council regarding the needs associated with a study of feasible flood mitigation options within the Onion Creek floodplain outside of the William Cannon Drive and Pleasant Valley Road area. This study is a result of that initiative. In addition to the flood mitigation evaluation, an update of the floodplains for Onion Creek and selected tributaries was included in the study

The streams studied were Onion Creek, Bear Creek, Little Bear and Rinard Creek. Previous floods in recent years also occurred in 1981, 1997, 2001 and _____, resulting in millions of dollars in damages to property, deaths and the destruction of entire neighborhoods. Unfortunately, until now, the major mitigation step taken has been the buyout of flooded homes and the relocation of those families, accomplishing little in actually mitigating the impact or severity of future flood events.

Following the 1981 Memorial Day Flood, a Report was written with the following conclusions:

- Floods will continue to occur, especially as Austin is the most flood-prone area in the United States;
- Responsibility and accountability for accomplishing floodplain management should be shared among all levels of government.
- Change is so frequent that FEMA has had to commit to a 5 year review cycle to review and possibly redraw the floodplain maps
- There is an urgent need to expand the level of public awareness
- A voluntary Buyout Plan is needed to remove all nonconforming structures from the 100 year floodplain by 2050.

The 1997 Task Force concluded that:

- Buyouts might have to be expanded to include mandatory buyouts in the 25 year floodplain.
- Detention facilities, especially upstream in Hays County should be explored further with the possibility of a multi-jurisdictional approach including federal agencies.

- Reduce the level of damage where homes could be repaired to 40% down from the FEMA standard of 50%, to force more damaged properties into the buyout program.

The 2013 and 2015 floods resulted in a need to redraw the floodplain, but also to look at possible ways to reduce the impact of future floods and preclude the need for Buyouts.

The goal of the current Onion Creek Floodplain and Flood Mitigation Study was to eliminate potential inundation of buildings in the focus area (IH35 to E. Slaughter Ln.) during the 1% annual chance event (ACE). It was determined that a 3 to 5 foot reduction in the peak would be needed to achieve the target of reducing flood risk by 30%.

The overall Onion Creek objectives of the Task Force are:

- To identify solutions to mitigate the maximum flood levels in Onion Creek so that no homes will be endangered, either in Upper or Lower Onion Creek.
- To identify practices that, once enforced, will ensure the ongoing reduced flooding risks
- To protect the ability of our residents to continue to enjoy their homes and neighborhoods free of unnecessary restrictions

Options evaluated included:

6. Property Buyouts
7. Regional Detention
8. Flood walls
9. Channel Modifications & Clearing
10. Channel Improvements

The Study is now complete and has examined the potential viability of actually temporarily diverting a significant amount of the floodwaters, then release them back into the creek once that major crest has fallen. For example, the 2013 Onion Creek flood crested at a record 41 feet, with the floodwaters flowing at approximately _____ cubic feet per second (cfs) in a creek that normally flows at .15cfs. Fortunately, the crest lasted less than one hour, so the objective would be to detain enough of the crest to mitigate the flood problem downstream.

BUYOUTS:

If buyouts were to be viewed as the sole solution for Upper Onion Creek flooding, the Study identified 222 structures within the preliminary floodplain. It was estimated that 147 of these properties would have to be purchased at an estimated cost of $91 million and annual O&M costs of $23k. It wasn't clear as to what would be done with the purchased property after it is cleared.

It should be noted that this approach would:

4. Not provide assurance of no further flooding in Upper Onion Creek if further measures are not introduced concerning development and redevelopment upstream (mostly, but not all, in Hays County)
5. Seriously damage the continued viability of the community through reduced property values and possible elimination of the golf course.
6. No ensure any improvements for properties downstream in Lower Onion Creek

REGIONAL DETENTION (Attachment)

Three Centex quarries in Hays County (Centex West, Centex East Offline and Centex East Inline were identified and studied as possible temporary retention options to hold the water. Centex West has a capacity of 5.7 acre feet, which was estimated could retain 10% of the targeted reduction, or approximately .5-1.0 feet, of the flooding. The time in which it could be detained was not identified. Estimated cost was $34 m.

Centex East Offline and Centex East Inline East Inline were discounted as having multiple constraints and a low viability.

The Bornheim Quarry, owned by the COA, fronts onto Little Bear Creek and was not considered in the Study.

While benefits from this option appear limited from this Study, we feel it bears further investigation by combining potential benefits from all of the quarries, including those not identified in the Study.

<u>Antioch Recharge Facility</u>:

While not necessarily a part of the Onion Creek Study, the Barton Springs Edwards Aquifer Conservation District (BSEACD) is studying ways that some of the detained water in the Centex Quarry might be diverted to the Antioch Recharge Facility, thus helping to recapture the water in the Edwards Aquifer and retain it for future use.

FLOODWALLS: (See attached map)

Floodwalls were identified as one means of eliminating the flood threat for the Onion Creek Community, but would require 6,200 ft of wall along Pinehurst with heights ranging from 7 to a maximum 16 feet in addition to the purchase of about 55 structures and installation of an internal drainage system to drain approximately 110 acres of local runoff.

In the Wild Dunes area, they would need 3,400 feet of wall with a height ranging from 5 to 12 feet. 31 structures would have to be purchased

In both neighborhoods, the wall would need to be relocated as close as possible to existing structures in order to minimize the height.

Total costs for the Buyout Option was $80 million with annual O&M costs of $44k. It wasn't clear as to what would be done with the purchased property after it is cleared.

We consider this option to be the most destructive of the options:

5. It would result in the purchase of 86 properties ,
6. Quality of life and property value would be seriously diminished for those directly behind the walls or having their view seriously interrupted.
7. Overall property values through the Onion Creek neighborhood and resultant property tax revenues to the COA and Travis County would be greatly reduced.

What is now viewed as an idyllic place to live would disappear.

CHANNEL MODIFICATIONS AND CLEARING:

CHANNEL CLEARING: (attachment) Clearing the channels and immediate overbanks can be considered an effective alternative to reducing flood elevations as it allows the water to run more freely and was estimated to decrease the water levels by up to 2.o feet in the Wild Dunes area. There is also a potential benefit reduction of fire threats in the area with the removal of the dead brush. However, efforts to clear and maintain the "cleared" channel would also significantly impact the riparian corridor along Onion Creek and cost approximately $11.2m with an estimated additional $1m in annual O&M costs. Also, the average width of the cleared channel would be 900 feet, which could seriously impact the golf course.

REMOVE CONSTRICTIONS: Selective efforts, such as excavating the channel below the River Plantation Bridge, could provide benefits by increasing the opening and reducing the water elevations in the Wild Dunes area. The result could also be to increase erosion in this area. The impact of this increased flow on Lower Onion Creek should also be evaluated.

CHANNEL BENCHING: Would result in increased velocity of water flow and could potentially be very erosive.

CHANNEL IMPROVEMENTS: (attachment) Combining the channel alternatives does offer potential, but must be further evaluated in the preliminary engineering analysis. Regular maintenance would be required and initial cost is estimated at $74m, but water surface decreases of 1.4 – 2.7 ft in the Pinehurst area and 2.5-4.0 ft in the Wild Dunes area make it worth further investigation and, combined with the quarry alternatives might achieve the mitigation goal. Once again, water velocity would be increased so the impact on Lower Onion Creek should also be considered.

Recommendations:

1. We recommend that the City of Austin (preferably in partnership with Travis and Hays Counties and, possibly, LCRA and the Corps of Engineers), immediately fund the remaining research needed to further quantify the CenTex and Bornheim and nearby quarries as a viable mitigation solution.
2. If the results are positive, then we recommend initiating discussions with the owners to gain their acceptance and participation to utilize the quarries.
3. ***If the negotiations are successful, then we recommend that funding and, if necessary, partners, be identified and the project to adapt the quarry and recharge facility be initiated as quickly as possible.
4. The Channel Improvements option should also be strongly considered and evaluated in the preliminary engineering analysis, with the possibility of combining this with Quarry detention.
5. ***Convene a Regional Conference/ Task Force comprised of all potentially interested parties (local, county, state, federal and private) at the earliest possible date to confirm the findings, identify tasks and funding needed and establish time frames and objectives. Consider securing the advice of other communities, such as El Paso, who have hosted conferences, for advice.
6. ***Require that any development (new or redevelopment) require the introduction or enforcement of mitigation regulations to ensure that there will be no adverse flooding impact downstream or in the neighborhoods and that the engineering analysis supporting each plan be signed by a licensed engineer in the State of Texas.
7. ***Consider creation of an Onion Creek Flood Control District extending from Hays County into South Travis County to provide ongoing management to the watershed. (with taxing authority?)
8. A moratorium should be imposed on all new development within the 500 year floodplain around Onion Creek, Rinard Creek, Williamson Creek and Slaughter Creek (others?) until FEMA has reviewed and completed any revisions to their floodplain map. The results of the study on which this will be based are expected to be released around Oct. 2016 with final approval by FEMA around October 2017. (An example can be cited of the proposed Bradshaw III development to be build alongside Rinard Creek near the confluence with Onion Creek. Much of it fronts on the 100 year floodplain and was under water during the recent floods)

9. Upon completion of the Onion Creek Flood Study, the City of Austin should provide resources and funding to immediately begin implementation of the recommended alternative(s).
10. As additional funding options for Onion Creek Mitigations, consider:
    a. Creation of an Onion Creek Flood Control District with taxing authority to manage and fund ongoing operations;
    b. Create partnerships with other interested parties with shared interests, including Hays County, State of Texas, LCRA, FEMA and private parties, such as TDS, to initially fund the mitigation project;
    c. Investigate partnering with Texas Disposal Systems in a project to build a desalination plant for the water recaptured from the Edwards and Trinity Aquifers

Appendix C
Flood Mitigation Task Force
Buyouts and Floodplain Variance Work Group Recommendations

Floodplain Buyouts

Background

Buyouts are just one type of flood mitigation tool that can be used to reduce the risks to human health and safety as well as to property. This mitigation tool serves as a method of last resort for responsible communities to support their citizens, when other structural or maintenance solutions are infeasible, ineffective, or have a disproportionately high in cost relative to the benefits they would achieve.

The most reliable way to ensure that people do not flood is to keep them as far away from the hazard as possible; however, in an urban area it would be a gross oversimplification of an extremely complex reality to adopt a management strategy of only removing development from flood-prone areas. All of the available flood mitigation tools need to be considered when selecting the appropriate solution, and the Watershed Protection Department does consider and utilize the entire range of tools, including regional detention ponds, storm sewer improvements, and flood tunnels.

In order to grapple with the question of buyouts, the buyout/variance subcommittee of the Flood Mitigation Task Force has focused on three primary areas:

IX. Examination of the Lower Onion Creek Buyout Program;
X. Examination of project prioritization approaches; and,
XI. Examination of the acquisition process.

The Lower Onion Creek Buyout Program is an extremely important focal point for Austin citizens and the City Council alike, and it serves both as an exercise in contrast and as a springboard for understanding the core elements that might form a general buyout policy, if one were to be adopted.

Prioritization is the first key step in the process of developing flood mitigation solutions. The Watershed Protection Department has developed a consistent and sophisticated process for prioritization, based on the philosophy that the highest risk problems should be addressed first.

Acquisition of property, along with relocation support, is at the heart of executing a buyout program. The City of Austin has significant flexibility in the acquisition process when the buyout program is

voluntary. There are more prescriptive processes that have been established when using the powers of eminent domain. However, even when eminent domain is used there may be flexibility: constraints stem from the regulatory requirements (federal, state, and city) associated with the funding source (e.g., requirement to use the Uniform Relocation Act for federal funding from U.S. Army Corps of Engineers buyout program).

I. Examination of the Lower Onion Creek Buyout Program

Lower Onion Creek is uniquely situated for several reasons:

1. Onion Creek is the largest watershed in Austin by far (apart from the Colorado River). With a drainage area that is 5.5% larger than the City's current total jurisdictional area (including the 5 mile ETJ), the Onion Creek watershed extends into Travis, Hays, and Blanco counties.
2. A tremendous number of homes were constructed in a very high-risk location, based on the topography, the location at the confluence of the main stem with a major tributary, and the large drainage area upstream of the development (approximately 83% of the total watershed).
3. The rate of increase in property values in the area has been far outpaced by the growing property values of Austin in general.

The unique circumstances which surround the Lower Onion Creek buyout program deserve to be recognized, just as we must examine the successes and shortcomings over the past 17 years to glean valuable lessons for designing any future flood buyout program in Austin.

Background

The area referred to herein as the Lower Onion Creek area is generally bordered by East William Cannon Drive to the north, Salt Springs Drive to the east, Onion Creek proper to the south and South Pleasant Valley Drive to the west (Figure XX). The area is entirely within the Austin Independent School District (AISD). The areas was first developed with residential structures on a large scale beginning in the 1970s, which was prior to the City's first flood study (**1978**) and initial Land Development Code (**1982**). Significant, widespread flooding occurred in the area in 1998 and 2001, followed by a 12-year period of relatively little or no flooding in that area. LOC was flooded significantly again during Halloween 2013 and Halloween 2015. Both storms were record-setting for rainfall amounts and rates, much greater than the "100-year storm" standard used in predicting urban flooding associated with a "100-year floodplain." Numerous families were displaced, substantial property damage occurred, and several lives were lost.

Initially, a 1998 USACE study (*USACE, 1998*) identified 855 properties in the LOC that warranted a thorough evaluation of the optimal flood mitigation strategy. The evaluation involved a series of hydrologic and flood hazard studies conducted by COA and USACE that included consideration of structural mitigations (i.e., floodwalls, levees, regional detention etc.) and buyouts. USACE concluded that due in part to the large area and the area geometry, structural solutions were infeasible, leading to their recommendation to buy out the 855 properties. Of the 855 properties, 623 are in the 25-year floodplain (yfp) and 232 are in the current 100-yfp. Generally, the properties in the 25-yfp areas are

closer to the main creek channel and at lower elevations than the 100-yfp, with greater predicted inundation depths and/or flood-flow velocities. For this reason, USACE considered 483 of the 25-yfp properties to be at higher risk than the others and therefore deemed them worthy of an involuntary buyout program, which started in 1999. The remaining 372 homes were identified as voluntary buyout targets, and that program was initiated with COA funding primarily, commencing in 2014.

LOC Buyout Program Performance

Statistics

The initial 483 properties in the 25-YFP ("Corps Area"), which are subject to mandatory (involuntary) buyouts, were funded using a shared funding arrangement of USACE (65%) and COA (35%) funding (total cost estimate of the USACE project was $73.2 million). A total of 427 properties in the 25-yfp had been bought out by the date of the Halloween 2013 floods in the same area (88% FACT CHECK). Federal law requires that flood buyout programs that are primarily funded by USACE must be mandatory (involuntary) buyout programs. The shared-funding arrangement also stipulated that COA had to contribute its 35% of the buyout program before USACE initiated their funding, which would not be applied directly but paid under a reimbursement program. Sixteen (16) of the Corps Area properties remain unpurchased as of 1/7/16 (97% complete). The WPD has reported that all home occupants have been relocated for these remaining at-risk properties. The reasons for the remaining unpurchased properties range from title issues to government administrative processes.

The 372 properties that are included in the voluntary buyout program are being purchased with COA funding (~98%) and FEMA grants (~2%). Of the 372, 140 are in the 25-yfp and 232 are in 100-yfp. The average pre-2013 flood Fair Market Value for this set of homes is $120,000- $130,000. (**FACT CHECK**). The 140 properties in the 25-yfp were not captured by the USACE (involuntary) program because the 25-yfp changed in **YEAR** after additional study of the Onion Creek basin (**FACT CHECK ON THE REASON THAT 25-YFP PROPERTIES ARE IN THE COA PROGRAM AT ALL**). $95.5 M in COA funding was approved in June 2014. In the 25-yfp area, first offers were made starting August 2014. For the March 2015 100-yfp properties, first offers were made starting in June 2015. A total of 215 properties remain in the voluntary buyout group as of 26 February 2016 (58% complete). Of those 215, 16 are in the 25-yfp (11%) and 199 in the 100-yfp (86%). The lower percentage remaining in the 25-yfp relative to the 100-yfp demonstrates the appropriate focus by WPD to prioritize the relocation of qualified residents out of the higher-risk area.

Based on current WPD projections, the program will require an additional 14 months to complete (all closings complete and families relocated). Within this timeframe, *initiation* of the buyout process with all 230 remaining owners is projected to be completed by June of 2016, with offers made to all by end of 2016 and closings/relocation completed by June 2017. That equates to a rate of 12-15 closings per month. This is considered a substantial accomplishment given the challenging Austin-area real estate market, in which only 40-60 homes were available within Austin ISD boundaries below $300,000 as of late 2015. The unbalanced housing market in Austin/AISD is definitely a challenge to conducting timely and cost-effective buyouts under the current program.

Public Perception

The LOC program is generally perceived to have worked well to this point. **Based on citizen input and criticism on the current COA buyout program received by the FMTF in open meetings, factors affecting the perceived success of the flood buyout program generally include, but are not limited to:**

- public education/perception of the process and its fairness,
- pace of buyouts in light of recurrence of floods
- availability of comparable housing in reasonable vicinity of affected property
- degree of disruption to resident's life

Although the LOC program has been successful in many ways, FMTF believes the program implementation has been inconsistently paced. As the graph in Figure X shows (*Pam K's vertical bar chart of # homes per year since 2000*), the last few years have seen a significant surge in WPD property purchases, after a decade-long period of relatively fewer closings during the period 2002-2012. Several of these years were significant drought years in Austin and surrounding areas). The resurgence of the LOC buyout program seems correlatable to the Halloween 2013 devastation throughout Central Texas, followed closely by the Memorial Day 2015 and Halloween 2015 flood events.

FMTF believes the LOC area and program can be viewed as unique or singular in several ways that should be appropriately weighted when potentially considering the program as a universally-applicable model for mitigating future flooding problems in the city. Four of the characteristics of the LOC buyout program considered by FMTF to be somewhat unique to that program are:

- Watershed Characteristics and Geometry and Location of Neighborhood Within – the LOC "neighborhood" (actually several neighborhoods) is at a downstream, topographically low, hydrologic funnel point of the largest sub-Colorado River watershed in the Austin area. The Onion Creek watershed occupies more area than any other sub-Colorado watershed in Austin, with the second largest being Barton Creek.
- NATURE OF IMPACTING STORMS – LOC experienced a close succession of two severe storm events within 2 years. The October 2015 event was the equivalent of a 1500-year to 2,000-year storm event in the eastern half of the Onion Creek watershed where it was centered, setting records for rainfall rate and amount. The October 2013 storm event was similar in rates and amounts, but because the center of the storm occurred in the far western reaches of Onion Creek, the nature and timing of the impacts were different but similarly devastating. The previous storm sequence of comparable rainfall and flood devastation in Austin was the 1998/2001 flood series, which was of similar temporal spacing and intensity. Future planning should consider that although these storms may have been somewhat rare compared to historical climate in Central Texas, but that the greater extremes of weather, as predicted by climate change scientists, may cause a greater frequency of similar storms in the future.
- NUMBER OF AFFECTED PROPERTIES IN CONCENTRATED AREA – The large number of properties at high to moderate risk identified at one time in a concentrated area (855) created significant initial backlog and funding requirements for buyouts. The 855 homes in LOC (neighborhood area of 0.6 sq miles or about 390 acres) represents 23% of the current 3,800 total homes inside the combined 25-yfp and 100-yfp within the full purpose city limits (240 sq mi). This density and

timing of affected properties created a significant challenge to efficiently and cost-effectively process the backlog, especially in light of the housing market factor described below.

- HOME VALUES RELATIVE TO OVERALL AREA MARKET - Home inventory in LOC area was and continues to be among the lowest market value within the full-purpose COA boundary. The average Fair Market Value for homes already appraised, pre- October 2013 floods, was in the approximate range of $120,000-140,000. For comparison, less than 5 homes were available for that price within the AISD boundary as of the fourth quarter of 2015. The lack of housing at this level of affordability within AISD has affected and may continue to affect the pace at which relocations were successfully completed.

Continued Challenges to the Remaining LOC Buyout Program

Although funding is currently available for the remaining homes to be bought out, significant challenges remain for relocating residents to areas where minimal disruption to their lifestyle, family goals, and financial resources are all adequately achieved.

- The residential housing market in Austin has been on a consistent upward price trend since the early 1990s, which has impacted the LOC program through lack of comparable houses in the City/AISD (there were less than 20 homes priced less than $200K and 62 less than $300K in AISD in fourth quarter 2015). The current LOC program budget is based on the median, pre-flood (2013) Fair Market Value of $120-140,000 per home, which may not be sufficient to maintain the remaining buyouts within COA budget without compromising on other program objectives or seeking additional funding.
- Time required for COA Real Estate Services to implement the buyout relocation package is perceived as excessive by many residents, including many who remain at risk. The typical duration required, about 18 months, is partly due to lack of homes in the AISD/Austin market, and partly due to the depth and breadth of assistance offered by COA as part of the buyout process. The time required for the relocation program to reach fruition subjects to further risk homeowners who remain in their homes.
- The Housing of Last Resort approach under URA potentially puts a resident in a more expensive home that may come with increased property taxes that may not be affordable for new owner. This could easily double or triple their property tax burden.
- The lack of affordable housing in the Austin/AISD area may create a situation where residents would have to move away from schools/jobs/special needs, etc. to achieve affordability effectively. This dilemma lowers the voluntary buyout acceptance rate, potentially leaving residents at risk and driving them to hold out for a better offer that further delays their relocation out of harm's way.

Recommendations

- A buyout program has shown to be a viable solution (although difficult at times), and it should remain a mitigation strategy. [note: move this to a general buyout section]
- Continue the buyout program as primarily a voluntary program, with mandatory buyouts undertaken only when Eminent Domain is a condition of funding.
- Consider expediting the remaining LOC buyouts to finish by end of 2016, which may, depending on future program flexibility, require additional budget of $6M-10M.

- Ensure that property owners fully understand the program. It is a very complicated process, and it is clear that it has been difficult for citizens to understand. Especially during the stress of flood recovery, it can be difficult to comprehend the multiple stages, requirements, property valuation, etc.
- Ensure that homeowners who choose not to voluntarily sell their home…education around the implications. [maybe this applies to other sections.]
- Develop a plan for eventually buying the LOC properties at risk, even if the current owner does not yet want to sell.
- Plan for a sustainable buyout program through consistent annual funding and ongoing focused evaluation and re-evaluation of flood risk [note: move this to a general buyout section]

II. Project Prioritization

Background

All flood mitigation projects evolve through a process from identification, to evaluation of suitable solutions, to implementation. Buyouts are one of many possible mitigation solutions that may be selected after careful prioritization and evaluation.

A discussion of prioritization is relevant when considering buyouts because there is a common misconception that buyouts are a preferred flood mitigation solution, whereas in fact, buyouts are only proposed by the Watershed Protection Department (WPD) when all other mitigation strategies are far less effective/cost-effective. When addressing flooding issues, WPD must first rank problems in order of priority with the goal of addressing the worst problems first.

Addressing the worst flooding problems first is a long-standing operating procedure that was vetted by a previous flood mitigation task force and has been 'codified' in multiple iterations of the Watershed Master Plan ([note to add references]). When evaluating a flooding location, WPD examines multiple potential mitigation solutions along with costs, impacts, and other constraints. Buyouts are only used where other mitigation strategies are unsuitable in comparison due to impacts (e.g. moving the flood problem to another neighborhood downstream; causing substantial erosion/stream stability issues; etc) and/or are significantly more costly relative to the benefits achieved ([note to add examples of C/Bs for LOC]).

Flooding may be caused primarily by creeks that overtop their banks ("Creek Flooding") or when the capacity of the local drainage network of inlets, pipes, and ditches is exceeded ("Local Flooding"). In general, Creek Flooding issues are identified through floodplain modeling and mapping, whereas Local Flooding issues are identified though citizen reporting and field verification. The Watershed Protection Department is currently in the process of developing models for the local storm drain network, which will allow for a transition to model-based identification of local flooding issues.

Risk-Based versus Event-Based Prioritization

The process of floodplain modeling and mapping is used to identify structures at risk through standardized rainfall events for several frequencies (e.g. 2-year, 10-year, 100-year). The storm frequency is equivalent to a probability of occurrence, and so the use of models to identify flood hazards may be

called a "risk-based approach." For example, the 2-year storm has a 50% probability of occurring in any given year, and the 100-year storm has a 1% chance of occurring in any given year.

Use of risk-based rather than complaint-driven approaches for identifying flooding issues may be considered to be pro-active since flooding need not actually occur for problem areas to be identified. Furthermore, the risk-based approach (use of standard rainfall events) is necessary because it offers a consistent and uniform approach to design and regulation for issuing development permits (e.g. design storm pipe to convey the 25-year event) and other regulations (e.g. buy flood insurance if in the 100-year floodplain).

Event-based prioritization is useful because it elevates the priority of properties which have actually flooded rather than those that are theoretically at risk (i.e. modeled risk of flooding in the 25-year event but structure has not yet actually flooded). The standard for rainfall events used for design and regulation are developed based on actual storms; however, it is worth noting that no two storms are exactly alike (in duration, aerial distribution, and other parameters). For example, when an actual storm occurs, it is described by the frequency based on some parameter such as "a 100-year, 24-hour depth" or a "250-year, 1-hour intensity." Because the behavior of real rainfall does not exactly mimic the standard design storms, it may be useful to consider actual flooding as a tool for prioritization.

Ideally, structures for which buyout is the optimal mitigation solution should be bought before they experience flooding. However, since this is not feasible (due to funding and programmatic constraints), a program could be put in place to quickly assess whether a flooded structure is a suitable candidate for buyout so that a (voluntary) buyout could be initiated by staff as soon as possible following the flood.

Recommendation:

- **Develop an event-based prioritization scheme for creek flooding.**
- **Consider creating a reserve fund for buyout of properties affected by an extraordinary flood event, or alternatively, approve requests by WPD to perform post-flood recovery buyouts on an as-needed basis.**

Clusters versus Individual Structures at Risk

Cluster analysis is the current method for prioritization and is useful for quantifying and ranking flood issues. This method involves identifying groupings of structures at risk of flooding and ranking the group based on scoring criteria. For creek flooding, the score is dependent on:

- The type of structure (or road) that is affected;
- The depth of flooding within each structure for all of the standard frequency storms (e.g. 2-year, 10-year, 100-year);
- The number of structures affected; and,
- The proximity of at-risk structures to one another.

For local flooding, the prioritization is based upon the number of flood complaints within a proximity of 150 feet from each other. A minimum of five properties must be affected to form a "cluster," and the clusters identified are prioritized based on the number of properties and the type of flooding: building, yard, and street (listed in the order of decreasing priority). Clusters may be further grouped together or left in isolation based on the drainage area for the local storm sewer system that drains the properties.

Currently, there is no mechanism for ranking individual properties that are not part of a cluster, nor is there a process for evaluating an individual property within a cluster which may merit a higher priority than the cluster as a whole. This is a complicated issue to resolve, as the nature of the mitigation solution is dependent on the characteristics of a cluster, and removing individual properties from a cluster affects the priority ranking of the cluster as a whole.

Recommendation:

- **Develop a method for prioritizing individual/isolated properties which are at risk of flooding (i.e. those that meet specific thresholds of risk such as 10-yr flood depth and which are not part of a cluster).**

[peer cities: HCFCD]

Recommendations:

- **Consider whether other risk parameters should be incorporated into prioritization (and perhaps design standards) such as watershed size, history of watershed experiencing high-magnitude events, etc.**
- **Consider setting goals for reducing the number of habitable structures at risk of flooding by frequency. For example, reduce the number of structures in the 2-yr floodplain by half within 3 years and eliminate within 5 years; reduce the number of structures in the 10-yr floodplain by half within 5 years and eliminate within 8 years; etc. [note that this should be undertaken based on the optimal mitigation solution and not limited to buyouts] [note that it would be helpful to add the bar chart of flooded structures by frequency to help explain this recommendation.]**
- **Given the above recommendations, develop a revised unified prioritization scheme that combines multiple approaches including risk- and event-based, and individual as well as cluster prioritization.**
- **Consider developing a program of voluntary buyouts by citizen request, such as that developed by the Harris County Flood Control District.**
- **Evaluate the potential need for buyouts or other costly flood mitigation before annexing new developments into the City of Austin. [follow-up with staff to better understand what they actually do. We should understand what it would cost to bring an annexed area up to COA drainage criteria…but how would be possibly know the cost of mitigation?! DALE?!]**
- **[maybe add something about C/B ratio as it could relate to prioritization]**

III. Acquisition Process

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (URA) was developed to ensure property owners are made whole, even under extraordinary circumstances when using eminent domain. The City of Austin does have eminent domain authority. But the City of Austin uses the URA, 49 CFR Part 24, as minimum standards for acquisition once property has been identified as a candidate for voluntary buyout, too. Generally speaking, voluntary buyouts are those buyout transactions with no use of eminent domain. The URA is a federal law that establishes minimum standards for federally funded programs and projects that require the

acquisition of real property (real estate) or displaces persons from their homes, businesses, or farms. The URA's protections and assistance apply to the acquisition, rehabilitation, and demolition of real property for federal or federally funded projects.

The URA's objectives are:

- to provide uniform, fair, and equitable treatment of persons whose real property is acquired or who are displaced in connection with federally funded projects;
- to ensure relocation assistance is provided to displaced persons;
- to lessen the emotional and financial impact of displacement;
- to ensure that no individual or family is displaced unless decent, safe, and sanitary (DSS) housing is available within the displaced person's financial means;
- to help improve the housing conditions of displaced persons living in substandard housing; and
- to encourage and expedite acquisition by agreement and without coercion.

The URA has set forth responsibilities with regard to real property acquisition, including:

- appraise property before negotiations;
- invite the property owner to accompany the appraiser during the property inspection;
- provide the owner with a written offer of just compensation and a summary of what is being acquired;
- pay fair market value (FMV) for the property;
- pay for the property before acquisition;
- and reimburse expenses resulting from the transfer of title such as recording fees, prepaid real estate taxes, or other expenses, etc.

Alternatively, although rarely used by the City of Austin, an acquisition is considered to be involuntary when an agency acquires property using eminent domain. Where federal funds are used, the agency must follow specific steps outlined in the URA when acquiring property through eminent domain (e.g., Project Partnership Agreement (PPA) with the USACE). In addition, Section 21.046 of the Texas Property Code outlines mandatory steps to be taken when acquiring property through eminent domain. The City Code (Chp. 14-3 'Relocation Benefits') also has rules in place for the acquisition of real property through the use of eminent domain. To be clear, eminent domain can be useful to resolve complicated titles.

During the recent Lower Onion Creek buyout project, the City deviated from the URA minimum standards. For example, the City Council passed an ordinance (20151108-003) in November of 2015 amending prior buyout authorizations for properties that had yet to be acquired by the City. This ordinance permitted the City to a) appraise properties as of October 29, 2015 (viz., a pre-flood appraisal) b) waive any occupancy requirements for individuals that occupied the property as of October 29, 2015 and c) exclude the deduction of any insurance proceeds up to $15,000 without receipts; and for sums beyond $15,000, receipts and City approval are required

(When federal funds are used, however, insurance payments or individual assistance from the pre-flood value is to be deducted.) Further, the City waived the eligibility requirements under 49 CFR 24.208. This departure from previous City acquisition policy is allowable and only applied to the 372 buyout properties (100% City funded) in the Lower Onion Creek and Middle Williamson Creek project areas, which was made to meet the needs of families who were victims of flooding and to address the increasingly challenging relocation situation.

Different sources of funding, however, require different methods used during the acquisition of real property. For instance, the FEMA Hazard Mitigation Grant Program (HMGP), 44 CFR Part 206, is used to fund projects to protect public and private property, including the acquisition and relocation of structures from hazard-prone areas. The FEMA has regulatory oversight of the HMGP. But the States are responsible for administering the HGMP, and prioritizing and selecting project applications from communities. The States then forward project applications to the FEMA for final approval. Flood-prone communities receiving HMGP funds must participate in the National Insurance Program (NFIP).

A few select requirements of the HMGP are the following: properties must be acquired only from property owners who voluntarily agree to sell their properties, and property owners must be notified that eminent domain will not be used if an agreement cannot be reached; because of the voluntary nature of acquisition, homeowners are not entitled to assistance under the URA – but displaced tenants are; and communities must subtract from the purchase price of every property the total value of other disaster-related repair assistance paid to the owner to avoid duplicating benefits – duplication of benefits (DOB). This deduction applies if the community uses pre-flood fair market value, but does not apply if post-flood FMV is used.

The FEMA Flood Mitigation Assistance Program (FMAP) provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to structures that are insured under the NFIP. The FMAP is a mitigation program that is not directly related to a disaster event. The FEMA annually provides funds to the States to conduct FMAP projects. The States then can offer two types of FMAP grants to their communities: planning grants to develop or update flood mitigation plans (plans must assess flood risk and identify actions to reduce those risks); or project grants to implement mitigation measures, such as elevation, dry flood-proofing, and acquisition.

In sum, the acquisition process for the City, as noted, is not required to follow the URA if City funds, and only City funds, are used to acquire the property – the City has freedom in its acquisition procedures. But where federal funding is involved, the City does not have the ability to depart from the URA's acquisition procedures. The City, however, still chooses to use the URA as its minimum standards for acquisition even when buyouts are executed with only City funds. With only City funds used, the City has flexibility in the application of its acquisition procedures, including extending more benefits to buyout candidates who are victims, or potential victims, of flooding – such as those located in the Lower Onion Creek and Middle Williamson Creek areas – than the URA would allow.

Recommendations:

- **The URA provides a widely-used standard for property acquisition. We recommend that the URA be used for both voluntary and eminent domain acquisitions, with a goal to use a very consistent process with minimal variations.** [note in the text that it still allows COA to use a pre- or post- assessment.]
- **Consider ways to facilitate easier comprehension of the buyout process (e.g., FAQs for buyout process to dispel misinformation).** [make the case in the narrative about the significance of this recommendation]
- **Ensure property owners understand the consequences of not participating in a voluntary buyout program (e.g., increase in insurance rates; health and safety concerns, neighborhood character, etc.).**
- **Ensure that City Code is vetted for consistency with federal law acquisition procedures, where applicable. For example, 14-3-5 (Calculation of a Real Estate Purchase Benefit) of City Code states that the total amount of a real estate purchase benefit may not exceed $22,500. Nevertheless, the URA (Replacement Housing Payment) changed this benefit in October of 2014 to $31,000.**
- **Seek additional sources of funds for acquiring properties such as the Stafford Act's Hazard Mitigation Grant Program (HMGP), the HUD's Community Development Block Grant Program (CDBG), Flood Mitigation Assistance Program (FMAP), Executive Order 12898 (Environmental Justice) funding (where applicable), and private partnerships.** [move to narrative: "In partnering with the federal government, however, recognize the potential consequences of pursuing federally funded projects (i.e., possibility of involuntary buyouts/eminent domain)."]

Floodplain Variances

Background

A floodplain variance is an exception to the standard development regulations for properties within the floodplain. There is a standard process for granting administrative variances by the Watershed Protection Department Director, when a development meets all of the administrative variance criteria. When a project does not conform to the requirements for an administrative variance, the Austin City Council may take action to grant a floodplain variance to the property owner/ developer.

It is important to note that there are other types of variances to environmental and drainage regulations which may be granted (e.g., variances to impervious cover limitations, variances to detention and/or water quality requirements). The request for a floodplain variance should not be conflated with these other types of variances. For example, a property can be within the allowable impervious cover limits and still require a floodplain variance in order to get a development permit to remodel a bathroom, to build a second story, or to add a carport.

On average, there are 3 administrative variances are granted per year (based on 2004-2015), and there is an average of 6 requests per year to Council to grant floodplain variances (based on 1995-2015).

City of Austin Floodplain Policy:

In general, the City's Land Development Code prohibits development of buildings or parking areas within the 100-year floodplain. However, there are general exceptions including:

- if the parking area is less than a certain size;
- if the structure is unoccupied and is no greater than a certain size;
- if the residential structure is on a lot platted before a certain date; or
- if the structure is within the 100-year floodplain of Lady Bird Lake or the Colorado River downstream of the Longhorn Dam.

In all cases, the structure must comply with flood proofing requirements and result in no adverse flooding impacts on other properties.

In addition, there are separate requirements for development in the Central Business District and for parking areas across the City that are within the 100-year floodplain, as well as additional exceptions for certain types of development within the 25-year floodplain, including park or outdoor recreational type structures (e.g.,. golf course restroom).

The City has adopted these floodplain policies to protect the health, safety and welfare of its citizens as well as for other regulatory and financial reasons. The Federal Emergency Management Agency (FEMA) requires adoption of minimum standards for floodplain regulations for a community to participate in the National Flood Insurance Program (NFIP). The NFIP allows homeowners and property owners to obtain flood hazard insurance at reduced rates compared to private flood insurance. Participation in the NFIP also qualifies Austin for federal disaster money through presidentially declared disasters and other grant funding through the State of Texas.

In addition, the City of Austin participates in the Community Rating System (CRS) that allows for further reductions in flood hazard insurance rates. The City estimates that its citizens save approximately $740,000 annually due to Austin's participation in the CRS program.

The floodplain policy applies to all structures and property within the zoning jurisdiction (full and limited purpose areas) of the City of Austin. The floodplain at the time of application for development, whether mapped, remapped or unmapped by the City of Austin or FEMA, applies. The current floodplain regulations affect approximately 16,425 residential, commercial or vacant properties citywide (i.e., currently-platted properties that lie either wholly or partially within the regulatory floodplain) or roughly ____ percent of all properties.

Floodplain Variance Requirements:

The City's floodplain regulations and the following floodplain variance processes attempt to balance the goal of protecting the health, safety and welfare of the citizens, and participation in the federal flood protection programs with private property rights as they relate to use and development of

land. This committee further acknowledges that a home, albeit in a floodplain, may represent a significant portion of the individual's personal assets.

A developer or homeowner may request a variance to develop or improve an existing structure or property in a floodplain – referred to as a "floodplain variance." A floodplain variance may be granted administratively (administrative floodplain variance) by the Director of the Watershed Protection Department or by Council ordinance (council floodplain variance). An application may be considered for an administrative floodplain variance if the applicant complies with the following seven criteria:

1. the finished floor elevation of a proposed building is at least two feet above the 100-year floodplain;
2. normal access to a proposed building is by direct connection with an area above the regulatory flood datum, as prescribed by Chapter 25-12, Article 1 (Building Code);
3. a proposed building complies with the requirements in Chapter 25-12, Article 1, Section 25-12-3 Appendix G (Flood Resistant Construction) and Section 1612 (Flood Loads);
4. the development compensates for the floodplain volume displaced by the development;
5. the development improves the drainage system by exceeding the requirements of Section 25-7-61 (Criteria for Approval of Development Applications), as demonstrated by a report provided by the applicant and certified by an engineer registered in Texas;
6. the variance is required by unique site conditions; and
7. development permitted by the variance does not result in additional adverse flooding impact on other property.

If a proposed development or improvement cannot meet all of these requirements for an administrative floodplain variance, then an applicant may request a floodplain variance from Council. City Code and FEMA regulations require a public hearing to decide the floodplain variance request. However, there is no public notification required for the hearing other than the agenda posting itself.

Currently, the additional criteria for Council to consider when making a judgement on a floodplain variance are found in City Code Chapter 25-12-3 Appendix G, Sections G105.6 and G105.7 and as outlined below.

G105.6 Considerations. In reviewing applications for variances, the City Council shall consider all technical evaluations, all relevant factors, all other portions of this appendix, and each of the following:

1. The danger that materials and debris may be swept onto other lands resulting in further injury or damage.
2. The danger to life and property due to flooding or erosion damage.
3. The susceptibility of the proposed development, including contents, to flood damage and the effect of such damage on current and future owners.
4. The importance of the services provided by the proposed development to the community.
5. The availability of alternate locations for the proposed development that are not subject to flooding or erosion.

6. The compatibility of the proposed development with existing and anticipated development.
7. The relationship of the proposed development to the comprehensive plan and flood plain management program for that area.
8. The safety of access to the property in times of flood for ordinary and emergency vehicles.
9. The expected heights, velocity, duration, rate of rise and debris and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site.
10. The costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water systems, streets and bridges.

G105.7 Conditions for issuance. Variances shall only be issued by the City Council upon:

1. A technical showing of good and sufficient cause based on the unique characteristics of the size, configuration or topography of the site;
2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable;
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, nor create nuisances, cause fraud on or victimization of the public or conflict with existing local laws or ordinances;
4. A determination that the variance is the minimum necessary, considering the flood hazard, to afford relief; and
5. Notification to the applicant in writing over the signature of the building official that the issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance, and that such construction below the base flood level increases risks to life and property.

However, after reviewing Council debate many floodplain variance requests, several additional, common considerations were observed.

1. Type of proposed development or structure (i.e. residential vs commercial or other, meaning do or will people sleep in the structure?)
2. Existing development or structure vs proposed development or structure?
3. Existing owner-occupied vs rental (i.e., is it a main residence or an income producing property?)
4. Proposed owner-occupied vs development speculation?
5. Is the proposed development or structure in a new vs existing vs recently revised floodplain map (i.e. was the property or structure in a floodplain when purchased?)
6. Any deleterious effects on the character of neighborhood if variance denied (i.e. are neighbors left with patchwork of vacant lots?)
7. Is there an imminent flood mitigation capital improvement project that will completely or substantially improve the condition for which a variance is being requested?
8. Does granting the floodplain variance affect NFIP or CRS ratings?
9. Rather than grant the variance should the City purchase the property?

Floodplain Variance Statistics

Attached is a Floodplain Variance Summary Chart, Location Map, and Summary Lists for all floodplain variance requests since 1994. City of Austin Watershed Protection Department staff prepared the graphics and lists.

The Floodplain Variance Request Summary Chart shows the number, types, and approval rates for all types of floodplain variance requests. Depicted on the Floodplain Variance Location Map are locations of all floodplain variance requests made since 1994. Floodplain variance requests listed by Council District and watershed name are shown as well.

The number of variances granted in any given year varies slightly and may be impacted by changes to the floodplain maps, development pressures on existing housing in flood-prone areas and desire of current homeowners to remodel or make additions to existing homes.

Recommendations

19. **Continue the current floodplain policies, except as modified below, while allowing a variance process for many of the existing homes to remain or be modified in a reasonably safe manner and without damage others.**
20. **Continue current floodplain policy as it relates to FEMA NFIP and CRS to help reduce flood hazard insurance rates for all homeowners and property owners.**
21. **Consider additional flood mitigation requirements if development is allowed in floodplain such as:**
    a. **education for safely sheltering in place and**
    b. **disclosure and education when selling or renting property that has been granted a floodplain variance that may constitute a health and safety risk.**
22. **Consider requiring public notice for Council floodplain variances.**
23. **Consider expanding the requirements of City Code Chapter 25-12-3 Appendix G, Sections G105 to include additional information commonly discussed at past floodplain variance hearings.**

Flood Mitigation Task Force – Appendix D
Flood Mitigation Task Force Regular Meeting Minutes
Citizen Communication

Listed below are the public testimonies given at the FMTF. Go to the COA website to hear the audio of any of the citizens' testimony.

October 20, 2015

Anna Perez spoke about issues regarding the City of Austin's buyout policy.
Eufracio Reyes spoke about issues regarding the City of Austin's buyout policy.

November 3, 2015

Isabel Lopez spoke about the October 30, 2015 flooding and the City of Austin's buyout policy.
Anna Perez spoke about the October 30, 2015 flooding and the City of Austin's buyout policy.
Joaquin Zea spoke about the October 30, 2015 flooding and the City of Austin's buyout policy.
Jacqueline Perez spoke about the October 30, 2015 flooding and the City of Austin's buyout policy.

December 15, 2015

Brian Maloney spoke about flooding in his neighborhood (Bryker Woods, 30th and MoPac).
Sarah Janecka spoke about flooding in her neighborhood (South Boggy Creek, Dittmar & S. Congress).
Erin Foster spoke about the Onion Creek buyout project.

January 19, 2016

Stuart Hersh spoke about flooding issues for Austin residents.
Anna Perez spoke about the Onion Creek buyout process.
Chris Clary spoke about integrating farmland preservation into flood policies.

February 9, 2016

Susana Almanza, Executive Director of People Organized in Defense of Earth and her Resources, (PODER), presented a report prepared by PODER on Drainage Fees, Capital Improvements and Equity in the City of Austin (January 4, 2016).

February 16, 2016

David Willson spoke about the effects of the 2013 and 2015 Halloween floods on his neighborhood and the proposed Report to Council.

Anne-Charlotte Patterson spoke about erosion along the Grover Tributary of Shoal Creek and requested funding to address flooding concerns in the Brentwood neighborhood.
Baihlah Rubin spoke about flooding issues along the Grover Tributary and requested funding for a comprehensive mitigation plan for the Brentwood neighborhood.
Patti Riggs spoke about the lack of maintenance along Williamson Creek.
Brigadier General Bill Welch spoke about the need for action in the upper Onion Creek watershed and possible partnership with the LCRA to clean and maintain the creek.

March 1, 2016

There were no speakers.

March 22, 2016

Richard Bernhart spoke about localized flooding and drainage issues in the Salem Walk/Stassney Lane area (Williamson Creek).

April 12, 2016

Task Force Member Ken Jacob spoke about flooding in the Onion Creek watershed.

April 14, 2016

There were no speakers.

April 20, 2016

Mary Owens (Zilker neighborhood) spoke about the localized flooding she has experienced at her home, her unsuccessful attempt at recourse in court, and her difficulties obtaining City approval to construct a retaining wall on her property.
Ray Combs (Upper Onion Creek neighborhood) spoke about the flooding he experienced at his home, his concerns about the speed of City response, and the impacts the proposed mitigation strategies outlined in the Flood Mitigation Task Force final report subsection 4 ("Onion Creek Mitigation") could have on his home.
Chris Frandsen (Upper Onion Creek neighborhood) spoke about the flooding he experienced at his home, that he and his family cannot move back in, and his desire to know what mitigation actions will be taken in his neighborhood, and encouraged the task force members to use strong language in their final report.
Task Force Member Robert Kibbie spoke about his personal experiences with flooding and his expectations for the Flood Mitigation Task Force.

April 25, 2016

David Willson (Upper Onion Creek neighborhood) spoke about his concerns with the Flood Mitigation Task Force final report subsection 4 ("Onion Creek Mitigation").
Ray Combs (Upper Onion Creek neighborhood) spoke about the flooding he experienced in his neighborhood and his desire to know what mitigation actions will be taken in his neighborhood.
Mark Kolar (Upper Onion Creek neighborhood) spoke about the City Council's prioritization of funds and the potential flooding impacts of upstream developments on his neighborhood.

May 4, 2016

Dick Perrone (Upper Onion Creek neighborhood) spoke about his concerns with the Regional Stormwater Management Program (RSMP).

Appendix E

Bond History Summary

Summary of GO Bonds for Drainage & Watershed Improvements, 1975 - 2015

General Description	Bond Election Year or Council Approval Fiscal Year	Bond Type*	Payment Source	Amount	Amount (2015 $)**
Drainage Improvements	1975	PIB	Tax Supported	$970,000	$ 4,425,515
Drainage Improvements	1979	PIB	Tax Supported	$ 2,155,000	$ 7,242,178
Flood Control Improvements	1982	PIB	Tax Supported	$ 14,000,000	$ 36,938,039
Drainage/Flood Control	1984	PIB	Tax Supported	$ 48,535,000	$ 118,141,635
Erosion & Flood Control	1992	PIB	Tax Supported	$ 21,570,000	$ 43,667,892
Waller Creek Tunnel infrastructure	1998	Rev	Hotel occupancy tax	$ 25,000,000	$ 42,618,243
Crystalbrook - Drainage and Flood Control Improvements-Walnut Creek	1998	CO	DUF and Tax Supported	$ 10,000,000	$ 17,047,297
Erosion, Flood & Water Quality Control	1998	PIB	Tax Supported	$ 10,750,000	$ 18,325,845
Developer Reimbursables	2001	CO	Tax Supported	$ 2,160,000	$ 3,436,658
Developer Reimbursements- Harris Branch	2002	CO	Tax Supported	$ 500,000	$ 771,796
Drainage Developer Reimbursement Annexed Areas - Harris Branch	2003	CO	Tax Supported	$ 500,000	$ 753,809
Crystalbrook Phase 2 Drainage and Flood Control Improvements-Walnut Cree	2003	CO	DUF	$ 3,800,000	$ 5,728,951
Equipment Replacement and Additions	2003	KO	DUF	$ 435,000	$ 655,814
Drainage Developer Reimbursement Annexed Areas	2004	CO	Tax Supported	$ 650,000	$ 921,968
Drainage ($95M) and Open Space ($50M)	2006	PIB	Tax Supported	$ 145,000,000	$ 188,793,704
Drainage Developer Reimbursement Annexed Areas - Harris Branch	2006	CO	Tax Supported	$ 210,000	$ 273,425
Waller Creek Tunnel	2011	CO	TIF	$ 67,301,000	$ 74,884,420
Waller Creek Tunnel	2012	CO	TIF	$ 32,675,000	$ 35,427,170
Waller Creek Tunnel	2013	CO	TIF	$ 6,075,000	$ 6,421,797
Open Space	2012	PIB	Tax Supported	$ 30,000,000	$ 32,526,859
Lott Avenue Site Improvements (contaminated site remediation)	2014	CO	DUF	$ 2,500,000	$ 2,572,915
Lower Onion Creek Buyout	2014	CO	DUF	$ 35,500,000	$ 36,535,386
Home Buyouts: Lower Onion Creek ($60M) & Williamson Creek ($18M)	2015	CO	Tax Supported	$ 78,000,000	$ 78,000,000
Totals				**$ 538,286,000**	**$ 756,111,317**

* Key:
GO = General Obligation
CO = Certificate of Obligation (non-voter approved; 20-30 year period)
KO = Contractual Obligation (non-voter approved; 7 year period)
PIB = Public Improvement Bonds (voter approved; 20-30 year period)
TIF = Tax Increment Finance
Rev = Revenue Bonds

** Amount in 2015 dollars accounts for inflation by ratio-ing the original dollar figure to Nov. 2015 dollars using the Engineering News Record Cost Index. See: https://enr.construction.com/

Over time as the City has changed the nature of doing business, various bond elections exist with a component of drainage, open-space or realted efforts that have been provided to other responsible departments, such as public works and parks and recreation that are not listed above.

Summary of Drainage Solutions Funded by 2006 General Obligation Bonds

Project Name	Project Category	Amount	Amount (2015 $)*
Onion Creek - Dixie Drive Voluntary Home Buyouts	Creek Erosion Mitigation	$1,045,100	$ 1,360,747
Boggy Creek- 38 1/2 Street to MLK channel improvements and culvert upgrade	Creek Flood Mitigation	$103,383	$ 134,607
Onion Creek Flood Hazard Mitigation, Ecosystem Restoration, & Recreation	Creek Flood Mitigation	$24,595,332	$ 32,023,751
Williamson Creek Flood Hazard Mitigation and Ecosystem Restoration Corps	Creek Flood Mitigation	$150,260	$ 195,642
Little Walnut Creek - Creek flood hazard reduction from Metric to Rutland	Creek Flood Mitigation	$3,295,617	$ 4,290,978
Onion Creek Floodplain Voluntary Home Buyout	Creek Flood Mitigation	$2,294,378	$ 2,987,339
Bayton Loop / Burrough Cove Buyout's	Creek Flood Mitigation	$1,895,732	$ 2,468,291
Williamson Creek - Bannockburn Storm Drain Improvements	Storm Drain Improvements	$1,900,662	$ 2,474,710
Blunn Creek - Long Bow Storm Drain Improvements	Storm Drain Improvements	$4,621,000	$ 6,016,660
Shoal Creek - Allandale Storm Drain Improvements	Storm Drain Improvements	$6,765,203	$ 8,808,467
Shoal Creek - Ridgelea Storm Drain Improvements	Storm Drain Improvements	$4,531,165	$ 5,899,693
Lady Bird Lake -East 4th Street Storm Drain Improvements	Storm Drain Improvements	$8,604,376	$ 11,203,117
Shoal Creek Madison Storm Drain Improvements	Storm Drain Improvements	$89,204	$ 116,146
Shoal Creek Brentwood Storm Drain Improvements	Storm Drain Improvements	$121,838	$ 158,636
Williamson Creek Blarwood Storm Drain Improvements	Storm Drain Improvements	$7,807,045	$ 10,164,972
Fort Branch - Oak Lawn Subdivision Storm Drain Improvements	Storm Drain Improvements	$1,640,743	$ 2,136,289
East Bouldin - Euclid-Wilson Storm Drain Improvements	Storm Drain Improvements	$10,461,000	$ 13,620,489
Shoal Creek - Rosedale Storm Drain Improvements Phase 2	Storm Drain Improvements	$6,761,805	$ 8,804,043
Fort Branch Creek Reach 6&7 Channel Rehabilitation - True Light and Eleanor	Multi-Objective Projects	$3,470,200	$ 4,518,289
Boggy Creek - Cherrywood Greenbelt Riparian Restoration	Water Quality Protection Projects	$924,584	$ 1,203,832
Boggy Creek Greenbelt -Reach B8 Stream Restoration	Water Quality Protection Projects	$3,602,316	$ 4,690,307
Misc sub-projects	Multi-Objective Projects	$319,057	$ 415,420
Totals		**$95,000,000**	**$123,692,427**

* Amount in 2015 dollars accounts for inflation by ratio-ing the original dollar figure to Nov. 2015 dollars using the Engineering News Record Cost Index. See: https://enr.construction.com/