BALCONES CANYONLANDS PRESERVE
LAND MANAGEMENT PLAN

TIER II A

CHAPTER XI
WATER QUALITY MANAGEMENT

August 2007

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1.0 INTRODUCTION

1.1 Importance as Preserve Management Goal

Water quality has been recognized as an important management goal for the Balcones Canyonlands Preserve (BCP) lands. The presence of high quality surface water is essential to the continued survival of all types of wildlife. Water itself creates the habitat for aquatic salamanders, fishes and other aquatic species. In karst limestone areas, the presence of unpolluted groundwater is necessary for sustaining appropriate habitat for listed karst invertebrates and a myriad of karst species that are to be protected under the multi-species concept of the BCP.

1.2 Protection of Water Supply Watersheds

The seven macrosites comprising the Balcones Canyonlands Preserve (see Map Figure 1) are located in watersheds that contribute to the public and private drinking water supply of the Travis County region. The Pedernales and Cypress Creek macrosites drain into Lake Travis where the Lower Colorado River Authority, the City of Cedar Park and numerous water districts withdraw drinking water. The South Lake Austin, North Lake Austin, Bull Creek and West Lake Austin macrosites drain largely into Lake Austin where two City of Austin water treatment plants take in their raw water. The Barton Creek macrosite drains into the environmentally sensitive Barton Creek and ultimately into Town Lake, where the City of Austin has another water treatment plant that supplies the central city. In addition, numerous water wells have tapped the aquifer to supply drinking water to residents and businesses in the region.

The existing water quality in Barton and Bull Creeks is exceptional, but nonpoint-source pollution generated by rapid urbanization of these watersheds remains a threat. By generating clear, clean flows throughout much of the year, natural areas such as preserves are important to maintaining good water quality in local watercourses and lakes. In addition, water percolating into preserve lands and recharging the Edwards aquifer from porous streambeds is an important groundwater resource.

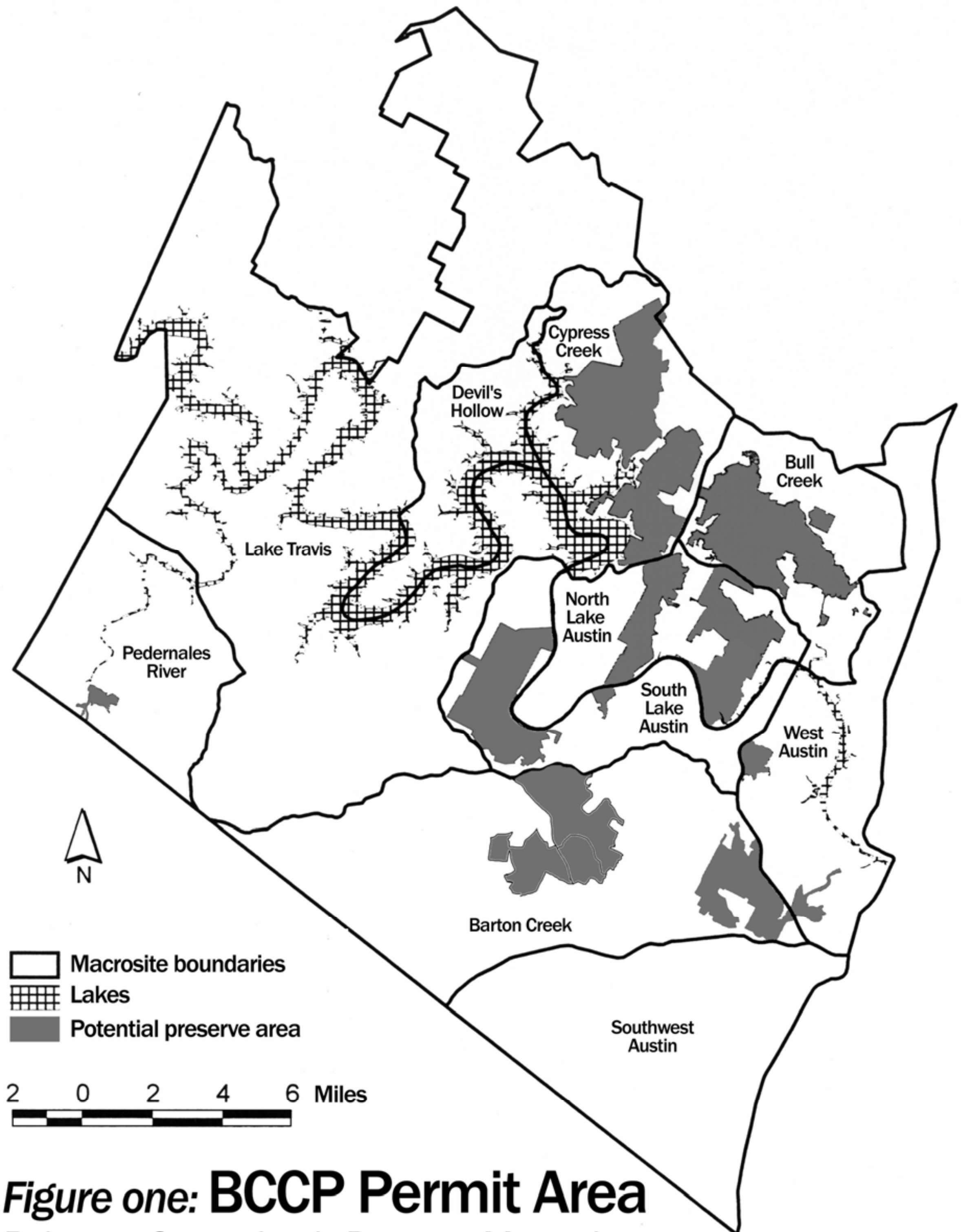

Figure one: BCCP Permit Area
Balcones Canyonlands Preserve Macrosites

1.3 Reduction of Nonpoint-Source Pollutant Loads to Watercourses

Natural areas with typical hill country vegetation intercept and percolate rainfall, thus minimizing the surface runoff peaks that carry sediment and pollutants into watercourses after heavy rainfall. When compared to adjoining urban areas that generate runoff with suspended solids, nutrients, oil and grease, toxic metals and pesticides, undeveloped preserve tracts have virtually no activities that generate such nonpoint-source pollutants. Runoff from undeveloped tracts contains lower concentrations of pollutants that can create problems for downstream aquatic life or violate established regulatory thresholds.

1.4 Offset Increasing Watershed Imperviousness

Impervious cover is the combination of paved roads, rooftops, driveways, parking lots and other surfaces that are impermeable to rainfall and therefore cause rainwater to drain off quickly, transporting pollutants that are dislodged, dissolved or suspended.

Stormwater research throughout the nation has shown that as a watershed approaches 15-20% impervious cover, fundamental changes occur in water quality during and after storm events. Limiting impervious cover in management projects is one way to minimize water quality degradation. Natural areas generally exhibit good ground absorption by infiltration, percolation and depression storage. Having significant undeveloped acreage within a watershed reduces runoff volume and pollutant loads to local creeks.

1.5 Provide Flood and Water Quality Retrofit Opportunities

In many watersheds, promising sites that effectively retrofit existing drainage problems are limited. Undeveloped sites in the upper reaches of watersheds are very important from an engineering context because overall site hydrology is more manageable and the design criteria for multi-purpose controls (i.e., combination flood and water quality basins) can be accommodated. Structural controls must be able to retain (capture high flows) and/or detain (slow down to allow sedimentation or water quality treatment processes to work) flowing waters to accomplish their intended purpose.

2.0 KEY CONCEPTS

Preserve managers are generally aware of the hydrologic cycle whereby rain falls on a parcel of land, a portion infiltrates and percolates into the ground, another portion runs off via overland flow, and the remainder is lost back to the atmosphere through evaporation and transpiration. Preserve managers should take steps to insure that management practices do not adversely affect water quality.

2.1 Water Resource Characteristics

Each preserve tract interacts with water in a variety of ways based on geological characteristics and temporal conditions. In the Austin area, 30-32 inches of annual rainfall is typical, yet annual evaporation is almost twice that amount. Periods of wet weather are in the spring and fall, while summer and winter periods may be quite dry. The dynamic nature of water presence or scarcity is important to the timing of many preserve management activities.

2.1.1 Base Flow Presence

During the wet season, intermittent streams flow due to the rainfall runoff from within their watersheds, but dry up within days after the rain ceases. Such streams may continue to flow for sustained periods if bank storage or groundwater seepage is significant. Alluvial gravel bars hold water that is released slowly over time into the stream channel and this phenomenon is responsible for sustaining a base streamflow during dry months.

2.1.2 Flooding Conditions

Heavy rainfall in hilly terrain produces runoff flows that may exceed the capacity of local streams to convey without overbank flooding. The streambank area typically subject to such flooding is the floodplain and a riparian community tolerant of episodic floods may become adapted to such water regimes.

Flooding conditions are also characterized by high water velocities, movement of channel bed substrates from sand to large rocks, and transport of floating woody debris. Fine silts and clays from the stream channel are picked up during flood flows; however, they take longer to settle once flows decrease and this may occur far downstream from their place of origin.

2.1.3 Groundwater Interactions

The karst topography in western Travis County has significant implications for water resources there. This karst zone contains faults, fractures and porous rock strata that rapidly absorb rain falling directly upon it, usually without producing overland runoff. Stream channels crossing such areas also experience rapid water loss into the subsurface realm that can leave some streams completely dry. Such areas are considered to recharge or replenish aquifers that provide groundwater to private and public well users.

Once underground, groundwater is considered a private property resource that can be pumped out and used by landowners. Rights to surface water are divided up among users by the State of Texas through an appropriation process by river basin. Ownership essentially changes hands when (1) surface water recharges underground aquifers or (2) spring flow emerges to establish surface water bodies.

Preserve managers should be aware of the presence of springs (flowing or not), wells, active stream recharge segments or karst features affecting surface drainage. Ambient water quality in both water environments can have significant effects on biota. While the listed birds use local surface water supplies for drinking; aquatic salamanders, listed karst invertebrates and other karst species of concern are directly affected by groundwater presence and quality, as well as surface water flows through caves.

2.2 Erosion and Sedimentation Processes

Erosion and sedimentation are linked physical processes created by the movement of water (and wind to a lesser extent) that transports soil, gravel and rock material from one location to another.

2.2.1 Land Surface Erosion

The greatest amount of erosion typically comes from exposed land surfaces devoid of vegetation. Leaf litter, mulch, plant roots and other surface covers intercept rainfall and store it for slow release. Exposed soil particles dislodged by rain and transported away by flowing water can settle in water bodies when water velocities decrease. On slopes, erosion normally occurs at the upper levels, and sedimentation occurs at the base.

In natural areas, unpaved roadway use, trails, burned areas and old development sites create conditions suitable for landform erosion. In some areas, soil loss may be so severe that vegetation is unable to become re-established. Preserve managers must be aware of exposed land surfaces and use erosion control practices that reduce the potential for soil loss.

2.2.2 Streambank Erosion

In contrast to the overland flow and rill erosion seen on slopes, water flow in channels often has higher velocities and hence more erosive power. Areas with reduced infiltration can increase water yield into streams due to excess runoff. In channels, erosion occurs along channel banks and streambeds experiencing faster water flow, while sedimentation prevails in deeper, slow-moving reaches. In sinuous tributaries with numerous bends, the outermost curve tends to exhibit erosion while the inner portion exhibits sedimentation.

2.3 Sources of Water Quality Parameters

Because water also possesses solvent characteristics, it is able to dissolve certain materials, suspend others, and allow surface films to form. All of these substances constitute water quality parameters that may affect the health of plants and animals.

2.3.1 Nonpoint-Source Pollution

Whenever water quality pollutants are picked up from the land surface by rainfall runoff and transported downstream, they have the potential for creating poor water quality in watercourses and lakes. Because it does not originate as treated effluent from pipes or outfalls (point sources), this type of diffuse land surface contamination is commonly called nonpoint-source pollution. It may involve a wide variety of pollutants, particularly sediment, organic matter/debris, and nutrients.

Nonpoint-source pollution is usually measured in terms of total load per storm event. Pollutant loads measured in a creek reflect the potential effects on downstream water quality and biota. The degree of imperviousness of the contributing watershed directly correlates to the pollutant loads discharging from a given watershed.

2.3.2 Spills and Accidental Releases

Occasionally accidental releases of gasoline, oil or industrial chemicals considered to be toxic or hazardous can occur from activities on or adjacent to preserve land. These spills may become chronic contributors to nonpoint-source pollution unless they are properly managed at the point of origin. Contaminated soil may have to be removed and transported to licensed hazardous material disposal sites at considerable expense.

Periodic releases of pollutants mandate regular inspections on preserve tracts to promote cleanups before storms disperse the material. Liable parties are often difficult to catch. In the case of utility providers and pipeline companies using easements through preserve properties, assignment of cleanup responsibility and liability for releases from their equipment is easier to document. They often have their own crews or can contract response crews who will perform immediate cleanup on land or in watercourses within regulatory guidelines to prevent pollutant dispersal. Utility line projects will most likely disturb more than one acre of land and be required to prepare a Stormwater Pollution Prevention Plan (SWPPP) to manage site erosion and potential spills during the construction process. The preserve manager should be certain that a SWPPP is prepared and strictly followed during the construction period until the disturbed areas are vegetated.

Properties bought by the City of Austin for the Balcones Canyonlands Preserve have undergone at least a Phase I environmental site assessment and cleanup of historical site contamination. Potential sources of water quality contamination have generally been remediated by the seller.

2.3.3 Use of Pesticides by Preserve Managers

Preserve land managers should use appropriate caution when planning to use herbicides for the suppression of nuisance plants and other pesticides for the selective control of insect or animal pests. Use of any pesticide along watercourses (flowing or intermittent), within floodplain zones, or even in isolated wetlands necessitates a thorough understanding of the chemical being used, its mode of action, potential damage to non target species, and other restrictions on usage. Some sensitive waterways, such as Barton Creek, have additional restrictions such as pesticide-free buffer zones that must be recognized by the land manager considering pesticide use as part of their land management practices.

Planning for pest control should use an Integrated Pest Management approach. When the use of hazardous chemicals is indicated, appropriate procedures should be closely followed to avoid incidental damage to offsite plants and animals, including humans. Field applicators should be trained and licensed by the Texas Department of Agriculture or the Structural Pest Control Board or operate under the close supervision of a licensed applicator. Land managers should establish an offsite location for the safe storage, mixing, and disposal of pesticides and wear protective clothing whenever handling hazardous chemical. Accidents happen that can affect water quality; even minor spills should be addressed quickly using proper hazardous material cleanup procedures.

Based on prior experience, the following guidelines are recommended:

(1) Pesticide applicators should be licensed by the Texas Department of Agriculture or the Structural Pest Control Board.
(2) Glyphosate (Round-up a) is a chemical of choice for most exotics during their growing season. Imazypr (Arsenal a) is a second choice for exotics not effectively controlled by Glyphosate.
(3) “Foliar spray” or “broadcast on soil” or “basal bark” (spraying the lower 18” inches of the trunk) applications are not recommended except as a last resort.
(4) Use direct spray into fresh cuts made into the cambium layer in the trunks of targeted trees or onto freshly cut stumps. Cuts should be sprayed within fifteen minutes after cutting.
(5) Applicators should be extremely cautious about not allowing spray to run down the sides onto the ground.
(6) Where physically possible, use HAND and HAND TOOL REMOVAL of seedlings and small saplings rather than pesticides.
(7) Follow the “Grow Green Guidelines” prepared by the City of Austin and the Texas Cooperative Extension Service and now adopted by LCRA.

3.0 SELECTING APPROPRIATE BEST MANAGEMENT PRACTICES

The City of Austin and the Lower Colorado River Authority have been in the forefront of water quality research and have developed their own Ordinances and technical manuals to provide direction in water quality management. Preserve managers should seek advice from local agencies to determine the best current management practices for each project.

The preserve manager must select best management practices that:

- manage pollutants,
- fit into the existing drainage system hydrology,
- blend with the natural environment,
- are safe and easy to maintain,
- are cost-effective to implement, and
- do not adversely affect the listed species or species of concern.

4.0 WATER RELATED ISSUES FOR THE PRESERVE MANAGER

In managing preserve lands adjacent to an urban setting, a preserve manager must be aware of the potential benefits the preserve offers to the local water resources. Local watercourses and lakes are important quality of life issues in central Texas, where they provide a high quality water supply, sustain aquatic life and support substantial recreation. Water quality protection is a key goal for the Balcones Canyonlands Preserve, and effective management will help protect this vital resource.

4.1 Managing Surface Erosion

In many portions of the Preserve, exposed soil surfaces on modified slopes and unimproved roadway networks are experiencing continued erosion and soil loss that may require immediate management attention. Even un-maintained trails that support public access (both approved and illicit) are in poor condition and must be included in an inventory of candidate projects.

Many of the components of the BCP system were formerly used for livestock grazing and “cedar chopping”, activities that often resulted in soil loss. Managers may find thin soils and exposed limestone substrates on flat upland areas that cannot generate enough vegetative cover to prevent continuing soil loss. Sedimentation areas, such as the base of slopes and watercourse floodplains, may have soil conditions that are conducive to better plant growth and diversity.

Besides land surface disturbances caused by past agricultural practices, many of the preserve tracts exhibit varying degrees of prior clearing for site development. Restoring these scars on existing preserve tracts and ones to be acquired in the future must be a major emphasis for preserve managers.

4.1.1 Preventing Soil Movement

The City of Austin and LCRA have developed technical manuals for use by the development industry. The manuals illustrate many effective mechanisms for preventing soil movement to protect nearby streams from adverse water quality effects. There are also other valuable manuals describing the universe of low-tech water quality protections from the Texas Commission on Environmental Quality, the U.S. Environmental Protection Agency, the Natural Resource Conservation Service and National Park Service.

4.1.2 Revegetation

The revegetation of preserve sites for water quality purposes can also have biological benefits if the planting mix includes both climax grasses and woody vegetation. Seeds of numerous native plant species are commercially available as well as potted specimens of typical hill country woody vegetation. Depending on the local site and soil conditions, seeds can be dispersed directly on the surface or, to increase germination success, applied as part of a hydro-mulch mixture, planted within biodegradable mats or surface mulches, or provided as established sod. Trees and woody shrubs can be planted as bare root stock during the colder months and as container plants at other times of the year. Guidelines for the planting of many native species have already been established within the City of Austin Environmental Criteria Manual.

4.1.3 Mulch

The use of mulch has become a mainstay of central Texas gardening and landscaping practice due to the high seasonal variability in soil moisture here. Mulch maintains soil moisture, prevents erosion of topsoil and reduces competition for slower-growing native species by fast-growing exotic invaders. Mulch can be produced onsite during hydro axing or by processing trees through mechanical vegetation grinders. Ground juniper mulch degrades slowly like cypress and other hardwood mulches, which is a benefit when used in revegetation. However, juniper mulch can significantly limit the growth of native grasses. Over the long-term, mulch has more value as a soil conditioner than as a nutrient. It is extremely valuable on thin eroding soils as a low-tech flow diffuser that slows sheet flow and promotes localized sedimentation which provides a good base for revegetation efforts.

4.1.4 Erosion Control Materials

During the period from initial vegetation removal through re-establishment of adequate grass protection, temporary erosion control materials may be used to protect the exposed soil from the erosive effects of wind and rainfall. The use of silt fences composed of geotextile fabric supported by metal stakes and mesh fencing is the practice of choice in central Texas. Silt fence fabric can be supported in a variety of shapes: linear rolls or tubes, pyramids and walls. The fence must be able to prevent overtopping of flow or undercutting to maintain its effectiveness as a water quality best management practice. These practices may not be suitable for all vegetation clearing projects in the preserve system. Preserve managers should use best practices while still achieving the management goal.

4.1.5 Rock Berms

Uniform overland flow during rainfall events has limited velocity to erode topsoil, but runoff accumulating in natural drainage-ways has the potential force to dislodge and transport solids. On sites exhibiting rill erosion or minor surface channels, water velocities can be diminished by placing rock diffusers perpendicular to the flow path. Water backs up behind piles of rocks allowing suspended material to settle. The rock berms should be placed in shape of a V with the point of the V placed downstream.

4.2 Managing Channel Erosion

The rapid urbanization of upland areas in key preserve watersheds (Bull Creek, Barton Creek, Lake Austin and Lake Travis) increases stormwater runoff, resulting in more frequent flooding, higher in-stream velocities, accelerated channel erosion and degraded water quality conditions. Stream segments crossing preserve lands may exhibit erosion problems along channel banks, loss of riparian trees that are undermined and toppled by the new flow regime, and piles of woody debris and trash accumulating along the channel and floodplain.

Routine inspection of drainage-ways is important to prevent emerging problems from becoming serious. A small erosion problem can grow after a major storm event and a downed tree can generate localized erosion by diverting flows into banks. Debris accumulation can divert flows or build-up against trees in the riparian corridor, pushing them over during larger flow events. Periodic maintenance can be performed in any season; however, during the winter when leaves are absent, access may be easier. Channel work should be minimized and include input from an individual experienced in stream dynamics and natural channel design. If channel work must be performed, this should occur during the summer to promote rapid construction in the typical “dry season”.

4.2.1 Armoring

When severe erosion develops along channel banks and along the outside bend of channels, further erosion can be limited by armoring or placement of resistant materials, i.e., rocks or boulders, against the bank to be protected. These heavy materials must extend from the predicted scour depth below the channel bottom to the height reached by the largest annual storm event.

4.2.2 Biorevetment and Natural Channel Design

Biorevetment is the practice of using living trees, rocks and riparian vegetation to protect streambanks from erosion. Banks may have to be contoured, armored with rocks, and vegetation placed strategically to anchor the protection. After plants become established, the area closely resembles other natural vegetated streambanks in the area. Biorevetment provides a more natural drainage channel appearance, which also provides useable aquatic and riparian zone habitat. Natural channel design concepts should be used before a biorevetment project is planned to ensure that scour, sediment load and hydraulic issues are properly managed.

4.2.3 Channel Modifications

In channels experiencing high velocities, substantial downstream bedload transport and steep bank erosion, it may be necessary to lessen the stream gradient by modifying the potentially unstable channel. Before performing a channel modification project, a natural channel design should be prepared to properly set the channel bottom slope, width, sediment discharge, bank height and other parameters. Construction of channel modifications without considering these parameters can result in significant channel degradation and other habitat problems.

4.2.4 Removal of Flow Obstructions

Natural channel obstructions, such as woody debris piles, tree root balls and boulders, may be diverting flows and creating localized erosion problems. Removal of such obstructions from the channel may require the use of heavy equipment, but the benefits may be worthwhile for proper stream function.

Manmade obstructions may also require periodic maintenance by the owner to prevent failures. Pipeline crossings, wastewater lines and manholes within the stream channel may create local hydraulic, stream erosion and water quality problems that are beyond the capability of the preserve manager to repair.

Whenever such problems are identified, managers should contact the appropriate infrastructure entity owning the easement to remediate the situation.

4.3 Managing Runoff from Neighboring Development

Preserve managers need to be aware of drainage from adjacent development. Storm drains, roadway drainage and outlets from drainage facilities may discharge stormwater runoff into natural watercourses and swales that cross preserve lands. Trash deposition, water quality deterioration and localized erosion problems may result from runoff from neighboring property. In most cases, the preserve manager can work with the upstream property owners to resolve the drainage issues. This approach should be the first option to repair preserve problems.

4.4 Mitigating On-Site Construction Impacts

Some areas of preserve tracts may require clearing, excavation and soil disturbance during management practices. Managers should expect to follow all relevant rules and ordinances regarding projects. If management objectives will disturb more than one acre of land collectively, the preserve must develop a Stormwater Pollution Prevention Plan in accordance with the Texas Commission of Environmental Quality requirements. Appropriate permits should be obtained, temporary erosion controls set up and maintained, and final site restoration completed on schedule. Plans for new land management projects should also be identified in Tier III tract management plans for the upcoming years.

Managers should be aware that utility providers and capital projects of covered preserve partners may proceed under the guidelines approved by the U.S. Fish and Wildlife Service. Such construction may proceed only in existing corridors, proposed new corridors designated in the infrastructure agreement, or at identified facilities.

4.5 Minimizing Effects of Trails and Public Access

The construction of new trails, fire breaks and access roadways may be necessary to facilitate management and use of preserve units. However, existing networks of hiking and biking trails, jeep paths and unimproved roads should also be used to achieve similar objectives. Unneeded segments of trails and roads should be closed and restored to resemble the natural surroundings. In some cases, compacted soils that may act like impervious cover may have to be tilled and exposed rock surfaces covered with soil to allow revegetation to occur.

Minor drainage improvements may be necessary to prevent erosion of trails on slopes. Water bars or diversions that direct runoff away from the trail or road will minimize future erosion problems. When vehicle traffic is involved, waterway crossings may require culvert drains to divert flow underneath and prevent tire ruts and generation of suspended sediment. Hillside seeps that flow onto trails and roads may require a French drain-type system to collect subsurface flow and divert it underneath the path to minimize surface ruts and mud dispersal.

4.6 Minimizing Karst Habitat Effects

Maintaining the existing hydrologic and water quality regimes that affect BCP caves and associated karst terrain is essential to providing the appropriate humidity and subsurface flow into caves. Appropriate protection strategies for karst water quality management starts with proper management of surface runoff and subsurface hydrogeology identified through an onsite investigation. Excessive diversion of surface flows through diking or berming should be avoided near the cave mouth to prevent caves from drying out and losing protected species. Impoundments and other surface water detention areas must be located outside of the areas that contribute significantly to recharge of karst features.

Runoff from roads and other nearby impervious cover must not flow into karst features. If residential development is close, a homeowner outreach program should be implemented that alerts the landowner to the sensitivity of karst features and informs them of appropriate integrated pest management strategies, fertilization rates, wastewater disposal options and contaminant spill response. Fire ant control using boiling water and nontoxic baits should be practiced by personnel maintaining designated caves.

4.7 Research Uses

Research use activities include those activities that gather and interpret site-specific data in a way that improves understanding of the ecology of preserve species, plant communities, and aquatic and subterranean environments. Research will be focused on topics that are directed toward management goals of permanently conserving the listed species and species of concern. Such activities will be coordinated through the appropriate BCP Partner. Research related to endangered species must have approval from the U.S. Fish and Wildlife Service. Additionally, the BCP Partners policy is that anyone conducting research on BCP tracts will have state and federal authorization for this research work. The BCP Partner may refer such research proposals to the Scientific Advisory Committee (SAC) for review and comment. Any and all research conducted on BCP properties should be made available to the land manager and subsequently to other BCP Partners and the SAC.

5.0 HOW TO GET STARTED

5.1 Conduct On-Site Drainage Assessment

Preserve managers seeking to improve water quality conditions on their properties will need to conduct a preliminary drainage assessment. Using an aerial photograph and/or topographic map (USGS or other topographic map source), each tributary and stream segment should be walked in its entirety and significant channel features (both natural and manmade) noted. Of particular interest are springs, eroded banks, obstructions, woody debris accumulations, riparian trees capable of being undermined by high flows, discharges of suspect quality (surface flow or pipe discharges), storm drain outlets, impoundments, waterfalls, dams and piles of dumped trash. Precise location for all features should be provided.

While the tour of onsite watercourses may be easiest during the winter months when foliage is not present, a similar site investigation during the rainy season may show a different wet weather perspective. Turbid discharges from tributaries can help pinpoint active erosion areas while water quality problems such as oil sheens and discolored water are other visual clues to nonpoint-source pollution.

5.2 Problem Identification and Characterization

Once the field survey is complete, the preserve manager should identify the location and magnitude of observed features and problems. If necessary, water quality monitoring can be undertaken using portable test kits for screening of suspected constituents, or arrangements can be made for stormwater investigators to undertake the monitoring. Considerable expertise is required to properly collect, handle and analyze wet weather water samples, and it is expensive to have the samples processed.

5.3 Problem Correction

Once problems of channel erosion or water contamination are identified, efforts should be made to quickly remedy the situation. If the problem requires manpower and equipment not currently on hand, cooperative arrangements with other entities performing routine drainage maintenance should be arranged. The magnitude of an erosion problem can grow tremendously after a single runoff event.

Maintenance using regular crews or cleanups using volunteer assistance may be useful in preventing observed problems from becoming worse. However, when emergency spill response is needed to prevent toxic contamination of a watercourse, spring, or cave, the preserve manager needs to contact other water quality professionals as soon as possible.

5.4 Long-Term Solution Planning and Interim Measures

Managers should implement interim measures to prevent an observed problem from worsening. At the same time, managers should seek input on design and funding to develop the long-term preserve management plan.

6.0 TECHNICAL RESOURCES

Preserve managers should be aware that the Austin area is recognized nationally as a leader in stormwater technology and water quality research in nonpoint-source pollution. There are a considerable number of recognized experts and local practitioners that can be contacted for advice and assistance on water resource issues. There are many technical reports and guidance documents available from these individuals or specialty libraries at the City's Watershed Protection and Development Review Department, Lower Colorado River Authority, and the Texas Commission on Environmental Quality.

- Lower Colorado River Authority Authority, Water Resource Protection Department (512-473-3200) http://www.lcra.org/water/watershedmanagement.html
- Texas Commission on Environmental Quality, (512-239-1000) http://www.tceq.state.tx.us/nav/eq/eq_water.html
- Natural Resources Conservation Service, (254-742-9800) http://www.txnrcs.usda.gov/programs/watersheds/index.html
- City of Austin Watershed Protection and Development Review Department (512-974-2550) http://www.ci.austin.tx.us/watershed/waterq.html

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