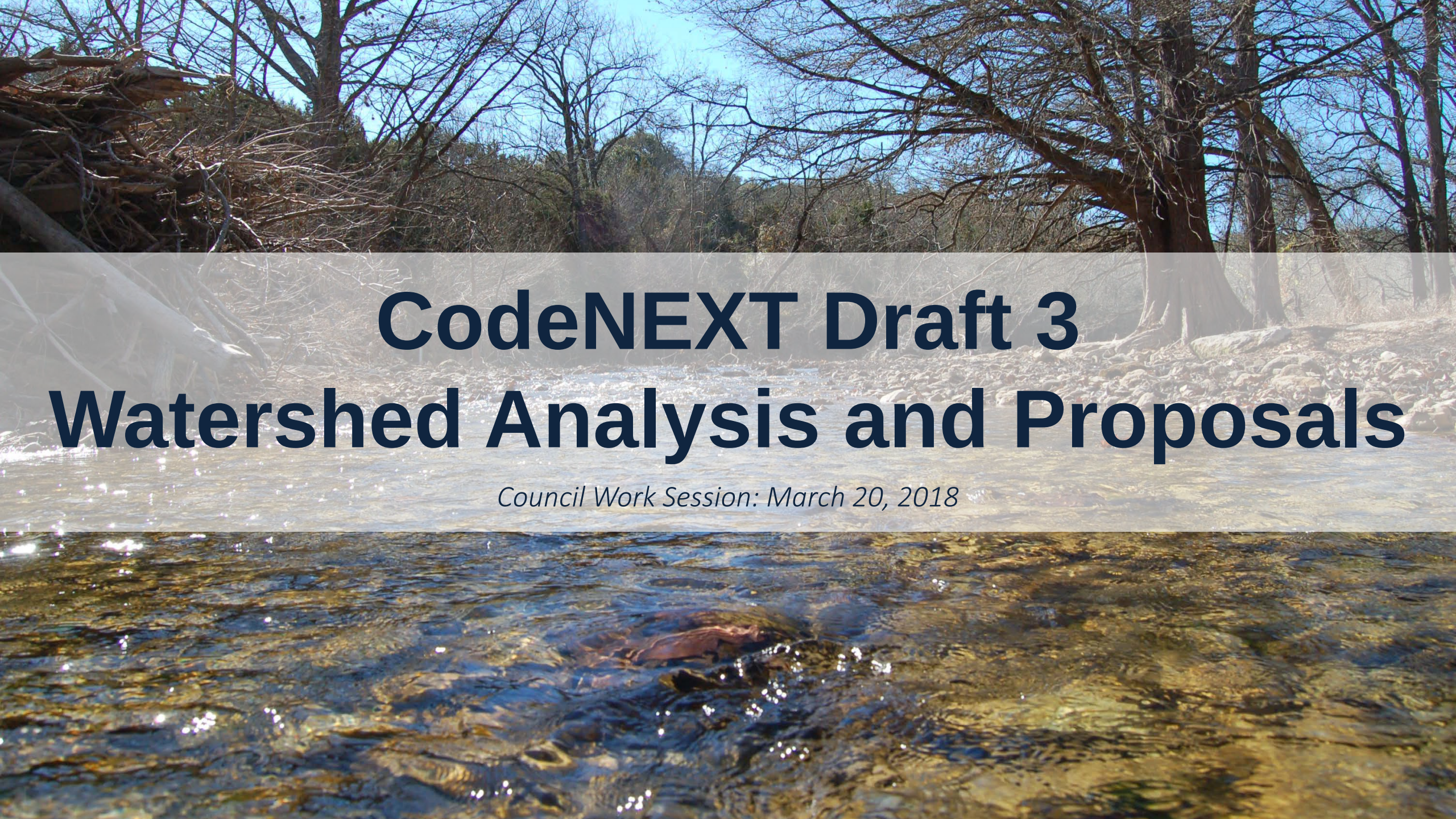
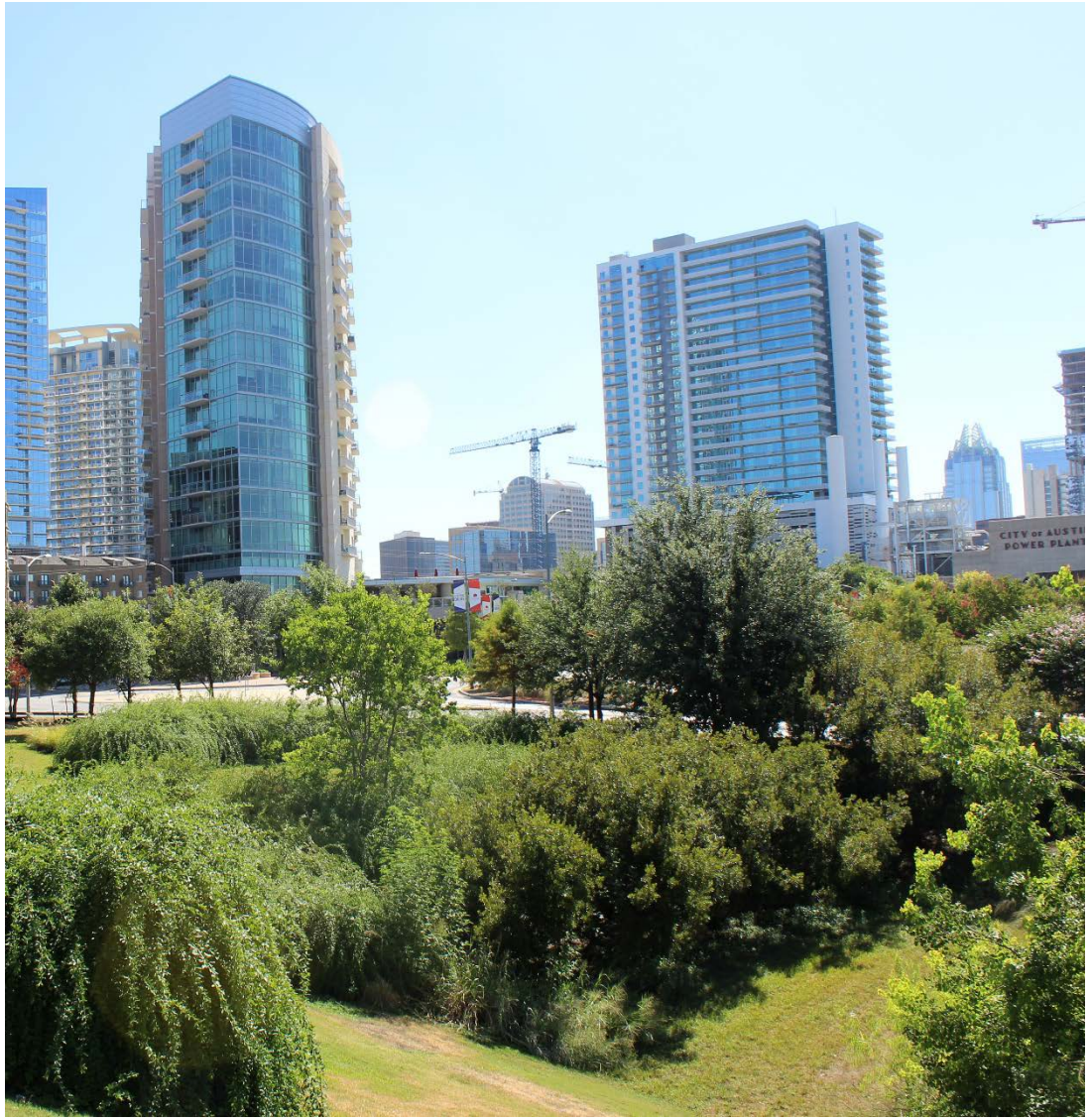


CodeNEXT Draft 3
Watershed Analysis and Proposals

Council Work Session: March 20, 2018

Overview of Presentation

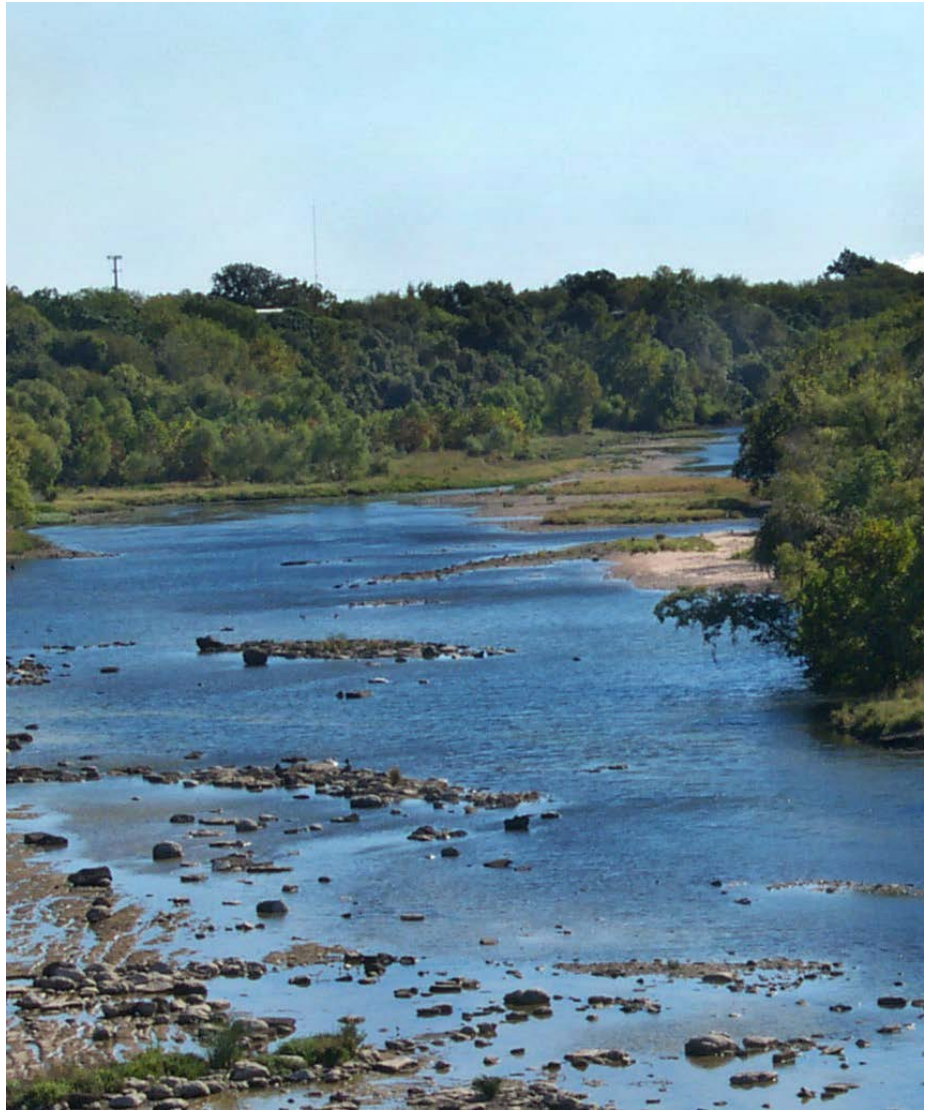
- Balancing Austin's priorities
- Maintain existing watershed protections
- Impervious cover analysis
- Flood risk reduction for redevelopment
- Green stormwater infrastructure (GSI)
- Residential development



Maintain Existing Watershed Protections

CodeNEXT proposes to preserve existing watershed regulations, including:

- Drainage and floodplain standards
- Stream & lake buffers
- Watershed impervious cover limits
- Critical environmental feature setbacks
- Steep slope protections
- Cut & fill limits
- Erosion & sedimentation control requirements
- Water quality treatment standards
- Tree protections



Impervious Cover Analysis

Purpose of Impervious Cover Analysis

- Compare existing impervious cover, current maximum entitlements, and proposed CodeNEXT maximum entitlements
  - 100-year floodplain and drainage infrastructure implications
- Understand areas of change

Draft 3 Impervious Cover Analysis

Area	Existing Impervious Cover	Current Code: Maximum Impervious Cover	CodeNEXT Draft 3: Maximum Impervious Cover	Difference between Current and Proposed Entitlements
Urban Watersheds	50.6%	64.6%	63.4%	**-1.14%**
Localized Flooding Problem Areas	48.8%	57.4%	57.3%	**-0.03%**
Zoning Jurisdiction	**26.8%**	**45.8%**	**45.4%**	**-0.44%**

Note: This analysis does not account for steep slopes, critical environmental feature setbacks, landscape, and protected trees. These requirements potentially lower the total amount of impervious cover for any given parcel.

Flood Risk Reduction

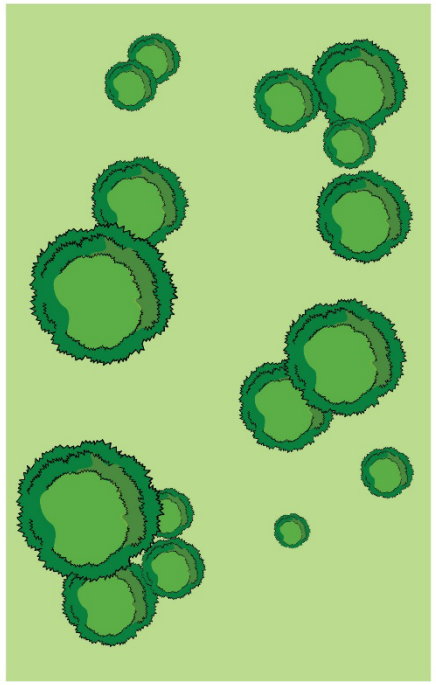
Challenges for Flood Risk Reduction

- Sites built before drainage regulations were introduced in 1974 lack stormwater controls, are often highly impervious, and can contribute to flooding and erosion
- Redevelopment in Austin's central core has put even greater pressure on existing infrastructure, which is often aging and undersized
- Current code does not require redevelopment to provide flood risk reduction in most cases

Draft 3: Flood Risk Reduction Proposal

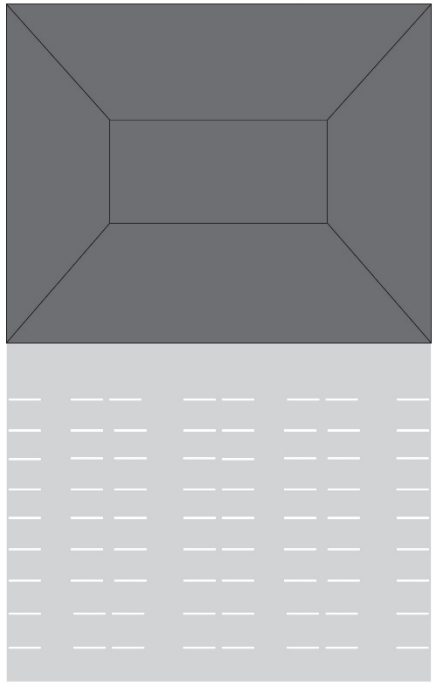
- Redevelopment must provide proportionate share of flood risk reduction for new and redeveloped impervious cover
- Applies to site plans (commercial & multifamily projects) & residential subdivisions
- Limit post-development stormwater peak flow rates from new and redeveloped impervious cover to that with **zero impervious cover** (thus same as “greenfield” development)
- Multiple options to comply: on-site detention, participation in RSMP (Regional Stormwater Management Program) with off-site drainage improvements and/or payment-in-lieu of detention
- Options dependent on site-specific drainage analysis and must be approved by City
- Projects must still prove no additional adverse downstream impacts

Undeveloped Land
0% Impervious Cover



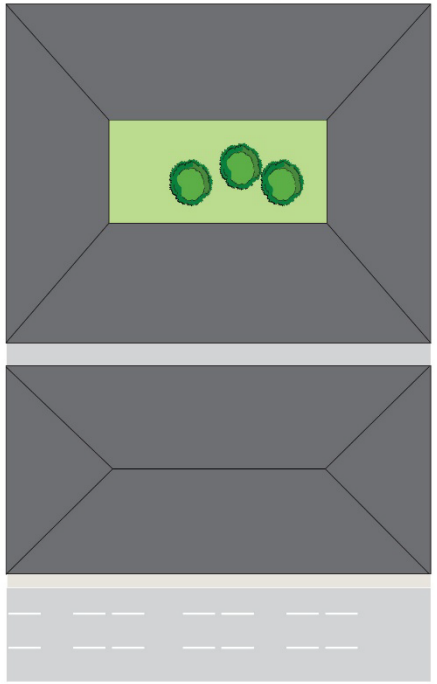
Natural land absorbs rainfall and reduces stormwater runoff.

1960s Development
No stormwater management



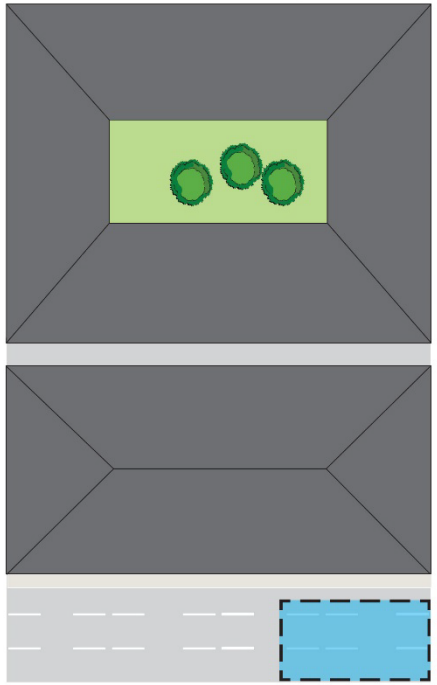
Sites built before flood requirements were introduced in 1974 lack stormwater management, and the runoff from these sites can contribute to downstream flooding.

Redevelopment of 1960s Site
Current Land Development Code



Under current code, redeveloping sites cannot increase stormwater runoff. This means that they continue contributing to downstream flooding.

Redevelopment of 1960s Site
Under CodeNEXT Proposal



CodeNEXT proposes redevelopment manage flood waters, as is currently required for projects on undeveloped land. This would be achieved through detention ponds or offsite improvements in proportion to the site's impact.

Creek Flood Modeling

Impact of proposed CodeNEXT regulations for commercial/multifamily redevelopment

- Peak flooding depths were reduced by up to 4.8 inches
- Up to 17% reduction in peak flows
- Generally small reductions in floodplain extent

Impact of maximum residential buildout

- Minimal increase in peak flooding depths—0.4 inches on average
- Average increase in peak flows of 2%

Localized Flood Modeling

Del Curto Study Area

Impact of proposed CodeNEXT regulations for commercial/multifamily redevelopment

- Peak flooding depths were reduced by up to 4.8 inches
- Reduced peak flows by up to 23%
- Reduction of flood depth >1 inch for
  - 7 buildings in the 2-year storm
  - 32 buildings in the 100-year storm

Impact of maximum residential buildout

- Peak flooding depths were increased by up to 1.4 inches
- Increased peak flows by no more than 3%
- Increase of flood depth >1 inch for
  - 1 building in a 2-year storm event
  - 0 buildings during all other storm events

Other Changes New to Draft 3: 23-10E (Drainage)

- Clarified that Regional Stormwater Management Program (RSMP) eligibility for new and redeveloped impervious cover will be based on a comparison to existing conditions
- RSMP participation will be based on a comparison to undeveloped conditions (e.g., the payment will be calculated as if the site was undeveloped)
- Added exemption from requirement to reduce peak rates of discharge to undeveloped conditions for existing impervious cover associated with City roadway projects*

*Inadvertently left out of initial Draft 3 publication. This language will be included in the updated staff recommendation.

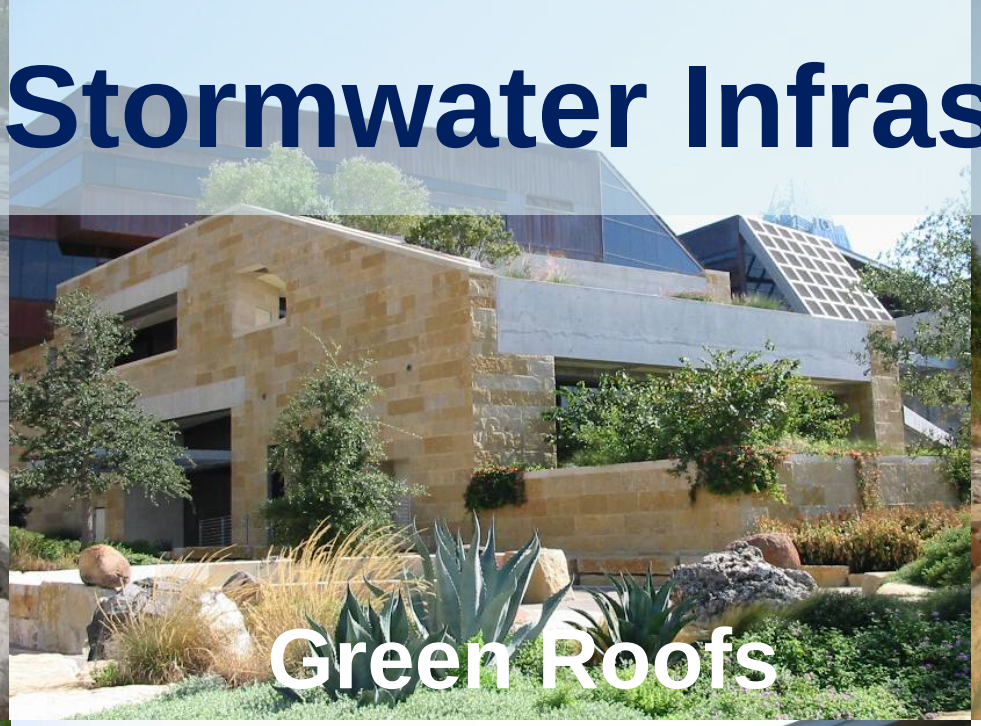
Green Stormwater Infrastructure

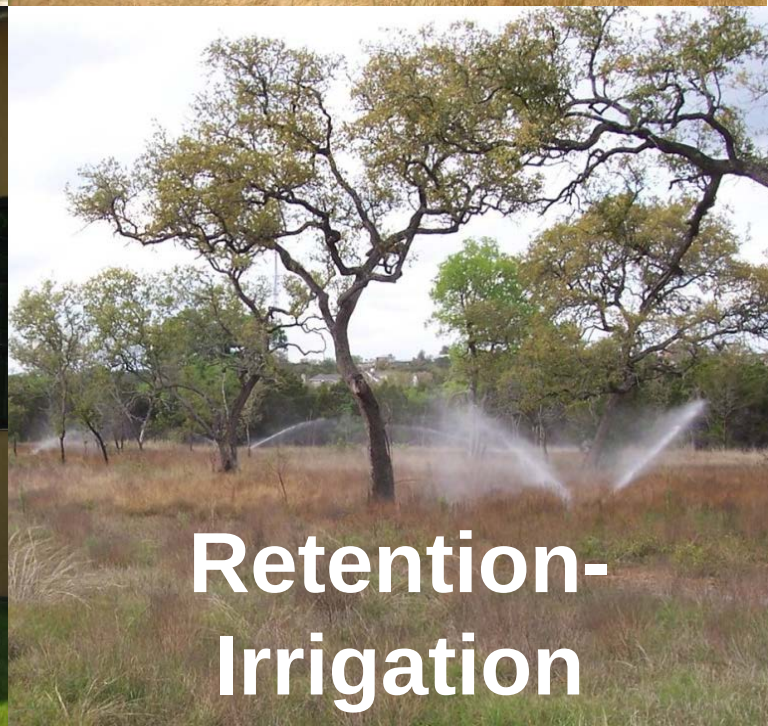
Green Stormwater Infrastructure

- **Infiltrate** to mitigate the impacts of impervious cover
  - Improve stream baseflow
  - Pollutant removal
  - Reduce creek scour and erosion
  - Improve aquatic habitat
  - Enhance recreational values

- **Conserve** potable water indoors and outdoors
- Green stormwater infrastructure for resiliency

Green Stormwater Infrastructure





Draft 3: Green Stormwater Infrastructure Proposal

Simplified beneficial use proposal to require the use of green stormwater infrastructure to capture and treat the entire water quality volume

- Conventional water quality controls (e.g., sand filter) allowed under certain conditions, including residential subdivisions, hot-spot land uses (e.g., auto repair), and regional ponds
- Sites with greater than 80% impervious cover may also use conventional controls, but would need to capture stormwater for onsite use
- Administrative modification for unique site conditions

Residential Development: Proposed Drainage and Environmental Requirements

Goals and Considerations

- Goal: Tailor applicable regulations and permit review procedures to a project's overall scale and intensity
- Opportunity to enhance outcomes for 1 – 2 unit construction and encourage missing middle housing
- Seeking to balance affordability goals with avoidance of drainage and environmental problems
- Analyses in progress to assess potential impacts on DSD resources and permitting process

New Residential Development Regulations

23-2A-3: Residential Development Regulations

- Establish the same environmental and drainage requirements for 1 – 6 units:
  - 1 to 2 units: Provides a higher level of environmental and drainage review than current practice
  - 3 to 6 units ("missing middle"): Creates a new, scaled and streamlined single-permit process for 3 – 6 unit development on residentially-platted lots
- Over 6 units: Maintain requirements for full site plan and building permit

Major Changes: 1 – 2 Units

- Current practice includes impervious cover, floodplain, and erosion hazard zone review
- Draft 3 proposes the following requirements:
  - Engineer's certification of no negative drainage impacts to adjacent properties;
  - Creek buffers (1986 Comprehensive Watersheds Ordinance, 2013 Watershed Protection Ordinance);
  - Construction on slopes requirements (Post-1986 Comprehensive Watersheds Ordinance); and
  - Cut/fill limits

Major Changes: 3 – 6 Units

- Creates a new, scaled single-permit process for 3 - 6 unit development on residentially-platted lots
- Offers a faster, lower-cost path for residential projects that provide a diversity of housing types while maintaining impervious cover limits and environmental/drainage requirements of 1 - 2 family projects
- Qualifying projects must:
  - be located outside the Barton Springs Zone;
  - not exceed 45% impervious cover; and
  - not require a Land Use Commission variance

Drainage and Environmental Requirements for 1 – 6 units

Environmental

- Impervious cover (zoning)*
- Tree protection*
- Creek buffers (based on date of subdivision and for all properties along Lake Austin)
- Steep slopes (based on date of subdivision)**
- Cut/fill restrictions**
- Erosion and sedimentation controls*

Drainage

- Floodplain*
- Erosion hazard zone*
- Engineer's certification that any drainage changes will not negatively impact adjacent properties

*Currently reviewed for 1-2 unit residential building permit

**Not required in Urban watersheds

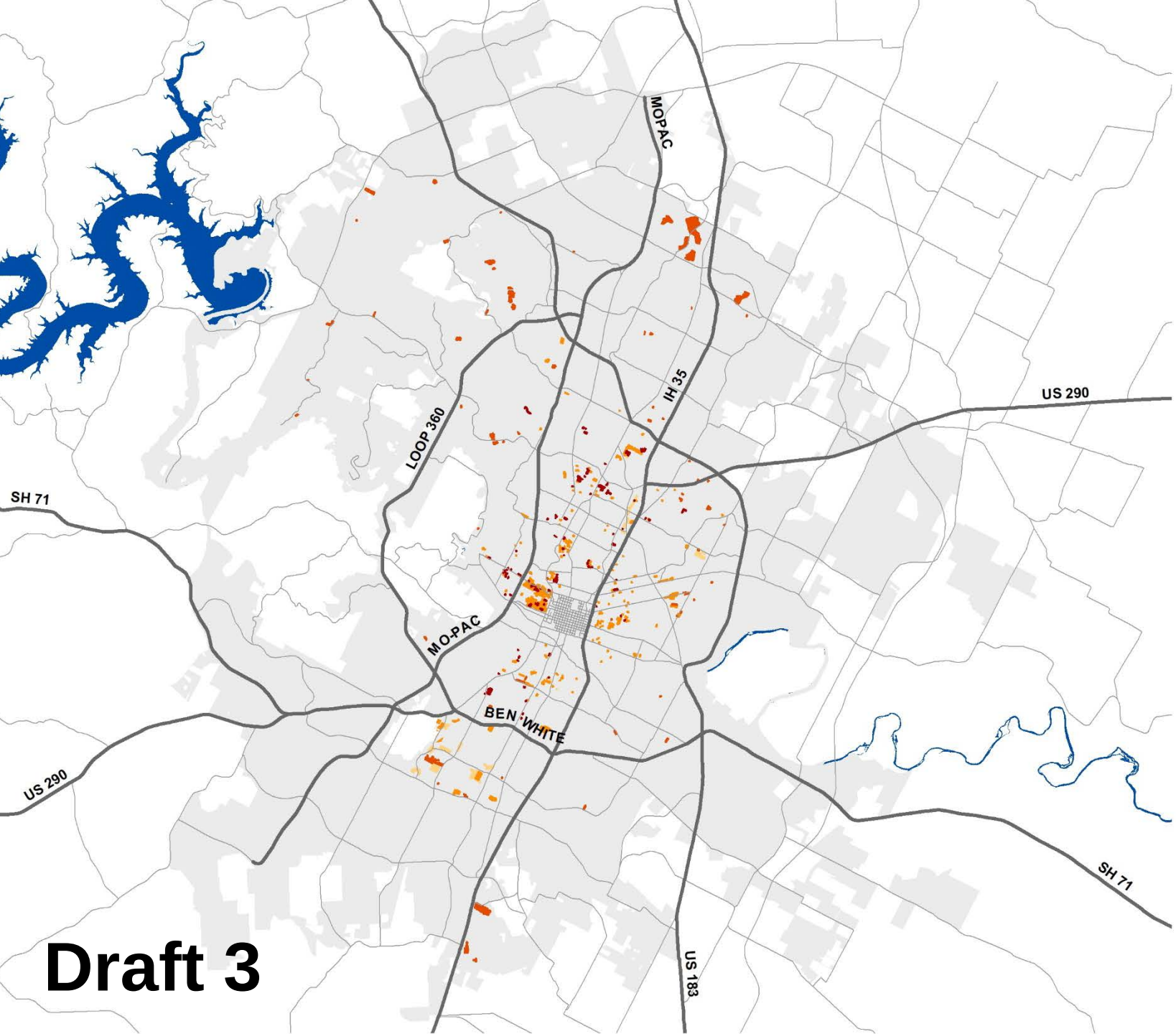
Residential Development (1 - 6 units)

Draft 3

Parcels	Parcels with creek buffers		Parcels with slopes over 15%*		Total Eligible Parcels
	Pre-86**	Post-86	Pre-86	Post-86	
1 – 2 unit	17,702	4,431	19,522	11,696	**171,231**
3 – 6 unit	190	182	138	525	**3,742**
Total	**17,892**	**4,613**	**19,660**	**12,221**	**174,973**

*Not including Urban watersheds, parcels with < 25 square feet of high slope area, or areas within buffers
**Subdivisions with no recorded date assumed to be pre 1986

Please note: These numbers represent planning-level estimates based on zoning and parcel size.



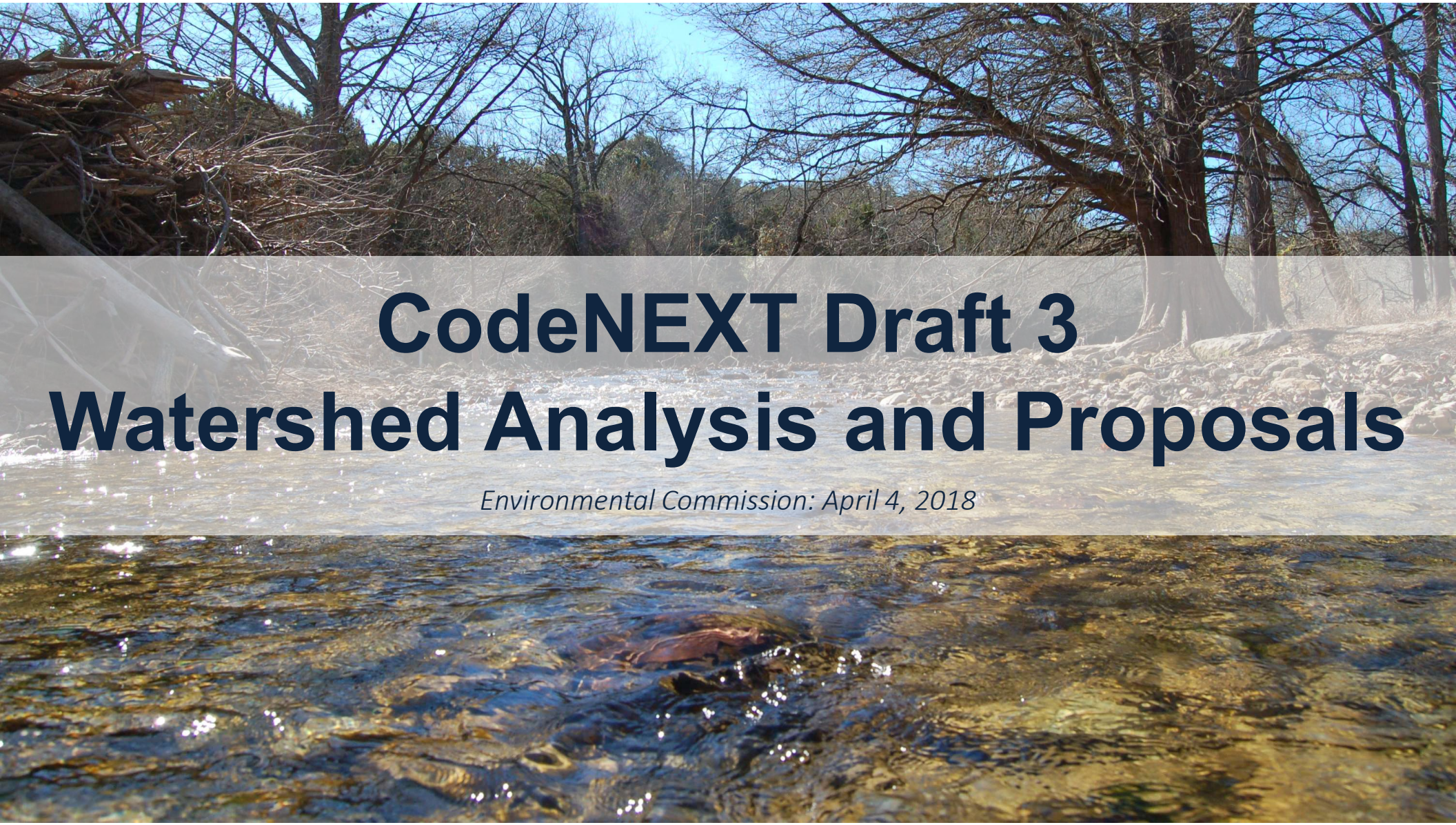
Potential 3 - 6 unit parcels

- R3
- R4
- RM1A
- RM1B
- Zoning Jurisdiction

Draft 3

0 2.5 5 Miles

Questions?

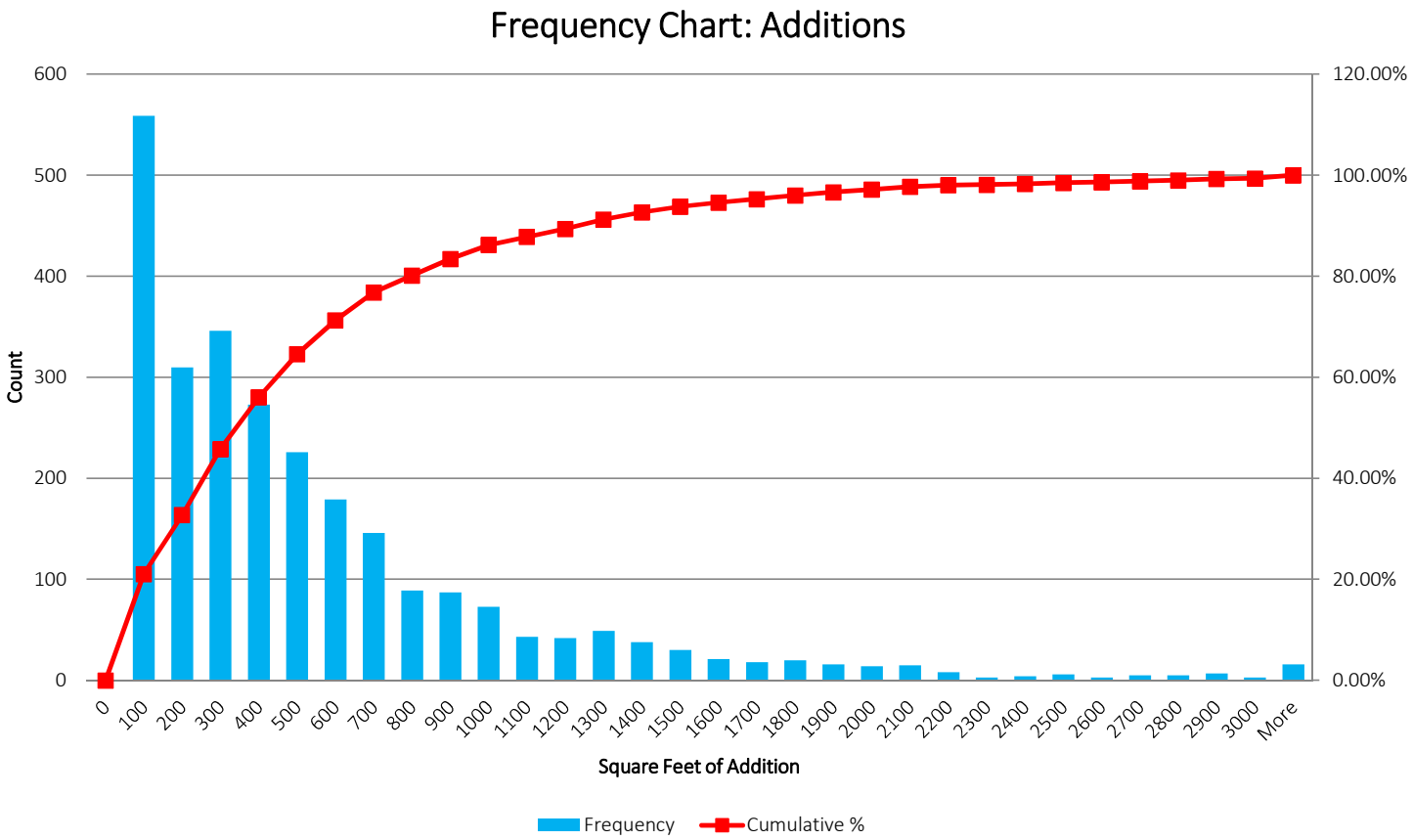


CodeNEXT Draft 3
Watershed Analysis and Proposals

Environmental Commission: April 4, 2018

Size of Residential Additions

Average Size of Additions

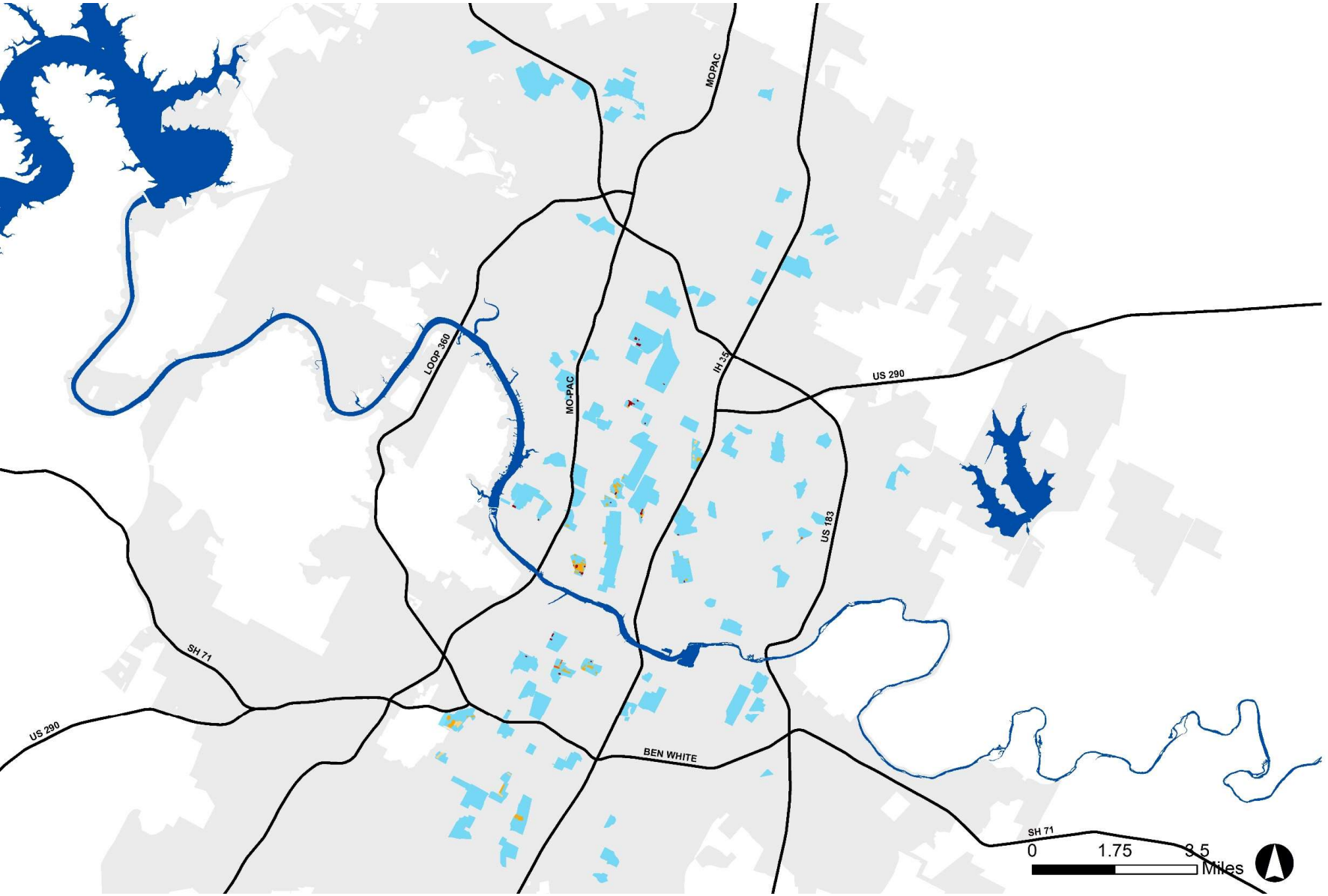


- Average: 519 square feet
- Median: 342 square feet
- Approximately 65% of additions to existing structure are less than 500 square feet.
- Approximately 45% of additions to existing structures are less than 300 square feet.

3 – 6 Units in Localized Flood Problem Areas

3 – 6 Unit-Eligible Parcels within Localized Flood Problem Areas

Zone	Acres	Parcel Count	Total Eligible Parcels	Percent of Eligible Parcels in Localized Flood Problem Areas
R3B	9.1	31	198	1%
R3C	6.3	42	247	1%
R4A	52.4	246	1051	7%
R4B	1.9	11	129	0%
R4C	0.5	4	116	0%
RM1A	3.1	16	1581	0%
RM1B	16.9	82	420	2%
Grand Total	90.1	432	3,742	12%



Localized Flood Problem Area

3 - 6 Unit-Eligible Properties within Localized Flood Problem Areas

- R3
- R4
- RM1A
- RM1B

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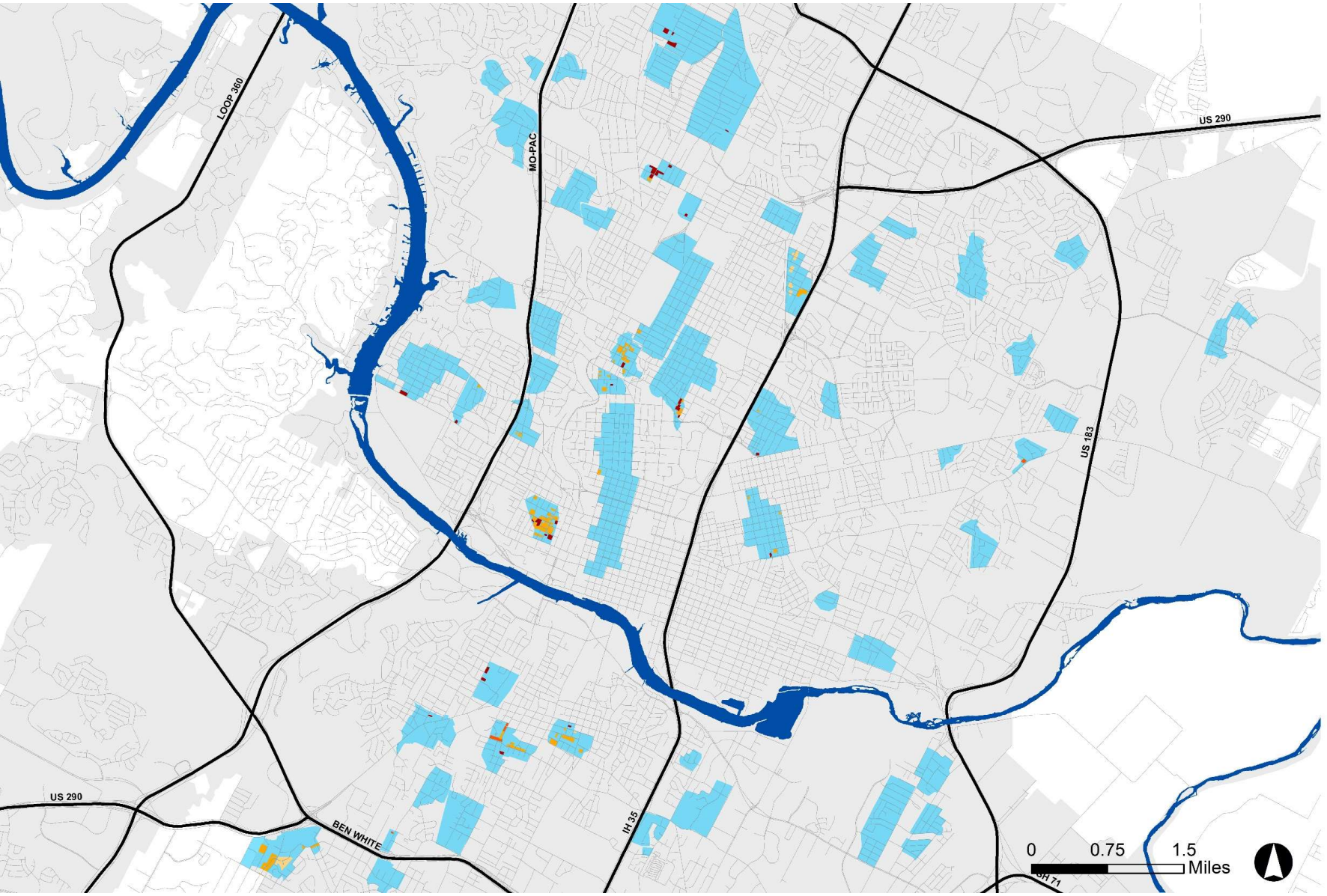

Localized Flood Problem Area

3 - 6 Unit-Eligible Properties within Localized Flood Problem Areas

- R3
- R4
- RM1A
- RM1B

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Localized Flood Problem Area
3 - 6 Unit-Eligible Properties within Localized Flood Problem Areas
R3
R4
RM1A
RM1B
0
0.275
0.55
Miles
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Steep Slopes/Cut and Fill in Urban Watersheds

Steep Slopes by Watershed Regulation Area

Watershed Regulation Area	Area (Ac.)	Percent of COA Jurisdiction	Acres over 15% Slope	Percent of Regulation Area over 15% Slope	Percent of COA Jurisdiction over 15% Slope
Barton Springs Zone	30,606	14.7%	2,343	7.7%	1.1%
Suburban	98,762	47.3%	3,543	3.6%	1.7%
Urban	38,115	18.3%	1,645	4.3%	0.8%
Water Supply Rural	16,880	8.1%	7,554	44.8%	3.6%
Water Supply Suburban	24,246	11.6%	5,398	22.3%	2.6%
Total	**208,609**	**100.0%**	**20,483**	**9.8%**	**9.8%**

Drainage Modeling Summary: Evaluating the Impact of the Proposed CodeNEXT Regulations on Flood Risk Reduction and Maximum Single-Family Residential Buildout on Flood Risk

April 25, 2018

The Watershed Protection Department's (WPD) mission is to protect lives, property, and the environment by reducing the impact of flood, erosion, and water pollution. We carry out this mission by constructing drainage projects, enforcing development regulations, and providing programs such as the inspection and maintenance of drainage infrastructure. These efforts help to mitigate existing drainage and flooding problems and prevent future problems. In response to the public's desire, recommendations from the Flood Mitigation Task Force, and the impetus of our mission to reduce the impacts of flooding, WPD has proposed new regulations in CodeNEXT that we believe will help reduce flood risks citywide. This summary discusses the results of engineering studies to determine the potential flood risk reduction benefits of the proposed regulations.

The current Land Development Code (LDC) includes regulations that require the control of post-development stormwater runoff from all development such that new development will not result in additional adverse flooding to other properties. To satisfy these regulations, development typically includes one of these three options: on-site stormwater controls, usually with a detention pond; off-site improvement or addition of stormwater infrastructure; or a payment-in-lieu of detention program. When determining the amount of pre-development stormwater runoff, the regulations allow the developer to include the amount of impervious cover that exists on the site at the time of application.

As part of the current CodeNEXT draft regulations, re-development of commercial, multi-family, and residential subdivision projects would be required to construct on-site stormwater controls to limit post-development stormwater peak flow rates from new and redeveloped impervious cover to that with zero impervious cover. Off-site stormwater infrastructure improvements or a payment-in-lieu of detention will still be an option as long as the developer can prove through a drainage analysis that the development will not create additional flooding downstream. These off-site options are dependent on this site-specific drainage analysis and must be approved by the City.

The intent of these proposed regulations is to require properties that were developed prior to the current drainage regulations to do their proportionate share to reduce the risk of flooding to other properties. For decades, the LDC has required that new development reduce the risk of flooding in proportion to each site's flood impacts. In large part due to development prior to regulations put in place by the City in the late 1970s and 1980s, there are more flood risks citywide than the Watershed Protection Department has resources to mitigate. The goal of the proposed CodeNEXT regulations is for both new development and re-development to assist in reducing flood risks.

WPD initiated an engineering study to better understand the effectiveness of the proposed CodeNEXT regulations in reducing flood risks along a typical major creek and within an urban drainage system. We refer to these as creek flooding and local flooding.

Because the proposed CodeNEXT regulations are not proposed to apply to individual single-family building permits, WPD also investigated the potential impact of residential buildout up to the maximum allowed impervious cover. Currently, compliance with most drainage requirements is not reviewed for individual one- and two-unit building permits, as the drainage requirements are not designed for this type and scale of development.

CodeNEXT proposes to better tailor applicable regulations and permit review procedures to a project's overall scale and intensity. To that end, CodeNEXT will not require compliance with the proposed requirement to limit peak flows to predevelopment conditions for individual homes and small multi-family structures, but it does propose to add a new requirement that most residential building permit applications include an engineer's certification that new construction will not change existing drainage patterns in a manner that negatively impacts adjacent property. The purpose of this requirement is to avoid lot-to-lot drainage impacts.

More details about both studies are provided in the remainder of this summary.

Local Flood Modeling

To assess the impact of the proposed CodeNEXT regulations on stormwater levels along an urban drainage system, WPD performed modeling of storm drain systems in four selected areas of the City utilizing an engineering model called StormCAD. The advantages of the StormCAD model are that it's relatively simple to build and effectively determines how efficiently stormwater flows through the pipes of the drainage system. However, it is not the best model to predict the depth of stormwater that flows along the ground when the pipes have reached their capacity. We use StormCAD as a starting point prior to proceeding with a more advanced model if indicated by the StormCAD model.

In order to represent development of properties according to the proposed CodeNEXT regulations, impervious cover for all multi-family and commercial parcels was set to zero in the model's runoff coefficient calculations to simulate pre-development peak flow conditions. The StormCAD modeling results clearly indicated an improvement in the capacity of the storm drain system and justified using a more advanced engineering model for more detailed results.

Staff selected an area near South Lamar at Del Curto Road in the West Bouldin Creek watershed as the study area for the advanced modeling effort because it has a combination of residential and commercial properties that are generally representative of Austin's central core. See Figure 1 at the end of the report for a map of the study area. The advanced model, also called a 2D model, is able to account for stormwater flowing through the storm drain pipes as well as stormwater flowing above ground to simulate water levels at the potentially impacted buildings.

Four scenarios were analyzed to assess the impact of the proposed CodeNEXT regulation on localized flooding. Scenario 1 simulates existing conditions in impervious cover, scenario 2 simulates the full buildout of multifamily/commercial properties under the current proposed CodeNEXT regulations, scenario 3 simulates the full buildout of multifamily/commercial properties under the current proposed CodeNEXT regulations with the maximum buildout of residential impervious cover, and scenario 4 simulates the maximum buildout of single-family residential impervious cover. In order to represent development of properties according to the proposed CodeNEXT regulations, engineering data such as curve numbers and times of concentration were adjusted as well.

The results of the 2D modeling effort show a reduction in flood risk due to the proposed CodeNEXT requirements. Table 1 below indicates the maximum and average reductions in the levels of the stormwater. The analysis shows peak flooding depths were reduced by up to 4.8 inches, and peak flows were reduced by up to 23% in the 2-year storm event. A total of seven buildings see a reduction in flood depths greater than one inch in the 2-year storm, with 32 buildings experiencing a reduction in depths greater than one inch in the 100-year storm. See Figure 1 for a map of the potential benefits of re-development mitigation in the 100-year storm. This analysis suggests that the proposed CodeNEXT regulation regarding mitigation for re-development provides measurable and beneficial reductions in flood risk.

Table 1: Benefits of proposed CodeNEXT mitigation to greenfield conditions for re-development compared to existing conditions

Storm Event	Number of Buildings Removed from Flood Risk	Number of Buildings with a Reduction in Flood Depths > 1 inch	Maximum Reduction (inches)	Average Reduction (inches)
2-year	5	7	1.9	1.2
10-year	5	12	3.0	1.7
25-year	4	20	4.8	1.3
100-year	3	32	2.6	1.2

The 2D modeling effort also examined the impact of the buildout of single-family residential areas to maximum allowed impervious cover on localized flood risk. The future development of residential properties increased peak flows at Del Curto, Kinney, and Thornton by between 1.2% and 3.2% in the 2-year storm event, and between 0.3% and 0.7% in the 100-year storm event. Peak flooding depths were increased by up to 1.4 inches in the 2-year storm, with the increase for 10- through 100-year events ranging from 0.12 to 0.24 inches. For the Del Curto study area, one building would see an increase in flood depths over one inch in a 2-year storm event. No buildings were impacted during the 10-year, 25-year and 100-year storm event. See Figures 2 and 3 for maps of the 25-year and 100-year events, respectively.

Overall, these results indicate that the redevelopment of residential properties to the maximum allowed impervious cover has a minimal impact on flood risk within the studied area. In this particular study area, the estimated flood depth reductions due to the proposed CodeNEXT regulation of post-development peak flows exceeds the flood depth increases from residential buildout.

Creek Flood Modeling

WPD staff selected the four areas shown in Figure 2 to analyze the impact of the proposed CodeNEXT regulations on creek flood levels: West Bouldin Creek watershed (South Lamar Boulevard), Country Club West Creek watershed (Riverside Drive, east of IH35 area), Hancock Branch of Shoal Creek (Brentwood Neighborhood), and Upper Tannehill Branch watershed (IH35 at Airport Boulevard). WPD selected these areas because they are generally fully developed, include portions of major re-development corridors identified in the Imagine Austin Comprehensive Plan, and have enough land use variety to cover the breadth of the impacts we would expect to see from the proposed CodeNEXT regulations.

Detention was selected as the most easily modeled form of mitigation to represent the proposed CodeNEXT regulations. However, in practice, the proposed mitigation approach would require that each re-development project be evaluated to determine the most effective strategy to address downstream flooding. In some cases, this would be on-site flood detention; in others, it might be the improvement of downstream conveyance either directly or through a payment-in-lieu of detention program. In all cases, the development would not be allowed to result in additional adverse flooding to other properties.

WPD staff developed a methodology for this analysis that represents the impact of detention distributed throughout the properties with the potential for re-development without modeling each individual detention pond directly. This method adjusts the Peak Rate Factor (PRF), which is a component of the NRCS Unit Hydrograph transform within the engineering model. Reduction of the PRF flattens the runoff hydrograph and reduces the peak flow produced by each subbasin. This effectively mimics the storage within the subbasin that would be provided by detention.

The Creek Flood modeling analysis shows that the proposed CodeNEXT regulations would have a measurable and beneficial impact on both flood levels and floodplain extents. The City's floodplain models, maps and regulations are based on the assumption of full development without detention in the watershed. The mitigation scenario was compared to this full development condition per the zoning recommendations in CodeNEXT. As expected, the magnitude of the benefit seen is dependent on the amount of land with the potential for re-development and on the location of this land within the watershed. For all watersheds studied, the average overall flow reduction was approximately 13% (ranging from 0 – 25%). The average depth reduction was up to 5 inches for a 25-year event and up to 4 inches for the 100-year storm event. Refer to figures 3 through 7 and table 1 for summaries of the average flow and depth reduction benefits for different areas within the evaluated watersheds.

The Creek Flood modeling analysis also examined the relative flooding impact of full impervious cover buildout of single-family residential areas under CodeNEXT. From a regulatory standpoint, the City's floodplain models and maps already account for full single-family residential buildout. This analysis helps answer the question about the degree of impact that residential buildout alone may have on flood risk.

As would be expected of an increase in impervious cover, the modeling shows a mathematical increase in flood depth between existing impervious cover conditions and the residential maximum allowed impervious cover conditions. However, this change is comparatively minimal; the flood depth differences averaged 0.5 inches over all storm events, with an average increase in peak flows of 1.8%. For the 100-year event, depth differences averaged 0.3 inches. The depths of flow in more frequent storm events (e.g. 2-year, 5-year, etc.), which tend to be more contained within existing channel banks, are more significantly affected which skews the average depth in all storm events.

Summary

The proposed CodeNEXT regulations requiring that re-developing properties mitigate to pre-development conditions has the potential to help the City address long-standing flood risk issues, especially in the urban core. The analyses summarized here show that mitigation for re-development as proposed in CodeNEXT (for simplicity modeled in the form of detention) provides measurable and beneficial reductions in flood risk.

- The magnitude of flood risk reduction depends on the location within the watershed and the amount of land area that is likely to redevelop within the watershed.

- The observed reduction is greater in the upstream portions of the studied watersheds and tends to decrease as the contributing area increases along the larger streams.

- The observed variation in flood risk reduction illustrates the need for a variety of mitigation measures, such as on-site stormwater controls, off-site improvements, or payment-in-lieu of detention, that will allow the mitigation approach to be tailored depending on the location within the watershed and the condition of the downstream drainage system.

- The 2D modeling exercise found that development of all single-family areas to the maximum impervious cover limits allowed by the proposed CodeNEXT zoning does not have a significant impact on flood risk within the studied watersheds.

The proposed CodeNEXT regulations produce demonstrable flood risk reductions. However, they will not provide an immediate solution to the City's flooding problems. Over time as existing development redevelops, the requirements will reduce the risk for flooding to buildings in or near the floodplain and thus reduce the cost of post-flood recovery to those affected by flooding. The proposed requirements could also make implementation of City-funded flood risk reduction projects within the urban core more cost-effective by reducing the magnitude of flows that must be managed through drainage system improvements and helping directly construct or contribute financially to such improvements.

It is important to reiterate that detention is not the only potential mitigation measure that could be associated with these proposed regulations. In practice, each re-development project would need to be evaluated to determine the most effective strategy to address downstream flooding. In some cases, this would be on-site flood detention, in others, it would be the targeted improvement of downstream conveyance either directly or via payment-in-lieu of detention towards such a project.

City of Austin
WATERSHED PROTECTION

0 200 400 Feet

De Verne St
Frazier Ave
Rabb Glen St
Oxford Ave
Paramount Ave
Arpdale St
Montclaire St
Ann Arbor Ave
Burris Cir
Goodrich Ave
Lamar Blvd
La Casa Dr
Lamar Blvd
Iva Ln
Kinney Rd
Delcrest Dr
Southland Dr
Ravey St
Thornton Rd
West Bouldin Creek Tributary

Limits of 2D Zone
Storm Drain

Flooding Complaints
- Building
- Yard
- Street

Parcel Groups
- Group C (Commercial/ Multifamily)
- Group A, B

S2 Decrease from S1 WSE (100-Year)
- 2 - 3"
- 1 - 2"
- 0.5 - 1"
- S2 Limits of Inundation (100-Year)
- Buildings with S1 Inundation Reduced by ≥1" (100-Year)
- Buildings Removed from S1 Flood Risk (100-Year)
- Buildings at Risk of S2 Flooding (100-Year) (58 buildings)

The structure and utility locations shown in this drawing are for informational purposes only and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Unless otherwise noted on the drawing, they do not represent an on-the-ground survey and represent only the approximate relative location.

PN PROJECT NO.: AU3162288
DATE CREATED: Date: 12/6/2018
DATUM & COORDINATE SYSTEM: NAD83 State Plane (feet) Texas Central
FILE NAME: Name: 2Q-9-S1 Differential 100y
PREPARED BY: JGJ

N W E S

CodeNEXT Scenario 2: Greenfield Conditions
100-Year Differential of S2 with S1

FREESE NICHOLS
FREESE AND NICHOLS, INC.
10431 MORADO CIRCLE
SUITE 300
AUSTIN, TEXAS 78759
PHONE: 512-617-3100
FAX: 512-617-3101

FIGURE
S2-9

Figure 1. Del Curto Local Flood study area showing benefits of re-development mitigation (100-year event)

City of Austin
WATERSHED PROTECTION

0 200 400 Feet

Limits of 2D Zone
Storm Drain Alignment

Flooding Complaints
- Building
- Yard
- Street

Parcel Groups
- Group C (Commercial/ Multifamily)
- Group A, B

S4 Increase from S1 WSE (25-Year)
- 0.1 - 0.5"
- 0.5 - 1.5"
- S4 Limits of Inundation (25-Year)
- Buildings with S1 Inundation Increased by ≥1" (25-Year)
- Buildings Added to S1 Flood Risk (25-Year)
- Buildings at Risk of S4 Flooding (25-Year) (44 buildings)

De Verne St
Frazier Ave
Rabb Glen St
Oxford Ave
Paramount Ave
Airpdale St
Montclaire St
Ann Arbor Ave
Burris Cir
Goodrich Ave
Lamar Blvd
La Casa Dr
Iva Ln
Kinney Rd
Delcrest Dr
Southland Dr
Ravey St
Thornton Rd
West Bouldin Creek Tributary

The structure and utility locations shown in this drawing are for informational purposes only and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Unless otherwise noted on the drawing, they do not represent an on-the-ground survey and represent only the approximate relative location.

PN PROJECT NO.: AU3160288
DATE CREATED: Date: 2/8/2018
DATUM & COORDINATE SYSTEM: NAD83 State Plane (feet) Texas Central
FILE NAME: Name: S4-8 Differential 25y
PREPARED BY: JGJ

N W E S

CodeNEXT Scenario 4: Future Conditions
25-Year Differential of S4 with S1

FREESE NICHOLS, INC.
10431 MORADO CIRCLE
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FIGURE
S4-8

Figure 2. Del Curto Local Flood study area showing the impact of the buildout of single-family residential areas to maximum allowed impervious cover (25-year event)

City of Austin
WATERSHED PROTECTION

0 200 400 Feet

De Verne St
Frazier Ave
Rabb Glen St
Oxford Ave
Paramount Ave
Arpdale St
Montclaire St
Ann Arbor Ave
Burris Cir
Goodrich Ave
Lamar Blvd
La Casa Dr
Iva Ln
Kinney Rd
Delcrest Dr
Southland Dr
Ravey St
Thornton Rd
West Bouldin Creek Tributary

Limits of 2D Zone
Storm Drain

Flooding Complaints
- Building
- Yard
- Street

Parcel Groups
- Group C (Commercial/ Multifamily)
- Group A, B

S4 Increase from S1 WSE (100-Year)
- 0.1 - 0.5"
- 0.5 - 1.5"
- S4 Limits of Inundation (100-Year)
- Buildings with S1 Inundation Increased by ≥1" (100-Year)
- Buildings Added to S1 Flood Risk (100-Year)
- Buildings at Risk of S4 Flooding (100-Year) (62 buildings)

The structure and utility locations shown in this drawing are for informational purposes only and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Unless otherwise noted on the drawing, they do not represent an on-the-ground survey and represent only the approximate relative location.

FN PROJECT NO.: AU3162288
DATE CREATED: Date: 2/8/2018
DATUM & COORDINATE SYSTEM: NAD83 State Plane (feet) Texas Central
FILE NAME: Name: S4-9 Differential 100y
PREPARED BY: JGJ

N W E S

CodeNEXT Scenario 4: Future Conditions
100-Year Differential of S4 with S1

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FIGURE
S4-9

Figure 3. Del Curto Local Flood study area showing the impact of the buildout of single-family residential areas to maximum allowed impervious cover (100-year event)

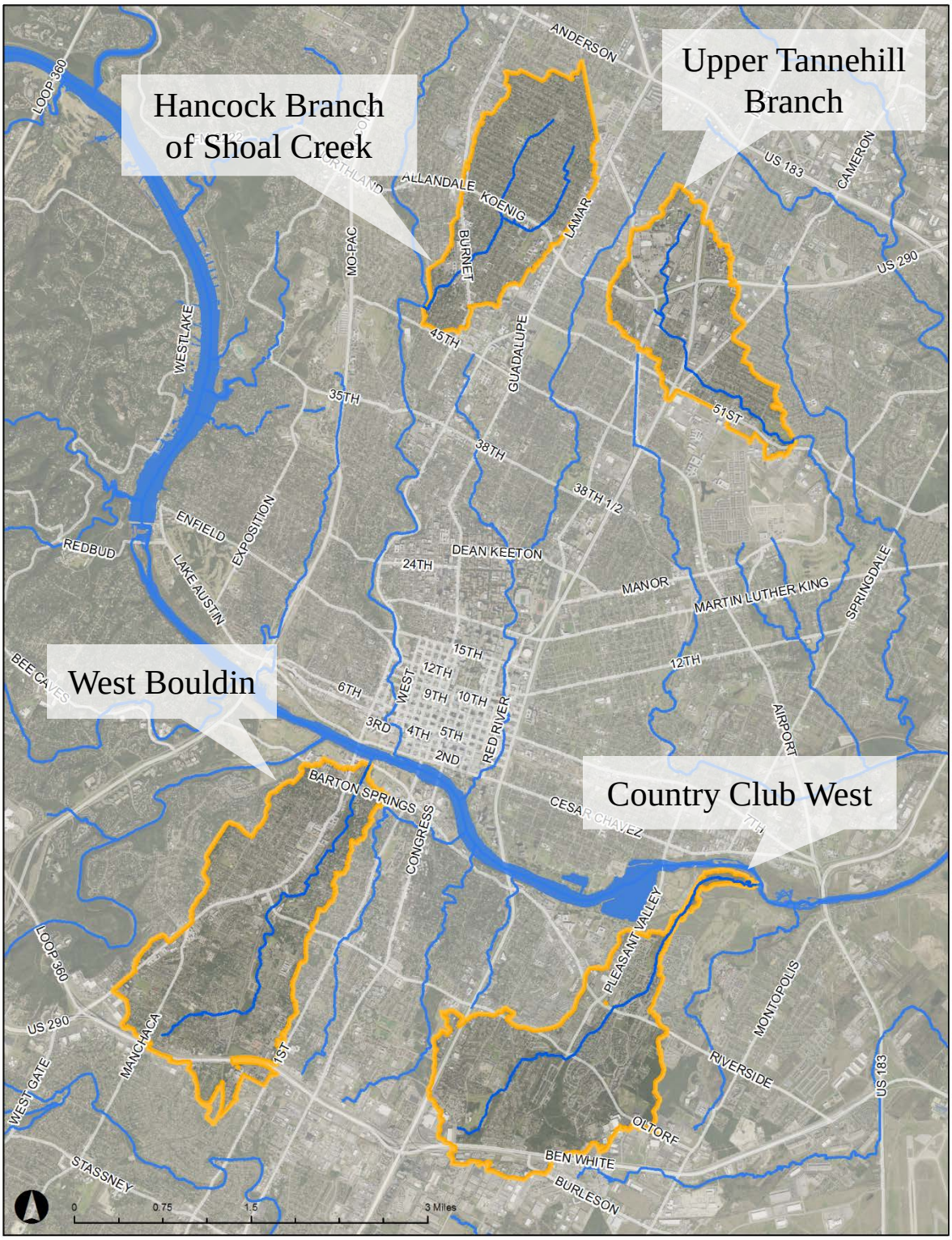

Figure 4. Four areas of Creek Flood analysis: West Bouldin, Country Club West, Hancock Branch of Shoal Creek, and Upper Tannehill watersheds.

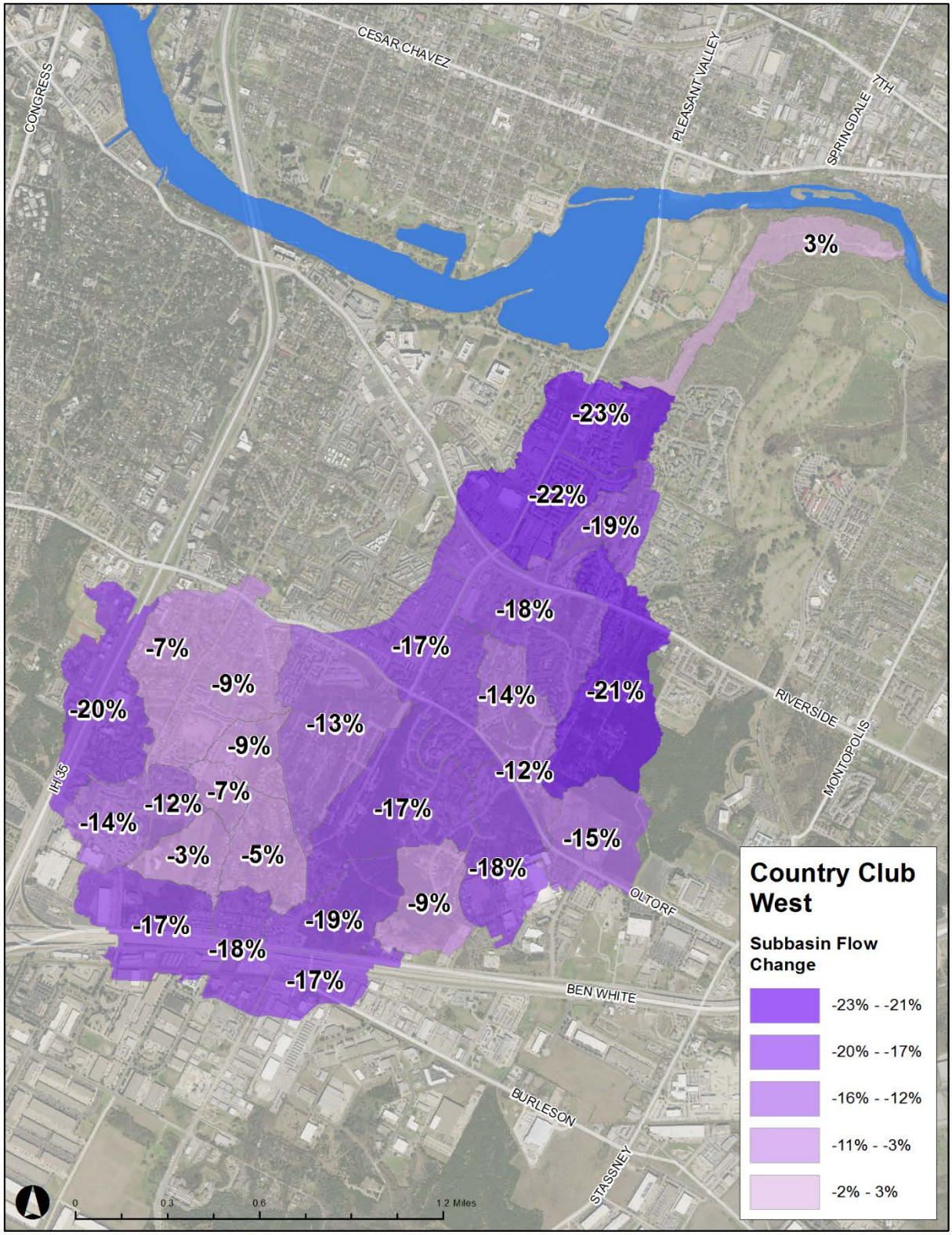

Figure 5. Percent change in subbasin flows between Mitigation Alternative (Ponds) and CodeNEXT proposed maximum allowable impervious for Country Club West. Negative numbers indicate a reduction in flow for the subbasin in the Mitigation Alternative analysis.

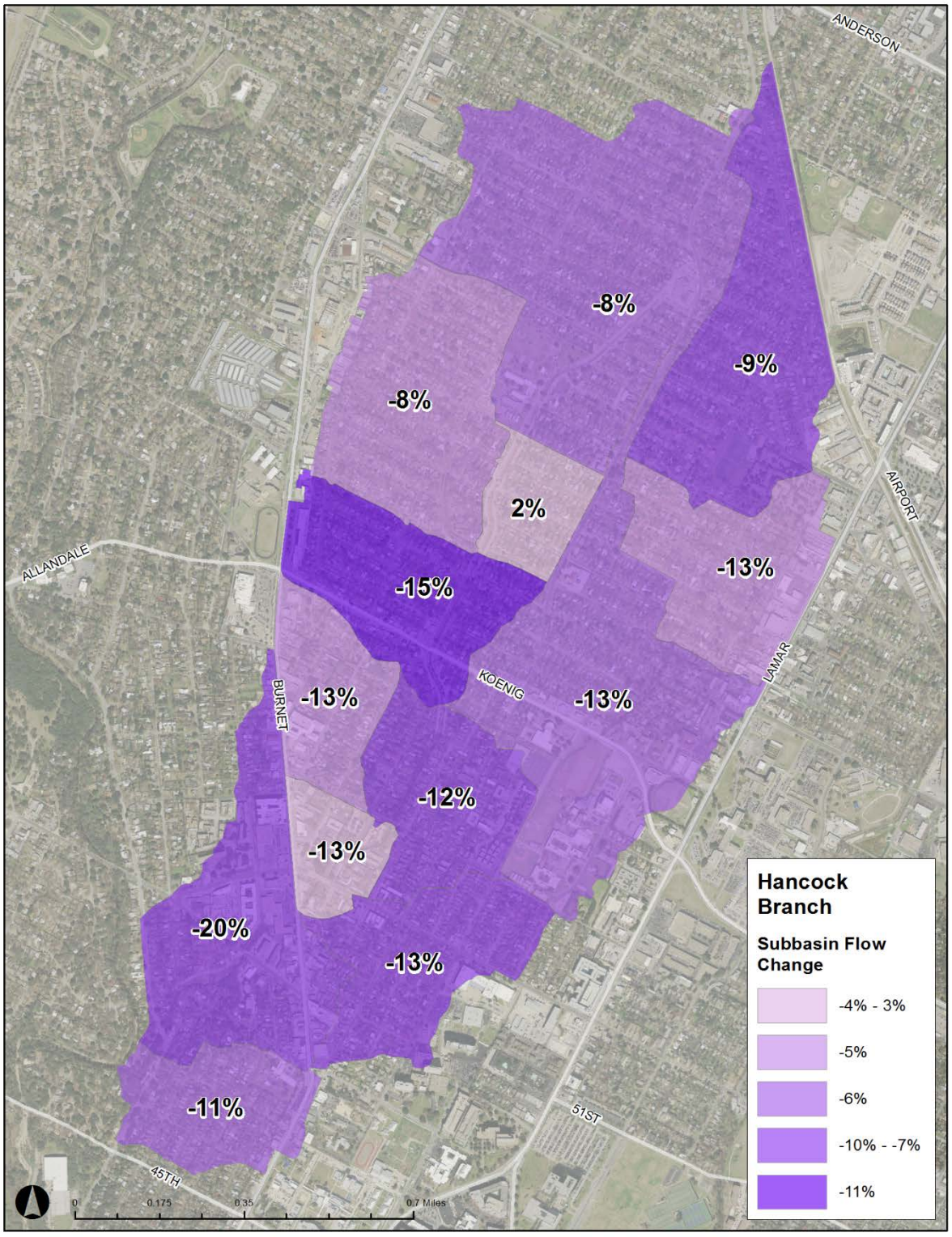

Figure 6. Percent change in subbasin flows between Mitigation Alternative (Ponds) and CodeNEXT proposed maximum allowable impervious for Hancock Branch of Shoal Creek. Negative numbers indicate a reduction in flow for the subbasin in the Mitigation Alternative analysis.

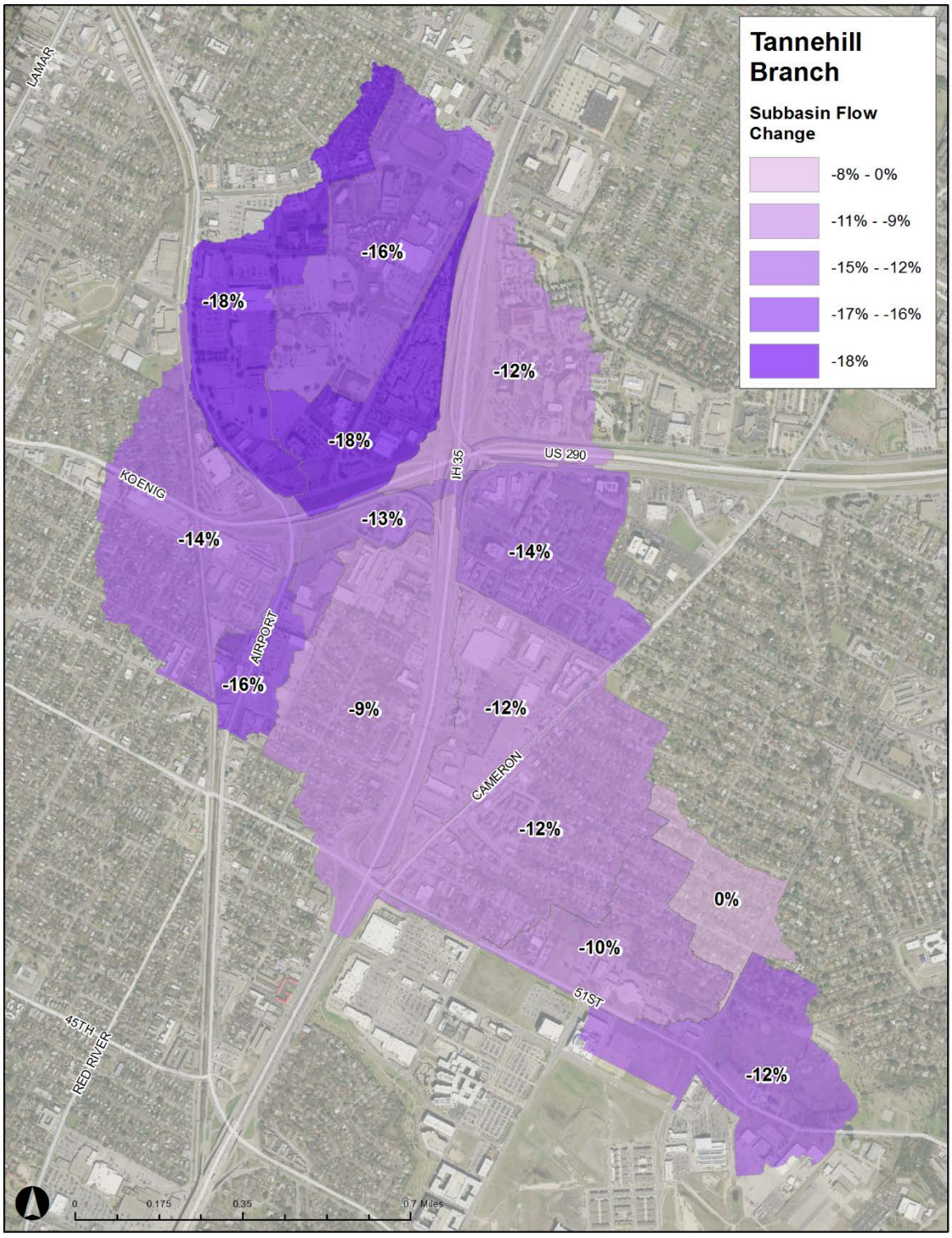

Figure 7. Percent change in subbasin flows between Mitigation Alternative (Ponds) and CodeNEXT proposed maximum allowable impervious for Tannehill. Negative numbers indicate a reduction in flow for the subbasin in the Mitigation Alternative analysis.

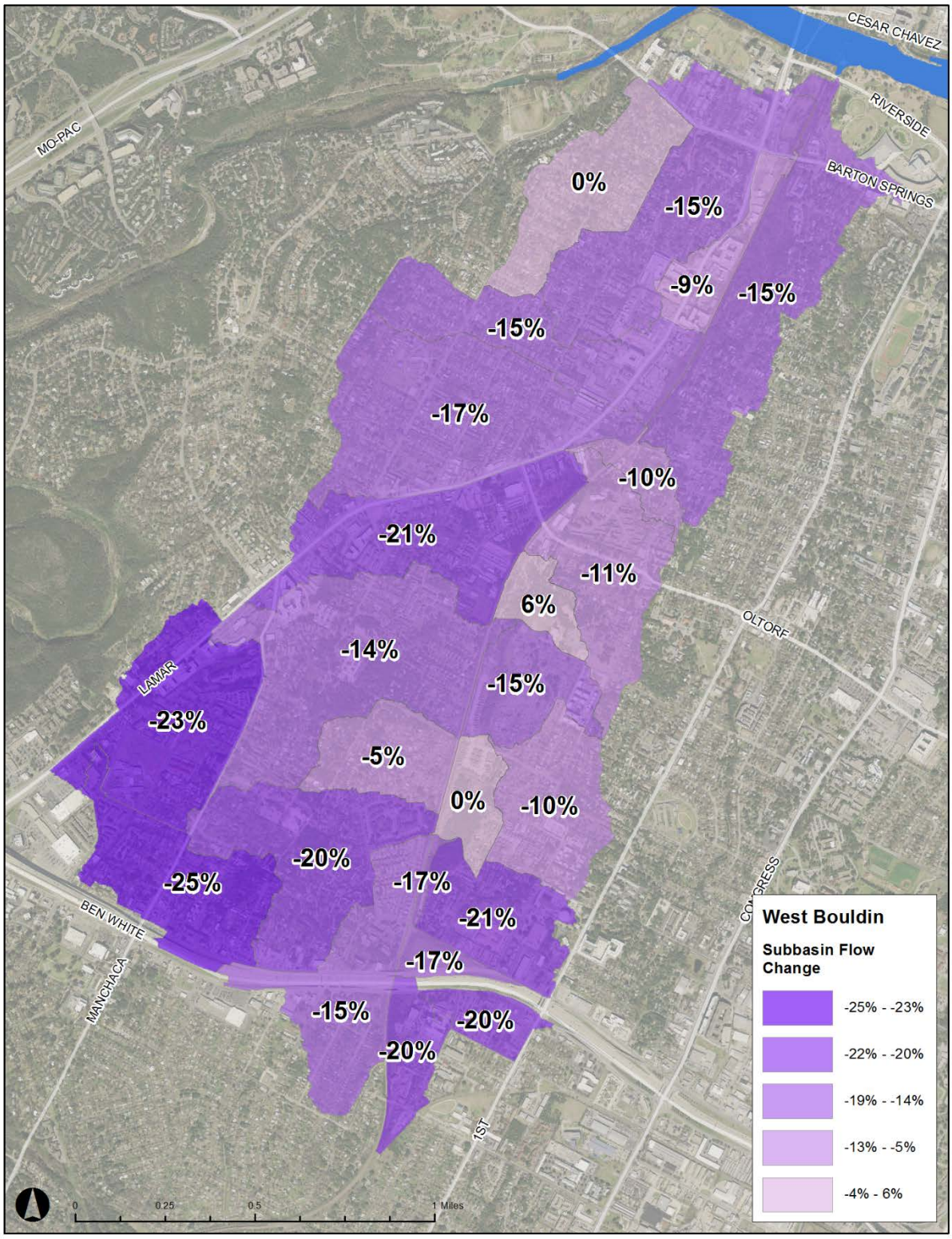

Figure 8. Percent change in subbasin flows between Mitigation Alternative (Ponds) and CodeNEXT proposed maximum allowable impervious for West Bouldin. Negative numbers indicate a reduction in flow for the subbasin in the Mitigation Alternative analysis.

Table 2: Summary of average flood depth reductions between CodeNEXT maximum allowable impervious cover (full development) and mitigation with ponds

Waterhshed and Stream Reach	Average Depth Reductions for Selected Design Storms (Inches)					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
West Bouldin						
South of North Fork	-2.8	-2.4	-2.5	-2.9	-2.9	-3.1
North of North Fork	-2.9	-4.4	-3.4	-4.9	-4.1	-4.0
North Fork Trib	-2.9	-4.2	-4.0	-4.1	-3.6	-4.0
Shoal Creek						
Hancock Branch	-1.9	-2.0	-2.0	-1.7	-1.6	-1.4
Grover Branch	-1.0	-0.8	-0.8	-0.8	-1.0	-1.1
Country Club West						
Mainstem	-1.6	-2.0	-2.3	-2.5	-3.0	-2.6
CCW1	-1.7	-2.2	-2.3	-2.7	-2.8	-2.9
CCW2	-2.1	-2.6	-3.3	-3.5	-3.3	-3.4
CCW3	-1.6	-2.0	-2.3	-2.6	-2.8	-2.9
CCW3a	-0.5	-0.6	-0.6	-0.7	-0.8	-0.8
CCW4	-2.6	-3.2	-3.7	-3.6	-3.9	-4.0
CCW5	-1.8	-2.9	-2.7	-3.4	-2.6	-2.3
Tannehill Branch						
Upstream IH35	-4.6	-4.8	-4.4	-3.8	-3.9	-3.4
Downstream IH35	-1.6	-1.7	-1.7	-1.4	-2.3	-1.6
Bartholomew Pond to Manor	-1.5	-1.2	-1.6	-1.1	-0.7	-1.5

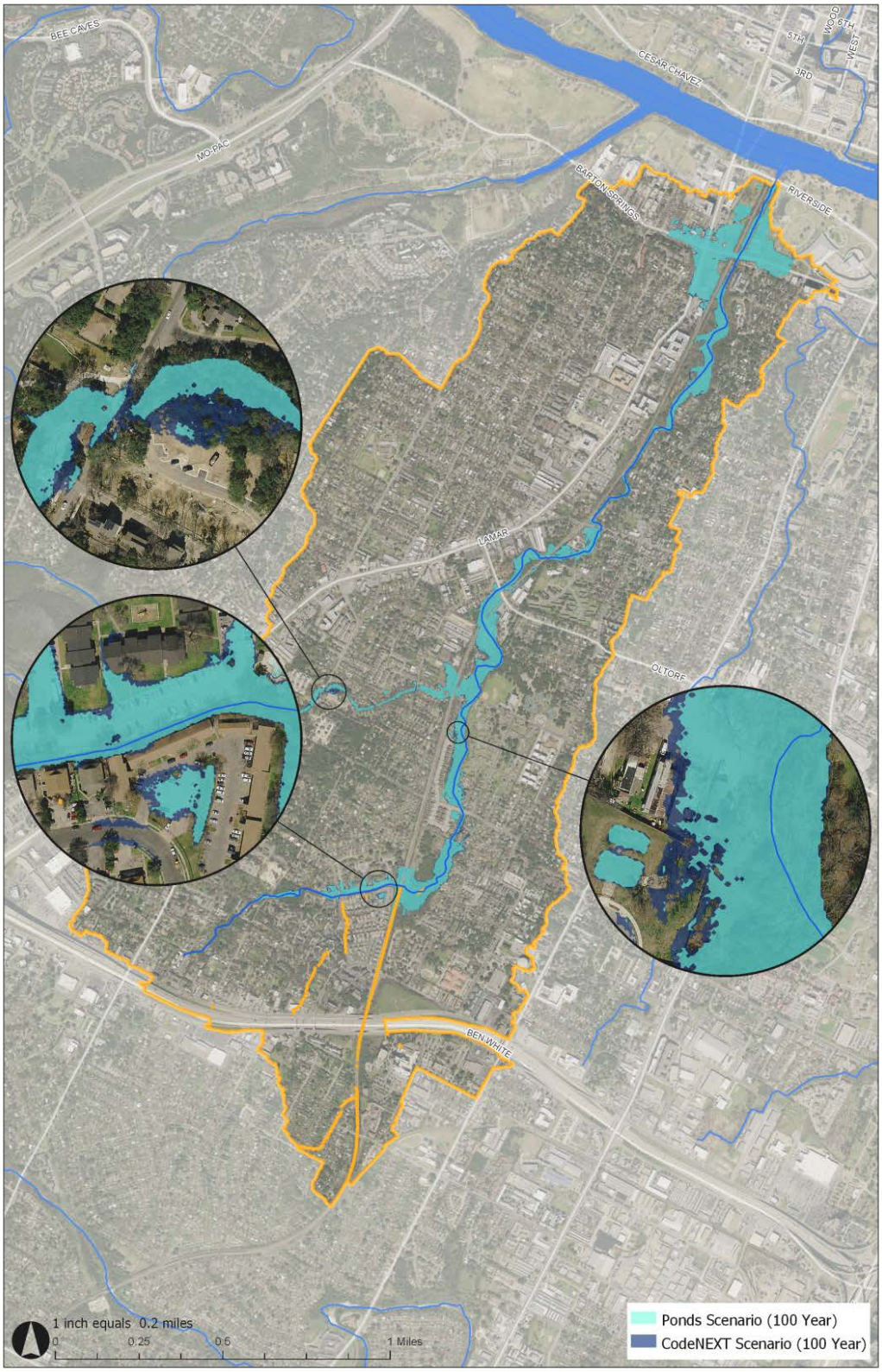

Figure 9. Floodplain comparison between CodeNEXT Maximum scenario and the Mitigation Alternatives scenario (ponds). Notice that while there are minimal floodplain delineation changes there are floodplain elevation reductions as shown in the Table