Colony Park Sustainable Community Pilot
Attachment 1
Existing and Proposed Watershed Regulatory Constraints and Opportunities for Superior Watershed Protection

Introduction

The Watershed Protection Department has been partnering with Neighborhood Housing and Community Development (NHCD) to develop guidance for the Colony Park Sustainable Community Pilot project with respect to flood control, erosion control, and water quality. This guidance is designed to be used directly or in part for the RFQ for consultants selected for the subsequent Master Plan, Planned Unit Development, engineering for subdivision and site planning, and infrastructure construction plans.

The Colony Park site is located entirely within watersheds classified as "Suburban," which affects the watershed regulations triggered by the existing Land Development Code. At Council direction, the City is currently developing a new Watershed Protection Ordinance to: improve creek and floodplain protection; prevent unsustainable public expense on drainage systems; simplify development regulations where possible; and minimize the impact on the ability to develop land. This section will summarize the following for each major regulatory component:

- What is required by the existing Land Development Code that could constrain the project
- What is being proposed under the new, draft Watershed Protection Ordinance that would address site constraints once these new provisions are applied
- What are the opportunities and strategies to demonstrate "superiority" by exceeding current code and/or the Watershed Protection Ordinance proposal.

"Superiority" is a term used in the consideration of Planned Unit Developments and other similar development requests, showing that a project goes "above-and-beyond" standard regulations, thereby providing a superior public benefit. The objective of this present analysis is to show how the Colony Park project might go not only beyond current code (which is considered out-of-date from a watershed protection perspective), but also the proposed Watershed Protection Ordinance. This exercise would approximate what a project developed under the future Watershed Protection Ordinance would consider to demonstrate superiority. This level of watershed protection also corresponds to that outlined in the Sustainable Sites Initiative Guidelines and Performance Benchmarks which have been used as an organizing structure for this evaluation. The major strategies of watershed protection including creek buffers, impervious cover, water quality controls, critical environmental features, cut and fill, steep slopes, floodplain modification, and tree protection are addressed.

Creek Buffers

The Colony Park site has numerous small, natural drainageways. However, under current code, none have sufficient drainage area to trigger critical water quality zone setbacks ("creek buffers"). The existing threshold for a waterway setback starts at 320 acres of drainage. Creeks with less drainage area do not require stream setbacks.

Under the Watershed Protection Ordinance, the threshold for a critical water quality zone would start at 64 acres of drainage. This means these smaller, "headwaters" creeks up to this point would also receive stream buffer protection. There are two headwaters creeks with a drainage area greater than 64 acres on the Colony Park site. The new ordinance would require a 100-foot setback from the centerline of the creek for these minor waterways. This 100-foot setback could

potentially be modified down to 50 feet in some areas if the buffer is increased elsewhere such that the overall surface area of the buffer remains the same.

Although development is prohibited within these buffers, park facilities (other than a parking lot), community gardens, trails (including crossings), and detention basins would be allowed if designed in accordance with the Environmental Criteria Manual (ECM). In addition, certain water quality controls, including vegetative filter strips, rain gardens, biofiltration ponds, and irrigation/infiltration areas would be allowed in the upper half of the buffer if located outside of the 100-year floodplain. Residential lots that are 5,750 square feet or less in size would need to be located outside of the buffer. Residential lots greater than 5,750 square feet can have portions of the yard located in the buffer, but cannot include any areas for construction of the driveway, home, or amenities within the buffer. Utility crossings would be allowed outside of the erosion hazard zone (to avoid being potentially endangered by future creek erosion and movement). Street crossings would be allowed every 900 feet along a minor waterway.

To demonstrate superiority, the Colony Park project can provide additional setbacks of 50 feet from the centerline along unclassified waterways with a drainage area of less than 64 acres. These additional setbacks should extend to at least 32 acres of drainage and in some cases may need to extend even further up based on the value and sensitivity of the riparian zone. In addition, the project should avoid the use of buffer averaging, minimize disturbance within the critical water quality zone to the maximum extent possible, provide vegetative restoration in the buffer areas, avoid backing up residential lots to the critical water quality zone wherever possible (e.g., through the use of single-loaded streets), and utilize bridge crossings instead of culverts. A public access easement and well-designed public trail could also be granted and built: community appreciation and participation in preservation of waterways increases with visibility and access.

Further background and recommendations for creek buffers can be found in Attachment 2 for Flood Control, Attachment 3 for Riparian and Water Quality, and Attachment 4 for Erosion Control.

Impervious Cover

Under current code, impervious cover will be limited on the site to 50 percent for single-family lots greater than 5,750 square feet; 55 percent for single-family lots smaller than 5,750 square feet; 60 percent for multifamily; and 80 percent for commercial. Impervious cover limits are calculated using a “net site area” basis. This means that sensitive areas such as waterway setbacks and steep slopes are deducted from the developable area before applying the percentage. If such setback and steep slope areas are present on a site, this reduces the overall (“gross site”) impervious cover otherwise allowed. Porous pavement for pedestrian use (e.g., sidewalks and plazas) does not count as impervious cover.

Under the Watershed Protection Ordinance, impervious cover limits would be calculated on a gross site area basis, meaning they are calculated across the entire site, including stream buffers and steep slopes. Also, installing porous pavement for vehicular use would allow sites to exceed the impervious cover limit to a limited extent (usually increased by 5%).

To demonstrate superiority, the Colony Park project could reduce impervious cover by at least 5 percent below the maximum limit allowed by code. It could also reduce the environmental impact of any proposed impervious cover using a number of strategies. It could increase the number of tree plantings (which intercept and retain rainfall otherwise converted to runoff). It could “disconnect” impervious cover by designing roofs and paved areas to drain to adjacent landscaped areas. It could protect existing soils by ensuring the proposed pervious areas are

maintained outside the Limits of Construction" (to avoid compaction and damage to soil structure). And soil amendments could be provided to improve the infiltration capacity of soils in pervious areas (thereby allowing more infiltration, healthier plant growth, and reduced irrigation requirements). In addition, the site could install porous pavement for pedestrian or vehicular use where feasible without seeking an impervious cover credit. Logical locations for porous pavement would be adjacent to significant, existing trees to be preserved on the site, thereby preserving infiltration of water into the soil near the trees' root zones.

Water Quality Controls

Under current code, the site will need to provide structural water quality controls (commonly known as "ponds") if impervious cover exceeds 20 percent net site area. The controls must provide a treatment level of a sedimentation/filtration system and capture the first "half-inch-plus" of rainfall. This refers to the size of the control basin with respect to the imperviousness of the site. The more impervious cover, the more runoff, and therefore the greater the need for a larger pond to store and buffer the impacts of this increased runoff.[1]

Under the Watershed Protection Ordinance, the site would need to provide water quality controls if impervious cover exceeds 5,000 sq. ft. There will also be additional limitations on the use of wet ponds and subsurface controls which can cause substantial O&M burdens. Changes to the sizing of controls are under review, but not known at this time. Background and recommendations for erosion and water controls for the project are provided in Attachment 4.

Critical Environmental Features

Information on what is currently required for critical environmental features and recommendations for enhanced protection are provided separately in Attachment 3.

Cut and Fill

Under current code, a maximum of 4 feet of cut and fill is allowed (with exceptions under buildings, for utilities, and within ROW). An administrative variance may be granted for cut and fill for water quality controls as well as for cut and fill up to 8 feet if not located on a slope of greater than 15 percent or within 100 feet of a classified waterway. The site must restore and stabilize the area.

The Watershed Protection Ordinance will allow an administrative variance for cut and fill for necessary appurtenances of water quality controls. Otherwise, no additional changes are being proposed at this time.

To demonstrate superiority, the Colony Park project can limit the depth, height, and extent of cut and fill to the maximum extent feasible. Where cut and fill is proposed, measures to offset negative impacts caused by such construction should be proposed, such as retaining walls, enhanced restoration and revegetation, terracing, soil amendments, enhanced erosion & sedimentation controls, and preservation of trees and natural areas not already required to preserve

Steep Slopes

Under current code, no roadway or driveway may be constructed on a slope greater than 15 percent unless the construction is necessary to provide primary access to at least two contiguous

[1] "Half-inch-plus" refers to the technical sizing criteria required by the Land Development Code. Structural control volumes must be sized to treat the first half inch of runoff plus one-tenth of an inch of runoff for each 10 percent increase in impervious cover over 20 percent gross site area.

acres with a gradient of 15 percent or less or building sites for at least five residential units. No building or parking structure may not be constructed on a slope greater than 25 percent. A parking area may not be constructed on a slope greater than 15 percent. A building or parking structure may be constructed on slope between 15 and 25 percent if certain conditions, such as terracing and revegetation, are met.

The Watershed Protection Ordinance is not proposing any changes to steep slope requirements at this time.

To demonstrate superiority, the Colony Park project can avoid construction on any slopes greater than 15 percent. Strategies to mitigate impacts from construction on steep slopes are similar to those used for cut and fill. See Cut & Fill section above for superior measures.

Floodplain Modification

Under current code, floodplain modification is allowed if the proposed development will not result in additional identifiable adverse flooding and preserves the natural and traditional character of the land and waterway. Floodplain modification is allowed in the critical water quality zone if done in accordance with the floodplain modification guidelines in the Environmental Criteria Manual.

Under the Watershed Protection Ordinance, the definition of natural and traditional character will be expanded to preserve the demonstrable natural functions of the riparian zone and waterway. This prioritizes the active or passive restoration of degraded floodplains rather than having the sole focus be on the preservation of existing floodplain areas in good or exemplary condition. Floodplain modification will only be allowed in the critical water quality zone to protect the environment or protect health and safety.

To demonstrate superiority, the Colony Park project can avoid any floodplain modification and provide restoration either using active (e.g., tree and vegetation plantings) and/or passive (e.g., ensure native riparian plants are allowed to recover and not be excessively mowed) approaches.

Tree Protection

A major watershed protection in current Land Development Code addresses tree protection. Since the Colony Park property appears to be predominately mesquite and degraded agricultural land, the opportunities for biophysically sound replanting are great. For superior tree protection the City Arborist recommends that plant selection considered to be “native” should be from seed source within the Texas Blackland Prairie or Edwards Plateau ecoregions as defined by USGS and EPA. Plant community assembly should be representative of plant communities that naturally occur in this ecoregion. Common areas that are not turf grass should be replanted with native grasses, forbs, and woody plants similar to the Mueller redevelopment project. A five-year maintenance plan by a certified arborist company for installed trees is required for proper pruning, mulching, pest control, and tree irrigation maintenance. The project should consider long term maintenance from the beginning to continue functions of vegetation for the life of the development. Street tree plantings must provide adequate available soil volume as calculated by a certified arborist.

Overall Regulatory Recommendations.

Implementation of superior watershed protection to address Colony Park site constraints through regulatory means is outlined below:

- Creek buffers should be set at an additional 50 feet from the centerline along unclassified waterways with a drainage area of less than 64 acres. These additional setbacks should extend to at least 32 acres of drainage and in some cases may need to extend even further up based on the value and sensitivity of the riparian zone.
- Projects should avoid the use of buffer averaging, minimize disturbance within the critical water quality zone to the maximum extent possible, provide vegetative restoration in the buffer areas, avoid backing up residential lots to the critical water quality zone wherever possible (e.g., through the use of single-loaded streets), and utilize bridge crossings instead of culverts.
- A public access easement and well-designed public trail could also be granted and built: community appreciation and participation in preservation of waterways increases with visibility and access.
- The Colony Park project could reduce impervious cover by at least 5 percent below the maximum limit allowed by code.
- The environmental impact of any proposed impervious cover using a number of strategies
    - Increase the number of tree plantings (which intercept and retain rainfall otherwise converted to runoff).
    - Disconnect impervious cover by designing roofs and paved areas to drain to adjacent landscaped areas.
    - Protect existing soils by ensuring the proposed pervious areas are maintained outside the Limits of Construction" (to avoid compaction and damage to soil structure).
    - Add soil amendments to improve the infiltration capacity of soils in pervious areas (thereby allowing more infiltration, healthier plant growth, and reduced irrigation requirements).
    - Insstall porous pavement for pedestrian or vehicular use where feasible without seeking an impervious cover credit. Logical locations for porous pavement would be adjacent to significant, existing trees to be preserved on the site, thereby preserving infiltration of water into the soil near the trees' root zones.

- Limit the depth, height, and extent of cut and fill to the maximum extent feasible. Where cut and fill is proposed, measures to offset negative impacts caused by such construction should be proposed, such as retaining walls, enhanced restoration and revegetation, terracing, soil amendments, enhanced erosion & sedimentation controls, and preservation of trees and natural areas not already required to preserve
- Avoid construction on any slopes greater than 15 percent.
- Avoid any floodplain modification and provide restoration either using active (e.g., tree and vegetation plantings) and/or passive (e.g., ensure native riparian plants are allowed to recover and not be excessively mowed) approaches.
- Plants and vegetative community assembly should be chosen among natives from Blackland Prairie or 'Edwards Plateau ecoregions and sufficient soil volume and maintenance should be provided to increase success of the plantings.

Colony Park Sustainable Community Pilot
Attachment 2
Flood Control Summary
July 23, 2012

The summary below provides guidance for RFQ preparation and scope of work for consultants working on the Colony Park project. While the next phase of the project may not include items of detailed design discussed herein, these factors should be addressed as fully as possible in this planning stage. It is assumed that the project team will include engineers capable of advising development planners for the project in the areas of storm water management, erosion and flood control outlined below. Existing drainage issues, current requirements for flood control and opportunities to avoid or reduce flood hazards on the site above and beyond current requirements using innovative methods are addressed. Sources for this information includes previous floodplain mapping studies, complaints in the Watershed Engineering Division (WED) database, and WED experience with surrounding roads, creeks, properties, and flood control facilities.

Existing Drainage Issues

The Colony Park site is mostly within the Walnut Creek watershed. A small portion to the northeast currently drains towards Decker Lake and a small portion behind the homes on Mayview Drive is within the Decker Creek watershed.

The Watershed Protection Department's Walnut Creek hydrologic model was created by Halff Engineering in 2005 (HEC-HMS version 2.2.2) and the Colony Park site overlaps with 4 sub-basins within the Walnut Creek watershed. However, there is no hydraulic model associated with the tributaries located on the Colony Park site. Mapped FEMA and City of Austin floodplains begin just south of Colony Loop Drive along Tributary 1 of Walnut Creek. The hydraulic model for Tributary 1 of Walnut Creek was also developed in 2005 by Halff Engineering. Sub-basins and floodplains are shown of Figure 1.

The Colony Park site tributaries convey water offsite via two culvert crossings under Loyola Lane. The capacity of these culverts is currently unknown due to the lack of hydraulic data for these tributaries. Runoff from Colony Park continues downstream of Loyola to the junction of Walnut Tributary 1. A subdivision at this junction, called Astroview for the purposes of this assessment, has an existing drainage problem associated with flows from Walnut Tributary 1. When water from the tributary overflows the creek banks, it travels to a low point in the road and cannot get back to the creek, causing significant street and yard flooding. There are other flooding issues along Tributary 1 including flooding at Pecan Mobile Home Park, a FEMA repetitive loss property, several businesses on Nixon Lane, and the Texas Juvenile Justice Department correctional facility (Austin District Office). Locations for these areas of flooding and drainage complaints are identified on Figure 2.

Above FM 969, the floodplains for Tributary 1 and the main stem of Walnut Creek combine to become one floodway.

Design Requirements for Flood Control

The consultant should be required to map a 25-year and 100-year fully developed floodplain based on the existing and proposed conditions of the site for all of the tributaries within the Colony Park site. Drainage areas should be delineated for existing and proposed site conditions based on the proposed points of conveyance off-site. This analysis may include multiple points. The existing capacity of the Loyola Lane culverts should be assessed. If undersized for the proposed condition of the site as defined in DCM Section 1.2.4D, the consultant should determine whether upgrading the culverts or an assessment of proposed on-site detention should be performed to verify the development does not cause any adverse flooding impacts at this culvert crossing.

Because there are existing flooding problems beginning at the junction of Walnut Tributary 1 and continuing downstream, the City's Regional Stormwater Management Program will not provide an acceptable alternative to providing flood control facilities. Flood control facilities should, at minimum, be designed according to the methods described in the COA DCM to reduce peak flow rate. If flood control facilities are designed per the DCM to match pre- and post-developed peaks, an impact analysis must be conducted downstream through the point that the Tributary 1 and main stem floodplains become one floodway. For this site, the timing differences of the pre- and post-developed runoff hydrographs will need to be evaluated in addition to pre- and post-developed peak flows for a complete analysis of no adverse impact.

If small-scale decentralized water quality and detention controls are used on the site, flood control credit may only be given for the portion of volume held within the facility that can infiltrate within 24 hours. Additionally, flows must be routed through each system to evaluate the effects on the runoff hydrograph. This is most easily achieved with pond routing software such as HEC-HMS or PondPack. Outlet structures may be adjusted to remove the volume of water held and drawn down within 24 hours.

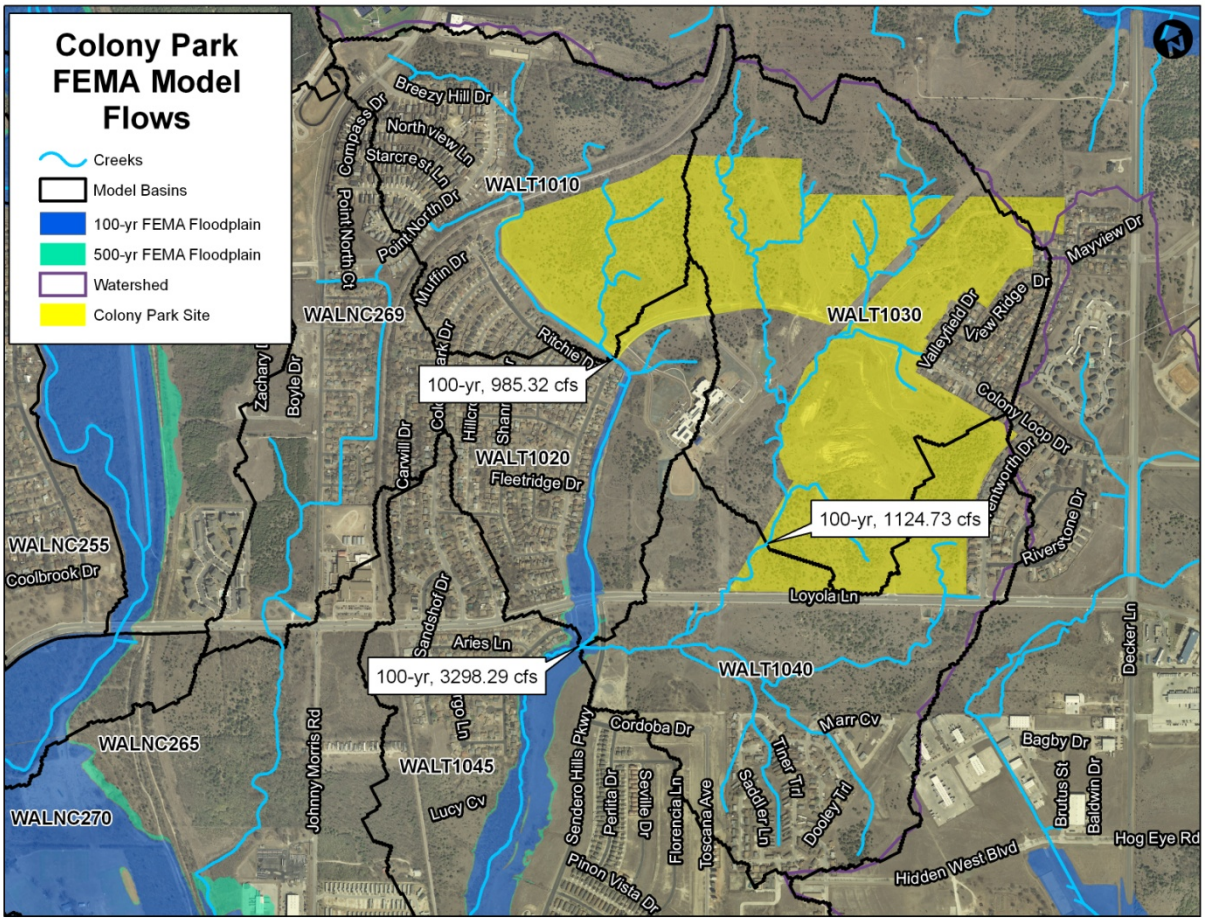
Opportunities and Recomendations for Flood Control

One opportunity for improved flood detention beyond that required under current City code would be to use volumetric flood control design Volumetric control for flood detention addresses the volume of stormwater vs. peak flows calculated according to current code. The procedure first requires determination of an "allowable" volume based on current conditions and then matching that allowable in proposed conditions. The difference in detention sizing from the current method is that the volume of water is calculated by an area under the runoff hydrogragh over a time period rather than the peak flow happening at a certain time period. The use of this method may significantly reduce the need for downstream impact analysis due to reduced volumes of flows from the site during periods when flooding would be expected to occur downstream.

To apply this method, design consultants selected for the Colony Park project would calculate the volume of runoff for a critical time period and adjust the outlet flows from flood detention facilities to match or release less volume during the critical time periods for their proposed conditions. The Critical time period is usually defined as the time period beginning at the peak rainfall (12pm if the 24 hour design storm begins at midnight) to the time period of maximum flow at the watershed outlet. The worst flooding in a watershed happens in between these two times. If volumetric controls are used, timing

issues with the hydrograph become less significant and the impact analysis can be limited to showing adequate downstream conveyance and no adverse impact as defined in the DCM.

There may also be opportunities for off-site detention on the adjacent City property north of Loyola Lane. In this case, the design should consider the benefits of over-detaining or providing regional detention. This property is in the upper one third of the Tributary 1 watershed and is an optimum location for drainage detention on a tributary with flooding problems downstream.



Erosion Control

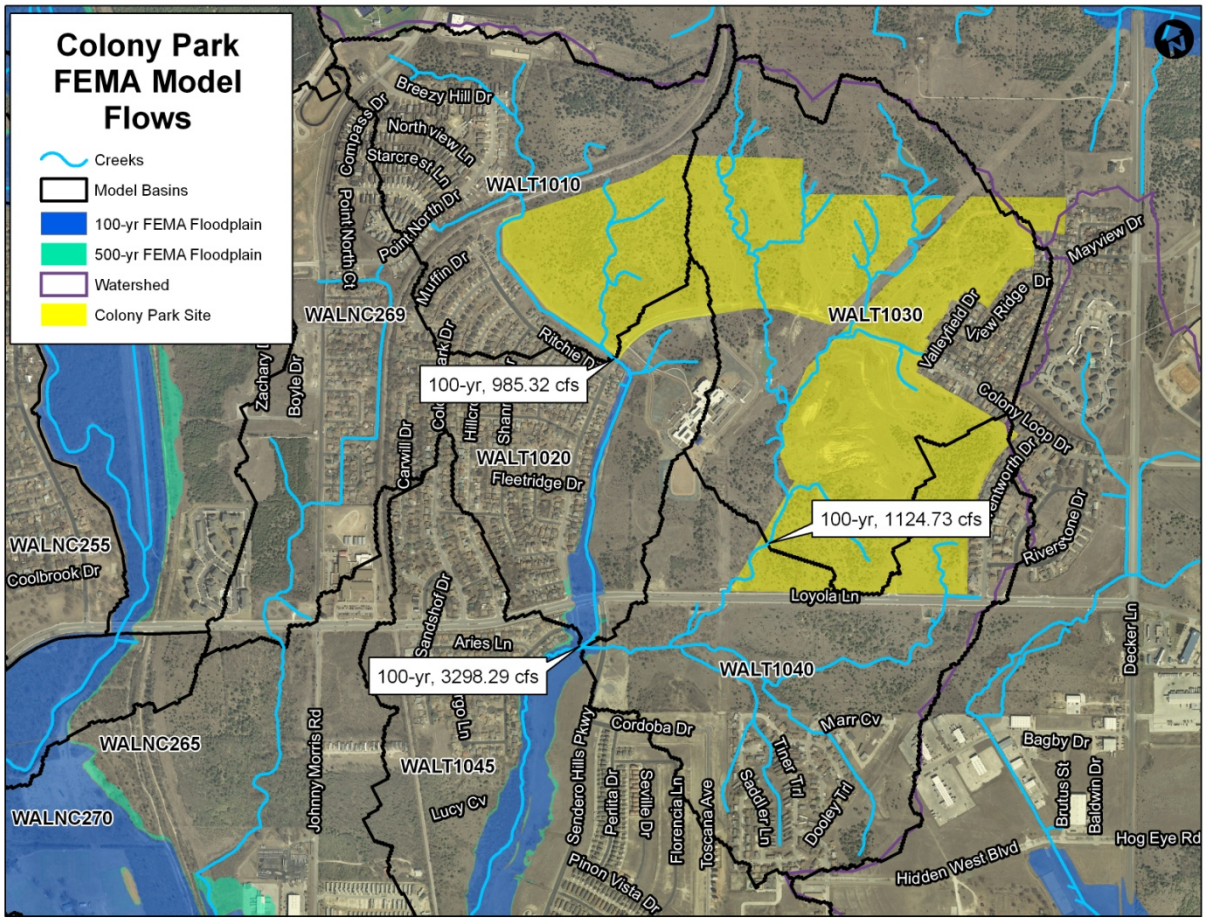
Project consultants also should evaluate potential erosion control issues associated with volumetric controls for flood detention. The consultant should determine whether the extended release times in volumetric controls are held at a level above the critical threshold at which erosion begins moreso than stable background conditions. This could be evaluated using a continuous simulation model with all stormwater BMPs in place. The selected consultant would calculate cumulative excess shear which is the

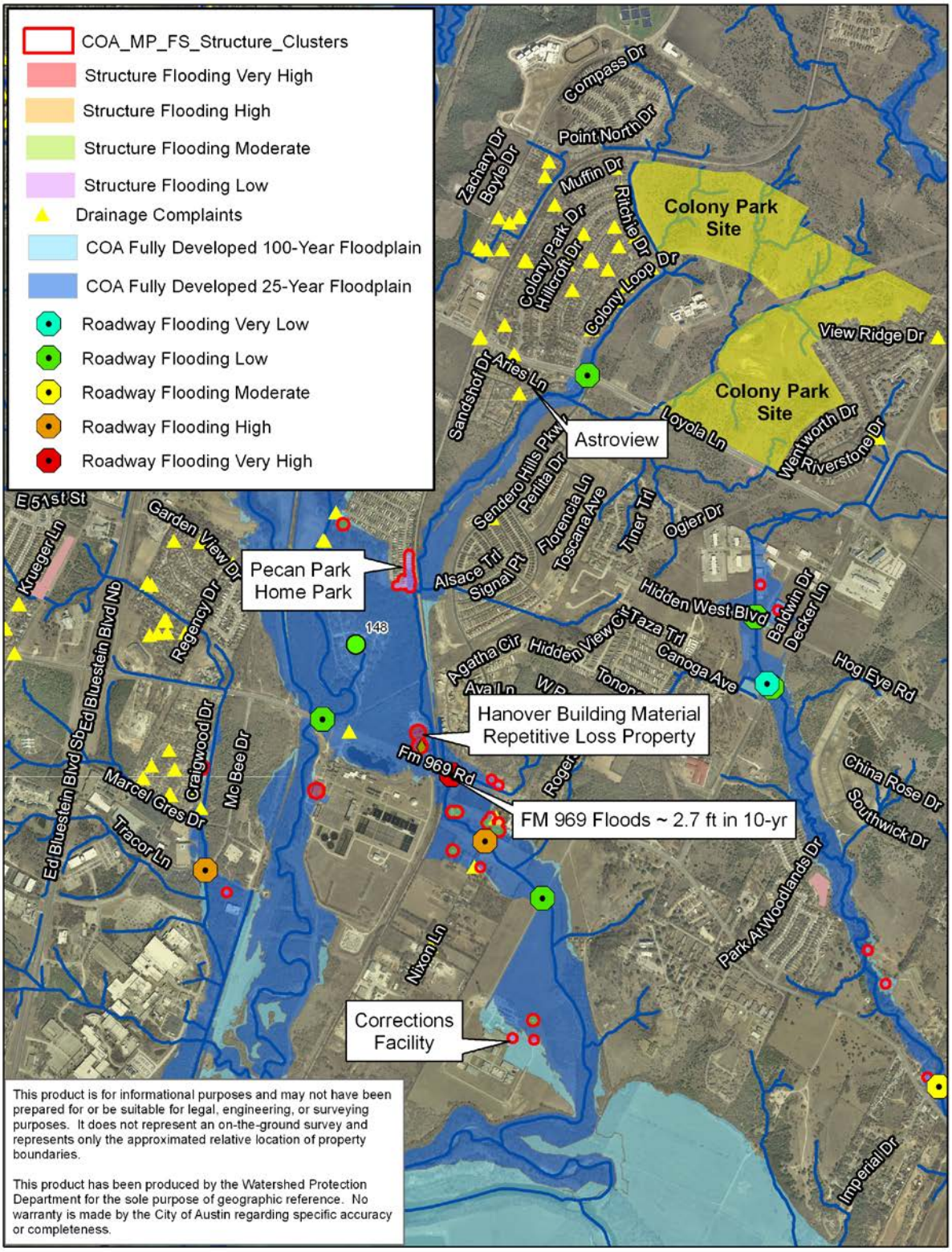
amount of time and to what degree the flows are above or below the erosion threshold as compared to the undeveloped conditions. This could also be performed on a storm event basis and the consultant should be prepared to consider both. It should be noted that controlling the frequency, duration and magnitude of erosion threshold exceedances may be mitigated with modifications to the outlets of detention structures.

Summary of Recommendations

From all the relevant information available, constraints and recommendations for addressing flood control on the Colony Park site are summarized below:

- The scope should include mapping a 25-year and 100-year fully developed floodplain based on the existing and proposed conditions of the site for all of the tributaries within the Colony Park site.
- The existing capacity of the Loyola Lane culverts should be assessed and either upgrading to culverts or on-site detention be recommended as necessary.
- Flood control facilities should, at minimum, be designed according to the methods described in the COA DCM to reduce peak flow rate addressing impact on properties downstream from post-development conditions.
- A potential for improved flood detention beyond that required under current City code that should be evaluated is to use volumetric flood control design Volumetric control for flood detention addresses the volume of stormwater vs. peak flows calculated according to current code.
- The RFQ should address opportunities for off-site detention on the adjacent City property north of Loyola Lane. In this case, the design should consider the benefits of over-detaining here to provide amelioration of flooding downstream.
- Project consultants evaluated under the RFQ should consider using a continuous simulation model to evaluate potential erosion control issues associated with volumetric controls for flood detention. The analysis should determine the amount of time the cumulative shear stress is above erosion thresholds compared to undeveloped conditions.


Colony Park
FEMA Model
Flows
Creeks
Model Basins
100-yr FEMA Floodplain
500-yr FEMA Floodplain
Watershed
Colony Park Site
100-yr, 985.32 cfs
100-yr, 1124.73 cfs
100-yr, 3298.29 cfs
WALT1010
WALT1030
WALT1020
WALT1040
WALT1045
WALNC269
WALNC255
WALNC265
WALNC270
Breezy Hill Dr
North view Ln
Starcrest Ln
Point North Dr
Point North Ct
Muffin Dr
Compass Dr
Ritchie Dr
Boyle Dr
Carwill Dr
Fleetridge Dr
Coolbrook Dr
Sandshor Dr
Aries Ln
Loyola Ln
Mayview Dr
View Ridge Dr
Valleyfield Dr
Colony Loop Dr
Riverstone Dr
Decker Ln
Bagby Dr
Brutus St
Baldwin Dr
Hog Eye Rd
Hidden West Blvd
Marr Cv
Cordoba Dr
Tiner Trl
Dooley Trl
Saddler Ln
Toscana Ave
Florencia Ln
Sevilla Dr
Perilla Dr
Sendero Hills Pkwy
Pinon Vista Dr
Lucy Cv
Johnny Morris Rd


COA_MP_FS_Structure_Clusters
Structure Flooding Very High
Structure Flooding High
Structure Flooding Moderate
Structure Flooding Low
Drainage Complaints
COA Fully Developed 100-Year Floodplain
COA Fully Developed 25-Year Floodplain
Roadway Flooding Very Low
Roadway Flooding Low
Roadway Flooding Moderate
Roadway Flooding High
Roadway Flooding Very High
Colony Park Site
Colony Park Site
Astroview
Pecan Park Home Park
Hanover Building Material Repetitive Loss Property
FM 969 Floods ~ 2.7 ft in 10-yr
Corrections Facility
Compass Dr
Point North Dr
Zachary Dr
Boyle Dr
Muffin Dr
Ritchie Dr
Colony Park Dr
Hillcroft Dr
Colony Loop Dr
View Ridge Dr
Sandshof Dr
Aries Ln
Loyola Ln
Wentworth Dr
Riverstone Dr
Sendero Hills Pkwy
Perilla Dr
Florencia Ln
Toscana Ave
Tuner Trl
Ogier Dr
E 51st St
Garden View Dr
Krueger Ln
Regency Dr
Alsace Trl
Signal Pt
Hidden West Blvd
Baldwin Dr
Decker Ln
Taza Trl
Canoga Ave
Hog Eye Rd
Agatha Cir
Hidden View Cir
Ava Ln
Ed Bluestein Blvd Nb
Ed Bluestein Blvd Sb
Craigwood Dr
Mc Bee Dr
Marcel Gres Dr
Tracor Ln
Fm 969 Rd
China Rose Dr
Southwick Dr
Park At Woodlands Dr
Nixon Ln
Imperial Dr
148
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Colony Park Sustainable Community Pilot
Attachment 3
Critical Environmental Features, Riparian Integrity, and Surface Water Quality Protection
July 23, 2012

In order to address the streams, drainage, wetlands, and riparian features on the Colony Park site, staff evaluated the existing Horizon environmental reports, reviewed in-house GIS information and conducted several field investigations of the Colony Park site. Findings are summarized below and recommendations are provided regarding wetland Critical Environmental Features, riparian corridors and surface water quality. Consultants working on preliminary site design and development locations should consider these features in general layout of roads, buildings, clusters of facilities, and amenities for the project.

Critical Environmental Features (CEFs)

As of June 15, 2012, a total of eight discrete Wetland CEFs have been identified on, or within 150ft of the Colony Park site. Four of these features were identified by Horizon and four were identified by WPD biologists. In addition, the large dense riparian corridor of the central project area was found to maintain a mosaic of small wetland pockets dispersed through the braided and meandering flow pathways. The following paragraphs describe these features.

A March 2008 feasibility report by Horizon indicated two potential wetland CEFs, while an October 2008 jurisdictional wetland determination report by Horizon indicated three potential wetland CEFs. A total of four discrete wetland CEFs were identified by Horizon (one CEF was described in both reports). These four features were evaluated in the field, and verified to meet the criteria as CEFs under the City of Austin Land Development Code (LDC). Two of these features were inundated basins which appear to have been used as stock ponds. These basins maintain communities of obligate and facultative emergent wetland vegetation. Both ponds are of satisfactory quality and function to consider for preservation. The other two wetland features are in-channel swales which maintain sufficient periods of saturation to support facultative wetland vegetation. Although these two features are of lower vigor and diversity, due to their presence in-channel, they perform environmental services including stream bed stabilization, habitat, and nutrient processing, and therefore are recommended for preservation as well.

During our field investigations, four additional discrete wetland CEFs were identified; two small features on-site, and two large features off-site, but within 150ft of the property boundaries. All features are recommended for preservation.

The main tributary of the southern half of the Colony Park site that extends from the future extension of Colony Loop to Loyola Lane is a high quality, dense and diverse riparian corridor. Dense grasses, wetland plants, shrubs, wildflowers and trees provide stability to the soils in the flat, undefined channel. Flow paths braid and meander through the area providing water quality treatment to storm water runoff by filtration of the water through a mosaic of wetland pockets. This area is a priority in the consideration of environmental features to be protected.

Current LDC considerations for CEFs and CEF setbacks

If the Colony Park site were developed under the current LDC, wetland CEFs would require preservation and/or mitigation pursuant to Environmental Criteria Manual (ECM) Section 1.3.0. The default for protection of these features is a standard 150 foot setback from the wetland boundaries (as per ECM

1.3.0(B)(1)(f)(2)). These standard CEF setbacks are shown on the attached map as an offset boundary around each wetland feature. However, ECM 1.3.0(B)(1)(f) (3) provides the flexibility to re-distribute this setback area by applying a modified buffer of comparable area to the natural drainage patterns above and below the wetland. This is the preferred method for in-line wetlands and wetland fringes for the features identified on or adjacent to the Colony Park site. Therefore, if reviewed under current LDC, much of the tributary channels and headwater areas of the Colony Park would be protected with a CEF setback.

Recommendations for progressive protection of CEFs and riparian corridors

The field reconnaissance revealed that project-area wetland CEFs and existing riparian corridors currently support a higher quality vegetation community (both in diversity and density) than aerial photography and anecdotal information implies. Since the Colony Park project goals include environmental protection above the bare minimum required by current regulations, an evaluation of function and quality of site features was used arrive at recommendations for site development.

The primary tributary that flows through the central portion of the project area supports a high priority riparian area. This riparian corridor should be protected with a minimum 100ft setback from centerline. This is consistent with the proposed CWQZ headwater protection 100ft buffer (see Map of Regulatory overlays).

Wetland CEFs appear to be performing valuable stability, nutrient processing and habitat within the flow paths of storm water runoff. We recommend protecting these features with a modified CEF setback pursuant to ECM 1.3.0(B)(1)(f)(3) in which a minimum 50ft setback is maintained around the feature, and the headwater tributary upstream and downstream of the feature is protected with a 50ft setback from centerline (see Figure).

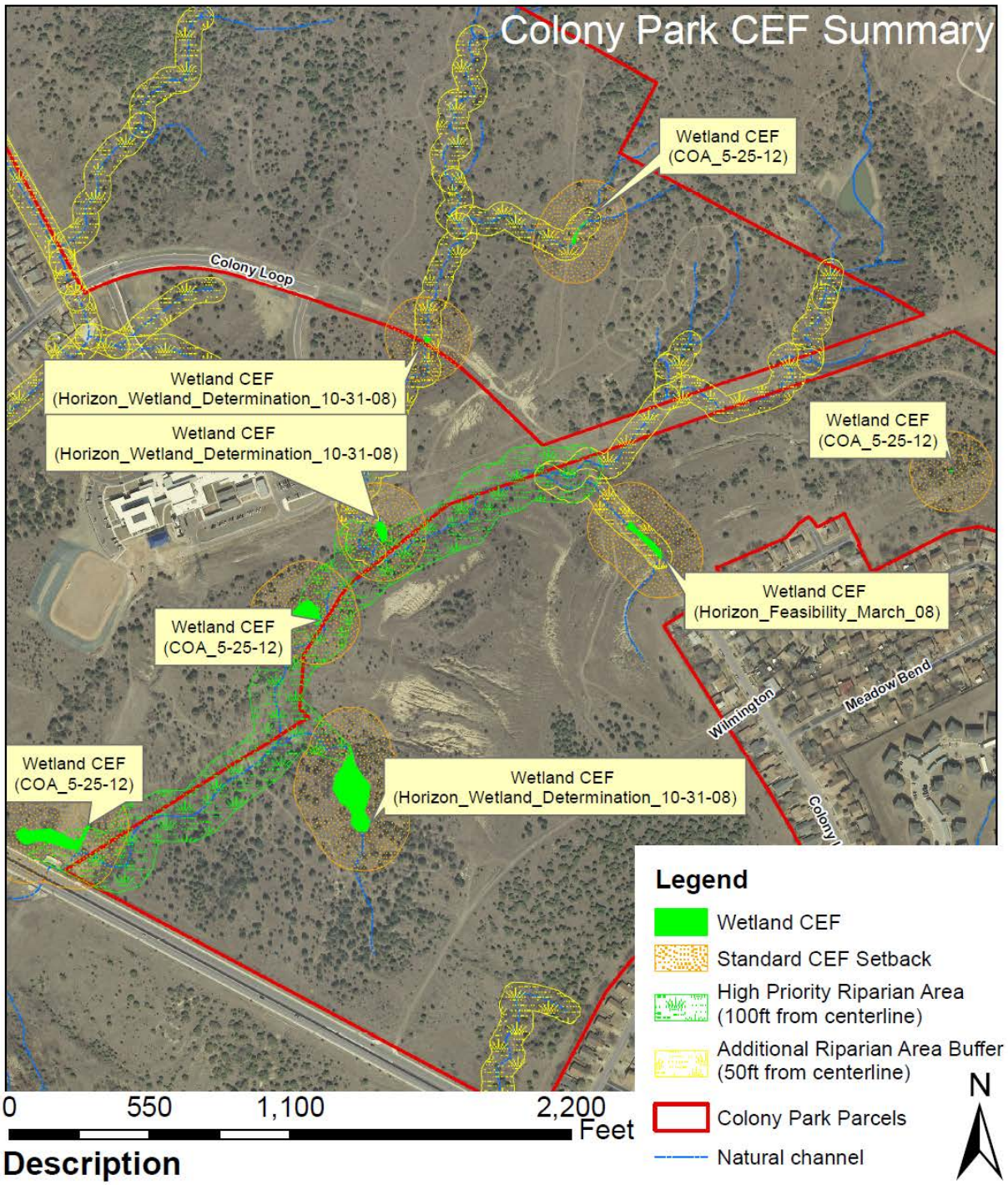
The headwater tributaries up-gradient of the future extension of Colony Loop drive are valuable and should not be disturbed. These headwater tributaries appear to meander through fragile soils that would be easily eroded if disturbed, and extremely difficult to re-stabilize. Disturbance of these headwater tributaries would be folly. We recommend a hands-off approach to all second order (as per City GIS creeks-network) waterways with a setback 50ft from centerline (see Figure). This setback would be considered a CEF setback since it would essentially be a modification, or re-distribution of the Standard CEF setback of the eight wetland CEFs on-site. One additional first-order waterway located at the southeast corner of the project should be protected due to the density, diversity and vigor of riparian vegetation (see Figure). Exceptions to these setbacks would be made for a reasonable number of roadway crossings.

Summary

Eight wetland CEFs and a high integrity riparian corridor (with wetland mosaic) would currently require preservation with setbacks under existing code language. Based on the soils and geology of the tract, we feel that it is imperative to protect the existing vegetation of the smaller headwater tributary channels to avoid accelerated erosion and degradation of the riparian corridors. To these ends, we recommend a series of setbacks that 1) are generally consistent with current CEF protection practices, 2) will coincide with proposed headwater CWQZ, and 3) are enhanced to include increased protection for the riparian areas of the smaller headwater tributaries. Specific setback recommendations are:

- A CEF setback 100ft from centerline of the primary drainage located from Colony Loop to Loyola that coincides with the proposed, new headwater CWQZ.

- A CEF setback 50ft from centerline of all second-order (as determined by using City GIS “creeks network” layer) tributaries. This setback will protect in-line CEFs, and the upstream and downstream reaches that support them pursuant to existing language in ECM 1.3.0(B)(1)(f)(3) which re-distributes the standard 150ft CEF setback.
- A minimum 50ft CEF setback from all CEFs not covered by the previous recommendation
- A minimum 50ft CEF setback for the first-order headwater tributary located at the southeast corner of the project area.



Description

Wetland CEF: Eight discrete Wetland Critical Environmental Features (CEFs) identified within 150ft of the project area by Horizon (4) and COA (4). ECM 1.3.0(B)(1)(f) provides guidance on preservation with setbacks and/or mitigation.

High Priority Riparian Area: Area strongly recommended for preservation due to high quality ecological form and function that meet the WPD mission statement and surface water goals. Area contains undefined wetlands, diverse woodlands, and dense native grasses that provide superior water quality benefits and habitat. This area should remain undisturbed.

Colony Park Sustainable Community Pilot
Attachment 3
Erosion Assessment and Stormwater Management Recommendations
Watershed Protection Department
July 23, 2012

Executive Summary

The Colony Park Subdivision site was assessed to identify the erosion potential and mitigation strategies for residential development. Due to the highly erodible soils, it is anticipated that the drainage channels and hillslopes will be sensitive to land disturbances at this site. Therefore the following strategies are recommended for long-term sustainability of the site:

- **Creek Setbacks**
- **Site Grading, Retaining Structures and Landscape Design for Cohesive Soils**
- **Construction Phase Erosion Controls**
- **Stormwater Management**

Erosion Hazard Zones (EHZ) were used to recommend minimum **creek setbacks** along the defined channels to prevent resources such as houses, infrastructure, trails, utilities, etc. from being placed in areas that have the potential to be impacted from channel erosion (see attached map). The recommended setbacks range from 10 to 50 feet from the channel centerline. Within these areas it is also important to maintain or improve the riparian vegetation to maintain channel stability.

The Colony Park sites includes topography and soils that have a high potential for erosion and vegetation plays a vital role in the soil stability at this location. Attention to erosion control by way of **site grading, retaining structures and vegetation** appropriate for cohesive expansive clay soils in the Central Texas climate is an important factor the long-term sustainability of the site.

Given the highly erodible nature of the soils, it is critical that **construction phase erosion controls** as described in section 1.4 of the City of Austin Environmental Criteria Manual is implemented to the greatest extent practicable. Site management practices to prevent and minimize erosion during construction should be the primary focus of erosion control plans.

Due to the highly erosive nature of the soils in this area **stormwater management** is critical to preserving the integrity of the drainage system. Emphasis should be given to maintenance of pre-development hydrology, particularly water storage. Volume control that may include extended detention, infiltration, storage and re-use , etc. are encouraged. Controls should be provided such that the volume, rates and distribution of runoff does not exceed the pre-development erosion rates within the existing drainage system. This can be verified through continuous simulation modeling of pre- and post development flows over an extended period. The model results should be used to calculate the expected channel erosion using cohesive erosion rate relationships simulated over a period of record of 10-years or longer.

Colony Park Erosion Assessment

Field Investigation

A creek walk was performed in May 2012 to asses the stream channel conditions within the footprint of the proposed development. The assessment was limited to channels within the drainage network with a contributing drainage area of 64 acres or greater. The stream network was divided into segments of channel with similar properties and designated as geomorphic reaches. Information on channel/floodplain geometry, bed materials and indicators of existing channel stability were collected. The stream reach segments are identified on the attached map and the channel properties are summarized in the table in Appendix A.

Geology and Soils

The site geology is comprised of lag gravel deposits in the upper reaches of the watershed underlain by the Taylor formation. The surface soils include the Ferris-Hieden Complex in the valleys and mostly Heiden soils in the ridges. Some Houston Black Clay is also apparent throughout the site. The characteristics of the surface and subsurface material are that they are fine grained (silt/clay), cohesive, have a high shrink-swell potential and are easily weathered/eroded. The infiltration rates of the soils are low which results in high runoff rates. The result for landform morphology is that the surface materials can be easily mobilized by flowing water and wind on steeper slope areas.

Channel Morphology

Most of the stream reaches in the southern portions of the site were considered very stable. The only reach showing any type of adjustment was reach 5.2 located north of the existing wet pond. This is also where lag gravel deposits are evident. Because of the stream type and fine-grained boundary materials (clay, silt) the sensitivity of the streams to land use disturbances is high and they will respond quickly to changes in the hydrologic regime. The heavy dependence of channel stability on vegetation is also significant. Therefore retaining or improving vegetation density in the riparian zone along the creeks is important.

Erosion Hazard Zone Setbacks

Erosion setbacks were estimated using the methodology is described in "Guidance on Establishing an Erosion Hazard Zone (EHZ) for Structure and Utility Locations near Streams" prepared by the City of Austin. Stream buffers representing the EHZ along the creek network for areas with a contributing drainage area of 32 acres and greater estimated are shown on the attached Colony Park Erosion Hazard Zone Assessment map. The buffers represent areas where structures should not be located to avoid impacts from long-term channel erosion process. The buffers are measured from the channel centerline. The larger of the calculated values or a minimum of 20 feet from the top of bank were used. In reach 1.1 where there was not a defined channel the EHZ was

increased in width due to the unpredictability of where the channel may exist following incision. EHZ buffers ranged in size from 25 to 50 feet.

Hillslope Erosion

Active hillslope erosion processes were observed at numerous locations throughout the site. The low permeability of the soils results in high runoff rates, which in combination with the characteristics of the soil produces in gullies in steeper areas. Other contributors to the hillslope erosion include historical disturbances that may have cleared vegetation. The aerial photographs and slope maps show this phenomenon is occurring in some areas where the slopes are less than 15% in the southern tract. For future development this should be recognized and appropriate grading, retaining walls and erosion control be incorporated into the grading plan such that thresholds for erosion are not exceeded. Where vegetation is used for erosion control on slopes, species suitable to withstand Central Texas climate variations including drought.

Construction Phase Erosion Control

Given the highly erodible nature of the soils, it is critical that section 1.4 of the City of Austin Environmental Criteria Manual is implemented to the greatest extent practicable. Site management practices to prevent and minimize erosion during construction should be the primary focus of erosion control plans.

Stormwater Management

In keeping with the Sustainable Sites Initiative, one of the goals of this development is to "replicate the hydrologic condition (infiltration, runoff, and evapotranspiration) of the site based on historic, natural and undeveloped ecosystems in the region. This is a worthy goal, but it may be more realistic to try to maintain the existing site hydrology, rather than bring it back to a pre-settlement condition. This translates to maintaining (or restoring) the water storage capacity of the site (vegetative interception, initial infiltration, surface depression storage and evapotranspiration (TR-55, SCS, 1986)). Storage can be achieved by infiltration into the soil, evapotranspiration and/or rainwater harvesting/storage (cisterns). First determine the pre-development storage capacity, and then determine the post-development storage capacities. The design goal is to get as close to the target pre-development storage capacity as possible.

The Sustainable Sites Initiative (Credit 3.5 Stormwater Management) is a good guide for how to quantify water storage capacity. However, it is recommended that the USEPA SWMM model be used to quantify the existing and proposed hydrology and the impacts of various development scenarios. The allowable CN approach in 3.5 does not adequately account for antecedent moisture conditions or the change in storage over seasons, where SWMM allows proper quantification of these elements.

One of the main model outputs needed is a flow duration curve that can be translated into the number of hours that the receiving channels have flows above an erodibility threshold. Inherent in this exercise is first establishing the erosion threshold for the natural channels on-site. This can be in the form of a critical shear stress or a permissible velocity approach. In addition, it should be demonstrated that the frequency, timing and location of runoff patterns and discharge points to receiving waters have replicated pre-development conditions.

Potential techniques and strategies to maintain water storage include: Minimizing impervious cover; using porous pavers where appropriate; amend soils to increase storage capacity; green or blue roofs; capturing runoff at the source (each lot or each block) using retention strategies like rain gardens; outfit commercial sites with rainwater harvesting cisterns to use for non-potable water sources; disconnect impervious cover and convey excess via vegetated swales instead of storm drains; direct runoff to landscaped areas rather than routing around (e.g. depress parking medians instead of raising them above pavement and routing runoff to curbs and gutters).

Recommendations

The following recommendations are provided for use in RFQ preparation and consultant selection for the Colony Park Project:

- In the stream channels where erosion is anticipated to occur, buffers along the riparian zone should be implemented to account for these natural processes.

- Design of stormwater management facilities should utilize a continuous simulation rainfall-runoff model to optimize the number, size and distribution of controls throughout the site that would minimize the impact to stream erosion following development, emphasizing the maintenance of pre-development hydrology.

- Site design and grading should account for the erosive nature of the soils and the dependence on vegetation for stability at steeper slopes.

- Temporary erosion controls should be designed, inspected and maintained during construction to minimize adverse impacts during land disturbance operations.

- To accomplish these goals the design team should include engineers, scientists and architects that have experience in site development and stormwater management in semi-arid climates with cohesive soils.

Appendix A
Channel Geomorphic Data

Colony Park Channel Geomorphic Information

Reach	Drainage Area Range (Acres)	Erosion Hazard Zone (Feet from Centerline) Calculated	Minimum	Final Rounded	Valley Slope %	Channel Geometry Bank Full Width	Bank Full Depth	W/D Ratio	Floodprone Width	Entrenchment Ratio	Stream Type
0	320 - 640	37	28	40	3.3	16.20	3.50	4.63	100	6.17	E6
0A	128 - 320	23	26	30	1	12.40	3.30	3.76	100	8.06	E6
0B	128 - 320	33	27	35	1.6	13.50	3.70	3.65	100	7.41	E6
1.1	128 - 320	n/a	n/a	50	0.3	n/a	n/a	n/a	n/a	n/a	F6
1.2	128 - 320	12	23	25	2.3	5.90	1.33	4.44	100	16.95	E6
2.1	128 - 320	24	24	25	2.7	8.00	2.33	3.43	100	12.50	E6
2.2	64 - 128	n/a	n/a	25	1	n/a	n/a	n/a	n/a	n/a	E6
2.3	64 - 128	21	23	25	1.1	5.00	2.50	2.00	100	20.00	E6
3	32 - 64	12	23	25	2.2	5.00	1.55	3.23	100	20.00	E6
4	32 - 64		25	25	1.3	n/a	n/a	n/a	n/a	n/a	E6
5.1	64 -128	15	25	25	0.4	9.50	1.40	6.79	100	10.53	E6
5.2	32 - 64	17	22	25	1.9	4.40	2.10	2.10	100	22.73	E6

Appendix B

Reach Photographs

Reach 0 - Downstream of Subdivision Site

Reach 1.1 - Undefined Channels

Reach 1.2

Reach 2.1

Reach 2.3

Reach 3

Reach 4

Reach 5.2

Reach 5.2 Headcutting

Reach 5.2 Bank Erosion

Hillslope Erosion

Active Surface Erosion from Unvegetated Areas the Recreation Center

Colony Park Sustainable Community Pilot
Attachment 5
Summary of Soils and Geologic Constraints and Recommendations
July 23, 2012

The following information should be used in developing a scope and selection of a consultant team for the Colony Park development project. It addresses soil, surface geology, and groundwater classifications and their influences on the proposed project.

Soil Conditions

According the Soil Survey of Travis County, five soil series are present on site; the Houston Black Clay, Heiden Clay, Ferris-Heiden Complex, Burleson Clay, and Trinity Clay (NRCS, 1974). In general, this soil series are fine grain montmorillonitic clays classified as vertisols and have an udic moisture regime. The high content of expanding clay; montmorillonite, is of primary concern. Roads, building, fence, pipelines and utility lines are moved about and distorted by the shrinking and swelling of these soils. The udic moisture regime identifies these soils capable of supporting wetland development.

Most of the site consists of the Ferris-Heiden Complex. This soil complex occupies rolling to hilly topography with slopes from 8 to 20 percent. The Ferris make up about 60% of unit and the Heiden the remaining 40%. The soil has a severe erosion hazard, making it not suitable for cultivation. The soil permeability is very slow with a high water and shrink-swell capacity. The Hieden consist of well-drained, deep clay soils that developed in calcareous marl. The Hieden occupies the slopes that range from 0 to 8 percent.

The Trinity Clay is found in small portion of the floodplain along Walnut Creek north of Loyola Lane. Trinity is the only mollisol soil on site, a soil with an accumulation of humus in the uppermost layer.

Houston Black Clay is present on slopes of 0 to 1 percent and is east-central area of site. The Houston Black is well suited for cultivation and occupies floodplain areas and ridge tops on western side of the site.

The Burleson Clay consists of a deep, well drained, clay soil and is suited for native range grasses. The Heiden gravelly clay and Burleson Clay are shown too coincide with the Quaternary-age Colorado River Upper Colorado River Terrace Deposits.

Major constraints of these soil types include severe erosion hazards, low overall permeability, high overall water and shrink-swell capacity. These factors affect road buildings, fences, pipelines, and utility line integrity from shifting soil, but also provide a moisture regime conducive to wetalnds development. Attention to soils in stream restoration and streambank stabilization is critical in these soils.

Surface Geology

The 1986 geologic map created by A.R. Trippet and L. E. Garner entitled Geology of the Austin Area; Texas indicates that Quaternary-age Colorado River Upper Colorado River Terrace Deposits (or lag gravel deposits) and Taylor Group (undivided) are exposed at the surface on the site (Figure 1).

The oldest rock units on site are the Taylor Group, which consists of alternating sandstone, mudstones, shale, claystone and marl that were deposited in a deltaic or shallow-marine shelf environment during the Late-Cretaceous. In the Austin area, the Taylor Formation consists of three members, the Bergstrom, Pecan Gap and Sprinkle members. On regional scale, these units dip to southeast and strike parallel to the Balcones Fault Zone. Like the other claystone members of Taylor, both units are poorly exposed because they weather and erode so easily. Based on nearby geologic mapping, it is likely that both Bergstrom and Pecan Gap Chalk members are present at surface on site, however, this has not been verified. The Pecan Gap ranges from a marl to chalk, but in Austin area is mostly a marl unit that is about 75-ft thick. Overlying the Taylor units is the Late-Quaternary-age the High Terrace Deposits of the Colorado River.

The High Terrace Deposit is referred to as the Manor Lag Gravel by Weber (Weber, 1968). The terraces are remnants of former floodplains of the Colorado River, when the river was flowing at higher elevation prior to an episode of down-cutting (Weber, 1968).

After completing site reconnaissance to evaluate the site geology and reviewing the geotechnical bore data collected by HVJ Associates, Environmental Resource Management staff has determined that Terrace Deposits are more extensive than indicated on 1986 geologic map. The terrace deposits drape the hummocky weathered surface of the Pecan Gap member at the highest elevation on the site along ridge tops from about 550-ft to 640-ft (msl). As a result, the youngest member of Taylor Formation, the Bergstrom member is not exposed on site. The Bergstrom member, which overlies the Pecan Gap member, appears to have been eroded away by the deposition of gravel deposits or is almost completed covered by High Terrace Deposits. Additional field investigation is needed to confirm this observation. The thickness of High Terrace deposit on site appears to vary from 2- to 10-feet with thickest portion of unit at hilltop.

Geologic & Groundwater Recommendations

The constraints of site geology and soils pose several construction challenges associated with groundwater interactions.

- The soft claystone and marls units of the Taylor are easily weathered and can be unstable. Soil development over the Taylor results in creating a soil with a high content of expanding montmorillonite clay. Roads, building, fence, pipelines and utility lines are moved about and distorted by the shrinking and swelling of these units. Special foundation design may be required for builds constructed on the soils.

- Civil and geotechnical engineers should be retained to determine if a special foundation and subgrade design are necessary for building and the infrastructure propose for this project.

- Lime treatment soils and sulfate content of the clays soils should be evaluated and considered for any proposed construction projects on the site. Lime treatment of soil is typical used to help control shrink/swell potential of clay soils. In addition, the clay soil on site might have high sulfate content. Sulfate-rich soils have a potential to deteriorate concrete.

- The low permeable soils, marls, and claystone, are overlain by high permeable terrace deposit (or lag gravel deposits) that tends to peached shallow groundwater in alluvial terrace deposit may occur during periods of frequent and extensive rainfall. Seepage from this deposit has resulted in the formation of several in-channel wetlands at or near the contact between the Taylor and the High Terrace Deposits, however, no seeps or springs were observed on the site.

- Based on field reconnaissance, the terrace deposits are much more extensive than indicated on 1986 geologic map. Water movement in these deposits indicate that site drainage should be adequately designed with this potential problem in mind. One solution would be to use existing natural drainage patterns and densely vegetated riparian tributaries into the overall site drainage plan to provide stable drainage network on site. Additional field investigation is needed to confirm the extent of terrace deposits..

- As listed in Prerequisite 4.3 of the Sustainable Sites Initiative, a soil management plan is recommended.

- Credit 7.3 of the SSI requires restoration of soils disturbed by previous development to approximate healthy site soils on undeveloped similar property.

- In order to complete the soil restoration and management plans, a number of onsite and laboratory soil tests are recommended in the SSI Site Assessment and Regional Resource Worksheet. Although these may be beyond the planning scope of the present project, they should be considered in more completely defining soil constraints prior to preliminary design.

- In determining reference conditions for restoration and management of soils, nearby undeveloped sites should be examined with the same soil field and laboratory tests as those performed on the proposed site.

- Due to the importance of soil and geology constraints onsite to the success of proposed developments, additional geotechnical investigation of the soil is recommended so that building foundations are properly designed.

References

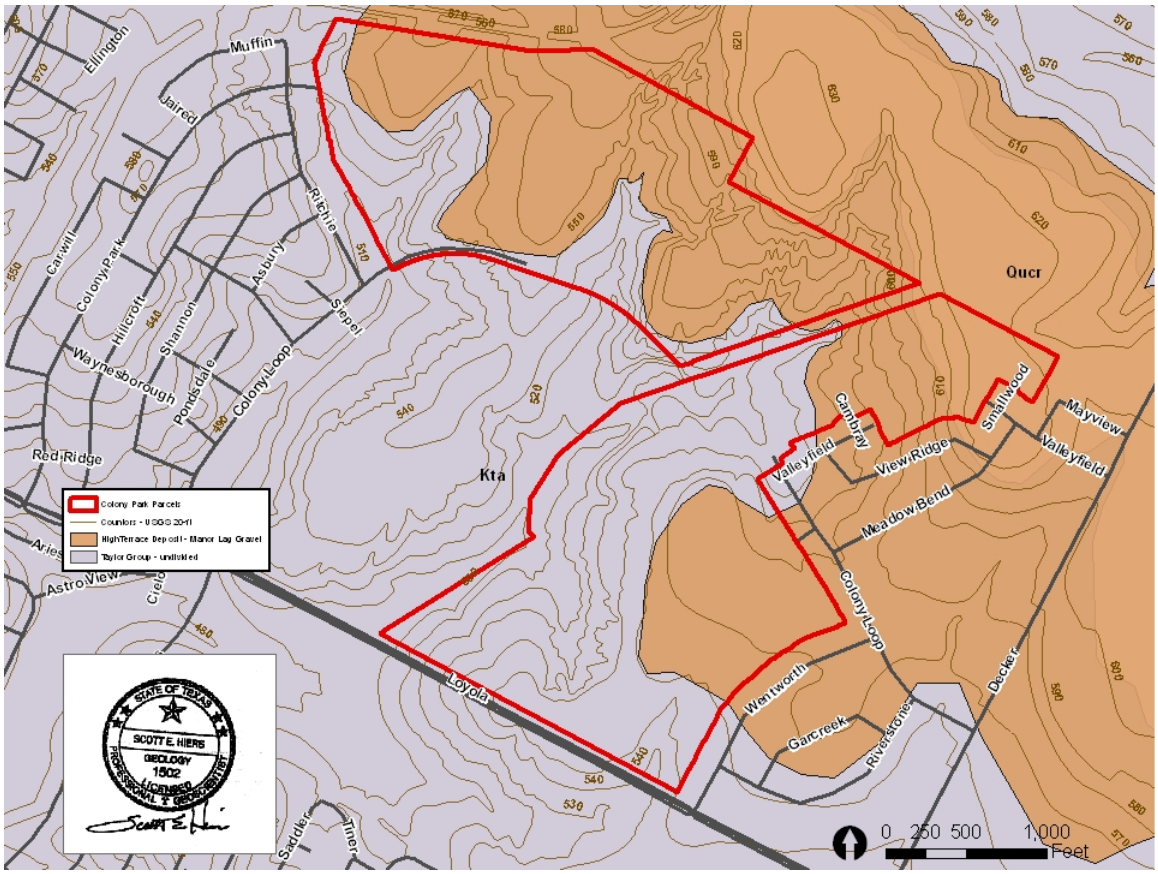
(NCCS) Soil Survey of Travis County, Texas, 1974, US Department of Agriculture, Natural Resource Conservation Service in cooperation with the Texas Experiment Station, Washington, D.C.,123 p.

The Sustainable Sites Initiative, Guidelines and Performance Benchmarks 2009. American Society of Landscape Architects, Lady Bird Johnson Wildflower Center at The University of Texas at Austin, United States Botanic Garden, Austin Texas, 2009. 230 p.

Trippet, A.R. and Garner, L. E., 1986, Guide to Points of Geologic Interest in Austin, Bureau of Economic Geology – the University of Texas at Austin, Guidebook 16, 37 p.

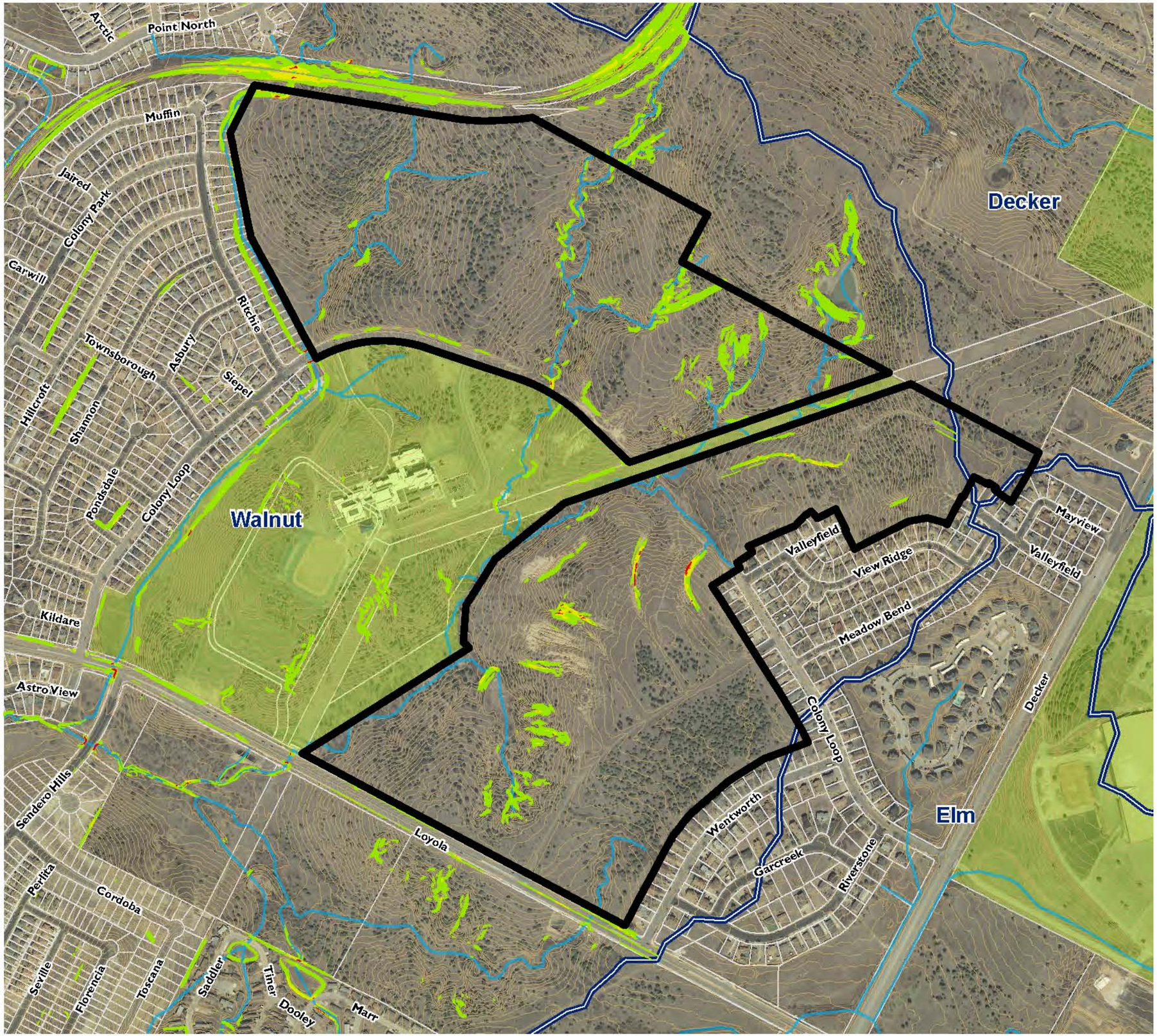
Weber, G.E., 1968, Geology of the fluvial deposits of the Colorado River Valley, central Texas [M.S. thesis]: Austin, University of Texas at Austin, 119 p.

Figure 1 Site Geology



Colony Park

Site Overview



Colony Park Parcels

Creeks

Contours

15 - 25% Slope

25 - 35% Slope

> 35% Slope

City Parkland

Watersheds

0 250 500 1,000 1,500 2,000 Feet

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City of Austin
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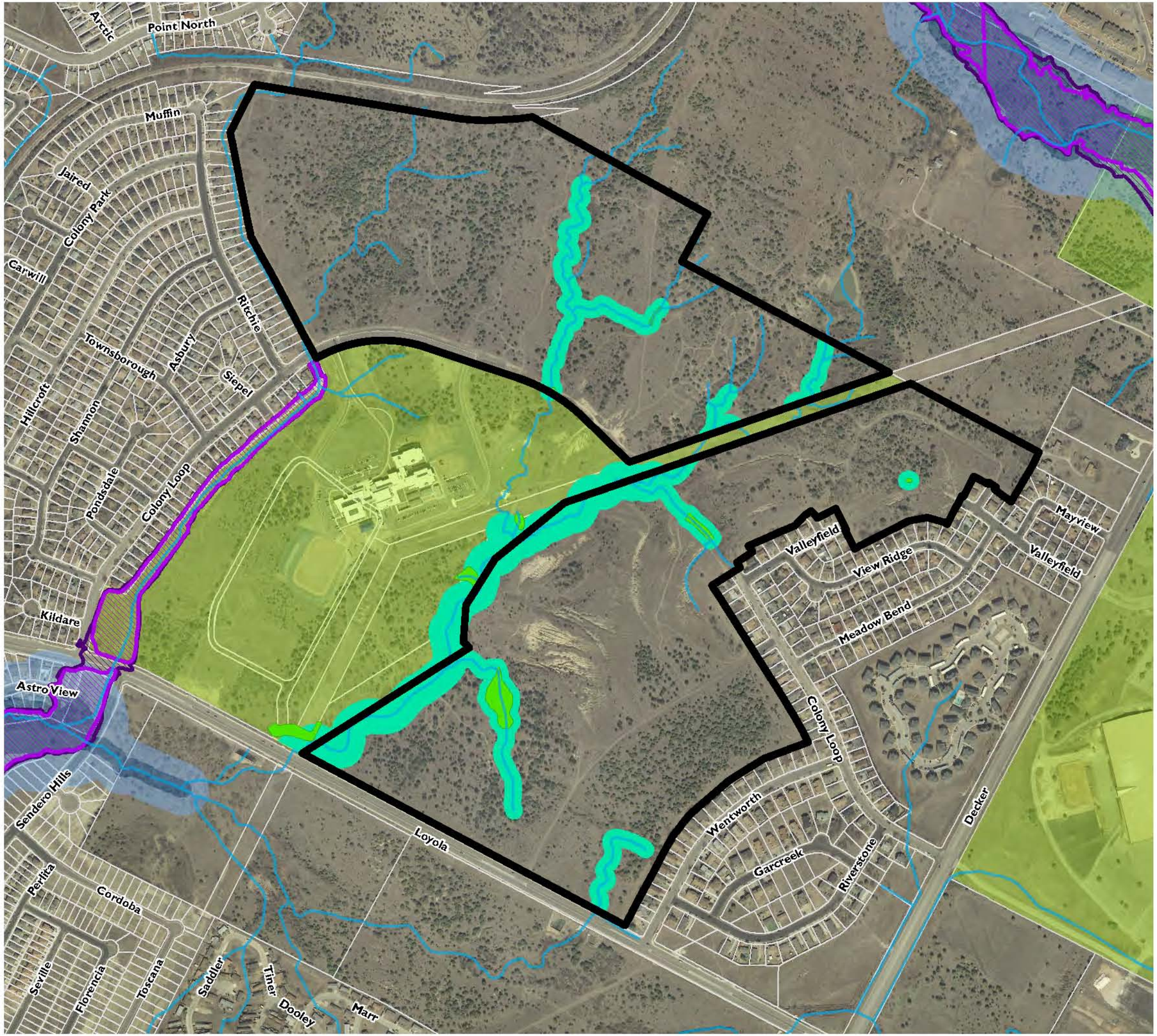
Figure
Current Code



Colony Park Parcels

Creeks

25-Year Floodplain

100-Year Floodplain

Critical Water Quality Zone

Water Quality Transition Zone

Wetlands

Wetland Buffer (Current Code)

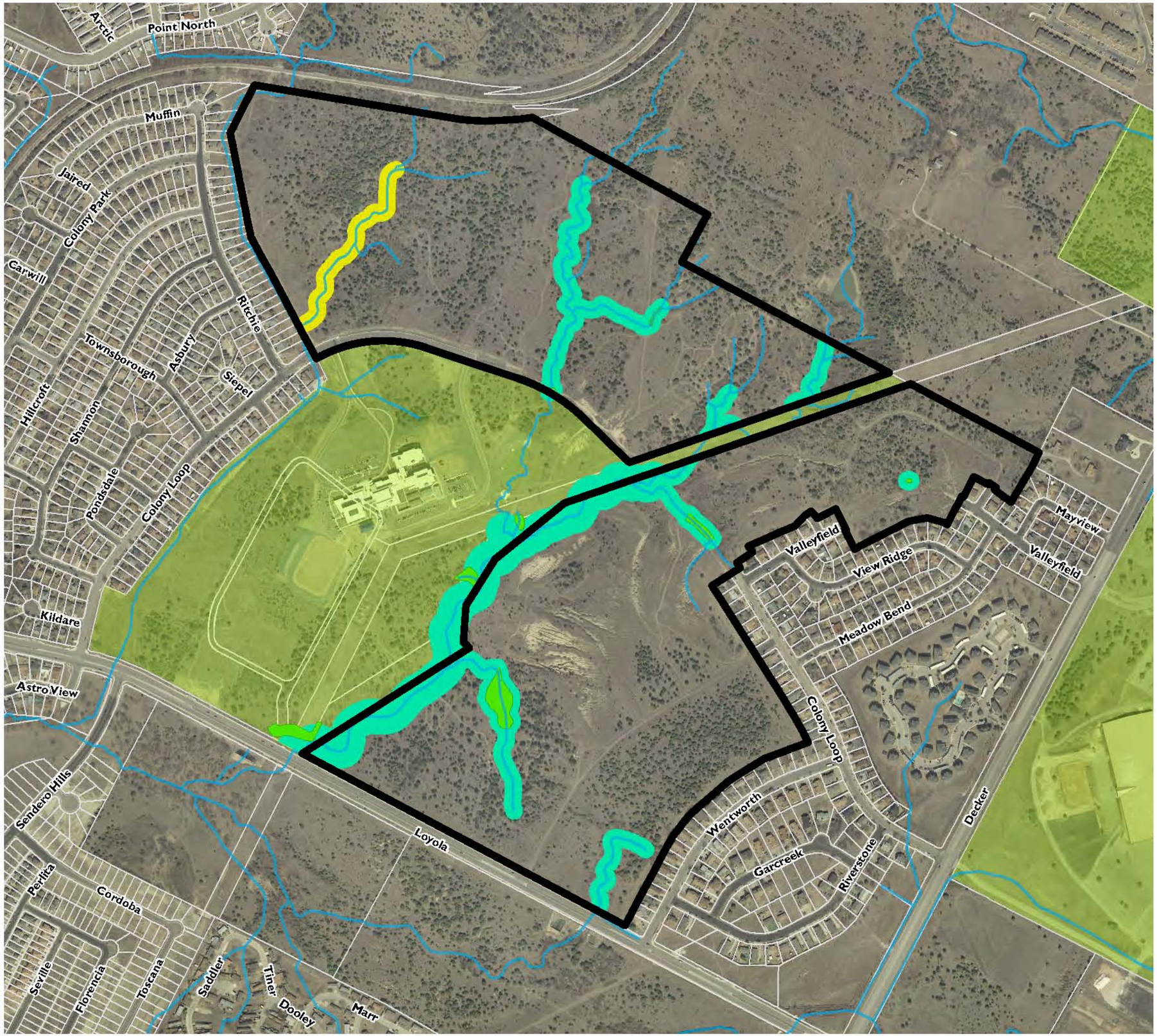
City Parkland

0 250 500 1,000 1,500 2,000 Feet

City of Austin
WATERSHED PROTECTION

Colony Park

WQ Analysis



Colony Park Parcels

Creeks

Wetlands

Wetland Buffer (Current Code)

Additional Riparian Buffer

City Parkland

0 250 500 1,000 1,500 2,000 Feet

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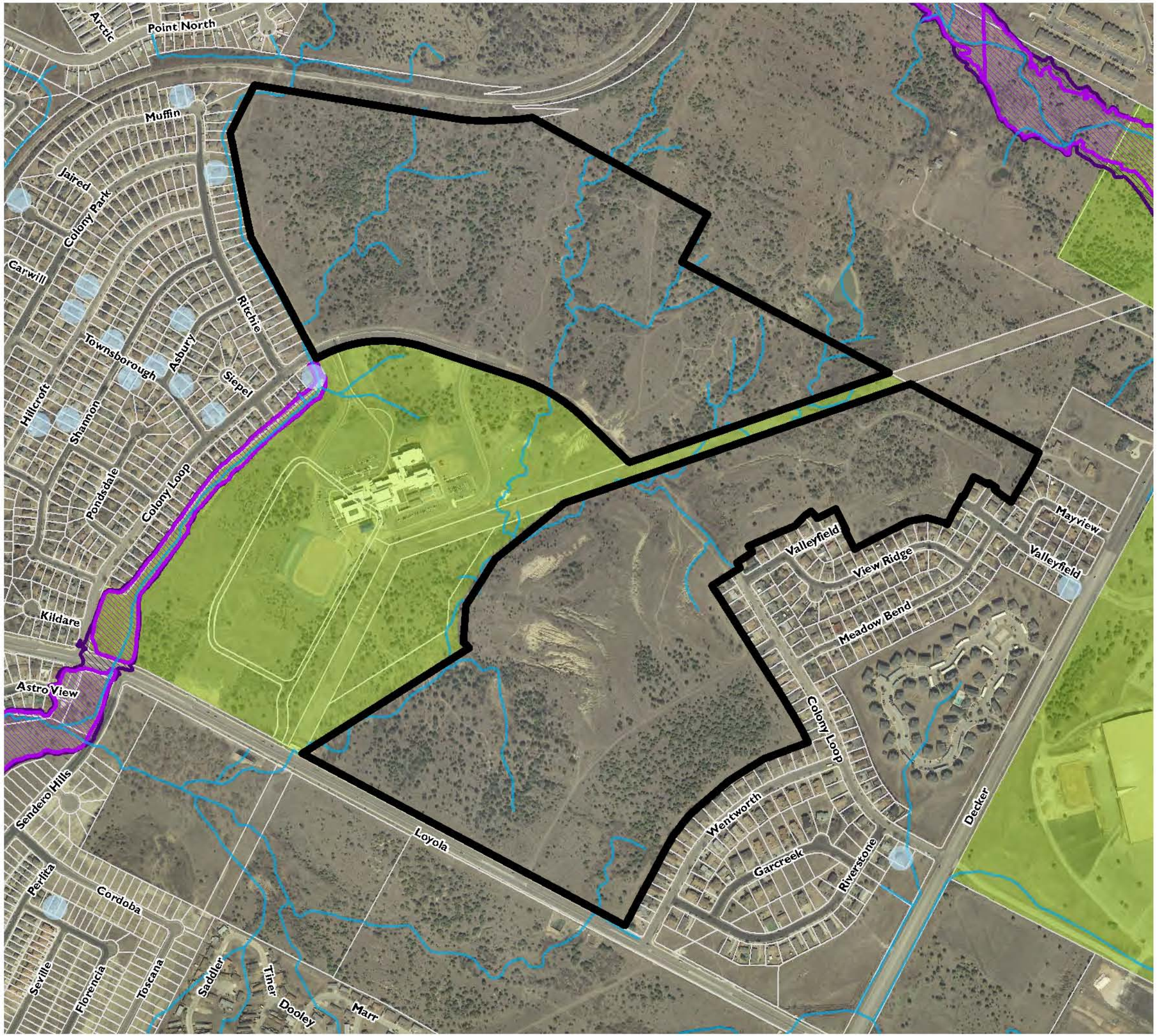
Colony Park

Flood Analysis



Colony Park Parcels

Drainage Complaints

Creeks

25-Year Floodplain

100-Year Floodplain

City Parkland

0 250 500 1,000 1,500 2,000 Feet

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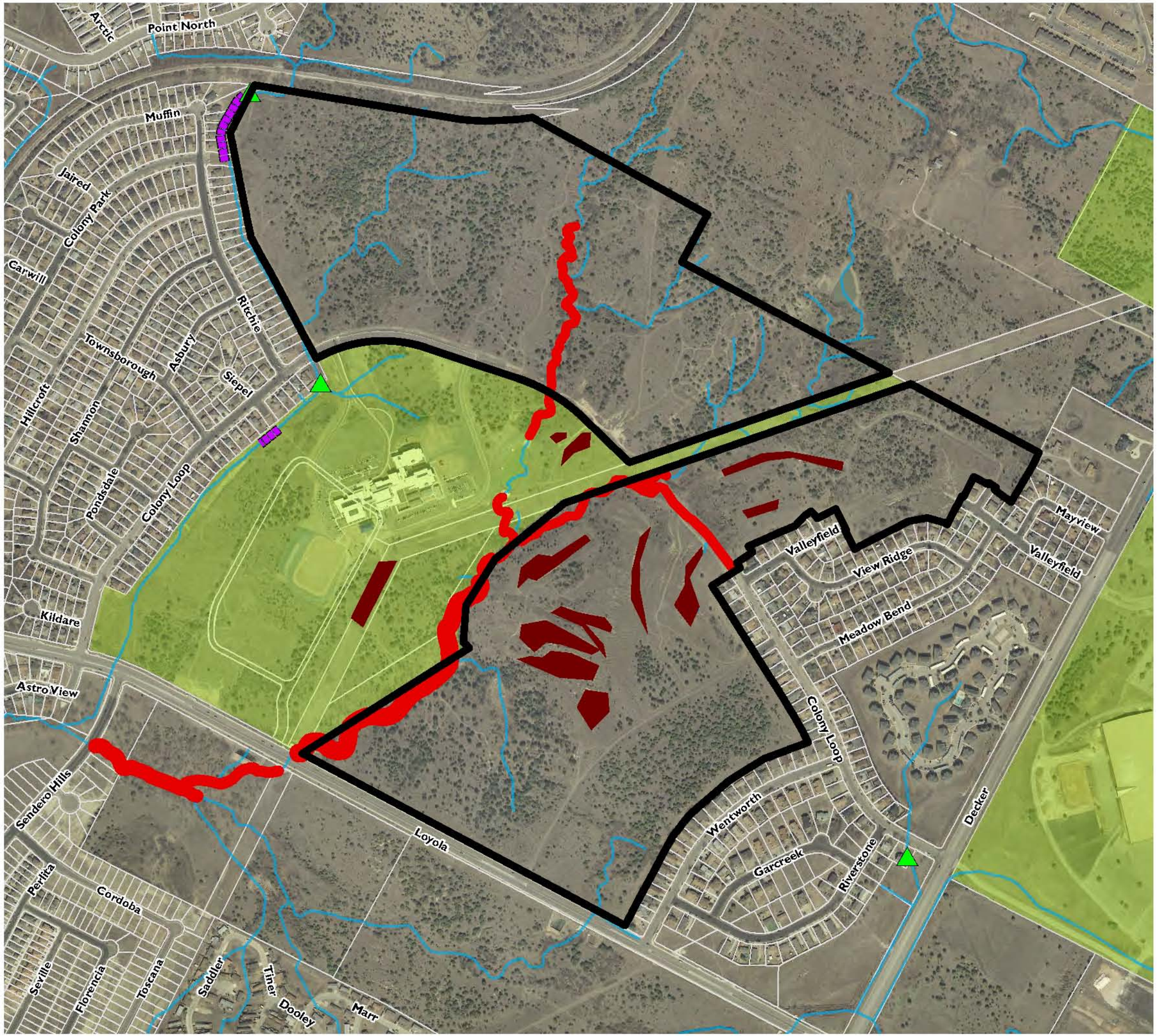
WATERSHED PROTECTION

Colony Park

Erosion Analysis



Colony Park Parcels

Creeks

Erosion Sites

Erosion Projects

Erosion Hazard Zones

Hillslope Erosion Areas

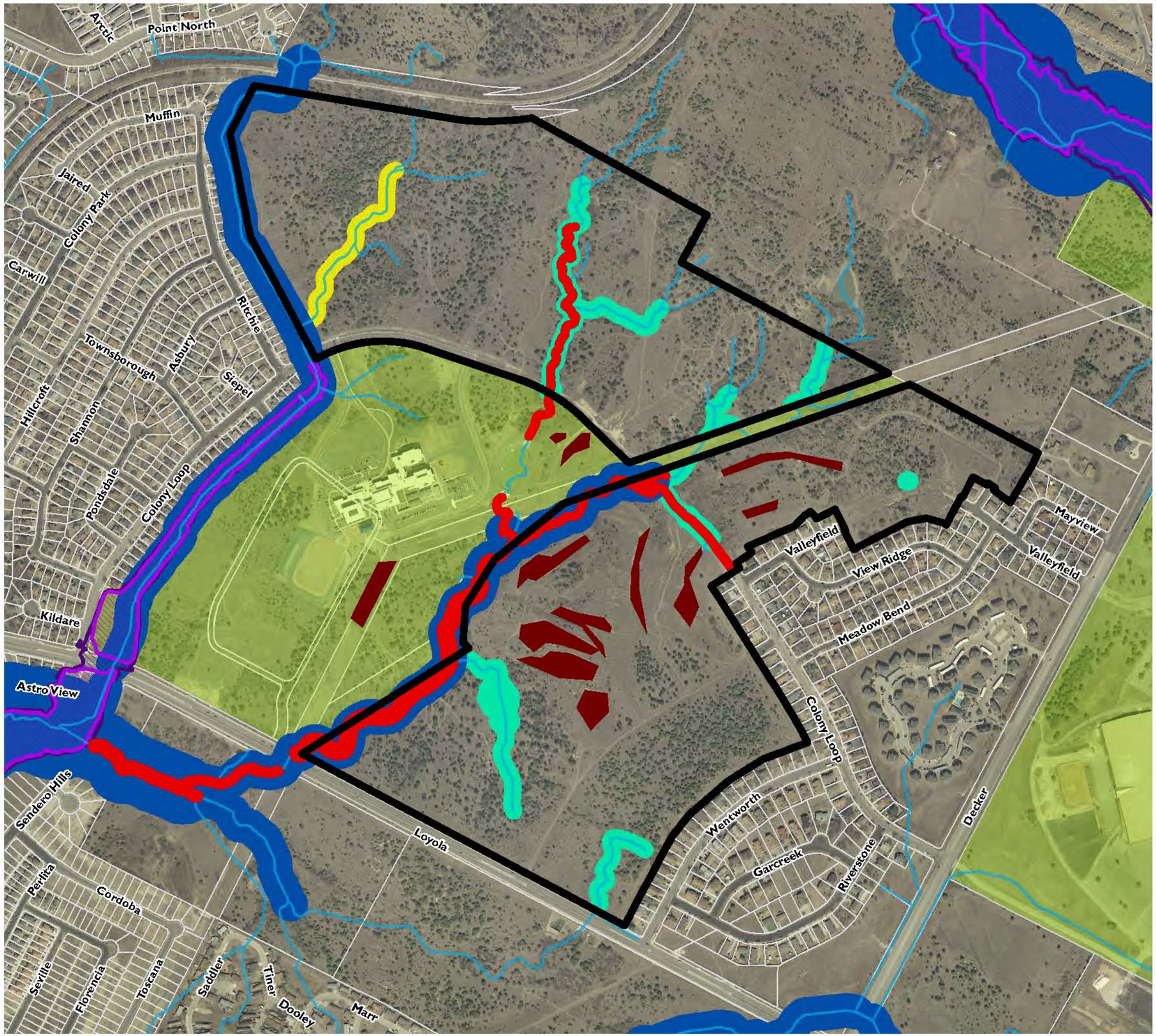
City Parkland

0 250 500 1,000 1,500 2,000 Feet

City of Austin
WATERSHED PROTECTION

Colony Park

Recommendation



- Colony Park Parcels
- Creeks
- Proposed Ordinance Buffers
- Erosion Hazard Zones
- Hillslope Erosion Areas
- Wetland Buffer
- Additional Riparian Buffer
- 25-Year Floodplain
- 100-Year Floodplain
- City Parkland

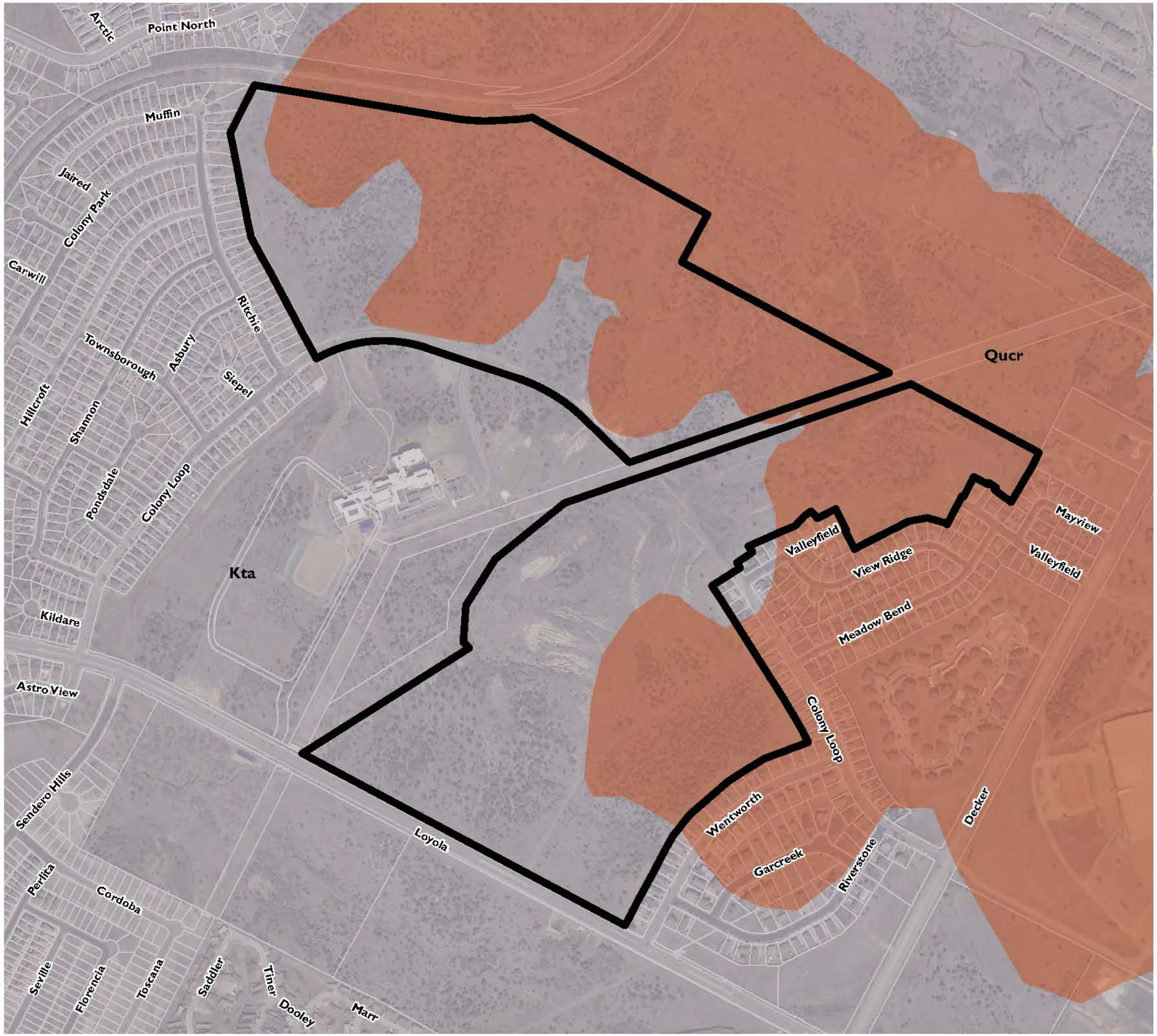
Scenario	Acres	Pct. Total
Total Site	209.25	100%
Current Code	21.58	10%
Wetland Buffer	*21.58*	*10%*
Recommendation	33.58	16%
Proposed Ordinance Buffer	*11.47*	*5%*
Wetland Buffer	*13.40*	*6%*
Additional Riparian Buffer	*2.60*	*1%*
Erosion Hazard Zone	*0.20*	*0%*
Hillslope Erosion Areas	*5.90*	*3%*

0 250 500 1,000 1,500 2,000 Feet

City of Austin
WATERSHED PROTECTION

Colony Park

Geology



Colony Park Parcels

Geology

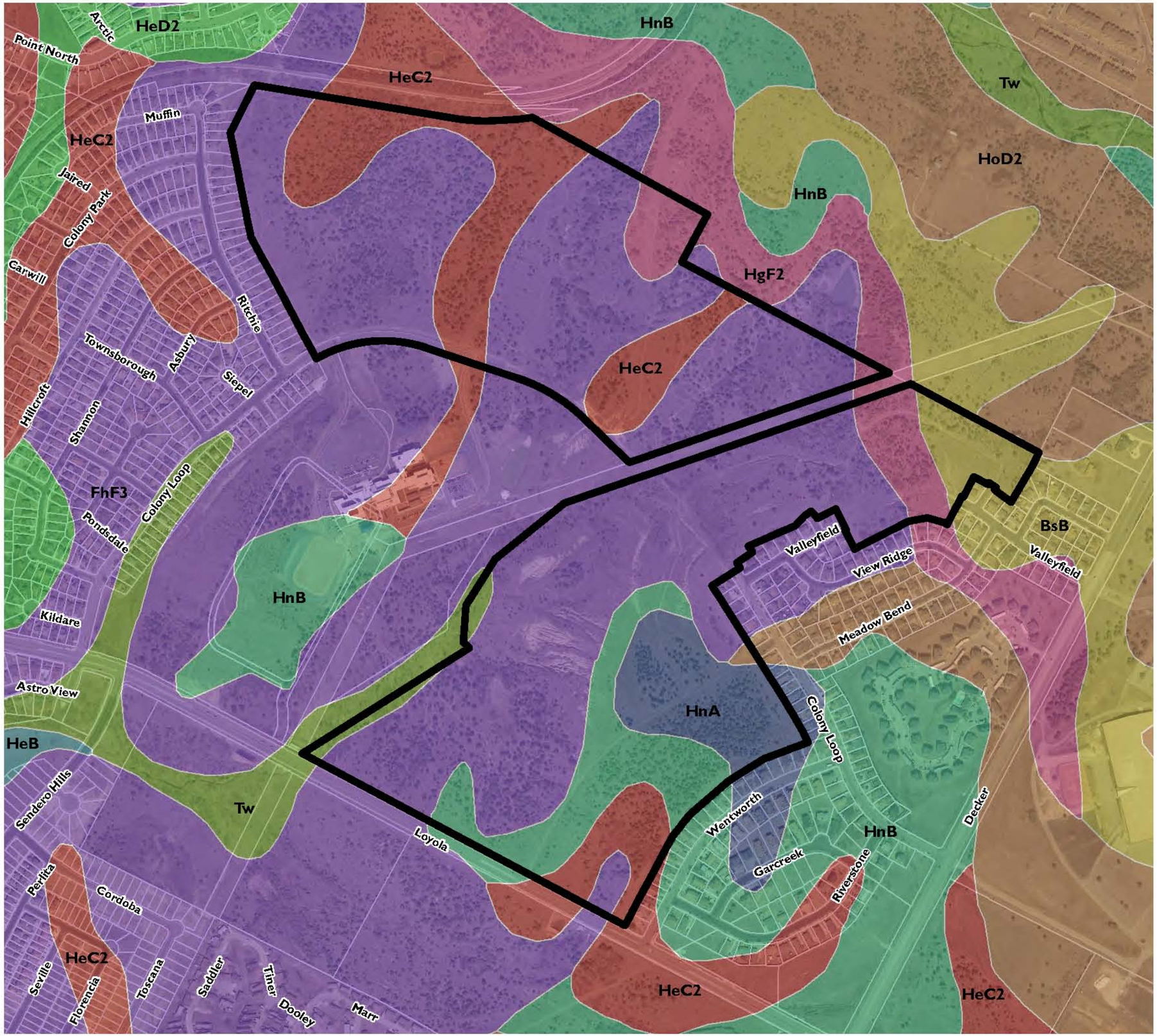
- Qal
- Kta
- Qucr

0 250 500 1,000 1,500 2,000 Feet

City of Austin WATERSHED PROTECTION

Colony Park

Soil Types



Colony Park Parcels

Soil Type

- BsB
- FhF3
- HeB
- HeC2
- HeD2
- HgF2
- HnA
- HnB
- HoD2
- Tw

0 250 500 1,000 1,500 2,000 Feet

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