

1.7.0 Floodplain Modification Criteria

1.7.1 Introduction

These guidelines set out standards for evaluating and processing proposed modifications of the 100-year floodplain with the following objectives:

- preserving the natural and traditional character of the land and waterway;
- encouraging sound engineering and ecological practices;
- preventing and reducing degradation of water quality;
- encouraging the stability and integrity of floodplains and waterways; and
- restoring floodplain health to support natural functions and processes.

The guidelines apply to development proposed within the 100-year floodplain, both inside and outside of the Critical Water Quality Zone. Whenever a modification to a floodplain is proposed, a request for approval shall be submitted in conjunction with an application for a development permit. Such permit applications shall be reviewed in accordance with the provisions of these guidelines and all applicable ordinances, including sections 25-8-364 (*Floodplain Modification*) and 25-8-261 (*Critical Water Quality Zone Development*) of the Land Development Code. Note: These guidelines address the environmental aspects of floodplain modification. Separate drainage requirements (e.g., no adverse flooding impact) can be found in Chapter 25-7 (*Drainage*) and the Drainage Criteria Manual.

Naturally functioning streams with connected floodplains dissipate stream energy, reduce soil erosion, reduce flood damage, capture and treat pollutants, and promote sustainable healthy ecosystems. Periodic flood flows that overtop the banks of stream areas are essential to the health of riparian corridors. The seasonal variability of flow and intermittent extreme events combine to shape the physical structure and biological diversity of floodprone areas. Healthy riparian zones filter pollutants from surface runoff and increase the baseflow of our waterways, thus improving water quality. Also, by providing shading and moderating water temperature, natural floodplains increase biodiversity and promote healthy riparian and aquatic habitats, improving water quality and the overall health of creeks.

1.7.2 Code Requirements

A. Critical Water Quality Zone

The Critical Water Quality Zone is a stream setback established by section 25-8-92 (*Critical Water Quality Zones Established*) of the Land Development Code. The geometry of the setback can vary with the size of the drainage area and the watershed classification (e.g., Suburban).

A Critical Water Quality Zone does not apply to a previously modified drainage feature located within a public roadway right of way that does not possess any natural and traditional character and cannot be reasonably restored to a natural condition. As a Critical Water Quality Zone would not be applied, the

requirements outlined in this section do not apply to a drainage feature determined to meet these conditions.

Within Suburban watersheds, buffer averaging can be used to reduce the width of the setback in certain places as long as the overall area of the buffer provided is the same or greater. The requirements outlined in this section apply to the Critical Water Quality Zone delineated after buffer averaging is applied.

Floodplain modifications are **prohibited** in the Critical Water Quality Zone unless:

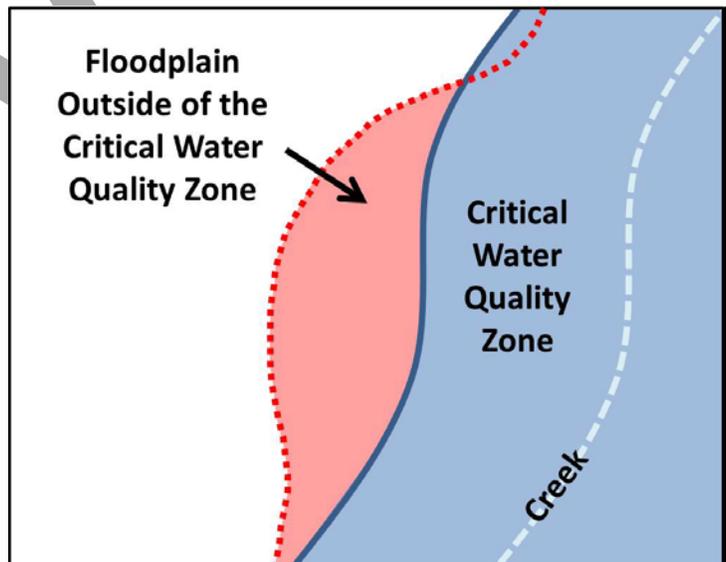
- (1) the floodplain modifications proposed are necessary to protect the public health and safety;
- (2) the floodplain modifications proposed would provide a significant, demonstrable environmental benefit, as determined by a functional assessment of floodplain health; or
- (3) the floodplain modifications proposed are necessary for development allowed in the Critical Water Quality Zone under section 25-8-261 (*Critical Water Quality Zone Development*) or 25-8-262 (*Critical Water Quality Zone Street Crossings*).

If the proposed modification does not qualify for one of the three exemptions listed above in accordance with Section 1.7.3 (*Exemptions*), then the applicant must seek a variance from the Land Use Commission.

B. Outside of the Critical Water Quality Zone

In some areas, especially in the flatter topography of the eastern watersheds, the width of the 100-year floodplain can extend beyond the Critical Water Quality Zone (see figure). Floodplain modification is **permitted** outside of the Critical Water Quality Zone if:

- (1) the floodplain modifications proposed are necessary to protect the public health and safety;
- (2) the floodplain modifications proposed would provide a significant, demonstrable environmental benefit, as determined by a functional assessment of floodplain health;



- (3) the floodplain modifications proposed are necessary for development allowed in the Critical Water Quality Zone under section 25-8-261 (*Critical Water Quality Zone Development*) or 25-8-262 (*Critical Water Quality Zone Street Crossings*); or
- (4) the proposed modification is located in an area determined to be in poor or fair condition by a Zone 1 functional assessment of floodplain health (see Section 1.7.4).

Floodplain modification permitted outside of the Critical Water Quality Zone must meet the following conditions:

- (1) the proposed modification is designed to accommodate existing and fully-vegetated conditions;
- (2) the proposed modification will encourage sound engineering and ecological practices, prevent and reduce degradation of water quality, and encourage the stability and integrity of floodplains and waterways; and
- (3) the applicant restores floodplain health, or provide mitigation if restoration is infeasible, to support natural functions and processes (see Sections 1.7.5 and 1.7.6).

1.7.3 Exemptions

A. Necessary to Protect the Public Health and Safety

Floodplain modification is permitted when necessary to relieve a clear and present or reasonably foreseeable threat to human life from flooding or erosion of existing occupied structures or public rights of way and private property. This shall include the stabilization of eroding creek banks where existing structures are threatened or where there is a recognizable threat to public recreation and safety. The applicant shall perform an environmental assessment of alternatives to determine the least environmentally damaging feasible alternative. These projects shall improve floodplain and riparian zone function using stream restoration techniques that limit the use of hard armor except as needed at key erosive locations. The project shall retain the natural stable creek plan, profile, and dimension with natural function, to the greatest extent practicable, using the following techniques: graded slopes with soil retention blankets; vegetated mechanically stabilized earth; native riparian vegetation; natural materials such as native limestone (instead of gabions or concrete); toe wood; and constructed riffles that double as grade control where required for vertical channel stability. These projects do not need to comply with the restoration or mitigation ratios outlined in Sections 1.7.5 and 1.7.6. Any disturbed areas will need to comply with the vegetative stabilization requirements of 1.4.0 (*Erosion and Sedimentation Control Criteria*).

B. Provides a Significant, Demonstrable Environmental Benefit

The applicant may propose modification to the floodplain, including the channel, to restore a significantly degraded stream system. If modification to the channel is being proposed, a Zone 3

functional assessment of floodplain health both for the existing condition of the system as well as the expected post-project condition after the restoration is complete (see Section 1.7.4) will be evaluated by staff from the Watershed Protection Department. Channel modifications will only be allowed where it can be demonstrated that the stream restoration will provide a significant environmental benefit to the floodplain health. If modification is not being proposed to the channel, then a Zone 1 and/or Zone 2 functional assessment of floodplain health would be used to evaluate both the existing condition of the system as well as the expected condition after the project is complete. Because these modifications are designed as restoration projects, these projects do not need to comply with the restoration or mitigation ratios outlined in Sections 1.7.5 and 1.7.6. Any disturbed areas will need to comply with the vegetative stabilization requirements of 1.4.0 (*Erosion and Sedimentation Control Criteria*).

C. Development Allowed in the Critical Water Quality Zone

Development permitted **conditionally** in the Critical Water Quality Zone under sections 25-8-261 (*Critical Water Quality Zone Development*) or 25-8-262 (*Critical Water Quality Zone Street Crossings*) includes:

- fences that do not obstruct flood flows
- open space uses such as parks
- hard-surfaced trails and trail crossings
- sustainable urban agriculture or community gardens
- athletic fields
- boat docks, piers, wharfs, or marinas
- utility lines and crossings
- detention basins and wet ponds
- green stormwater controls
- road crossings

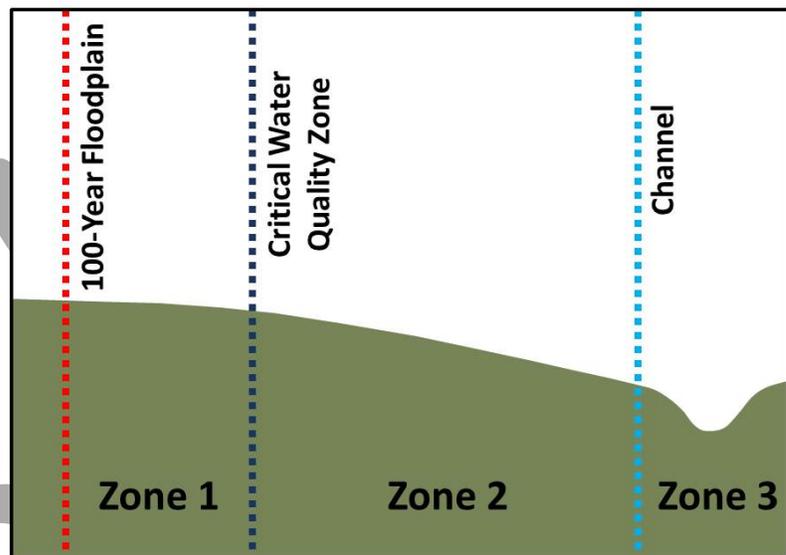
Development within the Critical Water Quality Zone shall be designed to protect the natural hydrologic function, long-term channel stability, and ecological function of the floodplain. These modifications do not need to comply with the restoration or mitigation ratios outlined in Sections 1.7.5 and 1.7.6. Any disturbed areas will need to comply with the vegetative stabilization requirements of 1.4.0 (*Erosion and Sedimentation Control Criteria*).

In-channel basins shall not adversely impact channel stability by creating additional erosion or sedimentation downstream of the structure. In alluvial channels, the basin shall not capture excess bed material load such that a “hungry water” effect results in additional erosion downstream. For channels with limited bed material load, the basins shall not extend the duration of erosive flows above the channel boundary material threshold and cause additional downstream erosion. Downstream impacts of in-channel impoundments shall be evaluated using a continuous simulation routing model that computes cumulative excess stream power or sediment transport.

1.7.4 Functional Assessment of Floodplain Health

The functional assessment is a quantitative tool designed to measure the health of the floodplain. There are three zones that potentially will be assessed, depending on the type of proposal:

- **Zone 1** – Zone 1 is the area proposed for floodplain modification outside of the Critical Water Quality Zone. The applicant will use five measures to assess the current condition of the floodplain (poor/fair/good) to determine if floodplain modification is allowed without a variance. A floodplain in good condition will require a land use commission variance. If the functional assessment needs to be performed between November and February, the assessment will be performed by staff from the Watershed Protection Department, due to a seasonal lack of vegetation.
- **Zone 2** – Zone 2 is the area proposed for restoration within the Critical Water Quality Zone but outside of the stream channel (see section 1.7.5). The applicant will use seven measures to assess the current condition of the riparian zone (poor/fair/good) to determine which restoration techniques (if any) should be applied. A Critical Water Quality Zone already in good condition will require off-site mitigation instead of restoration (see Section 1.7.6). If the functional assessment needs to be performed between November and February, the assessment will be performed by staff from the Watershed Protection Department, due to a seasonal lack of vegetation.
- **Zone 3** – Zone 3 is only assessed if the applicant is proposing modification of the channel. Staff from the Watershed Protection Department will use 24 measures to assess both the existing stream function as well as to estimate future stream function based on the proposed design of the applicant. The measures will evaluate the riparian zone, the channel geomorphology, and the aquatic habitat. To provide a significant, demonstrable environmental benefit, the project will need to elevate the stream function from poor condition to good.



Following is a description of the parameters that will be evaluated for each zone. A full explanation of each parameter, including methodology and scoring, is included with the functional assessment form in Appendix ___ of the manual.

A. Zone 1

Gap Frequency	A visual assessment of the number of gaps in vegetation allowing unimpeded flow out of the zone. Gap frequency is a predictor of nutrient discharge into the stream.
Large Woody Debris	An evaluation of the amount, composition, and distribution of large woody debris around the stream reach providing aquatic habitat erosion control.
Soil Compaction	An assessment of the bulk density of the soil. Compaction can result in degraded plant communities, impaired habitats, and decreased erosion control.
Plant Cover and Structural Diversity	An evaluation of the canopy, understory, and groundcover vegetation, with higher scores assigned to areas with increased coverage and structural diversity.
Tree Demography	An assessment of the woody species' age class distribution. Higher scores are assigned to areas with more complete age class distributions. Gaps in the age classes may indicate disturbance and lower system functionality.

B. Zone 2

Gap Frequency	A visual assessment of the number of gaps in vegetation allowing unimpeded flow out of the zone. Gap frequency is a predictor of nutrient discharge into the stream.
Large Woody Debris	An evaluation of the amount, composition, and distribution of large woody debris in and around the stream reach providing aquatic habitat erosion control.
Soil Compaction	An assessment of the bulk density of the soil. Compaction can result in degraded plant communities, impaired habitats, and decreased erosion control.
Plant Cover and Structural Diversity	An evaluation of the canopy, understory, and groundcover vegetation, with higher scores assigned to areas with increased coverage and structural diversity.
Tree Demography	An assessment of the woody species' age class distribution. Higher scores are assigned to areas with more complete age class distributions. Gaps in the age classes may indicate disturbance and lower system functionality.

Wetland Tree Status	Percent of tree species that are defined as facultative or more wetland oriented.
Riparian Zone Width	A measure of the width of the riparian zone, with larger widths receiving higher scores. The capacity of the riparian zone to filter pollutants, reduce erosion, prevent flooding, and provide habitat is correlated with riparian zone width.

C. Zone 3

Riparian Zone	
Gap Frequency	A visual assessment of the number of gaps in vegetation allowing unimpeded flow out of the zone. Gap frequency is a predictor of nutrient discharge into the stream.
Large Woody Debris	An evaluation of the amount, composition, and distribution of large woody debris in and around the stream reach providing aquatic habitat erosion control.
Soil Compaction	An assessment of the bulk density of the soil. Compaction can result in degraded plant communities, impaired habitats, and decreased erosion control.
Plant Cover and Structural Diversity	An evaluation of the canopy, understory, and groundcover vegetation, with higher scores assigned to areas with increased coverage and structural diversity.
Tree Demography	An assessment of the woody species' age class distribution. Higher scores are assigned to areas with more complete age class distributions. Gaps in the age classes may indicate disturbance and lower system functionality.
Wetland Tree Status	Percent of tree species that are defined as facultative or more wetland oriented.
Riparian Zone Width	A measure of the width of the riparian zone, with larger widths receiving higher scores. The capacity of the riparian zone to filter pollutants, reduce erosion, prevent flooding, and provide habitat is correlated with riparian zone width.
In-Stream Canopy Cover	An assessment of the amount of canopy cover extending over the stream banks, with higher amounts of coverage receiving higher scores.

Geomorphology	
Mass Wasting	An evaluation of the existing and the potential for future major bank sloughing within the reach.
Bank Protection	An evaluation of the amount and variety of vegetation covering the channel banks within the stream reach.
Obstructions, Deflectors, Sediment Traps	An evaluation of the presence of obstructions, deflectors, and sediment traps within the reach and of its relative permanence in the channel.
Cutting	An assessment of the prevalence and the height of cut and raw banks along the channel reach.
Deposition	An analysis of the amount of recent deposition of sediments in the reach resulting in new in-stream features such as bars, or filled-in pools.
Consolidation or Particle Packing	An analysis of the degree to which stream bed particles are stabilized in the bed, either due to embeddedness or the orientation of the particles.
Scouring and Deposition	An analysis of the extent of bed material mobilization within the reach, evidenced by scouring and/or deposition.
Aquatic Habitat	
Epifaunal Substrate and Available Cover	An evaluation of the channel substrate, snags, submerged logs, and other stable habitat features to determine the amount of habitat available for epifaunal community colonization.
Embeddedness	An evaluation of the degree to which gravel, cobble, and boulder particles are surrounded by fine sediments.
Velocity/Depth Regimes	An evaluation of the presence of four categories of regimes: slow-deep, slow-shallow, fast-deep, and fast-shallow. Highest scores are assigned to reaches with all four velocity/depth regimes.
Sediment Deposition	An analysis of the degree to which in-stream features are enlarging, with areas with less than 5 of the reach affected by deposition receiving the highest scores.
Frequency of Riffles	An analysis of the occurrence of riffles, with reaches in which the average distance between riffles is less than seven times the channel's bankfull width receiving the highest scores.
Flow Permanence Score	An assessment of the degree of coverage and species diversity of plants within the zone. High coverage and species diversity are indicative of stream functionality.

Additional Considerations	
Exposed Infrastructure	An assessment of exposed footings, pipes, or other infrastructure, which shows the degree of down cutting or channel movement within the system.
Evidence and Frequency of Headcuts	An assessment of the degree of and prominence of head cutting in the stream reach and its immediate tributaries.
Floodplain Connectivity	An assessment of how easily storm flows inundate the floodplain. Entrenchment of the channel decreases the floodplain connectivity and reduces stream functionality.

References:

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.
<http://water.epa.gov/scitech/monitoring/rsl/bioassessment/index.cfm>

Pfankuch, D. J. 1975. Stream reach inventory and channel stability evaluation. U.S. Department of Agriculture Forest Service. Region 1. Missoula, Montana.

Richter, F.A. and A. Duncan. 2012. Riparian Functional Assessment: Choosing Metrics that Quantify Restoration Success in Austin, Texas. City of Austin, Watershed Protection Department, Environmental Resource Management. SR-12-12.

1.7.5 Restoration

A. Requirements

Restoration of floodplain health as prescribed by this section is required for any proposed floodplain modification that does **not** qualify for one of the following exemptions:

- (1) the floodplain modifications proposed are necessary to protect the public health and safety;
- (2) the floodplain modifications proposed would provide a significant, demonstrable environmental benefit, as determined by a functional assessment of floodplain health; or
- (3) the floodplain modifications proposed are necessary for development allowed in the critical zone under section 25-8-261 (*Critical Water Quality Zone Development*) or 25-8-262 (*Critical Water Quality Zone Street Crossings*).

Outside of these exemptions, proposed modifications that **would** require restoration of floodplain health include:

- (1) a modification of a floodplain that is outside of the Critical Water Quality Zone and a Zone 1 functional assessment shows to be in poor or fair condition; or
- (2) a proposed modification that is seeking a variance from the land use commission.

Where possible, the required restoration shall always be located within the Critical Water Quality Zone adjacent to the proposed area of modification. If the applicant does not own enough of the adjacent Critical Water Quality Zone to meet the restoration requirements or a Zone 2 functional assessment shows the Critical Water Quality Zone is already in good condition, then mitigation can be provided off-site (see Section 1.7.6).

The amount of area within the Critical Water Quality Zone that is required to be restored shall be proportionate to the amount of area within the existing floodplain that is proposed to be modified, as shown in the table below. Depending on the condition of the area being modified, X square feet must be restored for every 1 square feet modified (for a ratio of X:1). There is a multiplier of two for modifications within the Critical Water Quality Zone. In addition, any disturbed areas will need to comply with the vegetative stabilization requirements of 1.4.0 (*Erosion and Sedimentation Control Criteria*).

Condition of the Area Proposed for Floodplain Modification (as determined by Functional Assessment)	Location of Proposed Modification	
	Outside Critical Water Quality Zone	Critical Water Quality Zone
Good	4:1*	8:1*
Fair	3:1	6:1*
Poor	2:1	4:1*

*Not allowed by Code without a variance from the land use commission

The applicant shall prepare and submit a Riparian Restoration Plan to be reviewed and approved by the Watershed Protection Department as part of the Site Development Permit. A restoration plan must contain the following minimum components:

- Soil Amendments
- Native Species Seeding
- Tree Seedling Planting
- Exotic Invasive Species Control
- Ragweed Management
- Performance Criteria

During the course of inspections and field observations, adjustments to the Riparian Restoration Plan may be required. The plan may be amended with the submission of additional or amended parts of the plan and approval by the Watershed Protection Department.

Riparian restoration will likely need additional time beyond the period of construction to successfully elevate the function of the restored area to a good condition. Projects which have not completed the riparian restoration process before the final environmental inspection may enter into a Developer's Agreement for up to three years. The fiscal posting amount for the Developer's Agreement shall be based on contractor estimates of current cost for the materials and labor for installation and maintenance outlined in the approved Riparian Restoration Plan. The estimates must be dated within 12 months of the request for an agreement and must list suppliers who can provide the required items. A certified estimate must be submitted to the City of Austin Environmental Inspector by a landscape architect or professional engineer for review and acceptance before a Developer's Agreement is written. The fiscal is returned only after a concurrence letter for restoration is received and the final inspection is passed.

B. Restoration Guidance

The overall goal of the restoration should be to elevate the function of the restored area from poor or fair condition to good. Restoration of floodplain function should focus on a passive approach that promotes managed succession and a minimal need for ongoing management. Restoration strategies and plant palettes will vary depending on the zone (hydric vs. mesic), the ecoregion (Edwards Plateau vs. Blackland Prairie), and the drainage area (minor vs. major waterways). Strategies should include simple, straightforward techniques such as seeding, bare-root saplings, invasive removal, and soil amendments rather than a more formal design involving containerized plants and irrigation. Once completed, projects may want to demarcate restoration areas with signage or large boulders to prevent future clearing or mowing.

C. Channel Design

Where modification of the channel is permitted (e.g., necessary to protect public health and safety, significant, demonstrable environmental benefit), design criteria, calculation of flood flows and limiting velocities shall be in accordance with the Drainage Criteria Manual. Innovative methods of design and construction which are intended to emulate natural watercourses, promote channel stability, preserve existing vegetation, preserve or improve in-stream aquatic habitat and protect mature riparian landscapes are encouraged, subject to approval by the Watershed Protection Department.

1.7.6 Mitigation

A. Requirements

Where possible, the required restoration shall always be located within the Critical Water Quality Zone adjacent to the proposed area of modification (see Section 1.7.5). If the applicant does not own the adjacent Critical Water Quality Zone or a Zone 2 functional assessment shows the Critical Water Quality Zone is already in good condition, then mitigation can be provided off-site. Mitigation must be located within the same watershed classification (e.g., Suburban) and shall consist of:

- (1) paying into the Riparian Zone Mitigation Fund a non-refundable amount established by ordinance;
- (2) dedicating land to the City or another entity approved by the Watershed Protection Department director in fee simple and which the City or other entity accepts; or
- (3) placing restrictions on land to the benefit of the City or another entity approved by the Watershed Protection Department director and which the City or other entity accepts.

If land is dedicated or restricted, it must be approved by the City and the applicant must file in the deed records a restrictive covenant, approved by the city attorney, that runs with the transferring tract and describes the restrictions on development and vegetation management. In addition, the applicant shall pay all costs of restricting the mitigation land or transferring the mitigation land to the City, including the costs of:

- (a) an environmental site assessment without any recommendations for further clean-up, certified to the City not earlier than the 120th day before the closing date transferring land to the City;
- (b) a category 1(a) land title survey, certified to the City and the title company not earlier than the 120th day before the closing date transferring land to the City;
- (c) a title commitment with copies of all Schedule B and C documents, and an owner's title policy;
- (d) a fee simple deed, or, for a restriction, a restrictive covenant approved as to form by the city attorney;
- (e) taxes prorated to the closing date;
- (f) recording fees; and
- (g) charges or fees collected by the title company.

The amount of area that is required as mitigation shall be proportionate to the amount of area within the existing floodplain that is proposed to be modified, as shown in the table below. Depending on the condition of the area being modified, X square feet of mitigation must be provided for every 1 square feet modified (for a ratio of X:1). There is a multiplier of two for providing off-site mitigation (versus the ratios established for restoration above).

Condition of the Area Proposed for Floodplain Modification (as determined by Functional Assessment)	Location of Proposed Modification	
	Outside Critical Water Quality Zone	Critical Water Quality Zone
Good	8:1*	16:1*
Fair	6:1	12:1*
Poor	4:1	8:1*

*Not allowed by Code without a variance from the land use commission

DRAFT