Texas Water Development Board

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April 19, 2016

Mr. C.E. Williams, Presiding Officer, Water Conservation Advisory Council
P.O. Box 637
White Deer, TX 79097

Re: Update to Brush Control/Management Best Management Practice

Dear Mr. Williams:

On August 26, 2013, the Water Conservation Advisory Council (Council) voted to give final Council approval to submit to the Texas Water Development Board (TWDB) updates made to five agricultural best management practices (BMPs). Texas Water Code §10.010 states that the council shall "monitor new technologies for possible inclusion by the board as best management practices in the best management practices guide developed by the water conservation implementation task force".

Internal procedures prior to posting updated BMPs on the TWDB website require approval by the Deputy Executive Administrator of Water Science and Conservation. Four of the updated BMPs (Contour Farming, Conversion of Supplemental Irrigated Farmland, Furrow Dikes, and Land Leveling) were approved by TWDB and posted to the TWDB's "Best Management Practices for Agricultural Water Users" webpage in September of 2013.

TWDB staff reviewed the proposed revisions to the Brush Control/Management BMP and do not recommend approving it in its current form. Included herein are three attachments for your reference:

Attachment 1: Current Brush Control/Management BMP;
Attachment 2: Proposed Brush Control/Management BMP, as submitted by the Council; and
Attachment 3: TWDB staff comments on the Council's proposed revisions to the BMP.

If the Council chooses to pursue updating the Brush Control/Management best management practice, please consider revising the document based on the comments provided.

Sincerely,

Robert E. Mace, Ph.D., P.G.
Deputy Executive Administrator, Water Science & Conservation

c: Jay Bragg, Chair of the Agricultural Workgroup of the Council
Mindy Conyers, Council support staff

Our Mission

To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas

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Attachment 1

Current Brush Control/Management BMP

posted online at http://www.twdb.texas.gov/conservation/BMPs/Ag/doc/4.1.pdf

4.1 Brush Control/Management

Applicability

This BMP, where appropriately based on regional factors and site location characteristics, is a potential means of reducing evapotranspiration by brush species (such as ash juniper, mesquite, and salt cedar) in order to improve soil conservation, water quality and water yield. It is intended for use by agricultural producers in riparian areas or on upland areas (rangeland, native or naturalized pasture, pasture, and hay lands) where sufficient rainfall or water exists as determined by a feasibility study prepared by the Natural Resource Conservation Service ("NRCS"), the Texas State Soil and Water Conservation Board ("TSSWCB"), or the project manager. This BMP is intended for use with governmental cost-share programs.

Description

Brush Control/Management includes the removal, reduction or manipulation of non-herbaceous plants by mechanical methods, chemical treatment, biological methods, prescribed burning, or combinations of these methods to achieve the desired plant community. Prescribed grazing shall be applied to ensure desired response from the above treatments. Chemical treatments should be applied in accordance with NRCS and TSSWCB recommendations and in a manner consistent with the product label so as to protect water quality and non-target plant or animal species.

To be considered a water conservation BMP a Brush Control/Management project should:

1) Demonstrate water savings. The project should be able to provide probable and measurable water benefits, and the project manager should establish reasonable hydrologic goals considering local conditions before implementation.
2) Be cost-effective.
3) Be compatible with the natural soil profile and conditions. Excessive removal of brush or removal of brush in areas that have thin soil profiles or steep slopes can lead to severe erosion. This can negatively impact water quality downstream and remove important soil microorganisms from the site.
4) Be compatible with natural vegetation. Before removal of brush, a project manager should identify the vegetation appropriate for restoration of the area. A manager should assess whether or not the restoration can occur naturally or if it needs to be augmented with planting.
5) Maintain or promote affected wildlife. A properly designed brush management project can provide habitats for a variety of wildlife species, including endangered species.
6) Incorporate an effective maintenance plan. Maintenance of the brush management area is critical to ensure continuance of water production.

Implementation

A Brush Control/Management plan should be developed for each pasture, field, or management area where Brush Control/Management will be applied. The Brush Control/Management plan should include the following information:

1) Brush canopy or species count and percent canopy or number of target plants per acre.
2) Maps or drawings showing areas to be treated and areas to be left undisturbed.
3) For mechanical treatment methods:
    a. Types of equipment to be used
    b. Dates of treatment
    c. Equipment operating instructions
    d. Techniques or procedures to be followed
4) For chemical methods:
    a. Herbicide name
    b. Rate of application or spray volumes
    c. Acceptable dates of application
    d. Mixing instructions (if applicable)
    e. Application techniques, timing considerations or other factors that must be considered to ensure safe, effective application, including available manufacturer's literature and/or instructions and NRCS or TSSWCD guidelines. The chemical will be used in a manner consistent with the product label so as to protect water quality and non-target plant or animal species.
5) For biological treatment methods:
    a. Kind of biological agent or grazing animal to be used
    b. Timing, duration and intensity of grazing or browsing
    c. Desired degree of grazing or browsing used for control/management of the target species
    d. Special precautions or requirements when using insects or plants as control/management agents

Brush Control/Management will be planned and applied in a manner to meet wildlife habitat requirements and consider wildlife concerns.

Schedule

Brush Control/Management projects are typically multi-year in scope to achieve initial removal levels and then require follow-up treatments every three to five years. A Brush Control/Management project can be scheduled over several years to reduce the cost of the project.

Scope

Brush Control/Management for water conservation is typically applicable to non-irrigated land in areas with sufficient rainfall, as determined by feasibility studies, for brush to become established and to present a problem or in riparian areas (land adjacent to water courses).

Documentation

To document this BMP, plans and specifications for each field scheduled for Brush Control/Management will be prepared and may include narratives, maps, and/or drawings. These documents may contain the following items:

1) Maps or aerial photographs of the field prior to brush treatment;
2) Maps or aerial photographs of the field one or more years after brush treatment;
3) Method used for Brush Control/Management and receipts for materials or contract work;
4) For chemical treatments, records should be kept of specific names and types of chemicals used, application rates, and total amounts used;
5) Estimates of the number of target plants per acre or percent canopy cover prior to treatment; and
6) Estimates of the number of target plants per acre or percent canopy cover one or more years after treatment.

Determination of Water Savings

Accurate determination of the quantity of water salvaged by Brush Control/Management requires expert analysis. In general, control/management of salt cedar in riparian areas has the potential to salvage significantly more water per acre treated than control/management of brush on uplands. However, there is significantly more land in Texas with brush infestation in upland areas as compared to riparian areas. The NRCS in cooperation with the Texas Agricultural Experiment Station through the TSSWCB reported that expected water yields for various levels of control/management of brush in upland areas range from 0.34 to 0.55 acre-feet per year per acre (net).[1] It was estimated that the annual amount of water salvaged from salt cedar control/management in riparian areas along the Pecos River in West Texas at 5 to 8 acre-feet per acre treated.[2]

Cost-Effectiveness Considerations

Texas A&M University at College Station, Department of Agricultural Economics, found that "present values of total upland brush control costs per acre range between $35.57 and $203.17" for a time period of ten years, and the cost of "added water" between $14.83 and $35.41 per acre-foot averaged for the same time period. The United States Natural Resources Conservation Service Environmental Quality Incentives Program for Texas provides partial funding for eligible mechanical brush control and management projects at rates per acre based on the "established county average cost of the practice". The county average costs range from $150 to $200. It was reported that the cost for chemical treatment of salt cedars on the Pecos River in West Texas using aerial application of between $183 and $189 per acre and a resulting cost for the salvaged water of $7.90 to $8.22 per acre-foot using a conservative estimate of the

effective life of the treatment of 3 years.[2] The cost of salvaged water per acre-foot in other locations may be significantly different.

References for Additional Information

1. *Brush/Water Yield Feasibility Studies II"*, USDA Natural Resources Conservation Office, Texas
2. Agricultural Experiment Station, USDA- Agricultural Research Service. Bednarz, S., *et al.*, no date.
3. *The Pecos River Ecosystem Progress Report*, Texas Cooperative Extension Service, http://farwest.tamu.edu/rangemgt/Saltcedar/2002_Progress_Reports.pdf, Hart, Charles, 2002.
4. *Assessing the Economic Feasibility of Brush Control to Enhance Off-Site Water Yield*, Department of Agricultural Economics, Texas A&M University, College Station. Dumke, L, *et al.*, no date.
5. *Conservation Practice Standard, Brush Management*, Natural Resources Conservation Service, April 1995, Code 314.
6. *Brush Management, "Myths and Facts",* Environmental Defense, 2003, 17 p. Ball, Laura and Melinda Taylor.
7. Technical Resources, USDA-NRCS, www.nrcs,usda.gov/technical

Attachment 2

Proposed Brush Control/Management BMP, as submitted by the Council

4.1 Brush Control/Management

Applicability

This Best Management Practice, where appropriately based on regional factors and site location characteristics, is a potential means of reducing evapotranspiration by brush species (such as Ashe juniper, mesquite, and salt cedar) in order to enhance water yield, improve soil conservation, protect water quality, manage invasive species, and allow for improved native vegetation.

This practice may be used by landowners in riparian areas or on upland areas (rangeland, pastureland, hay lands) to improve forage for livestock and/or wildlife. This Best Management Practice can also be used with governmental financial incentive programs where sufficient rainfall or water exists as determined by a feasibility study prepared in accordance with the Texas State Soil and Water Conservation Board Water Supply Enhancement Program policies.

Description

Brush Control/Management project include the removal, reduction, or manipulation of non-herbaceous plants by mechanical methods, chemical treatment, biological control, prescribed burning, or combinations of these methods to achieve the desired plant community. Prescribed grazing may be applied to ensure desired response from the above treatments. Chemical treatments should be applied in accordance with U.S. Department of Agriculture-Natural Resources Conservation Service and Texas State Soil and Water Conservation Board recommendations and in a manner consistent with the product label so as to protect water quality and non-target plant and animal species.

To be considered water conservation Best Management Practice, a Brush Control/Management project should:

1. Be compatible with the natural soil profile and conditions. Excessive removal of brush or removal of brush in areas that have thin soil profiles or steep slopes can lead to severe erosion which can negatively impact water quality downstream and remove important soil microorganisms from the site.
2. Be compatible with natural vegetation. Before removal of brush, the vegetation appropriate for restoration of the area should be identified, and whether or not the restoration can occur naturally or if augmenting with planting should be assessed.
3. Maintain or promote affected wildlife. A properly designed brush control/management project can provide habitat for a variety of wildlife species, including endangered species.
4. Incorporate an effective maintenance plan. Maintenance of the brush control/management area is critical to ensure continuance of water yield enhancement.

Brush control programs conducted specifically to increase water yield for offsite uses should:

1. Demonstrate water savings. The project should be able to provide probable and measurable water yield benefits, and reasonable hydrologic goals that incorporate and consider existing local conditions should be established before implementation.
2. Be cost-effective in terms of water yield relative to cost of water that could provide for the purpose for which the project is proposed or designed.

Implementation

A Brush Control/Management plan should be developed for each pasture, field, or management area where Brush Control/Management will be applied. The Brush Control/Management plan should include the following:

1. Existing brush canopy cover prior to treatment and targeted percent canopy cover after brush control/management.
2. Maps or drawings showing areas to be treated and areas to be left undisturbed.
3. For mechanical methods:
    a. Types of equipment to be used
    b. Dates of treatment
    c. Equipment operating instructions
    d. Techniques or procedures to be followed
4. For chemical treatment:
    a. Herbicide name
    b. Rate of application or spray volumes
    c. Acceptable dates of application
    d. Mixing instructions (if applicable)
    e. Application techniques, timing considerations, or other factors that must be considered to ensure safe, effective application, including available manufacturer's literature and/or instructions and United States Department of Agriculture-Natural Resources Conservation Service or Texas State Soil and Water Conservation Board guidelines. The chemical will be used in a manner consistent with the product label so as to protect water quality and non-target plant and animal species.
5. For biological control methods:
    a. Type of biological agent or grazing animal to be used
    b. Timing, duration, and intensity of grazing or browsing
    c. Desired degree of grazing or browsing used to achieve control/management of the target species
    d. Special precautions or requirements when using insects or plants as control/management agents

Brush Control/Management will be planned and applied in a manner to meet wildlife habitat requirements and consider wildlife concerns.

Scope and Schedule

Brush Control/Management for water conservation is typically applicable to (1) non-irrigated land in areas with sufficient rainfall, as determined by feasibility studies[1], where brush has become established and presents a problem or (2) in riparian areas (land adjacent to waterbodies).

Brush Control/Management projects are typically multi-year in scope to achieve initial removal levels and require follow-up treatments every three to five years (depending on the brush species being controlled). A Brush Control/Management project can be scheduled over several years.

Measuring Implementation and Determining of Water Savings

To measure implementation of this Best Management Practice, plans and specifications for each field scheduled for Brush Control/Management will be prepared and may include narratives, maps, and/or drawings. These documents should contain the following items:

1. Maps or aerial photographs of the field prior to brush treatment;
2. Maps or aerial photographs of the field one or more years after brush treatment;
3. Method used for Brush Control/Management and receipts for materials or contract work;
4. For chemical treatments, records should be kept of specific names and types of chemicals used, application rates, and total amounts used;
5. Estimates of the percent canopy cover prior to treatment; and
6. Estimates of the percent canopy cover one or more years after treatment.

Accurate determination of the quantity of salvaged water by Brush Control/Management requires expert analysis if participating in government cost-share programs such as the Texas State Soil and Water Conservation Board's Water Supply Enhancement Program. In general, control/management of salt cedar in riparian areas has the potential to salvage significantly more water per acre treated than control/management of brush on uplands. However, significantly more land in Texas with brush infestation exists in upland areas as compared to riparian areas. The U.S. Department of Agriculture-Natural Resources Conservation Service in cooperation with Texas A&M AgriLife Research through the Texas State Soil and Water Conservation Board reported that expected water yields for various levels of control/management of brush (for example, mesquite, Ashe juniper) in upland areas range from 0.34 to 0.55 acre-feet per year per acre (net).[1] It was estimated that the annual amount of salvaged water from salt cedar control/management in riparian areas along the Pecos River in West Texas was 0.5 to 1.0 acre-feet per acre treated.[2]

Cost-Effectiveness Considerations

Texas A&M University found "present values of total upland brush control costs per acre range between $35.57 and $203.17" for a time period of 10 years and the cost of "added water" between $14.83 and $35.41 per acre-foot averaged for the same time period.[3] The Natural

Resources Conservation Service Environmental Quality Incentives Program provides partial funding for eligible mechanical brush control and management projects. The Texas State Soil and Water Conservation Board Watershed Stewardship Education Program provides partial funding for a number of brush control/management projects. It was reported that the cost for chemical treatment of salt cedar on the Pecos River in West Texas using aerial application was between $183 and $189 per acre.[4] A resulting cost for the salvaged water, based on these treatment costs and the water yields of 0.5 to 1.0 acre-feet per acre treated per year, would range from $61 to $126 per acre-foot using a conservative estimate of the effective life of the treatment of three years. The cost of salvaged water per acre-foot in other locations may be significantly different.

References for Additional Information

1. Thirteen (13) *Brush Control and Water Yield Feasibility Studies* conducted on various watersheds. Performed by multiple entities for the TSSWCB WSEP. Published between 1999 and 2012. Accessible from http://www.tsswcb.texas.gov/reports#feasibilitystudy.
2. Sheng, Z., A.K. McDonald, C. Hart, W. Hatler, and J. Villalobos. 2007. *Quantity and Fate of Water Salvage as a Result of Saltcedar Control on the Pecos River in Texas*. Texas Water Resources Institute, AgriLife Research. TR-304.
3. Dumke, L., B. Maxwell, and J.R. Conner. 2003. *Assessing the Economic Feasibility of Brush Control to Enhance Off-Site Water Yield*, Department of Agricultural Economics, Texas A&M University, College Station. In Bednarz, S.T., et al. Brush Management / Water Yield Feasibility Study for Four Watersheds in Texas (Chapter 2). Texas Water Resources Institute, AgriLife Research. TR-207.
4. *The Pecos River Ecosystem Progress Report*, Texas AgriLife Extension Service, http://pecosbasin.tamu.edu/media/1932/2002_progress_reports.pdf, Hart, Charles, 2002.
5. *Conservation Practice Standard for Brush Management*, Code 314. USDA, NRCS Texas. January 2013.
6. *Brush Management - Myths and Facts*, Environmental Defense, 2003, 17 p., Ball, L. and M. Taylor.
7. Archer, S.R., K.W. Davies, T.E. Fulbright, K.C. McDaniel, B.P. Wilcox, and K.I. Predick. 2011. *Brush Management as a Rangeland Conservation Strategy: A Critical Evaluation*. In Briske, D.D. [ed]. *Conservation Benefits of Rangeland Practices: Assessment, Recommendations, and Knowledge Gaps* (Chapter 3). USDA, NRCS.
8. Jones, C.A., and L. Gregory. 2008. *Effects of Brush Management on Water Resources*. Texas Water Resources Institute, AgriLife Research. TR-338.
9. Saleh, A., H. Wu, C.S. Brown, F.M. Teagarden, S.M. McWilliams, L.M. Hauck, and J.S. Millican. 2009. *Effect of brush control on evapotranspiration in the North Concho River watershed using the eddy covariance technique*. J. Soil and Water Conserv. 64(5): 336-349.
10. Banta, J.R., and Slattery, R.N., 2012, *Effects of brush management on the hydrologic budget and water quality in and adjacent to Honey Creek State Natural Area, Comal County, Texas*, 2001–10: U.S. Geological Survey Fact Sheet 2012–3097, 4 p.

Determination of the Impact on Other Resources

The conservation practice physical effects document from the U.S. Department of Agriculture - Natural Resources Conservation Service provides guidance on how the application of that practice (that is, brush control/management) will affect the resources (soil, water, air, plants, animals) and the concerns associated with each of those resources.

In general, Brush Control/Management results in increased herbaceous land cover which reduces soil erosion and sedimentation of water bodies. Increased infiltration of water may improve aquifer recharge and base flow in streams. Increased herbaceous land cover generally improves rangeland quality and plant diversity. Wildlife habitat may be improved by providing both forage and cover.

Attachment 3

TWDB staff comments on the Council's proposed revisions to the BMP

1. Consider including in section 1 (*Applicability*) a clear statement on the specific types of water user groups that could potentially benefit from this BMP.
2. In section 2, a description should be included of the factors that a land owner must consider when determining if brush control/management is a feasible and appropriate choice for their property and their specific water conservation goals. Factors can include rainfall frequency, intensity, and duration; watershed and vegetative characteristics; local soil and underlying geology; and slope and aspect.
3. Consider rephrasing throughout to focus specifically on the water conservation benefits, if any, of brush control/management. Other potential benefits can be described in section 8 (*Determination of the Impact on Other Resources*)
4. The second half of section 2 (*Description*) borrows heavily Ball and Taylor's 2003 report (#6 in the reference list). However, the report is not referenced in the text. Please reference it wherever applicable in the text. Also, key elements of the 'recommendations', as they are referred to in the Ball and Taylor report, have been
    a. omitted (for example, "When a landowner has determined that it is appropriate to manage brush, whether to increase water yield or to improve wildlife habitat, he/she should follow the following guidelines.")
    b. or presented in a way that appears not to accurately portray the recommendations of the authors. For example,
        i. (Ball and Taylor, 2003) "A responsible brush control project should:
        1. Demonstrate effectiveness. Projects intended to increase water yield should be able to provide predictable and measureable water benefits. Before implementation, the project developer should establish realistic hydrologic goals considering local conditions. The project should clearly establish a system to measure its efficiency including a hydrologic baseline, monitoring stations, and evaluation of results."
        ii. (revised BMP, section 2) "To be considered water conservation Best Management Practice, a Brush Control/Management project should:", and then "Brush control programs conducted specifically to increase water yield for offsite uses should:
        1. Demonstrate water savings. The project should be able to provide probable and measureable water yield benefits, and reasonable hydrologic goals that incorporate and consider existing local conditions should be established before implementation."

5. Section 3 (*Implementation*) begins with the assumption that brush control/management has been determined to be feasible. However, guidance on how to make such a determination is not presented. Similarly, guidance is not presented for a landowner interested in determining which method (mechanical, chemical, etc.) is most appropriate.
6. Section 4 (*Scope and Schedule*) does not contain a clear scope (indicating the level of implementation necessary to consider the BMP complete) or schedule ("multi-year in scope" plus "follow-up treatments every three to five years" lacks important steps, such as feasibility study and/or pre-planning, and fails to address the importance of vigilant maintenance).
7. Section 5 (*Measuring Implementation and Determining Water Savings*) should provide the reader with directions on how to track progress, how and what kind of data should be collected both before and after a project begins, and how to actually calculate water saved. If no established methods for determining water savings exist in the literature, that should be clearly stated.
   A brief discussion on the difficulty of quantifying such numbers would also be appropriate here, including referencing recent research by Wilcox, McDonald, etc. Estimated water yield numbers included in the revised BMP, without any clarification on the site-specific factors related to those numbers nor the assumptions built into their calculation, can mislead the reader. Consider including a less specific statement describing the range of values observed in various studies, emphasizing again the wide array of considerations and site conditions present in the referenced studies.
8. Consider also including information on the impacts of replacement vegetation, uplands versus riparian considerations, rainfall versus evapotranspiration demand, and other considerations discussed in recent publications.

   Section 6 (*Cost-Effectiveness Considerations*) should provide an overview of the factors that need to be considered when performing an analysis of cost-effectiveness. It might also be the appropriate section to mention potential funding sources for brush control projects.
9. Consider updating section 7 (References for Additional Information) to include a web link for each entry, if available, and to maintain a consistent citation style.