EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Transmission Right-of-Way Steward Accreditation Pilot Audit Report

Arizona Public Service

2013 TECHNICAL REPORT

Transmission Right-of-Way Steward Accreditation Pilot Audit Report

Arizona Public Service

EPRI Project Manager
J. Goodrich-Mahoney

ELECTRIC POWER RESEARCH INSTITUTE

3420 Hillview Avenue
Palo Alto, CA 94304-1338
USA

PO Box 10412
Palo Alto, CA 94303-0813
USA

800.313.3774
650.855.2121

askepri@epri.com

www.epri.com

3002002272
Final Report, October 2013

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

THE FOLLOWING ORGANIZATIONS, UNDER CONTRACT TO EPRI, PREPARED THIS REPORT:

C.A. Nowak Consulting

Energy Initiatives Group, LLC

NOTE

For further information about EPRI, call the EPRI Customer Assistance Center at 800.313.3774 or e-mail askepri@epri.com.

Acknowledgments

The following organizations, under contract to the Electric Power Research Institute (EPRI), prepared this report:

C.A. Nowak Consulting
606 Lake Street
Chittenango, New York 13037

Principal Investigator
C. Nowak

Energy Initiatives Group, LLC
176 Worcester-Providence Turnpike, Suite 102
Sutton, Massachusetts 01590

Principal Investigator
T. Sullivan

This report describes work sponsored by Arizona Public Service, and administered by the Electric Power Research Institute (EPRI), under the auspices of the Right-of-Way Stewardship Council, which is administered by Dovetail Inc. This pilot audit was conducted under the current audit framework and although future reports' framework may vary this audit reflected the full vigor and rigor of the formal accreditation assessment process with results that may be harmonized to the final process at a future date.

This publication is a corporate document that should be cited in the literature in the following manner:

Transmission Right-of-Way Steward Accreditation Pilot Audit Report: Arizona Public Service.
EPRI, Palo Alto, CA: 2013.
3002002272.

Abstract

This report presents the findings of an independent audit conducted by specialists representing the Right-of-Way (ROW) Steward Program. The purpose of the audit was to evaluate the environmental, economic, and social aspects—the sustainability—of Arizona Public Service's (APS's) electric transmission line right-of-way vegetation management and to determine gaps in its sustainable conduct of integrated vegetation management.

Integrated vegetation management, or IVM, is a system for making decisions and applying vegetation management treatments based on a series of components and steps consistent with principles and practices of integrated pest management (IPM). It is used to understand, select, apply, and monitor different types of treatments with the goal of achieving site-specific, ecosystem-sensitive, economically sensible, and socially-responsible treatment outcomes that meet management objectives. The ROW Steward Program is an initiative that grew out of the utility vegetation management industry's commitment to the sustainable practice of IVM. The ROW Steward Program was developed as a means of recognizing excellence in the application and practice of IVM on the North American electric power grid. Accreditation by this independent group is based on receiving a passing score on a set of 10 principles and 32 criteria developed by EPRI.

Keywords
Right-of-Way Steward Program
Integrated vegetation management (IVM)
Integrated pest management (IPM)
Right-of-way

Executive Summary

This report presents the findings of an independent audit conducted by specialists representing the Right-of-Way (ROW) Steward Program. The purpose of the audit was to evaluate the environmental, economic, and social aspects—the sustainability—of Arizona Public Service's (APS's) electric transmission line right-of-way vegetation management and to determine gaps in its sustainable conduct of Integrated Vegetation Management.

Integrated Vegetation Management

Integrated Vegetation Management, or IVM, is a system for making decisions and applying vegetation management treatments consistent with the principles and practices of Integrated Pest Management (IPM). It is used to understand, select, apply, and monitor different types of treatments with the goal of achieving site-specific, ecosystem-sensitive, economically-sensible, and socially-responsible treatment effects that meet management objectives. Choice of vegetation management action is based on effectiveness, environmental impact, site characteristics, safety, security, and socioeconomics. IVM is meant to promote sustainable plant communities that are compatible with the intended use of the site. It uses combinations of treatments (usually chemical and biological) to prevent or control incompatible plants that may pose concerns, including safety, security, access, fire hazard, utility service reliability, emergency restoration, visibility, line-of-sight requirements, regulatory compliance, environmental, or other specific concerns. The key steps of IVM consistent with IPM are: 1) gaining science-based understanding of pest and ecosystem dynamics; 2) setting management objectives and tolerance levels based on institutional requirements and broad stakeholder input; 3) identifying and combining a broad array of treatment options, including biological, chemical, manual, mechanical, cultural, and physical methods, and applying them in concert to produce desired plant communities on a site-specific basis to prevent or control pest problems and produce the desired plant communities; and 4) monitoring the system to determine the effectiveness of treatments in achieving desired plant communities and meeting objectives. Because IVM balances socioeconomic and environmental concerns, it is considered a sustainable endeavor for management of a specific ROW site.

The ROW Steward Program

Building on a decade of research and development work by EPRI, the ROW Steward Program is an initiative that grew out of the utility vegetation management industry's commitment to the sustainable practice of IVM. The ROW Steward Program was developed as a means of independently accrediting right-of-way vegetation management programs for exemplary and sustainable performance of IVM on the North American electric power grid.

Implementing IVM on electric transmission line rights-of-way is complex. A wide array of management components needs to be brought together to fully conduct IVM, including elements from environmental, economic, and social arenas. Other administrative and institutional processes and procedures are needed in order to sustain IVM operations over time. The ROW Steward Technical Requirements identifies the elements of IVM performance that are consistent with recognized principles of sustainable environmental management. The requirements are a full, written accounting of the broad elements of vegetation management principles in line with the American National Standards Institute (ANSI) A300 standards and the companion International Society of Arboriculture Best Management Practices for Integrated Vegetation Management. The requirements consist of a series of criteria and indicators that capture the full breadth of a sustainable IVM program. The Requirements include 10 principles and 32 criteria by EPRI. To be awarded accreditation, an Asset Manager/Owner must receive a passing score on all criteria.

Benefits of ROW Steward Accreditation and Associated Third Party Audit of Electric Transmission Line Vegetation Management Program

Sustainable practice of IVM as defined in the Requirement and as accredited by ROW Steward can produce many benefits for a utility.

Benefit No. 1: Directly reduce treatment cost

IVM emphasizes biological prevention and control methods that can reduce the abundance of undesirable plants (tall-growing trees) and lead to a reduction in treatment efforts over time. Biological and ecological prevention and control are commonly produced by carefully removing undesirable plants while not disturbing desirable, low-growing plants such as shrubs, forbs, and grasses. Often herbicides are most cost effective for this type of treatment compared to other treatments (physical, mechanical, or cultural).

Benefit No. 2: Indirectly reduce treatment cost

Benefit No. 1 emphasizes the short-term (10-20 years) monetary gains to be made from using an IVM approach. In the longer term (>20 years), a wide variety of positive gains can be made for a company using IVM that lead to indirect cost savings. Some of these benefits are listed below, including reduced or minimized regulations (Benefit No. 3) and improved public relations (Benefit No.4).

Benefit No. 3: Improve relations with regulators

Vegetation management on power line corridors has been relatively free of regulations; but that is changing today due to society's growing interest in the broader environment and heightened awareness of the importance of power line corridors, especially in the aftermath of recent, broad-reaching blackouts. As regulations grow and regulators develop strong programmatic interest in power line rights-of-way, those organizations that use IVM on a voluntary basis may have an easier time working with regulations and regulators.

Benefit No. 4: Improve public relations

IVM places strong emphases on engaging publics in planning, conducting, and monitoring vegetation management activities and their outcomes. Positive public relations could lead to reduced lawsuits or time spent rebuilding public confidence lost in various stages and processes of vegetation management.

Benefit No. 5: Maintain elements of institutional memory

Much of the know-how developed in an IVM program resides in the vegetation manager. If he or she leaves a company without documenting the policies, procedures, and practices learned in training and vetted by experience, the next vegetation manager will face inefficiency in time and other resources as she or he "reinvents the wheel." IVM as accredited by ROW Steward includes emphases on documenting key elements of the IVM system.

Benefit No. 6: Ethics and sustainability

Sustainability is a central goal of IVM. Sustainability implies that what we do to the land should not compromise the opportunity of future generations to benefit from the environmental, social, and economic values of the power line corridor and the associated landscapes. Ethically, vegetation management should not compromise such values, including water quality and biodiversity. Environmentally sensitive vegetation management on power line corridors also promotes better relations with regulators and the public. Sustainability is classically framed as a balancing of

environmental, social, and economic concerns so that all three are accounted for in management decision making and operations. The IVM system accredited in the ROW Steward program fully accounts for the environment, along with social and economic structures and sensitivities.

Benefit No. 7: Organizational mission and *esprit de corps*

The process of a ROW Steward audit causes utility vegetation management staff to collectively focus on a core to their work mission: conducting responsible, positive vegetation management. The strengths and weaknesses of the organization's vegetation management work is revealed and clarified via an intense "trial by fire" audit experience that is professional and thought provoking. The process can catalyze a vegetation management team to work together to improve the organization and develop a higher appreciation for the value of their work, thus producing a greater, holistic affect this is centered on stewardship and sustainability. This, then, is another benefit of a ROW Steward Audit – *esprit de corps*: the capacity of members of an organization to strongly believe in a mission or goal, particularly as a result of and in the face of challenge – in this case – the challenge of ROW Stewardship.

Third Party Assessment of Arizona Public Service's Electric Transmission Line Vegetation Management Program

The ROW Steward Requirement was used to assess Arizona Public Service's (APS's) electric transmission line vegetation management program. A third-party, independent, performance standards and certification expert team—Dr. Chris Nowak, and Mr. Tom Sullivan—conducted the audit in concert with the ROW and personnel from APS under the auspices of the ROW Steward Council.

Audit methods

TASK #1 – Introductory and Gap Analysis Conference Calls

The audit process began with a brief introductory phone call on January 23, 2013 to affirm understanding of the ROW Steward Program and the expectations of each of the parties. The call yielded a document request list and possible dates for the field portion of the audit. Participants in the initial call included Dr. Phil Charlton (ROW Steward Program Manager), Mike Neal and Lisa Young (Manager of Forestry and Natural Resource Specialist, APS), and Chris Nowak and Tom Sullivan (ROW Steward Lead Auditor and Auditor). A 2.5-hour conference call was held on February 26, 2013 with the same people and including Jesse Sanchez (Metro Section Leader, APS) to completely review the ROW Steward Requirement with APS personnel and assess whether there are any shortfalls in the

APS vegetation management program. APS provided the audit team with select documentation related to their vegetation management work prior to the conference call; but most of the information used in the gap analysis was provided in summary, verbal form by APS during the call. At the end of the conference call, the Lead Auditor discussed the apparent strengths and weaknesses of APS in performance of IVM and other elements of management related to ROW Steward.

TASK #2 – Document Review and Audit Planning

The audit process continued with a comprehensive review of APS documentation related to management of transmission rights of way. Documentation was provided by APS over the two months leading to the full field audit and was used to plan and prepare for the audit fieldwork, as well as providing a source of information to begin learning about APS. The Lead Auditor completed an initial selection of field sites for visitation during the audit on March 5, 2013. The Lead Auditor and APS identified specific lines and spans within lines over the course of 2 weeks, with a final plan for site visitation completed on March 15th. Logistic planning for the subsequent weeks (travel, lodging, meeting times and places) continued.

TASK #3: Office and Field Site Visits, April 8-12, 2013

An office visit occurred during the morning of Day 1. Audit processes were introduced, principles and criteria were generally reviewed, and select APS staff met. The remainder of the morning and the full afternoon of Day 1 were spent in the Southern and Metro Divisions visiting various rights-of-way. The audit team split and went with separate APS teams. All of Days 2-4 (April 9-11, 2013) was focused on field visits to assess vegetation management performance – one day was spent in the Metro Division, one in the Northeast Division, and one in the Northwest Division. Auditors worked together on Days 2-4. The total number of rights-of-way visited was 25. A debriefing was held the afternoon on Day 5 (April 12th).

TASK #4: Document Gathering and Review, April 14-May 13, 2013

APS presented a series of documents for review by Dr. Nowak and Mr. Sullivan that described various components of the management system, including key vegetation management policies and procedures.

TASK #5: Audit Report (deliverable), first draft to APS on June 11, 2013

An audit report for APS, following the ROW Steward Program format template, was produced based on the third-party audit of APS's vegetation management program. This report features findings associated with each principle (n=10) and criterion (n=32) associated with the performance standard, along with series of highlighted strengths and weaknesses, sets of recommendations for successes, and recommendations and observations for program improvement.

Outcome

APS was found to have favorable performance across all Criteria and Principles. The audit team found APS to have an overall average of 3.96 / 5.00 (79%) across Principles. Principle-level scores ranged from 3.25 to 4.33, with three Principles with scores less than 4.0: Principle 8 (Accounting for Economic & Ecological Effects of Treatments); Principle 9 (Site-Specific Implementation of Treatments); and Principle 10 (Adaptive Management & Monitoring) (Table 1).

The audit team recommends that APS be accredited as a ROW Steward.

APS strengths and weaknesses

APS has been conducting the core elements consistent with the IVM performance standards, with strengths and weaknesses as noted below in Table 1.

Table 1
Findings by Principle via a listing of general strengths and weaknesses.

*A strength is defined as a unique or otherwise "above industry norm" practice. A weakness is defined as a gap that is important for the practice of IVM, with the following signs indicating the degree of weakness: *** major non-conformance with an associated Required Corrective Action (none at present for APS); ** a minor non-conformance with an associated Recommendation; * an observation that if rectified would elevate performance.*

Principle/Subject Area	Strengths	Weaknesses
P1: Commitment and Legal Compliance	High level of awareness and full compliance with the complex of laws and regulations that is above industry norm in complexity	No observed weaknesses
P2: Tenure & Use Rights & Responsibilities	Consistent review of land use rights documents and concomitant provision of opportunity for landowner to dispute these rights during the planning phase of each Project Unauthorized use of ROWs is effectively non-existent. ROWs generally contained only a single, well maintained road for APS crew access, as opposed to multiple roads often present on utility ROWs, indicating respect for the land and compliance with road best management practices (BMPs).	Lack of a written policy and procedure for stakeholder dispute resolution by the ROW Asset Manager and other related APS departments*
P3: Community Relations & Workers' Rights	Outreach to stakeholders Mapping and protection of historic and cultural sites Information about sustainability and APS's vegetation management program are accessibly provided on the corporate website. Hosting and supporting the 10th International Symposium on Environmental concerns in Rights-of-Way Management in October 2012 Long-term relationship with the herbicide contractor creates a high quality job opportunity for contractor employees. Industry leadership in promoting IVM and ROW Stewardship, as evidenced by being the first company to seek ROW Steward accreditation	Incomplete understanding of IVM and ROW Stewardship Principles and Criteria** Corporate environmental policy has not been fully adopted to be a formal part of APS Forestry and Special Programs** Summary of vegetation maintenance activities is short in details **

Table 1 (continued)
Findings by Principle via a listing of general strengths and weaknesses.

Principle/Subject Area	Strengths	Weaknesses
P4: Management Planning	Vegetation Management Manual establishes a formal written vegetation management program. 10-Year Transmission and Distribution Schedule establishes a good record of the ROW Resource asset. Transmission Vegetation Management Plans show improvement over time. Corridor Management Plans show improvement over time.	Relationships among the Vegetation Management Manual, Transmission Vegetation Management Plan, Herbicide Corridor Management Plan, and Project Corridor Management Plans are unclear.** The wildfire risk study is incomplete.* Lack of a policy and process for formal feedback based on results of monitoring**
P5: Understanding Pest & Ecosystem Dynamics	Diverse vegetation management team allows APS to collectively, efficiently, and effectively meet a complex of planning, decision making, and management action needs. Region-leading and ongoing support of extensive field research on the effectiveness of different vegetation management treatments, including different herbicide mixes, to control target plants and promote desirable plants	Training shortfalls for some staff include plant identification, autecology and synecology* Monitoring of IVM efforts are not used to identify research and development opportunities that may enhance program performance related to both environment and socioeconomics.* Herbicide efficacy as affected by herbicide mix and application technique coupled with plant biology and plant community ecology is not being formally researched.* There is a limited formal system of promoting and tracking training and education to improve skills and knowledge of vegetation managers and IVM workers.*

Table 1 (continued)
Findings by Principle via a listing of general strengths and weaknesses.

Principle/Subject Area	Strengths	Weaknesses
P6: Setting Management Objectives & Tolerance Levels	Investment into LiDAR data collection as part of vegetation management decision making, which has led to more consistent maintenance of vegetation in compliance with NERC Clearance 1 and Clearance 2 distances over the last 5 years	Stakeholder engagement is not formally tracked, specifically as related to the development of management objectives as part of the planning process.* Unclear definition of standard clearance prescriptions and management objectives, including definition and application of the wire zone/border zone and lateral zone / sag zone approaches to site-specific management of ROWs** Plant species are not consistently grouped as compatible or incompatible for fire hazard management.** A list of compatible and incompatible species is not available for the various types of ROWs.* Stakeholder interactions are not documented in a formal filing system.*
P7: Compilation of a Broad Array of Treatment Options	Development and progressive application of a variety of mechanical and chemical treatment methods that are leading directly to the establishment of a stable community of compatible species that enhances the prevention and biological / ecological control of incompatible species Broad and persistent effort to develop a herbicide-use program on federal lands	Lack of a herbicide use program on federal lands.** Computers are not used in the field, which limits real-time data collection (inventory and monitoring), recording of stakeholder interactions, and updating of field maps.* Existing geographic information system (GIS) is not accessible and useful for at-time-of-management activities, problem includes inability to update site data and field maps at the time of discovery.*

Table 1 (continued)
Findings by Principle via a listing of general strengths and weaknesses.

Principle/Subject Area	Strengths	Weaknesses
P8: Accounting for Economic & Ecological Effects of Treatments	Formal partnerships with organizations interested in wildlife management Leadership in developing and adopting the Avian Protection Program Spearheading of a programmatic consultation with the Forest Service and the Fish and Wildlife Service on rare, threatened and endangered species Use of fact sheets to field identify and understand rare, threatened, and endangered (RT&E) species Removal, chipping, or lopping of trees and shrubs on a treated ROW, which effectively reduces negative visuals associated with felled woody plants Large-scale, detailed efforts to account for, plan, and conserve cultural resources Commitment to a closed system of herbicide use, which minimizes waste disposal and on-site chemical mixing	Inadequate policies and procedures for managing vegetation in riparian areas.** Full consideration of invasive, exotic plant species is lacking for management.** Lack of written policies and procedures for management of visual impacts* Wildlife planning and management work generally considers only rare, threatened and endangered species.* Lack of formal attention to fragmentation and connectivity effects caused by the presence of ROWs* "Infestation area" of invasive, exotic plants is not defined for management.* Planning, decision making, and practice efforts surrounding the stewardship of biologically-based cultural resources is inconsistent across land ownerships.* Lack of an herbicide manual that is applicable to all possible lands where chemicals can currently be applied**

Table 1 (continued)
Findings by Principle via a listing of general strengths and weaknesses.

Principle/Subject Area	Strengths	Weaknesses
P9: Site-Specific Implementation of Treatments	Vegetation maintenance protocols vary by stakeholder group. This flexibility allows APS to produce more desirable, environmentally-sensitive plant community conditions with management and address stakeholder concerns for management.	Riparian zones are not consistently designated within rights-of-way.** Important natural resources are not added to maps and other means of tracking spatially explicit information when they are discovered in the field.* Land unit designations within ROWs are not regularly based on plant community and other ecological conditions.* Job Profiles, as important operational plans for ROW work on private lands, are not consistently used by APS across Divisions.** Corridor Management Plans are missing components related to the description of current vegetation and environmental conditions.** APS does not use a vegetation treatment method rubric where the desired future condition of ROW vegetation are clearly, consistently described as a function of line voltage, ROW width, and topography.* Desired vegetation conditions for the different line voltages and plant community types are not available as related to fire hazard. * APS's ground-based evaluations are not detailed to fully document vegetation condition.**

Table 1 (continued)
Findings by Principle via a listing of general strengths and weaknesses.

Principle/Subject Area	Strengths	Weaknesses
P10: Adaptive Management & Monitoring	Substantial monitoring of ROW resource conditions and monitoring of the effects and efficacy of ROW vegetation maintenance work Excellent reliability record on North American Electric Reliability Corporation (NERC) transmission line facilities Good record keeping practices to back-up compliance with inspections and annual vegetation maintenance requirements under NERC FAC-003-1	Lack of a list of performance indicators important for monitoring** Changes in the flora and fauna are not specifically monitored.** It is unclear if the sign-off of Audit Forms includes or does not include the full length of ROW segments.** APS does not have a continuous improvement and monitoring policy.** Data for unplanned outages and switching due to fires is not tracked.* A "pick list" of environmental and social impacts is not available on post treatment Audit Forms.*

Audit Criteria: Score and Findings

Table 2
A guide to scoring, performance level, and compliance

Score	PERFORMANCE General Description
0-0.5	Extremely weak performance; strongly unfavorable or data lacking
1.0-1.5	Very weak performance; significant improvement is needed (<1/4 of indicators and verifiers met)
2.0-2.5	Unsatisfactory performance; improvement is needed (1/4-1/2 of indicators and verifiers met)
3.0-3.5	Adequate performance; improvement is warranted (1/2-1/3 of indicators and verifiers met)
4.0-4.5	Favorable performance; improvement is possible (nearly all to all of indicators and verifiers met)
5.0	Clearly outstanding performance

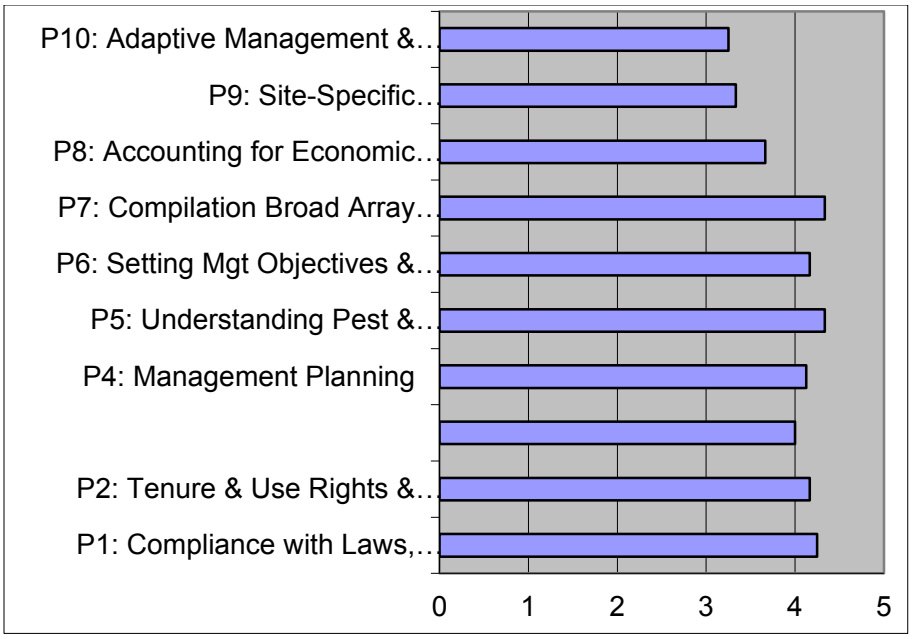

Figure 1
Average scores for each criterion associated with each of the 10 principle

Table of Contents

List of Tables

Section 1: Introduction

This report presents the findings of an independent audit conducted by specialists representing the ROW Steward Program. The purpose of the audit was to evaluate the environmental, economic, and social aspects—the sustainability—of Arizona Public Service's (APS's) electric transmission line right-of-way vegetation management, and to determine gaps in the sustainable conduct of Integrated Vegetation Management on APS's rights-of-way (ROWs).

Acronyms

APS	Arizona Public Service
BMPs	Best Management Practices
CMP	Corridor Management Plan
CMPs	Corridor Management Plans
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
IVM	Integrated Vegetation Management
NERC	North American Electric Reliability Corporation
OSHA	Occupational Safety and Health Administration
RT&E	Rare Threatened and Endangered
ROW	Right-of-Way
ROWs	Rights-of-Way
TVMP	Transmission Vegetation Management Plan
UVM	Utility Vegetation Management
WECC	Western Electricity Coordinating Council

Section 2: General Summary

Names and Contact Information

Source Name: Arizona Public Service

Contact Person: Michael Neal, Manager of Forestry

Address: Arizona Public Service, Black Canyon 2 Building, 2133 West Peoria Avenue, Phoenix, Arizona 85021

Telephone: 602-371-7183

E-mail: Michael.Neal@aps.com

General Background

Type and structure of operation

Arizona Public Service Company (APS) is a publicly-traded (via holding company), Fortune 500 energy company headquartered in Phoenix, Arizona. It is the largest utility in Arizona and the principal subsidiary of Pinnacle West Capital Corporation (since 1987). APS serves more than one million customers in 11 counties with a 34,645 square mile service territory throughout most of the state, but mainly concentrated in northern and central Arizona. About 2/3 of the City of Phoenix and all of Flagstaff, Prescott, Yuma and Douglas are served by APS.

APS manages 5,355 circuit miles of overhead electric transmission lines throughout the State (69 kV and above). APS also operates three transmission lines in New Mexico.

Years in operation

APS was formed in 1952, but was preceded by a series of companies and mergers that began with the Phoenix Light and Fuel Company in 1884 (only 3 years after the Town of Phoenix was formed).

_____

Most of the above text adapted from the Wikipedia website (accessed 03/17/13), http://en.wikipedia.org/wiki/Arizona_Public_Service

Details on transmission lines was provided by APS personnel

Latitude and longitude of operation

APS's electric transmission system extends across Arizona, from approximately 109°03' to 114°49' W longitude, and 31°20' to 37°00' N latitude. The State is approximately 300 miles wide and 400 mile long. ROWs were generally examined in rural areas, except in the Metro Division around Phoenix where suburban and urban areas were a large part of the audit.

Vegetation Management System

General description of details and objectives of the management system

APS describes their vegetation management system as follows (from the "APS NERC Standard – FAC-003-1 2012 Transmission Vegetation Management Plan", revised and approved by (12/2011-6/2012), Tracy Moore, Michael Neal, and Lisa Young, page 3):

> The primary objective of the APS Transmission Vegetation Management Program is to improve the reliability of the transmission system by minimizing risks of vegetation-caused outages to the greatest extent possible. It is the company's goal to accomplish the work in compliance with all applicable regulations and industry safety standards, and according to the sound, science-based best management practices including ANSI-A300 (Part 1 and 7), Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning and Integrated Vegetation Management a. Electric Utility Rights-of-Way). In addition, the companion publications for both standards Best Management Practices for Utility Pruning of Trees and Integrated Vegetation Management will be utilized.
>
> APS Forestry and Special Programs Department completes one full helicopter and/or ground patrol of the company's transmission corridors annually. Locations with vegetation concerns are recorded and documented. Following the aerial patrol, Forestry personnel will visit each of these recorded locations to inspect conditions and clearance distances from the ground. Any necessary work is assigned to vegetation management crews and the work is completed shortly thereafter. Additional aerial patrols are scheduled due to environmental conditions such as bark beetle infestations, fire, etc. All annual patrols are documented on the Annual Patrol Form.

APS conducts vegetation management on transmission lines using an Integrated Vegetation Management approach. A professional vegetation management staff works with contractors to control undesirable plant populations using combinations of manual, mechanical, and chemical treatments to facilitate the development of biological and ecological control elements in the managed ROWs. Vegetation management is strongly guided by strategic, tactical and operational plans, along with a long series of procedure documents.

Environmental Context

APS ROWs pass through the American Semi-Desert and Desert, the Colorado Plateau Semi-Desert, and the Arizona-New Mexico Mountains Semi-Desert – Open Woodland – Coniferous Forest – Alpine Meadow provinces. These areas are associated with tropical/subtropical steppes and deserts, which are defined by hot, semiarid to extremely arid climate regimes steppes that are typically grassland of short grasses and other herbs and with locally develop shrub and woodland. In the large expanses with dry-desert, widely dispersed xerophytic plants provide negligible ground cover. In low elevation areas, typical plants include grama and galleta grasses, palo verde, creosote bush, saguaro, mesquite and bursage. In higher elevation areas, Gambel oak, pinyon-juniper, ponderosa pine and spruce-fir are common. About 75% of APS ROWs are in low elevation environments, and 25% in high elevations.

_____

Above text adapted from: Bailey, R.G. 1996. *Ecosystem Geography*. Springer-Verlag, New York; McNab, W.H., and P.E. Avers. 1994. Ecological Subregions of the United States: Section Descriptions. U.S. Department of Agriculture Forest Service, Administrative Publication WO-WSA-5.

Socioeconomic Context

Arizona as a total population of over 6,000,000 people and an area of 114,000 square miles. The State is a complex of urban centers with large expanses of rural land. Approximately 15% of the state is privately owned, with the remaining area in public forest and park land, state trust land, and Native American reservations. Nearly 70% of land in Arizona is owned by the U.S. government, which leases a portion of the public domain to ranchers and miners. APS ROWs are largely located on private (39%), Indian Reservation (18%), U.S. Forest Service (17%), and State Trust (16%) lands, with the remainder (10%) on Bureau of Land Management, local or state parks, military, national parks, and other landowner lands. Eleven percent (11%) of APS transmission rights-of-way are urban based; 89% are rural based.

Arizona's hub of economic output is in the Phoenix metropolitan area, which accounts for nearly 75% of the state's domestic product. Arizonians produce copper (two-thirds of the nation's output) and various agricultural goods, but they produce mostly as a service work force, including health care, financial, defense and other governmental, and transportation.

_____

Above text adapted from: en.wikipedia.org/wiki/Arizona, accessed on 3/23/2013.

Section 3: Audit Process

Audit Dates

January through April 2013	Planning for site visit and performance audit
April 8 through 12, 2013	Field audit
May 2013	Draft assessment report produced
June 2013	APS review of draft audit report
July 2013	Final audit report

ROW Steward Audit Team

Lead Auditor: Dr. Christopher A. Nowak. Principal, C.A. Nowak Consulting, Chittenango, New York, and Professor, State University of New York, College of Environmental Science and Forestry, Syracuse, New York.

Auditor: Thomas E. Sullivan. Senior Consultant, Energy Initiative Group, LLC, Sutton, Massachusetts.

Audit Process

Step 1. Select visitation sites

Site selections were completed 3 weeks prior to the site visit, and affirmed each day during the field audit. APS has four main regions, or divisions, of operations: Southern, Metro, Northwest and Northeast. Sites were initially selected by the Lead Auditor via a random selection of ROWs within each APS division (stratum – a stratified sample). A few lines were removed and replaced with others in order to optimize audit time and facilitate visitation logistics. All visited rights-of-way were diverse and included variable environments, surrounding landowners, and vegetation management history. Span-to-span sections of ROWs were selected in areas that had complex environments or socioeconomic settings to observe the level of vegetation management performance in different, challenging situations.

Step 2. Site visit preparation

Select documents were sent to the audit team in March 2013. The audit team reviewed these documents during March and early April, planned for the audit week, and reviewed on-line information about APS and the State of Arizona prior to the site visit.

Step 3. Site visits

A briefing was held at the APS office complex in Phoenix, Arizona, on Monday morning, April 8th. The ROW Steward audit team met with a broad representation of the APS Forestry and Special Programs team (Table 3-1). The briefing included the following: introductions, review of the assessment process, overview of the performance standards, and a full accounting of APS expectations of the audit. Plans were affirmed for the field site visits.

Field sites across Arizona were visited by the ROW Steward audit team, an APS team leader (Manager and / or Division leader), a Natural Resource Specialist, and a planner or coordinator, from Monday afternoon through Thursday afternoon of the audit week, as follows:

Monday, April 8th

1. APS Office Building, APS Black Canyon 2, Phoenix, Arizona

Southern and Metro Divisions (audit team was split in two: Nowak went with SW/Metro group, and Sullivan went with SE group)

SW/Metro Group:

2. 230-06 and 230-7 lines, spans 23/4 to 23/5
3. 230-06 line, spans 24/3 to 24/4
4. 500-5 line, spans 6/2 to 7/4, and
5. 230-16 and 500-5 lines, spans 8/1 to 6/1 and 34/2 to 35/5
6. 230-16 and M109 lines, spans 13/1-13/4

SE Group:

7. 230-04 line, spans 27/1 to 27/7
8. 230-18 line, spans 46/2 to 47/3
9. 115-3 line, spans 9/7 to 10/8
10. 500-3 (NE Division)

Tuesday, April 9th

Metro Division

11. 500-6/230-24 lines, spans 5N, 1E
12. M-115 line, spans 1/1 to 1/5
13. 230-13/TEP-345 lines, spans 10/1-10/5
14. 230-12/TEP-345 lines, spans 2/2 to 2/4
15. 230-23 line, spans 2/2 to 2/4

Wednesday, April 10th

Northeast Division

16. 500-3 line, span 68/2
17. 345-1 line, spans 61/1 to 61/3
18. NE-21 line, and spans 17/1 to 17/2
19. 500-3 and NE-02 lines, across Little Colorado River from Cholla Power Plant (helicopter/land)
20. 230-01 line, spans 64/4 to 64/6 (helicopter/land)
21. 500-2 line, spans 184/2 to 185/2, and Yavapai Sub to 177/3 (helicopter/land) (Northwest Division)

Thursday, April 11th

Northwest Division

22. 115-6 line, spans 5/4 to 6/2
23. NW-9 line
24. 500-2 line near Mingus Mountain, spans 184/1 to 184/3
25. NW-02 line, Sugarloaf Ruin, spans 15N, 21/4 to 22/5, and 6/1 to 6/6 (at Oak Creek)
26. Copper Canyon (NW-4) line, spans 13N, 4E

Friday, April 12th

27. APS Office Building, APS Black Canyon 2, Phoenix

Transmission line ROWs were assessed on a variety of suburban and rural private and state, federal and tribal lands, covering a wide variety of voltages, land ownerships, plant communities, and special sites as follows (number of ROW sites visited is in the parentheses). .

Voltages:

69 kV (6)

115 kV (2)

230 kV (10)

345 kV (1)

500 kV (6)

Plant community on / surrounding ROW:

chaparral (3)

creosote-bursage (8)

desert scrub (1)

juniper grassland (1)

palo verde - mesquite (3)

pinyon / juniper (4)

ponderosa pine (3)

riverine (6)

semidesert grassland (1)

Sonoran desert (11)

Landownership:

Bureau of Land Management (2)

Bureau of Reclamation (1)

National Forest (7)

Private (7)

State (8)

Tribal (3)

Special sites:

riparian system (13)

cultural (4)

Table 3-1
APS employees consulted during this audit.

Person	Position	Days
Kent Bushman	Northeast Section Leader	Wednesday
Jennifer Moore	Natural Resource Specialist I	Monday, Tuesday, Friday
José Cordero	Planner – Metro	Monday, Tuesday, Friday
David Jallo	APS Environmental	Friday
Tracy Moore	Northwest Section Leader	Thursday
Michael Neal	Manager of Forestry	Monday, Tuesday, Wednesday, Thursday
Andrew Rable	South Section Leader	Monday, Friday (phone conference)
Jesse Sanchez	Section Leader – Metro	Monday, Tuesday, Friday
Josh Schwartz	Natural Resource Specialist / Contractor	Wednesday, Thursday, Friday
Maaike Schotborgh	Wildlife Habitat Council (invited observer)	Friday
Jon Shumaker	Natural Resource Specialist II / Archaeology	Monday, Wednesday, Friday
Chris Watkins	Natural Resource Specialist / Archaeology / Contractor	Monday, Thursday
Lisa Young	Natural Resource Specialist II	Monday, Thursday, Friday

Step 4. Report development

This confidential report was developed to present findings associated with each criteria in the ROW Steward Requirement, summarize strengths and weaknesses, provide commendations for high performance and recommendations and observations on how to improve in areas of low performance, and assign a score for each Principle.

APS documents reviewed for the audit

1. *Agency Coordination Process – T&D – Overview* (undated, circa April 2013)
2. APS 2012 Transmission & Distribution, Herbicide Corridor Management Plan, April 17, 2012 (prepared by Tracy Moore)
3. APS Power Line Corridor Management Plan for Vegetation Management, 230-6 and 230-7 for Salt River Pima-Maricopa Indian Community, August 25, 2008 (prepared by Scott Paulsen)
4. APS Corridor Management Plan for Vegetation Management, 500-3 Cholla to Saguaro Power Line, Version 1, April 25, 2012, Pleasant Valley, Tonto Basin, and Globe Ranger Districts, Tonto National Forest, U.S. Department of Agriculture Forest Service (prepared by Lisa Young)

5. APS Power Line Corridor Management Plan for Vegetation Management, 500-5 and 230-16 Gila Bend to Jojoba Substation Transmission Power Lines (share the same ROW corridor), March 31, 2009, Arizona State Land Department, Maricopa County (prepared by Scott Paulsen)
6. A set of other Corridor Management Plans
7. Arizona Public Service Vegetation Management Manual 2013 (undated, anonymous author)
8. DRAFT Biological Assessment for Vegetation Maintenance, APS 230-16 Liberty to Gila Bend and the M-106 Buckeye to Gillespie Transmission Lines, January 25, 2012, Bureau of Land Management (prepared by Lisa Young and Jennifer Cleland)
9. "NERC Standard – FAC-003-1 2011 Transmission Vegetation Management Program", Version 1-4, T. Moore and M. Neal, 1/3/2011-12/6/2011
10. "NERC Standard – FAC-003-1 2012 Transmission Vegetation Management Program", Version 1-4, T. Moore, L. Young, and M. Neal, 12/23/2011-6/22/2012
11. "2012 Tree Line USA.pdf"
12. "2011_TREELINE_USA.docx"
13. *Guidelines for Right Tree Right Place in Arizona: A homeowner's guide for choosing and planting trees for a lifetime of beauty, safety and energy efficiency*. "Right Tree Right Place.pdf"
14. "ROWSymposium20121.pdf"
15. *Forestry Vegetation Management Program*, T. Moore, "CPS_HerbicideTraining_20120126_27.pptx"
16. "BurrowingOwlProject.PPTX"
17. Association of Power Biologists, 53rd Annual Workshop, October 2-4, 2012, Tempe, Arizona, Host Utilities: Salt River Project & Arizona Public Service, "APB 2012 Agenda.pdf"
18. "2013 SWBEMC Field Season Summary.04.19.2013.doc"
19. Invasive Species Training, T. Moore, L. Young, R. Lee (BLM), L.D. Walker (BLM), and L. Howery (University of Arizona), "APSInvSppTrain_20091027.ppt"
20. "ApprenticeshipProgram.pdf", and files in Apprenticeship Program Tests folder
21. A set of easements (n=27 documents), with documents entitled *Private Easement* and *Right-of-Way Easement* for private land; *Right-of-Way* or *Right-of-Way Grant* for Arizona State Land; *Easement*, *Temporary Use Permit* or *Special Use Permit* for Forest Service or Bureau of Land Management; and *Application for Right-of-Way* or *Easement for Right-of-Way* for Indian Reservation land

22. A set of Job Profiles (n=9 documents), with documents entitled *APS Forestry and Special Programs Customer Profile Sheet*

Standards

The ROW Steward Technical Requirements (Version 1, December 2012) were used to audit APS's electric transmission ROW vegetation management program. These standards are supported by the ROW Steward Program and are consistent with recent standardization efforts in the electric industry, including American National Standards Institute (ANSI) A300 Part 7-2006 Vegetation Management (IVM) (ANSI 2006), and the associated International Society of Arboriculture's Best Management Practices for Integrated Vegetation Management (Miller 2007).

Literature Cited

ANSI (American National Standards Institute). 2006. ANSI A300 (Part 7)-2006 IVM, American National Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Integrated Vegetation Management a. Electric Utility Rights-of-Way). American National Standards, Inc., Washington, D.C.

Miller, R.H. 2007. Best Management Practices: Integrated Vegetation Management. International Society of Arboriculture, Champaign, IL.

Section 4: Audit Criteria: Scores, Categories of Strengths and Gaps

Table 4-1
A guide to scoring, performance level, and compliance.

Score	PERFORMANCE General Description
0-0.5	Extremely weak performance; strongly unfavorable or data lacking
1.0-1.5	Very weak performance; significant improvement is needed
2.0-2.5	Unsatisfactory performance; improvement is needed
3.0-3.5	Adequate performance; improvement is warranted
4.0-4.5	Favorable performance; improvement is possible
5.0	Clearly outstanding performance

Categories of Strengths, Weaknesses, and Gaps

Good Practice: This is a strength in performance of IVM that generally is above industry norms.

Non-Conformance—Required Corrective Action: This type of weakness or gap must be closed to be fully accredited as a ROW Steward and to be judged as fully performing the necessary elements of sustained IVM.

Recommendation: This type of weakness or gap is near to being a non-conformance with a required corrective action and should be closed to improve in the sustained practice of IVM.

Observation: This category is not a weakness or gap per se, but is an area for possible improvement in vegetation management practice so as to rise to highest levels of performance.

NOTE: all Good Practices, Non-Conformances, Recommendations and Observations are numbered in order with the year, e.g., 1/13 – "1" is the first, and "13" is the year produced.

Section 5: Principle-by-Principle Performance of Vegetation Management on APS Rights-of-Way

Principle #1: Compliance with Laws, Standards, and Best Management Practices

Laws and regulations are constructs developed to protect natural resources and associated benefits and values accruable to society. IVM practitioners meet or exceed all laws, regulations, and guidelines related to vegetation management on rights-of-way (ROWs) and safety of vegetation management workers.

Principle Score: = 4.25 / 5.00

CRITERION 1.1: The vegetation management program and vegetation maintenance practices respect all federal, state, and local laws and regulations. Vegetation management plans and maintenance practices incorporate appropriate industry standards, Best Management Practices (BMPs), and other guidance applicable to IVM that exist within the state or other appropriate jurisdiction(s) in which the operations occur.

Findings. DISCLAIMER: The audit team did not verify conformance to all possible laws and regulations, but instead audited field performance of vegetation management work and judged level of adherence to applicable laws and regulations related to those operations.

APS Forestry and Special Programs staff (referred to hereafter as "APS" or "APS staff") demonstrated a strong compliance commitment to all federal, state and local laws and regulations. The APS vegetation management program operates in a very complex legal and regulatory framework. Patterns of federal, state, tribal and private land ownership in Arizona requires compliance with many federal and state laws and regulations (see Good Practice 1/13). APS corporate level commitment to compliance is explicitly discussed in the 2011 Environmental Performance Report and Environmental Policy. The Report states: *the APS Compliance Assurance program establishes assessments and audits, reports results to management, establishes corrective and preventive actions, tracks open items, ensures*

the confidentiality of information, is responsible for record retention and establishes roles and responsibilities. Summaries of the completed compliance audits are provided to the Audit Committee of Pinnacle West's board of director's. APS demonstrated knowledge of the company's compliance commitment. The ANSI A300 Tree Care Operations (Parts 1 and 7) along with the companion Best Management Practices publications are listed (see page 3 of the *2013 TVMP*).

The *2013 Transmission Vegetation Management Plan* (page 5) contains a list of laws and regulations that relate to NERC and WECC electric reliability standards, OSHA safety requirements, ANSI safety standard Z133, federal and state environmental requirements related to clean water, birds, endangered species, plant protection, and historic preservation.

The auditors engaged APS Forestry staff in specific conversations related to compliance with the NERC Reliability Standard, Clean Water Act (Section 404), Migratory Bird Treaty Act, National Environmental Policy Act (related to vegetation management on federal lands), Arizona Pesticide Control laws and regulations, Arizona Native Plant Law, the National Historic Preservation Act, Archeological Resources Protection Act and the Arizona State Antiquities Act. The Federal Insecticide, Fungicide and Rodenticide Act; is not referenced in APS documents (see Recommendation 1/13). APS staff demonstrated an understanding of the listed laws and regulations.

The APS *2012 Transmission and Distribution Herbicide Corridor Management Plan* references compliance to federal and state laws and regulations related to herbicide use, including compliance with herbicide labels and State of Arizona applicator licensing laws. The APS Forestry Manager (Mike Neal, personal communication) indicated that pesticide storage sites owned by APS and Southwest Ground Control have been inspected by Arizona pesticide staff and been found to be in compliance with Arizona pesticide laws and regulations.

All APS Staff demonstrated knowledge with the laws and regulations referenced in these findings. APS Staff and Contractors also acknowledge understanding of applicable laws through a sign-off process on the APS *Vegetation Management Manual*. The *Vegetation Management Manual* does not contain the same listing of laws and regulations contained in the *TVMPs*, but does contain detailed sections on safety, electrical hazards and work procedures consistent with applicable laws and regulations. The APS *Master Agreement for General Services* contains a general provision (Section 23) for contractor compliance with Applicable Law. Compliance with Arizona Department of Transportation Commercial Driver's License requirements is also referenced in the *Vegetation Management Manual*.

APS reported there were no violations of laws or regulations or unresolved complaints over the past 5 years. These statements were not tested with the APS Compliance Assurance program, legal or environmental departments or with stakeholders.

All APS personnel appear to be trained and supervised in accordance with applicable regulations.

The audit did not include observations or interviews with APS IVM Workers, specifically vegetation management contractors.

Score: 4.5 / 5.0

Good Practice 1/13: APS demonstrates a high level of awareness and compliance with laws and regulations while operating within a legal framework that is more complex than the industry norm.

Recommendation 1/13: The *Vegetation Management Manual*, *Transmission Vegetation Management Plans,* and *Transmission and Distribution Herbicide Corridor Management Plan* list of laws and regulations should include the Federal Insecticide Fungicide and Rodenticide Act.

CRITERION 1.2: All workers working on the ROW Asset Manager's transmission system are legally documented and eligible to be employed.

Findings. The *Master Agreement for General Services* (section 41.2, page 22) requires the Supplier to provide proof of US Citizenship or appropriate United States work authorization under the Immigration Reform and Control Act of 1986. The I9 Employment Eligibility Verification Form is used to verify compliance by the Supplier. No field verification of this Criterion was carried out and no Supplier Verification Forms were audited. In conversation, APS demonstrated understanding of this Criterion. APS has the right to review records of Suppliers to verify compliance with this requirement (see Observation 1/13).

Score: 4.0 / 5.0

Observation 1/13: APS could annually document a review of contractor records to demonstrate compliance with the Immigration Reform and Control Act of 1986.

Principle #2: Tenure and Use Rights and Responsibilities

Sustainable ROW vegetation management requires that the right of use of the land be properly documented.

Principle Score: = 4.17 / 5.00

CRITERION 2.1: The ROW Asset Manager has evidence of long-term right of use of the land (e.g., the ROW Asset Manager may own the land in fee, own an easement, or have certain franchise rights, prescription, or license rights to construct and maintain the ROW facility) that is documented.

Findings. The auditors and APS staff visited 25 sites in the field. Of these, 19 locations were pre-planned and documents supporting long-term right of use were provided. A total of 27 land use documents were provided by APS for these 19 sites. Ownership of the sites included: private land; Arizona Trust Land; US Forest Service; US Bureau of Land Management; Indian Reservation; or a mix of

ownership types. Documents titled: *Private Easement* and *Right-of-Way Easement* were typical for private land; *Right-of-Way* or *Right-of-Way Grant* for Arizona State Land; *Easement*, *Temporary Use Permit* or *Special Use Permit* for Forest Service or Bureau of Land Management; and *Application for Right-of-Way* or *Easement for Right-of-Way* for Indian Reservation land. Most of these easement documents were in perpetuity or had 50- to 60-year terms. At two sites, there were multiple private owners. In these instances no supporting land use rights documents were provided. Various permits, letters and signed CMPs granting or acknowledging permission to carry-out vegetation management were also provided. Within these documents, there were no instances of land use rights disputes (see Good Practice 2/13 associated with Criterion 2.2).

All rights-of-way viewed in the field appeared to be maintained to a consistent width and no signs of landowner objections to the APS program were noted. Work observed on the NE21 ROW was reported to have been flagged by the contractor as the work proceeded. Flagging to mark the edge of ROW was observed on the NW9 ROW.

Customary use right for a hiking trail was evidenced on the 115-6 ROW. APS modified vegetation management to provide a visual buffer and stack cordwood for campers to use at this site. Customary use rights associated with cultural/historic sites were also viewed in the field on several ROWs including 230-4, 500-3 and NW-2. In all instances these customary use rights sites were noted in the supporting documents, flagged prior to vegetation management work and respected during the work.

Score: 4.5 / 5.0

CRITERION 2.2: Appropriate mechanisms are in place and employed to resolve disputes over right of use of the land to ensure that proper maintenance activities can occur.

Findings. APS Planners and Natural Resource Specialists are involved in substantial stakeholder engagement and communication during the development of CMPs and Job Profile forms prior to conducting vegetation management work on transmission ROWs. Note: APS uses the term "Project" to refer to scheduled maintenance activities planned and carried out on a ROW segment. Questions regarding land use rights may be raised by the underlying ROW landowner at any time in the process (see Good Practice 2/13). APS staff (personal communications) reported that disputes are rare and can usually be resolved at the field level by the Planner or Natural Resources Specialist during this work planning process. The APS Project Planning form requires coordination for each Project with federal agencies during the planning process. Two sections of the *2013 Vegetation Management Manual* (see sections 4.2 and 4.7 pages 18 and 20) address Property Owners Perceptions and Complaints. Content of the *Vegetation Management Manual* is primarily tailored to distribution work but apply to any property owner. APS noted during review of the draft audit report that: "Manual has since been updated. A new version has been provided with this review. The version you received only had minor edits, but it hadn't been changed since 2005.

We have made many changes, and will be continuing to edit this throughout the year." These documents reflect a positive customer/stakeholder attitude and require notification of the Planner if disputes arise. No formal policy or process for resolving disputes was provided to the auditors (see Observation 2/13). To some degree this is a reflection of the lack of disputes. An example discovered during the audit follows (Kent Bushman, personal communication): A private landowner initiated a complaint directly to the CEO of APS. The CEO passed along the complaint to field level APS Forestry and Special Programs personnel. Land use rights documents were provided and discussion of the vegetation management program with the owner resulted in resolution of the complaint at the field level. APS carried out the required vegetation maintenance work.

Score: 4.0 / 5.0

Good Practice 2/13: APS consistently reviews land use rights documents, and concomitantly provides landowners the opportunity to dispute these rights during the planning phase of each Project.

Observation 2/13: APS could update the *2013 Vegetation Management Manual* or revise the Project planning process to include a written policy and procedure for stakeholder dispute resolution by the ROW Asset Manager and other related APS departments such as the property department or legal department.

CRITERION 2.3: Unauthorized uses of the right-of-way are discouraged.

Findings. Field-based reviews of 25 sites during the audit revealed no significant unauthorized uses of transmission ROW Resources (Good Practice 3/13). APS personnel respected gates and access roads along observed ROWs, where they existed. Gates were in place in several locations as a measure to prevent unauthorized uses of the ROWs. In most instances, ROWs contained a single, well maintained road for APS crew access, as opposed to multiple roads often present on utility ROWs, indicating respect for the land and compliance with road BMPs (see Good Practice 4/13). APS did not provide any written policies regarding unauthorized use, and no signage was observed on ROWs to discourage or provide a phone contact to report unauthorized use of ROWs (see Observation 3/13). APS outreach efforts prior to vegetation management activities provide ample opportunities for landowners to raise unauthorized use issues.

The CMP for the 345-1 Project includes a request by US Forest Service to strategically position slash to block ATV access. APS will comply with the request. During field visits in the southeast Division on the 230-4, 500-3 and 115-3 ROWs, it was reported and observed that the tribes and private owners are very effective at dealing with unauthorized access.

Score: 4.0 / 5.0

Good Practice 3/13: Unauthorized use of ROWs was effectively non-existent.

Good Practice 4/13: ROWs generally contained only a single, well maintained road for APS crew access, as opposed to multiple roads often present on utility ROWs, indicating respect for the land and compliance with road BMPs.

Observation 3/13: APS could develop appropriate signage and policies to employ if and when preventing unauthorized use becomes a problem for the ROW Asset Manager.

Principle #3: Community and Worker Relations

The IVM program provides for outreach to affected communities and stakeholders.

Principle Score: = 4.00 / 5.00

CRITERION 3.1 Stakeholders affected by proposed IVM operations are informed of the primary goals of reliability, assuring access, and safety, and their potential environmental and aesthetic effects, and their concerns are considered in management planning and operations.

Findings. APS's outreach and engagement of stakeholders is exceptional compared to industry practice (see Good Practice 5/13). This outreach is primarily driven by federal agency requirements but extends to state, tribal and private land owners. Many documents, including the *2013 Vegetation Management Manual*, *2013 Transmission Vegetation Management Plan*, CMPs and other notification materials, all repeat the primary goals of the vegetation management program: reliable electric service, safe electric service, cost-effective service and environmental stewardship.

APS staff demonstrated an understanding of the likely effects of maintenance activities on property owners and local communities and incorporated their concerns into management planning and operations when practicable. APS has inventoried cultural resources/archeological sites on the full extent of the transmission system (see Good Practice 6/13). Biological resources, cultural resources, water resources, native plant communities, and aesthetics are taken into account in outreach to stakeholders and during Project planning and prior to developing strategic and tactical plans for vegetation management work.

Examples of considering stakeholder concerns were observed in the field (also see findings associated with Criterion 6.3). The ROW 500-3 and 115-3 ROW traverse nearly pristine Sonoran desert. APS modified its typical border/wire zone practices by also leaving tall growing Saguaro cactus across the full width of the ROW within "lateral zones." ROW 230-12 traverses a golf course. At this site APS conducts crown reduction pruning on some trees that would typically be removed and allows agave to grow in the wire zone. Both of these alterations to typical practice were in response to stakeholder concerns.

Score: 4.5 / 5.0

Good Practice 5/13: APS outreach to stakeholders is above industry normal practice.

Good Practice 6/13: APS proactive mapping and protection of historic and cultural sites is above industry normal practice.

CRITERION 3.2: Stakeholders are apprised of the benefits of ROW stewardship and IVM.

Findings. Vegetation maintenance Project planning begins up to a year before the work is carried out. One component of this Project planning involves contacting and often meeting with all landowner stakeholders along a ROW. APS staff communicates the benefits of environmental ROW stewardship and IVM during these interactions. The observed effectiveness and lack of customer complaints provides evidence that APS staff are effective in communicating the need for and benefits of ROW stewardship and IVM.

Documentation of private, tribal and agency landowner stakeholders was provided to varying degrees for most of the audited field sites. Executed CMP's with federal and state agencies and letters granting permission to enter on tribal lands provide evidence of stakeholder communication.

The APS *Vegetation Management Manual* (section 11 pages 69-73) describes APS commitment to environmental stewardship and preservation of cultural and biological resources. APS Natural Resources Specialists also have significant interaction with landowner and agency stakeholders. These professionals communicate their commitment to ROW stewardship and IVM in their interactions.

Communication of the benefits ROW Stewardship and IVM was less apparent. The majority of APS field staff were unable to articulate a definition of IVM. This inability would make it difficult to communicate benefits of IVM to stakeholders (See Recommendation 2/13). IVM is mentioned on the *APS Vegetation and Power Lines* page of the company website. Note: APS made appropriate changes to the company website following the field audit.

Work with the Navajo Nation, a significant stakeholder along APS ROW Resources, and communication of ROW stewardship and IVM principles has resulted in the Navajo Nation entering into a consultancy with an APS IVM consultant to implement IVM principles on Navajo Nation lands. This is clear evidence of APS staff apprising a stakeholder of the benefits of APS' IVM and stewardship approach.

Stakeholders include APS customers and members of the general public. APS customers and members of the general public that review the APS corporate website will find ample information on the APS corporate commitment to sustainability and good environmental performance (see Good Practice 7/13). The *APS 2011 Environmental Report* contains a section on APS Forestry and Special Programs. From the report: *The APS Forestry Program includes the*

maintenance and control of trees, shrubs and brush growing around APS facilities and equipment – including overhead power lines, poles and underground electrical equipment. APS employs about 100 forestry professionals who manage vegetation to ensure the safe and reliable delivery of electrical service. The APS Forestry Department maintains more than 20,000 miles of overhead power lines throughout the state. APS Forestry has adopted a closed chain of custody Best Management Practice process for herbicide treatment as part of the Integrated Vegetation Management (IVM) program. The benefits in using this program provide enhanced environmental stewardship through more accurate offsite mixing, reduced waste and no spillage, improved material tracking and no disposable concerns because of the returnable reusable containers. The Vegetation Management Program follows professional industry standards and Best Management Practices approved through the American National Standards Institute (ANSI A300). The high-quality standards of the F&SP's (Forestry and Special Programs) vegetation management have been recognized for the 15th consecutive year with the National Arbor Day Foundation's "Tree Line USA Utility" distinction.

The *APS Vegetation and Power Lines* web page discusses IVM and environmental benefits of establishing a long-term management plan. Discussions are not consistent with APS Forestry presentations in the *APS 2011 Environmental Report*.

The *APS 2011 Environmental Report* also presents a discussion of APS' commitment to ISO 14001. To date, the ISO 14001 accreditation has been focused on power plants. It was reported to the auditors that ISO 14001 principles will continue to be communicated and applied to field facilities and accreditation applied for across the APS system. As this accreditation effort continues, more staff will be informed of the APS Environmental Policy and ISO 14001 principles. This commitment will be integrated into all stakeholder engagement and communication. There was no discussion of applying for ISO 14001 accreditation of the transmission vegetation management program.

The APS Environmental Director of Sustainability Programs attended the briefing held at the end of the on-site audit. He provided copies of the APS Environmental Policy, SMART Card and Environmental "2-Minute Drill." These documents and messages were not apparent on any Forestry bulletin boards or in Forestry documents (see Recommendation 3/13).

Score: 3.5 / 5.0

Good Practice 7/13: The APS corporate website is used to promote sustainability and provides information about APS's vegetation management program.

Recommendation 2/13: APS staff should be trained in the IVM ANSI A300 Standard and BMP to acquire a better understanding of IVM. This training should extend to ROW Stewardship Principles and Criteria as well.

Recommendation 3/13: APS Forestry and Special Programs staff should adopt and customize the APS Environmental Policy to be part of its own governing

documents and practices. It should be highlighted on Forestry and Special Programs bulletin boards and promoted with all IVM Workers.

CRITERION 3.3: Communities adjacent to ROW vegetation maintenance activities are provided with opportunities for educational support services related to IVM from the Vegetation Manager, such as:

a. Support of and representation in local civic activities, e.g., Earth Day programs, Arbor Day celebrations, right tree right place plantings, participation in Pollinator Week programs, etc.

b. Proactive public education offerings related to IVM practices offered to the general public, natural resource agencies, schools, community colleges, and/or other providers of training and education.

Findings. The *APS 2011 Environmental Report* discusses the APS Forestry and Special Programs educational support services provided to customers and communities regarding "right tree – right place". A company brochure provides a homeowners guide to choosing and planting trees on residential property adjacent to electric facilities. The Report also references Arbor Day celebrations and tree planting events at local schools sponsored and attended by APS staff.

APS staff provided tree planting and "right tree – right place" materials to the auditors. These materials and programs are primarily oriented to distribution facilities.

Evidence of educational support services or public education offerings related to IVM practices offered to the general public, natural resource agencies, schools, community colleges, or other providers of training and education were provided to the auditors (see following table, developed by Lisa Young and others from APS at the request of the auditors):

Table 5-1
List of educational support services related to IVM

Item	Description
Tree Line USA	National Arbor Day Foundation recognition program – requires evidence of educational support for UVM programs
Right Tree, Right Place	Educational Handout/training
UAA ROW Symposium	Hosted, organized field trips; Presentation
Burrowing Owl Habitat Improvement	Time/resources donated
Association of Power Biologists	Co-hosted, presented at, and organized field trips, 2012
Bald eagle breeding area productivity survey	Forestry donates a helicopter and assists in this annual survey
Noxious Weed Training	Training given to contractors and Forestry employees
VP Southwest Vegetation Management Association	Tracy Moore serves as VP to this organization
Arbor Day Presentations	Forestry provides support and programs on Arbor Day for schools and other community group.
Apprenticeship Program	Standards and measures of the APS Apprenticeship Program
Arizona Archaeology Expo (Jon Shumaker, Chris Watkins)	Presented at this expo

Handouts from one educational session for national level ROW stewardship stakeholders attending the ROW 10 Symposium were provided to the auditor. Many attendees of the Symposium were provided training and education on IVM and ROW stewardship by APS Staff (see Good Practice 8/13).

Adoption of IVM by the Navajo Nation via APS provides evidence of successful educational support for this stakeholder.

Score: 4.0 / 5.0

Good Practice 8/13: APS hosted and supported the 10th International Symposium on Environmental Concerns in Rights-of-Way Management in October 2012. APS Forestry and Special Programs staff were involved in all aspects of the Symposium.

CRITERION 3.4: ROW work is offered in ways that create high quality job opportunities.

Findings. The auditors evaluated this criterion from two perspectives: ROW work opportunities for in-house Forestry and Special Programs staff and contractor IVM Worker staff.

APS staff were observed to be motivated, engaged and dedicated to successful implementation of the ROW vegetation management program. The Manager delegates responsibility for implementation to Section Leaders, Planners and Coordinators (see *APS Forestry and Special Programs Job Descriptions*). Natural Resource Specialists (biologists and ecologists) and Cultural Resource Specialists (archeologists) provide technical support and planning support for implementation. All of these positions are viewed as high quality opportunities where professionals can practice their respective professional disciplines. There was evidence of professional progression and opportunities for advancement within the APS Forestry and Special Programs department. Staff expressed a high degree of satisfaction with their positions and overall functioning of the team (see related findings associated with Criterion 5.3).

No IVM Workers contracted by APS were observed or interviewed during the audit (see Observation 5/13). Note: the auditors met the herbicide application contractor during the field tour associated with the ROW 10 Symposium in October 2012. APS has entered into a 4-year contract with a 2-year extension option for herbicide application with Southwest Ground Control, Inc. This approach to contracting shows APS' commitment to grow the program carefully and to provide a high quality opportunity for Southwest Ground Control and its employees. This practice is a good example of APS packaging work in ways that support stable employment (see Good Practice 9/13). The long-term contract provides the contractor an opportunity to grow with the APS program and be in a good position to compete at a later date when the process may be opened to competitors. Southwest Ground Control was recognized for environmental performance by the APS Environmental Department in 2011. This recognition provides additional evidence of APS offering ROW work in ways that create high quality job opportunities.

Score: 4.5 / 5.0

Good Practice 9/13: APS long-term relationship with Southwest Ground Control creates a high quality job opportunity for contractor employees.

Observation 4/13: Future ROW Steward auditors and APS need to meet and assess the mechanical and herbicide application contractors in the field.

CRITERION 3.5: ROW Asset Manager, the Vegetation Manager and the contractor demonstrate a long-term commitment to adhere to the ROW Steward Program and associated IVM principles and criteria.

Findings. The ROW Asset Manager, the Vegetation Manager and the contractor demonstrated a long-term commitment to adhere to the ROW Steward Program and associated IVM principles and criteria. The primary vegetation management documents: the *Vegetation Management Manual*, *TVMP's* and CMP's all address IVM principles as the framework for APS' vegetation management program. The social elements (adherence to laws and regulations, safety of the public and IVM Workers, stakeholder consultation, customer interaction and respect for cultural resources) of ROW Stewardship and IVM are

also addressed in these documents. Evidence of the contractor's commitment was observed through the good results observed in the field.

Consistent with findings for Criterion 3.2, these documents all present somewhat differing definitions of IVM and its elements. This inconsistency reveals an underlying weakness regarding understanding and implementation of IVM.

As referenced in the findings for Criterion 3.2, the APS *2011 Environmental Report* articulates the APS corporate commitment to sustainability. This commitment is reflected in the APS Forestry and Special Programs staff culture through a "do the right thing" attitude and observed practices with respect to social, cultural and biological resources impacted by the ROW vegetation management program. Several APS staff referenced "Do the right thing" as the corporate articulation of how decisions related to sustainability, natural and cultural resources impact on stakeholders should be guided.

APS is the first company to seek ROW Steward Accreditation. This demonstrates a willingness to lead the industry and to more publicly demonstrate environmental stewardship, sustainable IVM programs and adherence to ROW Steward principles and criteria (see Good Practice 10/13). APS has also supported the Utility Arborist Research Fund by providing the first substantial financial contribution to support utility vegetation management research. APS staff has also been at the forefront of promoting the development of national standards such as ANSI A300 (parts 1 and 7) and NERC FAC-003.

Score: 4.0 / 5.0

Good Practice 10/13: APS is an industry leader promoting IVM and ROW Stewardship, as evidenced by being the first company to seek ROW Stewardship accreditation, and providing leadership and support of industry-specific research.

CRITERION 3.6: A summary of vegetation maintenance activities is produced annually and made available to the general public. This may include a summary of the primary elements of the management plan (items in criterion 4.1) and a summary of the results of monitoring indicators (items in criterion 10.a). This criterion also acknowledges the need to respect the confidentiality of some information.

Findings. Several high level summaries of vegetation maintenance activities are produced annually by APS Forestry staff and were reviewed by the auditors. These include: a record of Annual Patrols of all lines 115 kV and higher; audits conducted per the *2013 TVMP* (see Inspections page 6); and updates to the *10-year Transmission and Distribution Schedule* showing work completed and ROW segment rescheduled out in time. Project Planning check lists for CMPs were also reviewed. APS provides a year-end summary of work completed on US Forest Service land per terms of the Programmatic Agreement with the US Forest Service.

No annual summary of work on the full APS ROW Resource was available from APS at the time of the field audit. Since the field audit, APS developed a brief summary of their vegetation maintenance activities in 2012, and this is now available to the general public and posted on the company website. In its present form, the summary does not include the primary elements of the management plan (items in criterion 4.1) or a summary of the results of monitoring indicators (items in criterion 10.a) (Recommendation 4/13).

Score: 3.5 / 5.0

Recommendation 4/13: APS should expand their new public summary of work activities to include the primary elements of the management plan (items in criterion 4.1) and the results of monitoring indicators (items in criterion 10.a).

Principle #4: Management Planning

Documentation of objectives, philosophy, principles, procedures and practices are critical to long-term, sustainable management, as embodied by various levels of plans, including resource inventories and maps. Written program management plans establish performance expectations and accountability for both successes and opportunities for improvement as judged against stated goals and objectives. Improvement in maintenance practices is predicated on learning from both successes and opportunities for improvement.

Principle Score: 4.12 / 5.00

CRITERION 4.1: The ROW Asset Manager has an established formal written strategic Vegetation Management Program Plan, with supporting documentation in place that guides IVM program decisions. The Vegetation Management Program Plan at a minimum addresses:

a. Management policy and objectives

b. Description of the ROW resources to be managed (e.g., lengths, maintained width, area, infrastructure attributes)

c. Description of the land use classifications of adjacent lands

d. Description of the vegetation management tasks and maintenance activities used, based on the ecology of the ecosystem in question and information gathered through resource inventories

e. Maps and/or geospatial record system describing the ROW resource base

f. Environmental limitations and safeguards, appropriate to the sites and ecosystems that occur on the transmission system

g. Plans for conservation of ecosystem services

h. A means of monitoring work, including feedback mechanisms for revising procedures as appropriate to more effectively achieve objectives

i. Wildfire management plan

Findings. APS has a formal written strategic *2013 Vegetation Management Manual*. This Manual is primarily oriented to the Distribution Vegetation Management Program but does address objectives, safety, customer relations, Integrated Vegetation Management, work procedures and environmental stewardship of cultural and biological resources. APS' *Transmission Vegetation Management Plans* (*2011, 2012 and 2013 TVMPs*), *APS 2012 Transmission and Distribution Herbicide Corridor Management Plan, and Corridor Management Plans* supplement the *Vegetation Management Manual*, providing additional policies, procedures and operational guidelines transmission ROWs and the use of herbicides within the context of an Integrated Vegetation Management framework.

Management policy and objectives

Vegetation management program objectives are presented in Section 1 of the *Vegetation Management Manual*. They are: *Reliable Electric Service, Safe Electric Service, Cost-Effective Service and Environmental Stewardship*. Each of these objectives is further described in the *Vegetation Management Manual*. The *2013 TVMP* provides additional reliability objectives for NERC-regulated ROWs under FAC-003-1. The *2013 TVMP and 2012 Herbicide Corridor Management Plan* describe APS objectives regarding use of herbicides to maintain the vegetation clearances achieved through a previously mechanical-only vegetation management program. Use of herbicides is described in the context of IVM.

Description of right-of-way resources

APS provided a list of all ROWs owned and managed by the company. The list contains infrastructure from/to descriptions, miles, estimated widths and acres of ROW Resources to be managed. The list also provides a region designation for management purposes and historic treatment data at a high level. A subset of this list is used in the *TVMP* to describe the annual inspections and work plan required for NERC FAC-003-1 compliance. All audit sites were selected from this list and APS staff used ROW Resource descriptions from this list demonstrating that it is the tool used to understand the resource base (see Good Practice 11/13).

Descriptions of the land use classifications of adjacent lands

APS staff were conversant in adjacent land use and ecological classifications of the ROW environment. Individual ROW CMPs document the land use of adjacent lands. The 2008 230-1 CMP provides the following description: *Vegetation types along this line on State Land include: ponderosa pine and ponderosa pine/gambel oak, pinyon juniper, and grassland, with some scattered shrubs and occasional juniper*. The 345-1 2013 CMP provides the following description:

Vegetation types along the line in the TNF (Tonto National Forest) *consist of Sonoran desert-scrub (Arizona upland division), semi-desert grassland, pinyon/juniper grassland, pinyon/juniper chaparral, ponderosa pine, mixed conifer with aspen and cottonwood/willow riparian forest*. Descriptions of terrain and elevation range are also provided. A subset of four CMP's was reviewed and each contained general land use descriptions/classification of adjacent lands(see Recommendation 5/13).

Description of vegetation management tasks

The *APS 2012 Transmission & Distribution Herbicide Corridor Management Plan* (see pages 3 to 5) includes sections titled: Project Description, Chemicals and Rates, Waste Disposal, Site Safety and Contractor Personnel. The Project Description section includes general guidelines for herbicide application, for example: *all herbicide applications will be spot treatments utilizing backpack, hand-held and quad/UTV-mounted sprayers*. APS staff reported that this document provides the guidance for all transmission ROW Resource herbicide use.

APS CMP's contain a section that describes Treatment Methods. Methods include a general discussion of access road use and the goals for vegetation maintenance (also see findings associated with Criterion 7.1). Methods are further described as Manual, Mechanical, and use of Herbicides. A Vegetation Maintenance Protocol is also described in each CMP. The protocol describes the permitted width of the ROW, maintenance cycle length, what species are targeted for removal/treatment, treatment of vegetation in close proximity to structures (towers), special considerations in canyons where conductors are high and special considerations/protocols for certain species such as saguaro cactus, Murphy's agave, century plant and other species specific to each ROW and CMP. Maintenance activities and special consideration are based on data gathered through resource inventories and data provided by agencies.

The description of vegetation management tasks and activities above are fully implemented on Federal USFS and BLM lands, State Trust lands and Tribal lands and to a lesser extent on private lands (see Recommendation 5/13).

Maps and/or geospatial record system to describe the ROW resource base

Maps were provided for all sites the auditors reviewed. Maps are included in CMP's, associated with land use right documents and were available in any scale to be printed or provided electronically. The APS GIS included all ROW resources searchable by descriptors in the lists of ROW assets and schedules discussed in the "Description of right-of-way resource" section above.

Environmental limitations and safeguards

Appropriate environmental safeguards are described in the *Vegetation Management Manual*, *TVMP* and *Herbicide Plan* at a general level. Individual ROW CMP's further describe ecosystem and site-level safeguards as appropriate. Site-level planning and protection of biological resources is further described in findings under Principle 8.

Plans for conservation of ecosystem services

The documents that guide APS strategic and tactical vegetation management plans address conservation, defined as the protection and wise use of resources, and the conservation of ecosystem services. Ecosystem services are things we get from nature without management including but not limited to: *food and water; flood and disease control; cultural services such as spiritual, recreational and cultural benefits; and supporting services such as nutrient cycling that maintains the condition for life on earth* (from Green Facts). Ecosystem services can be adversely affected by almost any human activity, including vegetation management of ROWs.

Conservation natural resources, cultural resources and ecosystem services are described in a general way in APS' overriding vegetation management program documents. Details of how ecosystem services are conserved are components of Principle 8.

A means of monitoring the work, including feedback

Monitoring the work is accomplished at two levels: annual aerial patrols for NERC regulated lines and aerial and/or ground patrols for all ROW Resources during Project planning and post treatment monitoring. The *2013 Vegetation Management Manual* and *2013 TVMP* contain references to report forms for both types of monitoring. Aerial patrols are recorded as completed and exceptions noted to the required clearances and to vegetation management deficiencies. Follow-ups to "deficiencies" are noted, scheduled and dates of corrective actions recorded. The APS Project Planning Checklist document includes a Work Reviews section where contacts with property owners and agencies and descriptions of findings from ground inspections are noted and tracked. The form also includes a Completion Date that acknowledges completion of all vegetation maintenance work for each Project. This Project Planning form appears to provide a mechanism for feedback related to completion of each Project. This form and process may also inform Planners and agencies for the next maintenance cycle. Feedback to the high level vegetation management program is not provided by this form or process. Feedback is further discussed in Principle 10.

Wildfire management plan

APS ROW Resources exist in a landscape where wildfire management is a key factor in development of vegetation management objectives. Wildfire prevention was cited as the reason for enhanced clearance between conductors and vegetation by APS personnel during the field observations. Potential for electric arcing from conductors to vegetation was cited as a significant issue for APS. Wildfire Management is not explicitly stated as an objective in the *Vegetation Management Manual* Section 1. The reliability and safety objectives in the *Vegetation Management Manual* are indirect references to the importance of wildfire management.

Electrical arcing from conductors, directly to vegetation or through ionized smoke from a fire, was mentioned as significant cause of unplanned line outages. It was reported that lines are sometimes de-energized in response to fires to allow safe firefighting and prevent unplanned outages from arcing through smoke. Clearly wildfire is an issue APS needs to address. APS Forestry staff presented evidence of an on-going study with an outside-consultant to assess impacts from fire and provide a fire risk map to APS to be used as a risk assessment tool to identify where wildfire management is more or less important to the vegetation management program. Completion of this study and use of the risk assessment tool will allow APS to improve its approach to wildfire management (see Observation 5/13).

Score: 4.0 / 5.0

Good Practice 11/13: APS *10-Year Transmission and Distribution Schedule* establishes a good record of the ROW Resource asset.

Recommendation 5/13: APS should, through updates to the *Vegetation Management Manual*, *TVMP*, *Herbicide Corridor Management Plan* and Project CMPs, add a high level description of land use classification of adjacent lands and clarify the relationships between these documents and the scope of the ROW Resource to which each applies.

Observation 5/13: APS could complete the wildfire risk study and amend its *Vegetation Management Manual* and vegetation management practices to reflect the outcome of the study.

CRITERION 4.2: The ROW Asset Manager has in place tactical project maintenance plans that are developed annually and take into account local considerations. They provide details of the intended activities planned for each IVM-based vegetation maintenance project.

Findings. APS produces an annual *Transmission Vegetation Management Plan (TVMP)* that lists all NERC lines for inspection and NERC lines for vegetation management work. The *TVMP* describes the inspection methodology, schedule, clearance distance requirements by voltage class, the vegetation management schedule, personnel and their roles in implementing the tactical plan.

The TVMP's include a list of all NERC lines scheduled for vegetation maintenance treatment in a given year (see Observation 8/13). The *TVMP* is applied to all APS lines scheduled for treatment in a given year, including 69 kV (Lisa Young, personal communication). The full list of lines to be treated is extracted from the 10-Year schedule maintained at a system level in a spreadsheet. The *TVMP* includes a discussion on IVM and site-specific vegetation management.

Project planning and development of CMP's for federal, state and tribal lands is carried out per *Energy Delivery Procedure no. VEG005: Agency Coordination Process*. Site specific conditions and vegetation management prescriptions are

presented in the CMP for each Project. This new Procedure has been applied in previous years as a Project Planning checklist for CMP's developed primarily for federal, state and tribal lands. Job Profile forms are used for Project planning on private land. Tribal lands, depending on the size of ownership and nature of the relationship between APS and the tribes sometimes have CMP's or more typically have Job Profile forms to describe the work.

Score: 4.0 / 5.0

CRITERION 4.3: Strategic management and tactical maintenance plans are periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social, regulatory, and economic circumstances.

Findings. The *Vegetation Management Manual* reviewed by the auditors was dated 2013. As noted elsewhere in this audit report, this document has been revised by APS subsequent to the field audit. *TVMPs* were provided for each year, 2011, 2012 and 2013. Review of the *TVMPs* shows annual changes reflecting more rigorous practices, year on year (see Good Practice 12/13). CMPs were provided to support individual site reviews. Applicable dates on these CMPs ranged from 2008 to 2012. The quality of the CMPs – evidenced in discussions on detailed site planning, sensitivity to biological and cultural resources, consultation with and approval of stakeholders, and other elements – clearly improved over the 5-year span these plans cover (see Good Practice 13/13).

The herbicide program at APS only began in 2008. The policy and procedure document that was provided is the APS *2012 Transmission and Distribution Corridor Management Plan*. This document guides the herbicide program on all ROW resources where herbicides are used. Herbicide mixes have been updated annually based on observed efficacy of past treatments, advice from Southwest Ground Control (the applicator contractor), input from herbicide manufacturer representatives and input from IVM Partners, Inc, an IVM consultant. See findings associated with Criterion 5.2 for more on herbicide efficacy and need for properly organized studies to assess results of treatments.

There is no clear feedback policy or mechanism for incorporating the results of monitoring impacts and efficacy of the vegetation management treatments (see Recommendation 6/13). Observed performance and review of evolving vegetation management program documents provide qualitative evidence of feedback into changes to the strategic and tactical vegetation management program.

Score: 4.0 / 5.0

Good Practice 12/13: Transmission Vegetation Management Plans show improvement over time.

Good Practice 13/13: Corridor Management Plans show improvement over time.

Recommendation 6/13: A policy and process for formal feedback to improve management practices should be implemented by APS based on results of monitoring. This Recommendation applies both to Criterion 4.3 and 10.1.

CRITERION 4.4: IVM workers are competent to ensure proper implementation of vegetation management plans.

Findings. APS staff are well qualified to conduct their professional work, as evidenced by the following listing of staff qualifications (developed by Lisa Young and others at APS in May 2013 at the request of the auditors):

Licenses and Certificates	Crew Foremen / Tree workers	Planner	Coordinator	Leader	Natural Resource Specialist	Manager
ISA Certified Arborist	x	x	x	x	x	x
ISA Certified Utility Specialist	x	x	x	x	x	x
ISA Western Chapter Certified Tree Worker	x			x		
ISA Municipal Specialist	x			x		
Office of Pest Management Applicator License	x	x	x	x	x	x
Office of Pest Management Qualified Party				x		
ISA Tree Risk Hazard Assessment	x					
Apprentice program	x					
Register of Professional Archaeologist (RPA)					x	
Class A CDL	x	x				
Bachelors Degree (Forestry)		x	x	x	x	x
Bachelors Degree (Archaeology, Biology, or Related)				x	x	
Graduate Degree					x	
Arizona Antiquities Act Blanket Permit					x	
Bureau of Land Management ARPA Permit					x	
Prescott National Forest Archaeological Survey Permit					x	
Tonto National Forest Archaeological Survey Permit					x	
AZSite Database Access					x	

Licenses and Certificates	Crew Foremen / Tree workers	Planner	Coordinator	Leader	Natural Resource Specialist	Manager
Arizona Game & Fish Scientific Collecting Permit (Desert Tortoise)					x	
Arizona Game & Fish Scientific Collecting Permit (Flat-Tailed Horned Lizard)					x	
Archaeological Resources Protection Act (ARPA) Law Enforcement Training Program					x	
Section 106 Principles and Practice					x	
Section 106 Negotiating and Writing Agreements					x	
Section 106 NHPA Consultation					x	
Innovative Approaches to Integrating Section 106 and NEPA					x	
Chiricahua Leopard Frog Certification					x	
Flat-Tailed Horned Lizard Certification Training					x	
Desert Tortoise Surveying, Monitoring, Handling Training					x	
Burrowing Owl Surveying Training					x	
Southwest Willow Flycatcher Survey Training					x	
Section 7 Consultation					x	

In addition to the above-listed qualifications, APS staff are active at continuing education and training (see findings associated with Criterion 5.3), with some of this effort at continuous improvement tied to the broad array of current professional affiliations (table developed by Lisa Young and others at APS, May 2013):

Professional Affiliations	Tree worker	Planner	Coordinator	Leader	Natural Resource Specialist	Manager
Utility Arborist Association (UAA)	x	x	x	x	x	x
International Society of Arboriculture (ISA)	x	x	x	x	x	x
ISA Western Chapter	x	x	x	x	x	x
ISA Finance Committee						x
AZ Ccommunity Tree Council (ACTC)	x	x	x	x	x	x
Society for American Archaeology					x	
Arizona Archaeological Council					x	
Utah Professional Archaeological Council					x	
Association of Power Biologists (APB)					x	
The Wildlife Society					x	
Avian Power Line Interaction Committee					x	
Southwest Vegetation Management Association				x		
Arizona Archaeological and Historical Society					x	
Old Pueblo Archaeology					x	
Center for Desert Archaeology (Past Member)					x	

The observed performance in the field was the only evidence the auditors had to develop findings for this criterion as related to treatment contractors. The auditors observed the results of mowing, manual cutting, pruning, herbicide treatments and transplanting of saguaro cactus. The results observed show a very high compliance by IVM workers with the APS vegetation management specifications and work practices. Mowing was low to the ground, as was slash. Stumps were low to the ground after hand cutting with chainsaws. Pruning was consistent with ANSI A300 standards. Herbicide applications were selective and target species properly selected. Work in riparian zones was inconsistent (See Criterion 8.1). Efficacy of herbicide treatments was inconsistent. This is more a prescription problem than IVM Worker problem. The transplanted saguaro cactus plants along the 500-3 and 115-3 ROW achieved a high degree of success.

No ongoing work by IVM workers was observed. No IVM Workers were interviewed (see Observation 6/13).

Score: 4.5 / 5.0

Observation 6/13: The next audit of APS should include observations and audit of active VM maintenance and the contractors IVM Workers. Qualifications of IVM Workers should also be reviewed.

Principle #5: Understanding Pest and Ecosystem Dynamics

Knowledgeable managers and practitioners are able to identify both incompatible and compatible vegetation and plant communities in the managed system, and understand the effects of various IVM methods based on knowledge of life histories and ecosystem processes. This is foundational knowledge for Vegetation Managers and vegetation management workers.

Principle Score: 4.33 / 5.00

CRITERION 5.1: Vegetation Managers are knowledgeable about the managed ecosystem, especially with regard to the basic biology and ecology of plant and animal communities occupying and/or making use of the ROW system, and the environment in which they occur.

Findings. APS staff demonstrated broad plant identification skills for common species, but only a few staff knew more than the basic species (see Observation 10/13). Since the mowing and herbicide work is based on knowing which undesirable plants to remove from a ROW, and since there really are few such plants on any one ROW (e.g., tamarisk, palo verde, ironwood, and mesquite in the lowland areas; oak, cedar, and pine in the upland areas; and cottonwood and sycamore in the riparian areas), the strict need for identification is really simple and broadly known by APS staff; it is expected that contractors have similar ID skills as observed vegetation management work indicated select and focused work only on target species.

As noted elsewhere in the report, the APS vegetation management team includes people with diverse education and work backgrounds (see Good Practice 14/13). The Natural Resource Specialists in particular are trained and educated biologists – these people appeared to have the strongest plant ID skills and ecological understanding of ROWs. Additionally, Natural Resource Specialists have been trained in identification and protection of select RT&E species (see findings associated with Criteria 4.4 and 5.3). While other staffs are well experienced and educated for their specific work tasks, there were some areas where more training could improve skills and knowledge needed for broader understanding of IVM (see Observation 7/13). For example, few interviewed staff knew what allelopathy was, despite its importance as a mechanism controlling plant succession in western environs. Select staff do participate in training to improve biological and ecological skills and knowledge, but a broader selection of staff could benefit from more biological and ecological education and training.

Score: 4.5 / 5.0

Good Practice 14/13: APS Forestry and Special Programs has a diverse vegetation management team, from the tree workers to the Manager of Forestry

and including Natural Resource Specialists, Section Leaders, and Planners – all with different job responsibilities and professional expertise – which allows APS to collectively, efficiently and effectively meet a complex of planning, decision making, and management action needs.

Observation 7/13: Training could be provided in the following areas to elevate APS full capacity to sustainably practice IVM: plant identification and understanding of life history of a full complement of target and non-target ROW species; and plant succession and community dynamics in a wide variety of ecosystems, from desert to montane.

CRITERION 5.2: Research, development, and demonstration activities such as field trials should be supported (and/or engaged in directly) to provide additional insights, and to provide an opportunity for enhancing understanding and knowledge of the ecology of the managed ROW ecosystem, and to support continuous improvement. Results of IVM efforts are monitored and used to identify opportunities for research and development that may enhance program performance.

Findings. APS does support research, development and demonstrations activities, including a new, extensive, replicated (across different ecosystems of Arizona), manipulative field experiment to test the effectiveness of different vegetation management treatments, including different herbicide mixes, to control target plants and promote desirable plants (plant community-level research). IVM Partners was contracted a few years ago to do the research, which began with workshops and interactions with various stakeholders (e.g., APS, Arizona State University, Cibola National Wildlife Refuge, DuPont, Navajo Nation, Prescott National Forest, Southwest Ground Control). One of the study sites was used as a field demonstration during the Fall 2012 10th International Symposium on Environmental Concerns on Rights-of-Way. One of these sites was visited during the audit (Mingus Mountain). Coincident to this ongoing field research, APS provided in-kind support to Arizona State University to conduct some small-scale research on herbicide efficacy on target plants. It is expected that results from the ongoing IVM Partner research will enhance ecological knowledge of the managed ROW ecosystem, and will be used by APS to support continuous improvement. This research is being conducted in concert with an operational program that is leading in the Western United States where herbicide use across the region is broadly only in the early stages of development (see Good Practice 15/13).

IVM efforts are monitored by APS (see findings associated with Principle 10), but these efforts have not been fully used to identify research and development opportunities that may enhance program performance (see Observation 8/13). For example, it is common knowledge based only on APS personnel's personal observations and anecdotes, that the current herbicide mixes used by APS are usually only 50% effective in controlling common target plants (e.g., tamarisk, mesquite, palo verde). Yet, APS has not committed funds to specifically research herbicide efficacy as affected by herbicide mix and application technique coupled with plant biology and plant community ecology (see Observation 9/13).

Score: 4.0 / 5.0

Good Practice 15/13: APS should be commended for their region-leading and ongoing support of extensive field research on the effectiveness of different vegetation management treatments, including different herbicide mixes, to control target plants and promote desirable plants.

Observation 8/13: Monitoring of IVM efforts could be used by APS to identify research and development opportunities that may enhance program performance related to both environment and socioeconomics.

Observation 9/13: APS could research herbicide efficacy as affected by herbicide mix and application technique coupled with plant biology and plant community so as to improve percent kill above the current, anecdotal level of 50%.

CRITERION 5.3: Vegetation Managers and IVM workers are provided opportunities to improve their skills and knowledge through education and training.

Findings. APS vegetation managers and IVM workers are provided opportunities to improve their skills and knowledge through education and training. APS Forestry and Special Programs staff are diverse in background and expertise, ranging from biology to forestry, archaeology to GIS, arboriculture to pesticide applicators – each person has a specific area of professional work that requires training and continuous improvement in order to maintain professional standing and associated certificates and licenses (see findings associated with Criterion 4.4 that highlight professional society membership). Examples of the types of annual training opportunities afforded by APS vegetation managers and IVM workers include (table provided by Lisa Young, APS, in May 2013 at request of auditors):

Training Courses, Conferences, Meeting, Continued Education, etc.	Tree Workers	Planners	Coordinators	Leaders	Natural Resource Specialist	Manager
AZ Community Tree Council Annual Conference	x	x	x	x		x
AZ Community Tree Council Tree Climbing Championships	x			x		
Arizona State University Regional Tree and Shade Summit				x		
Weekly Tailboard	x	x	x	x	x	x
OPM CEU Training Class	x	x	x	x	x	x
ISA International Conference	x	x	x	x	x	x
WCISA Annual Conference		x	x	x	x	x
Vegetation Managers Summit: FAC-003						x
UAA Regional Meetings				x		x
UAA ROW Symposium	x	x	x	x	x	x

Training Courses, Conferences, Meeting, Continued Education, etc.	Tree Workers	Planners	Coordinators	Leaders	Natural Resource Specialist	Manager
Association of Power Biologists Annual Conference					x	
Chiricahua Leopard Frog Training					x	
Yellow-billed Cuckoo Survey Training					x	
Desert Tortoise Council Desert Tortoise Training					x	
Southwest Strategy Biological Assessment Workshop					x	
Western Burrowing Owl Training					x	
Flat-Tailed Horned Lizard Certification Training					x	
Desert Tortoise Surveying, Monitoring, Handling Training					x	
SWCA's Southwestern Willow Flycatcher Survey Training					x	
Courtney Conway's Secretive Marsh Bird Survey Training					x	
FWS National Conservation Training Center Course: Migratory Birds - A trust responsibility					x	
ESRI International User Conference					x	
National Environmental Training Center: Writing the Perfect EA, FONSI, or EIS					x	
Davey Institute of Tree Sciences Training					x	
National Preservation Institute: Section 106 - Agreements Documents					x	
TCIA Electrical Hazards Awareness Program				x		
Apprenticeship Program	x					
Rigging Crane Training	x	x	x	x		
Business Improvement University (APS Program for Leadership)			x	x		

Clearly, APS staff can observe and report sites occupied by incompatible plants that exceed action thresholds. Additionally, APS staff have the capacity to observe and report significant forest and tree pests and pathogens when they are encountered in the field, e.g., while such occurrences are rare in Arizona, the auditors did discuss pine bark beetles and their landscape management, particularly as related to off-ROW hazard and danger trees. APS has limited need for off-ROW danger tree work since much of their system is in desert environments that have limited tall tree presences – it is only in select situations in the desert (e.g., plant communities with ironwood, tamarisk, or other tall-growing trees), riparian areas (cottonwood, willow) and as elevation and longitude is increased that problem off-ROW trees become more and more important and a need to understand forest pest and pathogens increases too. APS noted in reviewing a first draft of the audit report that:

"limited" may be an understatement. Agreed that most of the system is in desert, but for the portions that are in forested in the northern part of the state, off-ROW hazards are a real concern and annual patrols specifically target large trees, mostly ponderosa pines. Because of our dry climate, bark beetle, and other factors, we cut down off-ROW hazard trees every year.

APS apparently has an informal system of promoting and tracking training and education to improve skills and knowledge – an "if you need it, you will get it when needed" approach that is currently effective, but could be improved upon by having formal, annualized training reviews and expectations as part of annual employee reviews or planning for the following year (see Observation 13/13). APS noted in reviewing a first draft of the audit report that:

Some continuing education and certification is required as part of the job (ISA, OPM) and tracked through these systems. Also, the performance management process (APTMS) provides a annual screening of performance and trainings. It is not possible to provide an example of this without including personal information.

Score: 4.5 / 5.0

Observation 10/13: APS could develop a more complete, formal system of promoting and tracking training and education to improve skills and knowledge of vegetation managers and IVM workers.

Principle #6: Setting Management Objectives and Tolerance Levels

IVM, as developed adapting principles from Integrated Pest Management (IPM), depends upon basic elements to function as a system. Tolerance (a.k.a. "action threshold") levels are one of the fundamental elements of IVM. Vegetation management actions are scheduled based on conditions and maintenance activities occur when tolerances are exceeded and at the optimal time to meet stated objectives. Primary operational objectives of reliability, access, safety, and regulatory compliance are considered in the context of socioeconomics and environmental desires.

Principle Score: 4.17 / 5.00

CRITERION 6.1: Management planning, including the development of management objectives, considers the societal impact of planned activities. The input of stakeholder groups affected by ROW IVM is invited and considered when developing management objectives. (See also Criterion 6.3 and PRINCIPLES #3 and #4).

Findings. APS's policy of "doing the right thing" is a basis for its regular and routine effort to engage stakeholders before management activities occur on a ROW. Procedures for engaging stakeholders are documented in APS's *2013 Vegetation Management Manual*, though this is mainly intended for distribution or urban transmission work. The manual does include a section on the "Agency

Coordination Process", which describes some stakeholder interaction processes for public agencies. Landowners of a ROW are contacted before ROW work, usually early in the year or during the previous year for Federal lands. Outcomes of stakeholder contacts with private landowners (positive or negative, from problems to solutions) are usually, only informally recorded by APS personnel (e.g., it was observed by the auditors that some APS planners only keep handwritten notes on field maps – these maps are placed in job files, but are informal at best as a record of stakeholder interactions) (see Observation 11/13). When work is being planned for public agency lands, APS has a multi-point coordination process that includes direct interactions with agency reps to engage them in planning and decision-making. This process is documented in the APS's *Agency Coordination Process – T&D – Overview* (undated, circa April 2013).

Score: 4.5 / 5.0

Observation 11/13: APS could more formally track stakeholder engagement in the vegetation management arena, specifically as related to the development of management objectives as part of the planning process where specifics on how management objectives have changed with stakeholder input can be more readily demonstrated (e.g., see findings associated with Criterion 6.3).

CRITERION 6.2: Tolerance levels for incompatible species of vegetation (defined in terms of height and density) are used to develop action thresholds for vegetation maintenance treatment options. They may vary by site type and requirements, and are used in planning and scheduling vegetation maintenance tasks intended to control incompatible vegetation.

Findings. APS has documented clearance thresholds for when ROW vegetation is a problem and needs to be removed, for both on- and off-ROW, in their *2012 Transmission Vegetation Management Plan*. This plan was developed to meet the NERC Standard – FAC-003-1, and per that standard includes specific distances between the conductor and vegetation, consistent with NERC Clearance 1 and Clearance 2 distances. Clearance 1 distances are presented that range from 21.0 to 41.3 feet for under conductor conditions, for voltages of 115 to 500 kV, but with a notation that these could be increased to adjust to local environments. Clearance 1 distances describe what condition ROW vegetation should be just after management. Clearance 2 distances, which range from 2.4 to 18.4 feet, represent the zone that plants should be keep out of at all times (varied distances reflect differences in line voltages and elevation).

In 2008-2010, APS had all its transmission ROWs (115 kV and above) inventoried for ROW vegetation condition using LiDAR (see Good Practice 16/13). LiDAR data information indicated more clearance between vegetation and conductors was immediately needed in many areas. Starting in 2008, APS aggressively and actively managed many ROW corridors so that today they all are in compliance with both Clearance 1 and Clearance 2 distances. During the field audit, all APS ROWs were observed to meet Clearance 1 distances for both under and side of conductor.

APS purports to use a wire zone / border zone in managing ROW vegetation, but this was observed in practice on only a few ROWs (for example, the 500-6/230-24 lines in the Metro Division). In some CMPs, the use of a wire zone / border zone approach was presented (e.g., see the CMP for the 500-3 line), but in practice it was observed that vegetation was aggressively managed in the same manner from edge-to-edge of the ROW. Additionally, some CMPs also reference a lateral zone / sag zone concept, which is similar to the wire zone / border zone except taller vegetation is allowed to grown towards the towers. Similarly, this concept was only observed to be applied to one ROW (500-3 ROW in the Southeast Division). A reason for the lack in use of these concepts is that APS is still refashioning vegetation on their ROWs after the circa-2008 reclamation work. But, it appears that inconsistent application of the wire zone / border zone and lateral zone / sag zone concept is a lack of consistent knowledge and accounting of IVM workers on APS lines (see Recommendation 7/13). APS noted in reviewing a first draft of the audit report that:

> *We agree that we are not consistently apply(ing the) wire zone/border zone. However, wire zone/border zone is only one approach that only applies to some situations. In fact, we use a diversity of management goals based on site specific conditions, rather than always applying wire/zone border zone. We recognize that this is different than what some of our documents say and we will be making changes so that this concept is not listed as our central management tool.*

APS does not have a list of compatible and incompatible species, nor could they consistently identify important low-growing vegetation (see Observation 12/13). Lack of such a list may contribute to inconsistent use of the wire zone/border zone and lateral zone / sag zone approaches. Additionally, there is some inconsistency in APS on what the actual desired future condition of any one ROW is, with different APS staff saying different things for the same ROW corridor. It is clear that managing fire hazard is critical, and that ROW vegetation needs to be managed to meet fire management needs, but at present APS staff do not have a consistent approach to managing vegetation to control fire hazard (e.g., which species at what height can be left on ROWs to minimize fire risk, yet still meet fully the concepts of biological and ecological control associated with a stable, low-growing vegetation community) (see Recommendation 7/13).

Score: 3.5 / 5.0

Good Practice 16/13: APS should be commended for their investment into LiDAR data collection as part of vegetation management decision making, which has led to more consistent maintenance of vegetation in compliance with NERC Clearance 1 and Clearance 2 distances over the last 5 years.

Recommendation 7/13: APS should better define standard clearance prescriptions and management objectives in their Vegetation Management Manual, including a more consistent definition and application of the wire

zone/border zone and lateral zone / sag zone approaches to site-specific management of ROWs when opportune and appropriate.

Recommendation 8/13: A listing of plant species that are compatible and incompatible for fire hazard management should be developed by APS to promote consistent management of plant communities across ROWs.

Observation 12/13: APS could develop a list of compatible and incompatible species for their different ROWs that should vary as a function of voltage and location of plants in wire zone and border zone areas.

CRITERION 6.3: Significant concerns identified in Criteria 6.1 and 3.1 are considered in maintenance policies and plans (for example, management activities are modified in response to concerns, or a rationale is provided for not responding to a concern).

Finding. APS has demonstrated willingness to adjust vegetation maintenance practices based on landowner inputs. There are many examples where the process of stakeholder engagement has led to a change in management activities on a ROW, including the following.

> Example #1: a wetland demonstration area with cottonwoods and willows was "illegally" established by the Salt River Pima-Maricopa Indian Community in 2003 on ROWs 230-06 and 230-7, between spans 23/4 to 23/5. After negotiations between APS and the Salt River Indian Reservation, APS today maintains vegetation in the demonstration area by pruning dozens of tall-growing trees on a near annual basis, which causes APS to do extra, off-cycle work as compared to the rest of the ROW. Normal vegetation management in such a situation would be to completely remove the cottonwood and willow trees.
>
> Example #2: in urban areas, and commonly in the Metro Division, APS has worked to resolved issues regarding tree removal from transmission lines by offering a replacement tree via a voucher system, where the voucher, as an agreement, is used to "order trees, identify the planting locations, and is the customers' assurance that APS will meet its obligations." (p. 46, *2013 Vegetation Management Manual*). Replacement trees can only be those on the APS Tree Replacement list (consistent with a "right tree/right place" program).
>
> Example #3: on the 115-6 ROW, recent vegetation management resulted in large cedar and pine being cut, but rather than lop and scatter the cut trees as per normal practice, APS IVM workers cut the trees into 18 inch lengths and stacked the pieces as free firework for use by the general public, at the request of landowner – the Prescott National Forest.

Tracking of stakeholder engagement has generally only been informal (see Observation 13/13) (see also the findings and observations associated with Criterion 6.1), such as including stakeholder-based changes in management activities via CMPs (see Examples #1 and #3, above).

Score: 4.5 / 5.0

Observation 13/13: Stakeholder interactions could be documented by APS in a formal filing system that includes who was interacted with, the subject of interaction, and the outcome. This information could be used as a performance indicator (see Principle #10), e.g. to assess the overall quality of stakeholder relations, how complaints are handled, and ability to reduce complaint levels over time.

Principle #7. Compilation of a Broad Array of Treatment Options

IVM does not focus on the use of one treatment; instead, every ROW management situation has a treatment prescribed only after considering all viable treatment options. A complete "toolbox" of treatment options is available and used.

Principle Score: 4.33/5.00

CRITERION 7.1: A wide variety of methods including mechanical, physical, chemical, cultural, and biological/ecological maintenance practices are available and considered as appropriate for each site.

Findings. APS uses a wide variety of treatment methods to manage vegetation on their ROWs. Manual and mechanical treatments are routinely used on federal lands, including all of the National Forest lands since the U.S. Forest Service does not yet allow herbicide use by APS in Arizona. Hand cutting with chainsaws was observed by the auditors on private land on 69kV ROWs, and on some higher voltage lines across the system. On private lands, APS expects to treat any resprouting incompatible vegetation with herbicides in a year or more after manual treatment. Mechanical treatments with both a drum grinder and a hydro-axe were observed on various types of ROWs, and commonly across the whole system where APS ROWs were being reclaimed (circa 2008).

APS spent a considerable amount of resources to mechanically and chemically reclaim ROWs after they had been left generally unmanaged or only hot-spotted for the previous decades. These ROWs are now being managed with progressively more refined treatment techniques to create desirable, low-growing, compatible vegetation. Starting right after the major reclamation effort, APS embarked on an herbicide program that became system-wide in 2010. APS is currently in a tight cycle of treating ROWs with herbicides, anticipating it will take at least 2 years to control incompatible vegetation that has resprouted after mechanical treatments. It is expected that only periodic follow-up treatment will be necessary once the initial herbicide treatments have been put fully into effect.

APS is currently working with their herbicide contractor and consultants to refine herbicide mixes used in the varied plant communities and ecosystems. Currently, and based on the geographic location of each line, the following products are being applied using Thinvert (paraffinic oil) as the carrier: Northern Upland Mix consisting of Garlon 3A (triclopyr), Method (aminocyclopyrachlor), Escort (metsulfuron methyl), and Arsenal (imazapyr); Southern Upland Mix consisting of Garlon 3A (triclopyr), Method (aminocyclopyrachlor), and Escort (metsulfuron methyl); and an Aquatic Mix consisting of Accord (glyphosate) and Habitat (imazapyr). These mixes have been adjusted over the last few years to increase efficacy.

Methods for applying herbicide have included cut stump, backpack foliar, and low-volume hydraulic foliar - all used to selectively remove individual incompatible stems, which should lead to increase biological and ecological control (see also findings associated with Criterion 7.2).

APS has staff that are clearly knowledgeable about all of these treatment methods, and the availability of various IVM methods.

Score: 4.5 / 5.0

CRITERION 7.2: Treatments are progressively evaluated and added to the vegetation management program, with emphasis on developing selective treatment options, minimizing the impact on compatible vegetative cover types. Where possible, preferred treatments lead, directly or indirectly, to the establishment of a stable community of compatible species that enhances the prevention and biological/ecological control of incompatible species.

Findings. Prior to 2008, APS had a limited set of treatments used in their vegetation management program: pruning, tree removal by hand (manual), mowing and some cut stump herbicide treatment. APS changed their management program in response to the 2007 letting of the North American Electric Reliability Corporation (NERC) Reliability Standard FAC-003. Beginning in 2005 (and prior to the NERC standard), APS has aggressively reclaimed all of their ROWs by conducting hand and mechanical vegetation management projects across its transmission system. A variety of different mowing machines were used depending on site and vegetation conditions. Today, private, state and Native American reservation lands are receiving follow-up herbicide treatments where select incompatible vegetation (e.g., mesquite, palo verde, tamarisk) are being individually treated with foliar herbicides. Herbicide mixes have been changed each year in response to low-levels of control from previous years of treatment.

APS does have policy and procedure documents that commit the utility to predominant use of selective treatment methods, e.g., see the *Vegetation Management Manual*, the *TVMP*, and the *Herbicide Corridor Management Plan*. The combination of treatments – reclamation to today's selective use of herbicides, is leading directly to the establishment of a stable community of compatible species that enhances the prevention and biological/ecological control

of incompatible species (see Good Practice 18/13). Complex ROW plant communities were observed across the transmission system that include a variety of forbs and shrubs that are an outcome of a selective treatment method approach and indicative of a stable ROW plant community.

On federal lands, APS is restricted from using herbicides and allowed only to manually or mechanically treat vegetation. These non-chemical approaches to managing vegetation will gradually lead to ROWs dominated by incompatible species and short treatment cycles (see Recommendation 9/13). APS noted the following in reviewing a first draft of the audit report:

> *With BLM we have submitted a scope of work and begun the process of coordinating with them for the NEPA process. With FS, we have also started the process and are awaiting a funding agreement with the FS before beginning. We also have started separate discussions with Tonto NF for use of herbicides on 2 transmission lines on Tonto, and the approval process is underway.*

See Good Practice 18/13 in response to APS's comments.

Score: 4.5 / 5.0

Good Practice 17/13: APS's development and progressive application of a variety of mechanical and chemical treatment methods, from reclamation efforts starting in 2005 to today's selective use of herbicides is leading directly to the establishment of a stable community of compatible species that enhances the prevention and biological/ecological control of incompatible species.

Good Practice 18/13: APS's broad and persistent effort to develop a herbicide use program on federal lands.

Recommendation 9/13: APS should continue working with the U.S. Forest Service and other federal agencies to develop an herbicide use program on federal lands, consistent with the tenets of IVM and as currently being practiced by APS on non-federal lands across Arizona.

CRITERION 7.3: Equipment, tools and technology are up to date and adequately maintained and supported to ensure proper implementation of the management plans.

Findings. APS office facilities were ample and well maintained. Fleet vehicles, while old (~10 years old), were clean, well kept and maintained. APS has in-house fleet maintenance, and contracts out regular washing. APS has the routine of checking vehicle and vegetation management equipment for condition. During the audit, two wood chippers in one Division had problems with the hitches that caused them to be removed from service while being repaired, and caused a system-wide check of this type of equipment for similar problems (weld breakdown on hitch). Computer systems were adequate, though mainly only office-based (Observation 14/13). GIS and data management technologies were

available in the office, but were not field accessible, nor were updatable except by select APS personnel (Observation 15/13).

Score: 4.0 / 5.0

Observation 14/13: APS could consider introducing field computers to aid in real-time data collection (inventory and monitoring), recording of stakeholder interactions, and updating of field maps.

Observation 15/13: Utility of existing GIS could be expanded to be more accessible and useful for at-time-of-management activities, including adding an ability for site data and field maps to be updated at the time of discovery.

Principle #8: Accounting for Economic and Ecological Effects of Treatments

Cost effectiveness and expected ecological effects over time are used as a basis for selecting IVM treatments. The preferred approach systematically establishes compatible vegetation cover types that assist in reducing populations of incompatible trees on the ROW.

Principle Score: 3.67 / 5.00

CRITERION 8.1: The vegetation management program must be economically viable, while taking into account the full environmental, social, and operational costs of vegetation management activities. Treatment choices are made with full consideration of direct and indirect cost, including a wide array of positive (ecosystem services) and negative environmental and social externalities, as follows:

a. Water resources: perennial and ephemeral streams, wetlands, vernal pools, seeps

b. Wildlife and their habitats, including insects, animals, and birds

c. Rare, threatened, and endangered plant and animal species, their habitats, and communities (according to state and federal statutory listings).

d. Invasive species of plants

e. Aesthetic impacts

f. Cultural resources

Findings. APS has written guidelines across various documents to ensure that the vegetation management program is economically viable, while taking into account the full environmental, social, and operational costs of vegetation management activities. Treatment choices are made with full consideration of direct and indirect cost, including a wide array of positive (ecosystem services) and negative environmental and social externalities.

A key overarching document is the *2013 Vegetation Management Manual*. While this manual is mostly about distribution work, it does extensively cover environmental stewardship, cultural resources (including procedures), biology with an emphasis on rare, threatened and endangered species and wildlife (including agency coordination) and noxious weeds (non-native invasive plants). In practice, APS was observed to regularly implement their plans for these environmental and social externalities, with some variability over time (last 5 years) and across their ROW system.

APS does not have a specific set of policies or procedures for maintenance of biodiversity per se, but takes care of biodiversity through the conservation of resources listed in these criteria and addressed below. APS does have policy for identification and selection, and description of areas of ecological significance that they afford protection as special management areas.

Water resources

Water resources were observed to be protected by APS with adequate planning and appropriate, sensitive maintenance operations, but there was variability in performance with field definition of riparian areas (see Recommendation 10/13). For example, cut trees were observed to be pulled back from water edges as per Forest Service directives, but it was unclear if the pull-back zone was from water's edge or from the edge of the riparian zone. APS commented with the following after reviewing the first draft of this report:

> *The FS documents clearly state "25 feet from high water", though crews may not have followed this correctly. Could this be more of a problem of crews misunderstanding the requirements rather than the requirements not defined well?*

Herbicides were observed to be used up to water's edge, and by contract are supposed to be an aquatic mix. Numerous field interviews with APS staff demonstrated an inconsistency in where riparian areas were located on a ROW. APS staff did indicate that heavy equipment was not used in wet soils, including in riparian areas. No rutting from vegetation management activities was observed across all APS ROWs. APS does have general inventories and GIS-based maps showing site-specific location of large water resources, but smaller courses, wetlands, and site-specific riparian zones and areas are not regularly mapped (see Recommendation 10/13).

Wildlife and their habitats

Wildlife and their habitats are conserved by APS with adequate planning and appropriate, sensitive maintenance operations. *W*ritten policies and procedures were developed by APS for the conservation and protection of wildlife, particularly for sensitive and/or federally listed threatened and endangered wildlife and plants and their habitat (see the *2013 Vegetation Management Manual*) (see Observation 16/13). APS notes that (in response to the first draft of the audit report that:

We already include and consider sensitive species, migratory birds, and even game and non-game species. We have numerous documents (CMPs and letters) to show this and can provide these on request. For game, we are implementing a timing restriction on for a quiet area for large game animals on the Coconino NF.

APS personnel work early in the planning process with various agencies to define species and habitats of concern. From the APS *2013 Vegetation Management Manual (p. 69):*

In 2008, APS and other utilities in Arizona, FS, and FWS completed a programmatic consultation for all federally listed threatened and endangered species that could be affected by utility maintenance work (FS 2008, FWS 2008). NPS and tribal consultations are typically done on a project by project basis. Other agencies, such as BLM and State Trust Land require a less formal process for conserving federally listed and sensitive species and the process involves APS Natural Resource Specialist and the agency specialist coordinating to determine what conservation measures should be applied to a project and documenting the requirement informally through an email or formally through a letter or Operating Plan.

APS Natural Resource Specialists manage plant and wildlife species data that are provided by the agencies. For the power lines on FS land under the programmatic consultation (FS 2008, FWS 2008) and where a permit renewal or new permit has required Endangered Species Act section 7 consultation and specialist reports, species conservation measure data is stored in the APS Online Transmission GIS system and locally in the Natural Resource Specialists' computer data folders. For many other areas, specific conservation measures have not been identified and the area requires a review of species data provided by the agency. The majority of the species data is stored in GIS databases and can be accessed and reviewed by a qualified Natural Resource Specialist. For areas where APS does not have species data, the project area is reviewed in the Arizona Heritage Data Management System On-line Environmental Review Tool (http://www.azgfd.gov/hgis/) to get a list of species that potentially could be present in the vicinity of the project area.

Citations:

U.S. Fish and Wildlife Service. 2008. Biological Opinion: Phase II Utility Maintenance in Utility Corridors on Arizona Forests. July 17, 2008.

U.S. Forest Service. 2008. Biological Assessment: Phase II Utility Maintenance in Utility Corridors on Arizona Forests. February 29, 2008.

Species conservation measures used by APS to protect wildlife include: 1) timing restrictions for work on power lines; 2) avoidance; and 3) modified treatment.

For example, work on power lines near Mexican spotted owl nesting sites is avoided as much as possible during the breeding season (March 1 to August 31) – one ROW pre-selected by the Lead auditor for visitation was in this habitat type, but was excluded for site visit by APS as it was the breeding season. Additionally, the audit team observed how tree logs and whole cactus plants were cut and left on the ground to provide habitat at the request of the landowner, and how trees in some riparian areas were pruned to maintain conductor clearance and still provide for plant cover as corridors that crossed a ROW.

APS has had a long-term partnership with the Wild Turkey Federation with an observed, protected feeder/watering station observed on the Apache-Sitgreaves National Forest (via overflight of ROW 345-1 in a helicopter). Additionally, APS does have a formal partnership with Liberty Wildlife. They are engaged with the Wildlife Federation and work with the Arizona Game and Fish to develop a tortoise awareness program. APS donates helicopter time with this state agency to located and band eagles. APS has partnered with Liberty Wildlife and Wild at Heart to locate and establish burring owl habitat (see Good Practice 19/13).

APS ROW management can result in improved connectivity across the ROW (and less fragmentation), especially in riparian areas with high overhead clearance. Management of riparian area and deep washes where vegetation could be left taller and in more complex state than in the upland ROW areas was observed to be mixed in application – on some ROWs these zones were managed for continuous higher vegetation cover (e.g., on Oak Creek where it is crossed by the NW-2 line and where two coyotes were observed by the audit team using the corridor in mid-afternoon to cross the ROW), but a similar opportunity on the riparian area and associated wash on ROW 115-6 had all high cover vegetation removed from the ROW (Observation 17/ 13). APS provided the following comment as part of their responses to the original draft report:

> *We agree that consideration to fragmentation should play a part in ROW management decision making in some areas. However, much of AZ contains sparse, disconnected vegetation where fragmentation would not be likely. As described above, there are areas were canyons and such are not maintained. Additionally, in the FS programmatic consultation, fragmentation was considered for effects to T&E species. Though the specific word "fragmentation" may not have been used, effects from clearing the ROW were assessed in regards to species habitat.*

APS has been a leader in developing and adopting the use of Avian Protection Plan (APP) guidelines (see Good Practice 20/13), as found in "Suggested Practices for Avian Protection on Power Lines" guidelines written in partnership through USF&WS and the Avian Power Line Interaction Committee. APS was instrumental in developing the national APP, and has worked to implement it on ROWs over the last 5 years. Transmission structures were observed to have been modified to prevent large bird electrocutions (see engineering solutions, e.g., conductor covers). APS has established a migratory bird protocol with the BLM

to protect nest birds. This protocol is incorporated in the draft Avian Protection Plan as well.

Rare, threatened and endangered species and communities

Rare, threatened and endangered species and communities are well-protected by APS with adequate planning and appropriate, sensitive maintenance operations. APS spearheaded programmatic consultation with the Forest Service and the Fish and Wildlife Service (see Good Practice 21/13). They played a major role in this effort, and were ahead of the times for many utilities when this was completed in 2008. Written policies and procedures for the protection of RT&E species and their habitat are presented as part of the general wildlife plan (see above). It was clearly observed in the field that when the ROW Asset Manager is aware of the presence of RT&E species and their habitats, management operations are adjusted in terms of timing and type of management activity. For example, on the 500-5 and 230-16 Gila Bend to Jojoba Substation ROW, APS avoided conducting vegetation maintenance/clearing work in the floodplain of the Gila River during the Yuma clapper rail and Southwestern willow flycatcher breeding seasons (March 15 and May 1st to August 31st, respectively). Similar work was conducted with the Chiricahua leopard frog on the Tonto National Forest where it was necessary to avoid use of the northern access point of FR202 from July 1 to September 15th, or if operations were conducted during this time frame, a maximum of five pickup trucks were to be allowed daily. APS works closely and persistently with the various state and federal agencies on management associated with RT&E species.

A good practice by APS is the addition of photos and life history descriptions of select RT&E species to aid IVM workers in identification of said organisms in the field and to elevate the carefulness and sensitivity of vegetation management work (see Good Practice 22/13).

Invasive species of plants

APS reported that invasive exotic plants are controlled when it is practical to do so. Most of the invasive, exotic work by APS is centered on minimizing inadvertent movement of these plants. APS does work with land management organizations, and will remove invasives at their request – although this was not observed in practice. APS should be more proactive in the management of invasive exotic plants across their ROW systems (see Recommendation 11/13).

APS presented the following in their 2013 Vegetation Management Plan (p. 73, under "Noxious Weed Control"):

1. *Minimize the number of trips in and out of an area infested with noxious weeds.*
2. *Wash vehicles and brush plant parts off vehicles after completing an area infested with noxious weeds.*
3. *Crews are to brush off clothing and equipment free of plant parts before leaving an area infested with noxious weeds.*

4. *Conduct training sessions with crews, planners, and contractors in the identification of noxious weeds.*
5. *In areas where herbicide treatment of vegetation occurs, use of the herbicide on noxious weeds present in ROW is recommended if the herbicide in use is effective against that weed.*

Cleaning of people and equipment after work in a US Forest Service-defined infestation areas is a norm for APS (in addition to the above, see the 2012 CMP for the 500-3 line). It is unclear how an "infestation area" is defined, including what invasive, exotic species and abundances normally dictate assignment of an area to this status (see Observation 18/13).

It was observed on one recently constructed ROW that APS used native plants to seed disturbed areas associated with tower construction (the 3-year-old ROW associated with the 500-6 and 230-24 lines). This is a practice consistent with proactive management of invasive plants, which in this cited case was required by the landowner.

Aesthetic impact

Visual impact of vegetation maintenance activities were observed to be considered by APS in planning work and operations. For example, on the 115-6 line, a visual buffer of managed taller shrubs and short trees was maintained along a Forest Service road at the request of the Prescott National Forest (this was also described as part of planning in the ROWs CMP). A good practice by APS across all of their lines is the removal, chipping or lopping of trees and shrubs on a treated line, which effectively reduces negative visuals associated with felled woody plants (see Good Practice 23/13). In practice, it is the unwritten policy of APS to use foliar herbicides on undesirable plants less than 10 feet tall, and more commonly less than knee height, so as to minimize "brown-out" – the shift of plants from green to brown color as the plant and its foliage is killed with herbicides (Mike Neal, APS, personal communication). Apparently, this policy for size of vegetation to be treated is not documented, nor does APS have written policies or procedures for management of visual impacts (see Observation 19/13).

Cultural resources

Cultural resources, including sites of religious importance and historic and community significance, are fully considered by APS with adequate planning and appropriate, sensitive maintenance operations. In 2012, APS received the Governor's Award in recognition of the high level of company-wide conservation of Arizona's cultural resources. From 2008 to present, APS has inventoried all cultural resources on their transmission lines (millions of dollars invested to locate, describe and document thousands of sites) (see Good Practice 23/13). Early on, the higher voltage lines were inventoried for cultural resources, and later the subtransmission 69 kV lines. .

Cultural resource protection is presented as core to company philosophy: "do the right thing" (APS *2013 Vegetation Management Manual*). From the *2013*

Vegetation Management Manual the following procedures are presented in general for the protection of cultural resources: pre-project consultation are completed by IVM workers with the APS Archaeologist, then the APS Archaeologist contacts the appropriate land managing agency's archaeologist in order to work out a specific approach for the project as it may affect cultural resources (usually APS commits to certain actions with regard to how cultural resources will be treated for a given project, and that information is written into a CMP). For mowing projects, any cultural resource areas within those ROWs are flagged by a qualified archaeologist prior to any vegetation management work, and those sites are then avoided by the mowers. This practice was observed for ROWs 230-18 and 115-3 (artifact scatter areas). For hand cut areas, it is routine that on "fire sensitive sites" the IVM workers carry (not drag) cut trees and other plants to be scattered within the ROW but outside the flagged cultural site boundary. Maps of cultural sites are not provided to IVM workers to protect the confidentiality of site locations, but sites are flagged for avoidance to avoid adverse impacts. As a backup, site tables indentifying spans including archaeological sites are provided to IVM workers.

APS apparently has excellent relations with the various Native American Tribes, which leads to a strong sensitivity and effective protection on important cultural sites (J. Shumaker, APS, personal communication).

Aspects of biologically-based cultural resources were discussed with APS personnel, with reference to ironwood and agaves. Agave plants [e.g., Murphey's Agave (*Agave murpheyi*) and Tonto Basin Agave (*Agave delamateri*)] were used by native peoples as a cultivated food source. Today, when these are found in the field, they are often protected as long as they do not interfere with the safe and reliable transmission of electricity. APS could elevate this element of cultural resource stewardship in policy and procedure documents, as at present it is only documented in CMPs with ROWs on some National Forests (see Observation 25/13). APS provided the following comments in response to reviewing this finding in the first draft report:

> *Some plant types such as agaves can be indicators of archaeological sites, but the plants themselves are not called out by any tribe or agency for specific protection. We work with agencies and tribes to address any concerns regarding sensitive plants.*

Additionally, APS commented separately that they "have and continue to consult with both agencies (including SHPO) and tribes about this issue. No concerns have been express to us and we were very proactive on this issue. In fact, tribes who are … more concerned with biological resources have been more receptive to herbicide treatments (than) most other agencies."

Score: 3.5 / 5.0

Good Practice 19/13: Formal partnerships with organizations interested in wildlife management are used to promote species of concern.

Good Practice 20/13: APS's leadership in developing and adopting the Avian Protection Program is commendable as part of their overall strong program in conserving wildlife on ROWs.

Good Practice 21/13: Programmatic consultation leadership with the Forest Service and the Fish and Wildlife Service on rare, threatened an endangered species.

Good Practice 22/13: Field identification and understanding of RT&E species on APS ROWs is elevated by the use of factsheets with photos and life history descriptions of select species.

Good Practice 23/13: Removal, chipping or lopping of trees and shrubs on a treated ROW effectively reduces negative visuals associated with felled woody plants.

Good Practice 24/13: APS is commended on its large scale and detailed efforts to account for, plan, and conserve cultural resources.

Recommendation 10/13: APS should expand and refine their policies and procedures for managing vegetation in riparian areas with specific attention to defining areas and riparian zones on maps and in field inventories and maps showing site-specific location of these water resources.

Recommendation 11/13: APS should be more proactive in management of invasive, exotic plant species, including developing priority listing of IE species and gathering other documented information on the identification, biology and ecology of invasive exotic plant species that might occur on ROW, and develop that list with general directions on specific priority and needs for management.

Observation 16/13: Wildlife planning and management work could be expanded to include wildlife in addition to those considered as rare, threatened and endangered, possibly focusing more on common game and non-game animals that require early-successional habitat.

Observation 17/13: Fragmentation and connectivity effects caused by the presence of the ROW could be more formally included in planning and decision making as a part of APS's overall strategy for conserving biodiversity.

Observation 18/13: "Infestation area", as used by the US Forest Service to reference problem areas with invasive, exotic plants, could be defined by APS for management, possibly in the Vegetation Management Manual, including what invasive, exotic species and abundances normally dictate such a status.

Observation 19/13: APS could develop written policies and procedures for management of visual impacts.

Observation 20/13: APS could elevate formal planning, decision making and practice surrounding the stewardship of biologically-based cultural resources across all landownerships.

CRITERION 8.2: Vegetation management systems promote the development of stable, compatible vegetative cover types through the use of selective vegetation maintenance methods. Vegetation maintenance plans include site-specific prescriptions designed to control incompatible vegetation on the ROW while minimizing the use of non-selective techniques and application methods. Non-selective treatments may be used in efforts to reclaim a site that has not been maintained or for cover type conversions. Following conversion, selective treatments are the preferred option.

Findings. Observed ROW vegetation conditions support the conclusion that APS's vegetation management system promotes the development of stable, compatible vegetative cover types through the use of selective vegetation maintenance methods (see findings associated with Criterion 8.1). The various ecosystems across Arizona can be readily shifted from a complex of plants to low vegetation cover or non-vegetated conditions, and held in this state for long periods due to the harsh environment (mostly various types of deserts). Yet, APS ROWs were managed to maintain complexes of grasses, forbs and shrubs. Of all of the ROWs visited during the audit, only one (the riparian area of the 230-23 line, spans 2/2 to 2/4) had 100% vegetation cover – all other ROWs had on average about 50-60% cover of compatible plants with the remainder as open space to soil – this is the normal, stable vegetation system in desert environments where plant community dynamics are controlled by deficiency in water (in contrast to other, more temperate areas of the United States where light is the most limiting resource that controls plant community stability and dynamics). As noted in Criterion 8.1, APS has a documented account of treatment techniques used over time and space that are shifting APS ROWs from their tree-dominated condition in the 1990s through 2010, to their currently reclaimed condition where most ROWs are now dominated by low-growing compatible species (see progressive shift from reclamation with mechanical treatments to maintenance and management with mechanical and chemical treatments). APS has limited documentation of the long-term patterns of plant community conditions and herbicide use over time (see findings associated with Principle 10). But, the auditors did observe large stumps and dead tree stems from the reclamation efforts and clear evidence of contemporary mechanical and chemical treatments that show the beginnings of stable plant communities.

Score: 4.0 / 5.0

CRITERION 8.3: The effectiveness of vegetation maintenance methods and their associated environmental impacts are specifically, fully accounted for in management planning and maintenance operations. Herbicides are used to eliminate incompatible woody plants on ROWs because most woody plants are not controlled by hand or mechanical cutting. Selective applications of herbicides conserve grasses, herbs, shrubs and compatible trees which lead to biological / ecological control. This is a core concept of IPM and undergirds IVM criteria in Principle #8.

Findings. One means of considering the full cost effectiveness, or cost benefits of treatments, is APS's documentation of some of the risks and benefits of each

vegetation maintenance method and the precautions that workers must employ. In general, these are included in the *2013 Vegetation Management Manual* (featuring a section on Herbicide Application, with specifics on herbicide toxicity) and the *2012 Herbicide Corridor Management Plan for State Lands* (including sections on chemicals and rates, waste disposal and site safety) (see Recommendation 12/13). Written policies for proper use and disposal of herbicides are presented in the *Herbicide Corridor Management Plan*, and focusing on APS's commitment to a closed system. Herbicides are acquired as pre-mixed to APS specifications, and all containers returned to the supplier empty – there is no waste disposal or on-site chemical mixing associated herbicide use on APS ROWs (see Good Practice 25/13).

Vegetation management treatments were just beginning on the last day of the field audit, and it was not possible to observe the herbicide contractor during work. Therefore, it was not possible to determine if vegetation maintenance equipment including mechanized mowers and herbicide application equipment is maintained to minimize adverse site impacts such as contamination with chemicals, including petroleum products. No evidence of spills was observed during the field audit, and APS staff report that both their hand and mowing contractors (including Asplundh, and Phillips and Jordon) and herbicide contractor (Southwest Ground Control) have well maintained, and in the case of herbicides, state-of-the-art equipment.

Score: 3.5/ 5.0

Good Practice 25/13: APS's commitment to a closed system of herbicide use, which eliminates waste disposal and on-site chemical mixing associated herbicide use on APS ROWs, is to be commended.

Recommendation 12/13: APS should produce an herbicide manual that is applicable to all possible lands where chemicals can currently be applied, including information from both the *Vegetation Management Manual* and the *Herbicide Corridor Management Plan*.

Principle #9: Site-Specific Implementation of Treatments

ROW corridors are divided into vegetation maintenance units based on their operational, economic, ecological and socioeconomic significance. Each maintenance unit has a specific prescription. A record of vegetation maintenance performed on each unit is retained and serves as a benchmark for future evaluations of treatment effectiveness.

Principle Score: 3.33 / 5.00

CRITERION 9.1: Land management units are designated within rights-of-way for areas that warrant different maintenance treatments, for example, buffers to protect water resources, conservation areas, and vegetative communities that may cause a change in successional directions or rate.

Findings. APS has strong spatial control of ROWs, including engineering-based maps of tower structures (locations, and unique line and tower numbering system) and GIS data for all ROWs that includes: line and tower location; roads; landownerships; cultural resources (in-house, controlled by archaeologist and reported to APS workers as by span); biotic communities (including wetlands, freshwater ponds, lakes and riverine systems); and species maps (commonly from the Arizona On-line Environmental Review Tool that includes a reporting of possible Special Status Species Occurrences, Critical Habitat, and Tribal lands). The on-line tool is only periodically used as an initial screening, following or replaced by APS's species data that is reviewed for projects, including nest locations, critical habitat, suitable habitat, specific protected areas (such as northern goshawk post fledgling areas [a sensitive species] and Mexican spotted owl protected activity centers), sensitive plants, noxious weeds, etc. Much of this data is obtained from agencies and provided to APS with annual updates through a sharing agreement. For some areas, specific species data is not available beyond the online tool, which only tracks species sightings.

Field conditions were observed to be matched to map units, with some exceptions on water resources (some water resources were observed in the field but were not on maps) (see Observation 21/13). Additionally, riparian zones were not mapped, but were left for designation in the field at time of management, which caused some inconsistency in field definition (see findings associated with Criterion 8.1) (see Recommendation 13/13). However, riparian zones that require specific management are located on a map for the field crews, though the specific boundary (edge of riparian area) is not shown on a map because the scale of the map would be difficult to use in the field.

APS generally does not use land unit designations within ROWs as a basis for vegetation management except on political designations and water resources (see Observation 22/13). Land unit designations are done in biological assessments and some CMPs where specific attention to these designations warrant a revision in treatment protocol. However, this consideration is not consistently applied over all land owners. Field use of the "wire zone-border zone" concept could be an important application of site-specific management, but is currently inconsistently applied by APS across their ROW system (see findings associated with Criterion 6.2).

Score: 3.5 / 5.0

Recommendation 13/13: Riparian zones should be more consistently designated within rights-of-way as areas requiring different maintenance treatments.

Observation 21/13: As various important natural resources are discovered in the field, they could be added to maps and other means of tracking spatially explicit information, e.g., when a riparian zone is defined in the field that is not on existing GIS maps, APS could develop a means of keeping maps updated with contemporary field information.

Observation 22/13: APS could most regularly use land unit designations within ROWs based on plant community and other ecological conditions (e.g., soil moisture: washes versus upland) as a basis for describing overall vegetation condition on different lines across Arizona.

CRITERION 9.2: Written prescriptions and operational plans are used to define treatments for each ROW vegetation maintenance unit, and justify treatment choices considering economic, ecological, and socioeconomic factors as well as administrative opportunities and constraints. Prescriptions include:

a. ROW maintenance unit designation

b. Description of current vegetation (compatible and incompatible) and environmental conditions

c. Desired future vegetative cover types and conditions

d. Definition of vegetation maintenance treatment method(s) being prescribed

e. Justifications for treatments prescribed based on tolerance thresholds (also see PRINCIPLE # 6) and economic, ecological, environmental, stakeholder, and administrative considerations

f. Site-specific maps that detail ROW vegetation maintenance units, and show important cultural and environmental features

Findings. APS's approach to operational planning varies by landowner. Public (state and federal) and tribal lands – which control ~60% of APS ROWs – have detailed operational plans referred to as Corridor Management Plans (CMPs) (NOTE: these CMPs have undertones of both strategic and tactical plans [see findings associated with Criterion 4.1], but are considered in this Criterion 9.2 for their operational elements). Biological Assessments have been developed by APS (e.g., see Biological Assessment for the 230-16 ROW, developed in 2012 for the Bureau of Land Management) that have many of the CMP operational planning components. APS commented here in the first draft audit report as follows:

> *All Forest Service was assessed in a programmatic consultation, some Tribal (see Navaho Nation documents) and BLM land BAs were done for a few lines. We are in discussions to do a programmatic consultation with BLM. In the meantime on BLM, a BLM biologist reviews all APS proposals and suggests restrictions/conservation measures where appropriate. Additionally, BAs are conducted for all new construction and permit renewals with review by Forestry Natural Resource Specialists. Great effort is spent ensuring proper compliance with ESA and sensitive species.*

Both CMPs and Biological Assessments are written by APS Natural Resource Specialists. APS commented here on the draft audit report as follows:

Some of the BA documents are partially prepared by APS, but always with review and sign-off from the agency. Others are not written by APS staff, but are written by the agency or sometimes a consultant. New construction and permit renewal BAs are nearly always prepared by a consultant.

Private lands do not have CMPs, but since all of the CMPs are for whole lines, many of the private lands are covered in principle by the public land CMPs – private land is commonly area inclusions within a public land matrix. Specific plans for private lands are supposed to be covered by Job Profiles (also referred to as "Work Profiles") developed by APS Planners. Planners contact landowners about pending work, referencing the easement as the basis for a right to conduct vegetation management work. Profile sheets are written guides to IVM Workers performing work on the circuit. Job Profiles are less detailed than a CMP, and generally only include line description (specific sections of line for work, including feeder name, line-voltage and the location of energy source controls as well as any observed hazards or special precautions, and any special concerns or agreements that the Planner has made with the property owner) (see *2013 Vegetation Management Manual*), checkbox summary of efforts to contact the landowner, and planner notes, job description, diagram of work, and administration information.

Since 39% of APS managed ROWs are on private lands, the use of Job Profiles is an important component of the APS ROW management system and operational level planning. Use of Job Profiles for the coordination of approval process of ROW work on private lands in rural areas varies by Division (Lisa Young, personal email communications) (see Recommendation 14/13).

A total of nine Job Profiles were reviewed for the audit (refer to forms *APS Forestry and Special Programs Customer Profile Sheet*).

A total of 13 CMPs were reviewed for the audit (five State, six federal – U.S. Forest Service, and two tribal), all associated with ROWs field visited by the auditors. Additionally, one Biological Assessment (Bureau of Land Management) was reviewed.

CMPs were first used by APS in 2008 and have been expanded in content over the last 5 years – CMPs written in 2012-2013 are more detailed than earlier plans. A representative sample of recent CMPs (n=6) was evaluated in detail for content with reference to the elements listed in this Criterion, as follows.

<u>ROW maintenance unit designation</u>

CMPs are generally written for a specific agency portion of the line. For example, a line crossing BLM, FS, and State Land would have a CMP for FS and State, but a notification letter and coordination and approval process with BLM. These can be a few miles to over 100 miles long. ROW maintenance unit designation is provided on the cover of the plan, but also presented in more detail in sections of the plan titled "Project Area Description" or "General Description". A large scale map is provided that shows the subject line. State CMPs have tables

detailing location (township, range and section), permit (*sensu* "easement") and ROW width.

Description of current vegetation (compatible and incompatible) and environmental conditions

Only two plans had a description of current vegetation condition (the 2012 Biological Assessment for the Bureau of Land Management and ROW 230-16, and the 2012 CMP for the Tonto National Forest, line 500-3), with both only briefly referencing current plant cover by general type groups (see Recommendation 15/13). No planning document included any detailed information on current conditions, such as abundance, size and species composition of plant communities. Very little environmental information is provided in the CMPs, aside from maps that show water courses (see Recommendation 15/13). APS did point out the following in their responses to the draft audit report:

> *Detailed maps with treatment specifics are provided supplemental to CMPs. An example map called NE-7_ProjectMap_CNF-17x22 has been provided with this review. The CMP for this line refers to this map and is saved in the project folders for this line. Every line with special requirements has a project map. Also included is a map for CN-4 (a distribution line) that is a good example of mapping specific requirements.*

The one Biological Assessment did include reference to general land forms and uses (e.g., floodplain, ag land), and did provide elevation information.

Desired future vegetative cover types and conditions

Desired future vegetative cover types and condition is only generally provided by APS in their CMPs: in short, to reduce incompatible plants and increase compatible plants. In the Tonto National Forest CMP, APS indicated that (p. 11, 2012 CMP for line 500-3): "the corridor should be converted to low growing plant communities that do not interfere with overhead power lines, pose a fire hazard, or hamper access". Some CMPs list what the common incompatible and compatible plants are for the line in question, but not all plans include this description. A few CMPs reference a wire zone / border zone, and a lateral zone / sag zone approach to vegetation management (Observation 23/13), apparently the higher voltage lines with the wider ROWs. Most CMPs have reference to fire hazard management, with some plans having explicit reference to compatible vegetation conditions such as species and spacing (spacing is managed to control spread and intensity of fire) (Observation 24/13).

Definition of vegetation maintenance treatment method(s) being prescribed

Vegetation maintenance treatment methods that are being prescribed are well defined in APS's CMPs. All plans have descriptions of manual vegetation removal (hand crews using chainsaws) and vegetation disposal (lop and scatter). Many plans include details on mechanical mowing and hazard vegetation. On

tribal and state lands, APS includes detailed information that defines what herbicide mixes and application methods are planned for that year on the subject ROW.

CMPs for National Forests can include "Vegetation Maintenance Protocol", which are directions for vegetation management unique to the Forest and more generally unique to the plant community type (can apply across National Forests). For example, on the Tonto National Forest (2012 CMP for ROW 500-3) there is a general protocol that covers the whole line, but is then modified with different protocols for Forest Districts, and for different plant community types: Sonoran desert, Saguaro cactus, and ponderosa pine and piñon/juniper (Good Practice 26/13).

Justifications for treatments prescribed based on tolerance thresholds (also see PRINCIPLE # 6) and economic, ecological, environmental, stakeholder, and administrative considerations

In most CMPs, APS represents their objectives for vegetation management as justification for treatments. Following is common boilerplate that is found in many CMPs and other APS planning documents.

> *Vegetation maintenance serves four main purposes: 1) provides reliable, uninterrupted service to customers; 2) provides safe and efficient transmission of power along existing lines; 3) provides safe and reasonable access to the lines and structures for inspection and maintenance; and 4) provides protection against wildfires that could result from vegetation coming into contact with power lines or arcing to the power line (removal of vegetation within power line corridors can reduce the potential for fire ignition). Failure to address vegetation clearance and fuel hazards could result in wildfires, major power outages, and injury to life or property. Additionally, new federal energy regulations mandate vegetation inspections and treatment to maintain transmission lines in safe and reliable operating conditions (NERC Reliability Standard FAC-003-1). These new federal regulations require mandatory compliance to reliability standards dealing with various aspects of the planning and operation of the power system, including vegetation maintenance. The North American Electric Reliability Corp. (NERC) monitors utility compliance with these standards and may impose fines, restrictions, or directives for corrective action to utilities not in compliance. Fines are $1,000 to $1 million a day if vegetation violates the mandatory standards. Thus, because of the reasons listed here, APS is required to maintain vegetation along their 500-3 power line.*

This statement covers some justifications based on tolerance thresholds and economic, ecological, and administrative considerations. Environmental justifications are not directly made, but are presented in the plan and used in the field to modify treatments (e.g., moving of downed trees outside of 25 feet from high water mark in riparian systems; or using different herbicide mixes in or outside of riparian zones). Similarly, stakeholder concerns are addressed in the

context of the CMP via site-specific adjustments in management that are described in the CMP (e.g., see National Forest District-level adjustments in vegetation management).

Site-specific maps that detail ROW vegetation maintenance units, and show important cultural and environmental features

Maps in CMPs are only small scale, with a whole line mapped on one report page. More site-specific maps can be produced by APS as needed for management, and were produced for the audit. Detailed project maps are produced for areas with specific requirements; see example project maps for CN-2 and NE-7. These larger scale maps showed the transmission line on a span-by-span basis, roads, general plant community type on and off the ROW, special conservation areas, and land ownerships. Cultural features are not mapped, but are known on a specific, within-span basis (instead of mapping, an archaeologist field marks the cultural sites with flagging before any vegetation management field activities). APS provided the following comments as part of their review of the draft audit report:

> *In the CMPs, we lay out the cultural resource management history of the line describing whether or not survey has been completed and management recommendations for the line. When the CMP is implemented, we follow that process which involves flagging sites for avoidance by equipment and monitoring and hand carrying when prudent. Site location data is maintained in a GIS layer, but this information is only provided to crews in tabular form to protect the confidentiality of site locations.*

Score: 3.5 / 5.0

Good Practice 26/13: Vegetation maintenance protocols that vary by stakeholder group (e.g., National Forest District) and vegetation cover types (e.g., Sonoran desert vs. ponderosa pine and piñon/juniper) allow APS to produce more desirable, environmentally-sensitive plant community conditions with management, and address stakeholder concerns for management. Of particular import and long effort in development is APS's Saguaro Cactus protocol which details how and when these socially important cacti will be cut down, how they will be processed when downed (left whole, or cut into small pieces), pruned, or moved and replanted.

Recommendation 14/13: Job Profiles, as important operational plans for ROW work on private lands, should be more consistently used by APS across Divisions, and expanded in use to focus on including information that covers elements listed in Criterion 9.2.

Recommendation 15/13: Corridor Management Plans should be improved by adding a description of current vegetation (compatible and incompatible) and environmental conditions..

Observation 23/13: APS could develop a vegetation treatment method rubric where the desired future condition of ROW vegetation, including possible application of a wire zone / border zone approach, could be clearly, consistently described as a function of line voltage, ROW width, and topography. Desired, compatible vegetation (abundance, size, and species) could be presented with each treatment / line type combination, which is expected to be different from one ecoregion to another across Arizona.

Observation 24/13: A fire hazard management plan element related to vegetation condition could be developed by APS, including a listing of desired vegetation condition for the different line voltages and plant community types.

CRITERION 9.3: Plans, prescriptions and the decision to treat incompatible vegetation are based on current surveys of vegetation and site conditions.

Findings. APS does not conduct formal span-by-span, line length explicit evaluation of vegetation and site conditions on their managed ROWs; only informal considerations are made of plant community composition, density, size and structure, and site conditions (access roads, stream crossings) (Recommendation 16/13). APS's inventory policy and procedure focuses on annual aerial and ground surveys to find problem spots ("hot spots") that need to be managed immediately or in the near future (see APS's *2012 Transmission Vegetation Management Plan*). Formal inventory forms are not used by APS, and documented inventories of ROW vegetation and environmental conditions were only generally available. APS has periodically assessed the abundance of incompatible plants on their ROWs using a class system of low, medium and high abundance. These "inventories" are produced generally from helicopter overflights, though they are ground-based for the Metro Division. Rubrics connecting vegetation condition to possible treatment techniques are not currently used by APS (see Observation 25/13).

Score: 3.0 / 5.0

Recommendation 16/13: APS should more formally conduct ground-based evaluations of at least a representative sample of their ROWs to document vegetation condition as a basis for decision making, planning, prescribing treatments, and monitoring.

Observation 25/13: Rubrics connecting vegetation condition to possible treatment techniques could be developed by APS as a means of consistent decision making, improved communication with stakeholders about treatments and their justification, and increased accountability.

Principle #10: Adaptive Management and Monitoring

IVM includes a continuous improvement mechanism. Quality control and quality assurance monitoring are used to ensure that outcomes meet stated vegetation management objectives. Quality monitoring includes the collection of appropriate data to evaluate successes and failures of vegetation management outcomes. Monitoring

procedures are consistent and replicable over time sufficient to allow comparison of results, make an assessment of the need for changes, and to support continuous improvement.

Principle Score: 3.25 / 5.00

CRITERION 10.1: The strategic IVM program plan and tactical project plans include performance indicators that are periodically monitored to assess:

a. The degree to which the management vision, goals and objectives have been achieved

b. Deviations from the management plan

c. Unexpected effects of vegetation maintenance activities and other site disturbances

d. Social and environmental effects of vegetation maintenance activities

Findings. Monitoring is conducted by APS on activities and outcomes of management related to strategic and tactical plans, but various key elements are not carried through full to assess overall performance (see following findings for the elements listed in this criterion).

Degree to which management vision, goals and objectives are achieved

Electric reliability is the primary objective of the APS vegetation management program as referenced in the *2013 TVMP*. More broad objectives are stated in the *2013 Vegetation Management Manual* (see findings for Criterion 4.1). No specific performance indicators are articulated in the *Vegetation Management Manual* or *2013 TVMP*. APS does track vegetation caused outages. This is a high level indicator of the reliability objective. Completion of Annual Patrols for NERC lines and completion of each vegetation maintenance Project is also tracked.

Deviations from the management plan

Deviations from the vegetation management activities as described in the *Vegetation Management Manual*, *TVMPs* and CMPs are tracked in several ways. Annual Patrols of NERC lines are carried out and documented. Identified tree/vegetation hazards are noted and corrected through an off-cycle Maintenance Order process. Project Audit Forms are used to monitor recently completed vegetation management work. Deficiencies are noted. Date of deficiency resolution is recorded on the Audit Forms and the system level aggregation of the Audit Forms. Project Planning checklists contain work review notes following field meetings with contractors and/or property owners. These notes sometimes discuss/document deviations from the planned vegetation maintenance.

Unexpected effects and other site disturbances

APS staff reported that unexpected effects such as incomplete work, ineffective herbicide treatment, and major site disturbances such as rutting from equipment, road damage, erosion or removal/treatment of compatible vegetation, would be noted on the Audit Forms and/or Project Planning checklists.

Social and environmental effects

APS staff reported that social effects such as customer complaints, damage to historical/cultural resources, and improper vegetation management work that resulted in site damage would be noted on the Audit Forms and/or Project Planning checklists or other records kept by APS staff. Damage to biological resources and their environmental effects would be reported on the Audit Forms and/or Project Planning checklists.

Substantial APS Forestry staff resource time is spent reviewing ongoing vegetation maintenance work and reviewing results of the work (see Good Practice 27/13). This monitoring could be far more efficient if performance indicators were consistently applied across the ROW Resource (see Recommendation 17/13).

Score: 3.0 / 5.0

Good Practice 27/13: APS staff carryout substantial monitoring of ROW Resource conditions and monitoring of the effects and efficacy of ROW vegetation maintenance work.

Recommendation 17/13: APS should develop a list of performance indicators for each of the above elements of criterion 10.1.a. to 10.1.d. These performance indicators should be incorporated into the *Vegetation Management Manual*, *Herbicide CMP* or *TVMP* and applied in a consistent manner to all ROW Resources.

CRITERION 10.2: Results of monitoring are incorporated into any assessment of the need for, and subsequent implementation of necessary revisions and refinement of vegetation management plans. Data used in monitoring includes, at a minimum, the following indicators:

a. Reliable delivery of energy

b. Condition of the right-of-way

c. Composition and changes in the flora and fauna

d. Environmental and social impacts of operations

e. Appropriate record keeping regarding the all vegetation maintenance methods completed including the use of herbicides

f. Cost, productivity, effectiveness and efficiency of vegetation management

Findings. Results of monitoring are incorporated into revisions and refinement of vegetation management plans (see following findings for the indicators listed in this criterion).

Reliable delivery of energy

APS staff reported there has been only one grow-in vegetation-caused, sustained outage on transmission lines from 1995 to present. This outage pre-dated the NERC Standard – FAC-003-1. Staff reported that no FAC-003-1 Category 1 or Category 2 outages have been reported to WECC and FERC (see Good Practice 28/13). The staff indicated that fire caused outages and unplanned switching off of lines due to fire occurs far more frequently. No quantitative data on fire-related outages and unplanned switching was provided (see Observation 26/13).

Condition of the right-of-way

Very few deficiencies in the prescribed treatment are shown in the post treatment audits (details provided in Record-Keeping section below). Overall condition of APS's ROW Resource is not reported as a monitoring indicator. Project completion sign-off acknowledges completion of the work consistent with APS vegetation management program objectives and prescribed work for the specific Project.

Compositional changes in flora and fauna

Composition change to flora and fauna are not documented in any monitoring report (see Recommendation 18/13).

Environmental and social impacts

Deficiencies or deviations from the vegetation management prescription and their social and environmental impacts are reported on monitoring Audit Forms or if discovered and dealt with during the treatment work, on the Project Planning checklist Work Reviews section. Audit Forms viewed by the auditors did not report any environmental or social impacts (see Observation 27/13).

Appropriate record-keeping regarding all maintenance methods completed

Annual patrols of NERC lines 115kv, 230 kV, 345 kV and 500 kV are documented. The NERC Standard FAC-003-1 is applied by APS to all lines in these voltage classes. APS noted that 69 kV lines are also included in the annual patrol. The *Ten-Year Transmission and Distribution Schedule* spreadsheet indicates there are 32 ROW segments maintained to the NERC Standard. The Annual Patrol summary form provided by APS indicates that all 32 segments were patrolled in 2012. These records are retained in an APS shared drive accessible to all appropriate APS Forestry personnel. Additional lines identified as SRP 230 kV and TEP 345 kV, were also patrolled. These records appear to be complete for calendar year 2012 (see Good Practice 29/13).

An Audit Report summary was also provided for inspections of vegetation management work specified in the *2012 TVMP*. Per provisions in the *2012 TVMP*, deficiencies in line clearance and deficiencies in the application of the prescribed treatment are noted. Records are kept of the date of resolution for each identified deficiency. The Audit Report for 2012 vegetation management work was provided to the auditors. A check of audits versus lines scheduled for treatment in 2012 shows that all 22 scheduled lines were audited. The Audit Report indicates that three additional lines were audited – apparently to monitor follow-up applications to ROW segments treated in 2011. These Audit Reports are retained in an APS shared drive accessible to appropriate APS Forestry staff. Each line audit indicates the "location of the audit". Location is described as the entire line or portions of the line such as USFS National Forest, State Land, private or a section from a landmark to another landmark is described. Some lines have multiple audits that may in total include the full line segment. The Audit Report provided by APS does not demonstrate a full end-to-end audit of each line segment (see Recommendation 20/13). These reports appear to only include TVMP Projects – 69 kV lines were not included on reports provided to the auditors. The "Comments" column of the report show entries related to herbicide use/effectiveness. Another Audit Form reported deficiencies related to failure to relocate Saguaro cactus plants along the ROW.

Completion of a vegetation maintenance Project is recorded in the 10-Year Transmission schedule. Completions are recorded for all vegetation maintenance Projects, 69 kV to 500 kV.

APS and state of Arizona pesticide applicator law requires reporting of herbicide use. To meet these requirements, the *APS Vegetation Management Manual* (see section 6.17 and Appendix C: Herbicides), requires *that all crew members document applications onto the APS Herbicide Application Log*. This requirement is oriented to distribution stump treatment. Transmission herbicide applications are not documented on the referenced APS document. Herbicide use on transmission ROWs is documented by the contractor for state law reporting purposes. The contractor supplies daily herbicide application updates to the APS Natural Resource Specialist. These updates record location of application by line number, structure from/to and gallons of each APS authorized herbicide mix. Records for April 2013 applications on the 345-1 line were reviewed by the auditors. It is not clear why the *APS Herbicide Application Log* is not used by transmission (see Observation 28/13).

Cost, productivity, effectiveness and efficiency of vegetation management

Cost of each vegetation maintenance Project is recorded and tracked by APS for evaluation against program goals and budgets. Cost of herbicide treatments and re-treatments are also tracked. APS uses this to track effectiveness of the herbicide treatments. This data will be valuable to APS for evaluation of the effectiveness of herbicide use as a means of lowering program costs at some future date. APS does not have sufficient historic data to carry-out an evaluation of the herbicide program.

APS tracks "off-cycle" vegetation treatment costs through its Maintenance Order system. A continuously smaller expenditure for "off-cycle" work is a good measure of overall program effectiveness. APS reports that off-cycle costs are lower each year.

Overall, APS presented evidence of meeting five of the above six sub-criteria (indicators). The criterion score below indicates APS does not demonstrate good practice on one of the six sub-criteria. APS did not provide evidence of a written process for implementation of necessary revisions and refinement of vegetation management plans such as the *Vegetation Management Manual*, *TVMPs* or the *Transmission and Distribution Herbicide Corridor Management Plan* (see Recommendation 20/19).

From a performance perspective and from the auditors reading of the program documents, it is apparent that results of monitoring are incorporated in updates to vegetation management program documents, Project CMPs and prescriptions. From an IVM perspective, monitoring of treatment impacts and input of the results of monitoring into the revision of objectives, site evaluation methods and criteria, defining action thresholds, developing control methods and future implementation of IVM are core requirements of IVM and ROW Steward. APS provided no policy or evidence of a formal process for incorporating results of monitoring.

Score: 3.5 / 5.0

Good Practice 28/13: APS demonstrates an excellent reliability record on NERC transmission line facilities.

Good Practice 29/13: APS demonstrates good record keeping practices to back-up compliance with inspections and annual vegetation maintenance requirements under NERC FAC-003-1.

Recommendation 18/13: APS should monitor changes in the flora and fauna at least on a sample basis across the ROW Resource.

Recommendation 19/13: APS should clarify that sign-off of Audit Forms includes or does not include the full length of ROW segments.

Recommendation 20/13: APS should include a continuous improvement and monitoring policy that explicitly outlines the process for incorporating the results of monitoring in to changes in the vegetation management program and guiding documents.

Observation 26/13: APS could track data for unplanned outages and switching due to fires. This data would support or not support the need for vegetation management prescriptions based on fire caused outages and switching.

Observation 27/13: APS could create a "pick list" of environmental and social impacts to record on post treatment Audit Forms.

Observation 28/13: APS could update the Vegetation Management Manual to include transmission work, including use of the *Herbicide Application Log*.

Appendix A: Listing of Good Practices, Non-Conformances—Required Corrective Actions, Recommendations, and Observations

Good Practices

Good Practice 1/13: APS demonstrates a high level of awareness and compliance with laws and regulations while operating within a legal framework that is more complex than the industry norm. (Criterion 1.1)

Good Practice 2/13: APS consistently reviews land use rights documents, and concomitantly provides landowners the opportunity to dispute these rights during the planning phase of each Project. (Criterion 2.2)

Good Practice 3/13: Unauthorized use of ROWs was effectively non-existent. (Criterion 2.3)

Good Practice 4/13: ROWs generally contained only a single, well maintained road for APS crew access, as opposed to multiple roads often present on utility ROWs, indicating respect for the land and compliance with road BMPs. (Criterion 2.3)

Good Practice 5/13: APS outreach to stakeholders is above industry normal practice. (Criterion 3.1)

Good Practice 6/13: APS proactive mapping and protection of historic and cultural sites is above industry normal practice. (Criterion 3.1)

Good Practice 7/13: The APS corporate website is used to promote sustainability and provides information about APS's vegetation management program. (Criterion 3.2)

Good Practice 8/13: APS hosted and supported the 10th International Symposium on Environmental Concerns in Rights-of-Way Management in

October 2012. APS Forestry and Special Programs staff were involved in all aspects of the Symposium. (Criterion 3.3)

Good Practice 9/13: APS long-term relationship with Southwest Ground Control creates a high quality job opportunity for contractor employees. (Criterion 3.4)

Good Practice 10/13: APS is an industry leader promoting IVM and ROW Stewardship, as evidenced by being the first company to seek ROW Stewardship accreditation, and providing leadership and support of industry-specific research. (Criterion 3.5)

Good Practice 11/13: APS *10-Year Transmission and Distribution Schedule* establishes a good record of the ROW Resource asset. (Criterion 4.1)

Good Practice 12/13: Transmission Vegetation Management Plans show improvement over time. (Criterion 4.3)

Good Practice 13/13: Corridor Management Plans show improvement over time. (Criterion 4.3)

Good Practice 14/13: APS Forestry and Special Programs has a diverse vegetation management team, from the tree workers to the Manager of Forestry and including Natural Resource Specialists, Section Leaders, and Planners – all with different job responsibilities and professional expertise – which allows APS to collectively, efficiently and effectively meet a complex of planning, decision making, and management action needs. (Criterion 5.1)

Good Practice 15/13: APS should be commended for their region-leading and ongoing support of extensive field research on the effectiveness of different vegetation management treatments, including different herbicide mixes, to control target plants and promote desirable plants. (Criterion 5.2)

Good Practice 16/13: APS should be commended for their investment into LiDAR data collection as part of vegetation management decision making, which has led to more consistent maintenance of vegetation in compliance with NERC Clearance 1 and Clearance 2 distances over the last 5 years. (Criterion 6.2)

Good Practice 17/13: APS's development and progressive application of a variety of mechanical and chemical treatment methods, from reclamation efforts starting in 2005 to today's selective use of herbicides is leading directly to the establishment of a stable community of compatible species that enhances the prevention and biological/ecological control of incompatible species. (Criterion 7.2)

Good Practice 18/13: APS's broad and persistent effort to develop a herbicide use program on federal lands. (Criterion 7.2)

Good Practice 19/13: Formal partnerships with organizations interested in wildlife management are used to promote species of concern. (Criterion 8.1)

Good Practice 20/13: APS's leadership in developing and adopting the Avian Protection Program is commendable as part of their overall strong program in conserving wildlife on ROWs. (Criterion 8.1)

Good Practice 21/13: Programmatic consultation leadership with the Forest Service and the Fish and Wildlife Service on rare, threatened an endangered species. (Criterion 8.1)

Good Practice 22/13: Field identification and understanding of RT&E species on APS ROWs is elevated by the use of factsheets with photos and life history descriptions of select species. (Criterion 8.1)

Good Practice 23/13: Removal, chipping or lopping of trees and shrubs on a treated ROW effectively reduces negative visuals associated with felled woody plants. (Criterion 8.1)

Good Practice 24/13: APS is commended on its large scale and detailed efforts to account for, plan, and conserve cultural resources. (Criterion 8.1)

Good Practice 25/13: APS's commitment to a closed system of herbicide use, which eliminates waste disposal and on-site chemical mixing associated herbicide use on APS ROWs, is to be commended. (Criterion 8.3)

Good Practice 26/13: Vegetation maintenance protocols that vary by stakeholder group (e.g., National Forest District) and vegetation cover types (e.g., Sonoran desert vs. ponderosa pine and piñon/juniper) allow APS to produce more desirable, environmentally-sensitive plant community conditions with management, and address stakeholder concerns for management. Of particular import and long effort in development is APS's Saguaro Cactus protocol which details how and when these socially important cacti will be cut down, how they will be processed when downed (left whole, or cut into small pieces), pruned, or moved and replanted. (Criterion 9.2)

Good Practice 27/13: APS staff carryout substantial monitoring of ROW Resource conditions and monitoring of the effects and efficacy of ROW vegetation maintenance work. (Criterion 10.1)

Good Practice 28/13: APS demonstrates an excellent reliability record on NERC transmission line facilities.

Good Practice 29/13: APS demonstrates good record keeping practices to back-up compliance with inspections and annual vegetation maintenance requirements under NERC FAC-003-1.

Non-Conformances—Required Corrective Actions

None discovered during the audit.

Recommendations

Recommendation 1/13: The *Vegetation Management Manual*, *Transmission Vegetation Management Plans,* and *Transmission and Distribution Herbicide Corridor Management Plan* list of laws and regulations should include the Federal Insecticide Fungicide and Rodenticide Act. (Criterion 1.1)

Recommendation 2/13: APS staff should be trained in the IVM ANSI A300 Standard and BMP to acquire a better understanding of IVM. This training should extend to ROW Stewardship Principles and Criteria as well. (Criterion 3.2)

Recommendation 3/13: APS Forestry and Special Programs staff should adopt and customize the APS Environmental Policy to be part of its own governing documents and practices. It should be highlighted on Forestry and Special Programs bulletin boards and promoted with all IVM Workers. (Criterion 3.2)

Recommendation 4/13: APS should expand their new public summary of work activities to include the primary elements of the management plan (items in criterion 4.1) and the results of monitoring indicators (items in criterion 10.a). (Criterion 3.6)

Recommendation 5/13: APS should, through updates to the *Vegetation Management Manual*, *TVMP*, *Herbicide Corridor Management Plan* and Project CMPs, add a high level description of land use classification of adjacent lands and clarify the relationships between these documents and the scope of the ROW Resource to which each applies. (Criterion 4.1)

Recommendation 6/13: A policy and process for formal feedback to improve management practices should be implemented by APS based on results of monitoring. This Recommendation applies both to Criterion 4.3 and 10.1. (Criterion 4.3)

Recommendation 7/13: APS should better define standard clearance prescriptions and management objectives in their Vegetation Management Manual, including a more consistent definition and application of the wire zone/border zone and lateral zone / sag zone approaches to site-specific management of ROWs when opportune and appropriate. (Criterion 6.2)

Recommendation 8/13: A listing of plant species that are compatible and incompatible for fire hazard management should be developed by APS to promote consistent management of plant communities across ROWs. (Criterion 6.2)

Recommendation 9/13: APS should continue working with the U.S. Forest Service and other federal agencies to develop an herbicide use program on federal lands, consistent with the tenets of IVM and as currently being practiced by APS on non-federal lands across Arizona. (Criterion 7.2)

Recommendation 10/13: APS should expand and refine their policies and procedures for managing vegetation in riparian areas with specific attention to defining areas and riparian zones on maps and in field *inventories and maps showing site-specific location of these water resources.* (Criterion 8.1)

Recommendation 11/13: APS should be more proactive in management of invasive, exotic plant species, including developing priority listing of IE species and gathering other documented information on the identification, biology and ecology of invasive exotic plant species that might occur on ROW, and develop that list with general directions on specific priority and needs for management. (Criterion 8.1)

Recommendation 12/13: APS should produce an herbicide manual that is applicable to all possible lands where chemicals can currently be applied, including information from both the *Vegetation Management Manual* and the *Herbicide Corridor Management Plan*. (Criterion 8.3)

Recommendation 13/13: Riparian zones should be more consistently designated within rights-of-way as areas requiring different maintenance treatments. (Criterion 9.1)

Recommendation 14/13: Job Profiles, as important operational plans for ROW work on private lands, should be more consistently used by APS across Divisions, and expanded in use to focus on including information that covers elements listed in Criterion 9.2. (Criterion 9.2)

Recommendation 15/13: Corridor Management Plans should be improved by adding a description of current vegetation (compatible and incompatible) and environmental conditions. (Criterion 9.2)

Recommendation 16/13: APS should more formally conduct ground-based evaluations of at least a representative sample of their ROWs to document vegetation condition as a basis for decision making, planning, prescribing treatments, and monitoring. (Criterion 9.3)

Recommendation 17/13: APS should develop a list of performance indicators for each of the above elements of criterion 10.1.a. to 10.1.d. These performance indicators should be incorporated into the *Vegetation Management Manual*, *Herbicide CMP* or *TVMP* and applied in a consistent manner to all ROW Resources. (Criterion 10.1)

Recommendation 18/13: APS should monitor changes in the flora and fauna at least on a sample basis across the ROW Resource. (Criterion 10.2)

Recommendation 19/13: APS should clarify that sign-off of Audit Forms includes or does not include the full length of ROW segments. (Criterion 10.2)

Recommendation 20/13: APS should include a continuous improvement and monitoring policy that explicitly outlines the process for incorporating the results

of monitoring in to changes in the vegetation management program and guiding documents. (Criterion 10.2)

Observations

Observation 1/13: APS could annually document a review of contractor records to demonstrate compliance with the Immigration Reform and Control Act of 1986. (Criterion 1.2)

Observation 2/13: APS could update the *2013 Vegetation Management Manual* or revise the Project planning process to include a written policy and procedure for stakeholder dispute resolution by the ROW Asset Manager and other related APS departments such as the property department or legal department. (Criterion 2.2)

Observation 3/13: APS could develop appropriate signage and policies to employ if and when preventing unauthorized use becomes a problem for the ROW Asset Manager. (Criterion 2.3)

Observation 4/13: Future ROW Steward auditors and APS need to meet and assess the mechanical and herbicide application contractors in the field. (Criterion 3.4)

Observation 5/13: APS could complete the wildfire risk study and amend its *Vegetation Management Manual* and vegetation management practices to reflect the outcome of the study. (Criterion 4.1)

Observation 6/13: The next audit of APS should include observations and audit of active VM maintenance and the contractors IVM Workers. Qualifications of IVM Workers should also be reviewed. (Criterion 4.4)

Observation 7/13: Training could be provided in the following areas to elevate APS full capacity to sustainably practice IVM: plant identification and understanding of life history of a full complement of target and non-target ROW species; and plant succession and community dynamics in a wide variety of ecosystems, from desert to montane. (Criterion 5.1)

Observation 8/13: Monitoring of IVM efforts could be used by APS to identify research and development opportunities that may enhance program performance related to both environment and socioeconomics. (Criterion 5.2)

Observation 9/13: APS could research herbicide efficacy as affected by herbicide mix and application technique coupled with plant biology and plant community so as to improve percent kill above the current, anecdotal level of 50%. (Criterion 5.2)

Observation 10/13: APS could develop a more complete, formal system of promoting and tracking training and education to improve skills and knowledge of vegetation managers and IVM workers. (Criterion 5.3)

Observation 11/13: APS could more formally track stakeholder engagement in the vegetation management arena, specifically as related to the development of management objectives as part of the planning process where specifics on how management objectives have changed with stakeholder input can be more readily demonstrated (e.g., see findings associated with Criterion 6.3). (Criterion 6.1)

Observation 12/13: APS could develop a list of compatible and incompatible species for their different ROWs that should vary as a function of voltage and location of plants in wire zone and border zone areas. (Criterion 6.2)

Observation 13/13: Stakeholder interactions could be documented by APS in a formal filing system that includes who was interacted with, the subject of interaction, and the outcome. This information could be used as a performance indicator (see Principle #10), e.g. to assess the overall quality of stakeholder relations, how complaints are handled, and ability to reduce complaint levels over time. (Criterion 6.3)

Observation 14/13: APS could consider introducing field computers to aid in real-time data collection (inventory and monitoring), recording of stakeholder interactions, and updating of field maps. (Criterion 7.3)

Observation 15/13: Utility of existing GIS could be expanded to be more accessible and useful for at-time-of-management activities, including adding an ability for site data and field maps to be updated at the time of discovery. (Criterion 7.3)

Observation 16/13: Wildlife planning and management work could be expanded to include wildlife in addition to those considered as rare, threatened and endangered, possibly focusing more on common game and non-game animals that require early-successional habitat. (Criterion 8.1)

Observation 17/13: *F*ragmentation and connectivity effects caused by the presence of the ROW could be more formally included in planning and decision making as a part of APS's overall strategy for conserving biodiversity. (Criterion 8.1)

Observation 18/13: "Infestation area", as used by the US Forest Service to reference problem areas with invasive, exotic plants, could be defined by APS for management, possibly in the Vegetation Management Manual, including what invasive, exotic species and abundances normally dictate such a status. (Criterion 8.1)

Observation 19/13: APS could develop written policies and procedures for management of visual impacts. (Criterion 8.1)

Observation 20/13: APS could elevate formal planning, decision making and practice surrounding the stewardship of biologically-based cultural resources across all landownerships. (Criterion 8.1)

Observation 21/13: As various important natural resources are discovered in the field, they could be added to maps and other means of tracking spatially explicit information, e.g., when a riparian zone is defined in the field that is not on existing GIS maps, APS could develop a means of keeping maps updated with contemporary field information. (Criterion 9.1)

Observation 22/13: APS could most regularly use land unit designations within ROWs based on plant community and other ecological conditions (e.g., soil moisture: washes versus upland) as a basis for describing overall vegetation condition on different lines across Arizona. (Criterion 9.1)

Observation 23/13: APS could develop a vegetation treatment method rubric where the desired future condition of ROW vegetation, including possible application of a wire zone / border zone approach, could be clearly, consistently described as a function of line voltage, ROW width, and topography. Desired, compatible vegetation (abundance, size, and species) could be presented with each treatment / line type combination, which is expected to be different from one ecoregion to another across Arizona. (Criterion 9.2)

Observation 24/13: A fire hazard management plan element related to vegetation condition could be developed by APS, including a listing of desired vegetation condition for the different line voltages and plant community types. (Criterion 9.2)

Observation 25/13: Rubrics connecting vegetation condition to possible treatment techniques could be developed by APS as a means of consistent decision making, improved communication with stakeholders about treatments and their justification, and increased accountability. (Criterion 9.3)

Observation 28/13: APS could track data for unplanned outages and switching due to fires. This data would support or not support the need for vegetation management prescriptions based on fire caused outages and switching. (Criterion 10.2)

Observation 29/13: APS could create a "pick list" of environmental and social impacts to record on post treatment Audit Forms. (Criterion 10.2)

Observation 30/13: APS could update the Vegetation Management Manual to include transmission work, including use of the *Herbicide Application Log*. (Criterion 10.2)

Export Control Restrictions

Access to and use of EPRI Intellectual Property is granted with the specific understanding and requirement that responsibility for ensuring full compliance with all applicable U.S. and foreign export laws and regulations is being undertaken by you and your company. This includes an obligation to ensure that any individual receiving access hereunder who is not a U.S. citizen or permanent U.S. resident is permitted access under applicable U.S. and foreign export laws and regulations. In the event you are uncertain whether you or your company may lawfully obtain access to this EPRI Intellectual Property, you acknowledge that it is your obligation to consult with your company's legal counsel to determine whether this access is lawful. Although EPRI may make available on a case-by-case basis an informal assessment of the applicable U.S. export classification for specific EPRI Intellectual Property, you and your company acknowledge that this assessment is solely for informational purposes and not for reliance purposes. You and your company acknowledge that it is still the obligation of you and your company to make your own assessment of the applicable U.S. export classification and ensure compliance accordingly. You and your company understand and acknowledge your obligations to make a prompt report to EPRI and the appropriate authorities regarding any access to or use of EPRI Intellectual Property hereunder that may be in violation of applicable U.S. or foreign export laws or regulations.

The Electric Power Research Institute Inc., (EPRI, www.epri.com) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, affordability, health, safety and the environment. EPRI also provides technology, policy and economic analyses to drive long-range research and development planning, and supports research in emerging technologies. EPRI's members represent approximately 90 percent of the electricity generated and delivered in the United States, and international participation extends to more than 30 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; and Lenox, Mass.

Together...Shaping the Future of Electricity

Program:

T&D and ROW Environmental Issues

3002002272

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com