

# CHATFIELD STORAGE REALLOCATION PROJECT

## TECHNICAL ADVISORY COMMITTEE (TAC)

### TAC RECOMMENDATION DOCUMENT - No. 03

SUBJECT: Fluctuation Zone Tree Management

Rev 06

Date: May 26, 2016

#### Purpose:

This document serves as the basis of the TAC recommendation on the subject noted above.

#### Background:

The management of trees potentially impacted by increased and fluctuating water storage levels in Chatfield Reservoir is described in both the FR/EIS and the Fish, Wildlife and Recreation Management Plan (FWRMP, or 122.2 Plan). The purpose of tree management is to provide for the safety of visitors and boaters as well as protect the operation of the dam. The FR/EIS includes references to trees within the fluctuation zone in Section 4, Environmental Consequences; Appendix K, Compensatory Management Plan (CMP); Appendix Z, Tree Management Plan (TMP); and Appendix GG, Adaptive Management Plan (AMP). The FR/EIS states that tree management is to be done prior to storing water. Within the FWRMP, further refinement of tree management in accordance with the AMP is addressed in Section 4.5, Wildlife, Wetlands and Riparian Habitat (See Section 4.5.5, Tree Management Plan) and Table 1, Proposed Mitigations for Proposed Action. Recommendations

Based on the recommendations contained in the FR/EIS (July 2013) and the FWRMP (Jan 2014), the issue of tree management in the fluctuation zone has evolved over time, from one of clearing and grubbing of the zone to a more selective approach that recognizes the unknowns associated with tree mortality from a fluctuating water surface and the ecological benefits that can be derived from standing dead wood and stabilized woody debris (i.e., anchored downed trees). This adaptive management approach between El 5432.0 and El 5444.0 also relies on monitoring of mortality and annual removal of dead wood and debris that poses a hazard to reservoir use and operation.

Recommendations for moving forward on tree management include the following additional actions:

- Trees impacted by recreational mitigation, generally below El 5444.0 should be identified and removed before the onset of facility relocation. There are stands of trees around the Marina and swim beach that will be impacted from excavation and fill, and trees along Fox

Run, Catfish Flats and Jamison that may also be impacted by recreation facility relocation. These areas should be surveyed and trees to be removed identified.

- Cottonwood and willow locations as identified on Figure 1 of Appendix Z should be reviewed and verified or modified as appropriate to identify potentially impacted tree areas below El 5432.0, between El 5432.0 and El 5435.5, between El 5435.5 and El 5437.5, between El 5437.5 and El 5439.0 and between El 5439.0 and El 5444.0. See attached reference document prepared from 2014 LiDAR data. Field verification of these elevation zone assessments should be conducted by the consultants for EM1- EFU Independent Technical Review, EM2 – Preliminary Design of On-site Environmental Mitigation, RM1 – Preliminary Design of the Marina and RM2 – Preliminary Design of Recreation Facilities Modifications.
- Based on this assessment, a coordinated plan should be developed that addresses all on-site mitigation and the CRMC storage schedule to monitor and selectively remove trees and / or secure deadwood in a manner that does not impact CRMC storage requirements. Removal actions will occur prior to storage within an elevation zone that addresses deadwood and living trees determined to pose a risk to recreational use or reservoir operations and adaptive management of trees that are determined to not pose an immediate risk.
- Adaptive management should continue through all phases of environmental and recreation mitigation and storage until a state of equilibrium is achieved in which tree stands are naturally cycling through life stages and adapted to the changes in storage elevations.
- Consideration should be made for implementing a debris screen between wake and no-wake boating areas of the reservoir that prevent floating and submerged debris from entering the wake zone or impacting the dam intake or spillway structure.

### Referenced Documents (attached):

FR/EIS, July 2013. Appendix Z, Figure 1

CDM Smith, May 2016. CSRP Tree Management in the Fluctuation Zone

CDM Smith, May 2016. GIS exhibits of tree zones

### Requested Action:

The TAC is requested to accept the refined approach to managing trees within the Fluctuation Zone.

### Requested Rationale:

The appropriate management of trees in the FZ to prevent recreational hazards and operational impacts is consistent with the intent of the CMP in the FR/EIS that recognized refinements to the feasibility level study would be required for implementation of the Project and changing conditions at Chatfield. Taking an adaptive management approach to tree management in the FZ is critical to allowing the storage of CRMC water in the reservoir while minimizing environmental, recreational and operational impacts within the reservoir. Tree management will be addressed by the preliminary design consultants with independent technical review. Tree management designs for

all habitat preservation projects will be reviewed by the TAC and the PCT and evaluated against the requirements.

### TAC Recommendation:

The TAC recommends to use the Adaptive Management approach to managing trees within the Fluctuation Zone as described above, with the exceptions that: 1) the suggested debris screen not be implemented and 2); the CPW be included, along with the PCT and the TAC as reviewers of the refined Tree Management Plan.

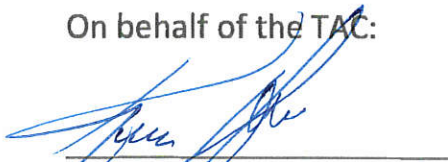
### TAC Voting


The TAC members in attendance voted on this Recommendation, in accordance with the TAC Charter Section C. The vote tally was 14 votes to "agree"; 0 votes to "accept"; and 0 votes to "reject" the Recommendation. The recommendation is based on the total votes for "agree" and "accept". TAC adopted voting procedures also require that any Member voting to "reject" a recommendation to propose alternative(s) for consideration to move the issue forward.

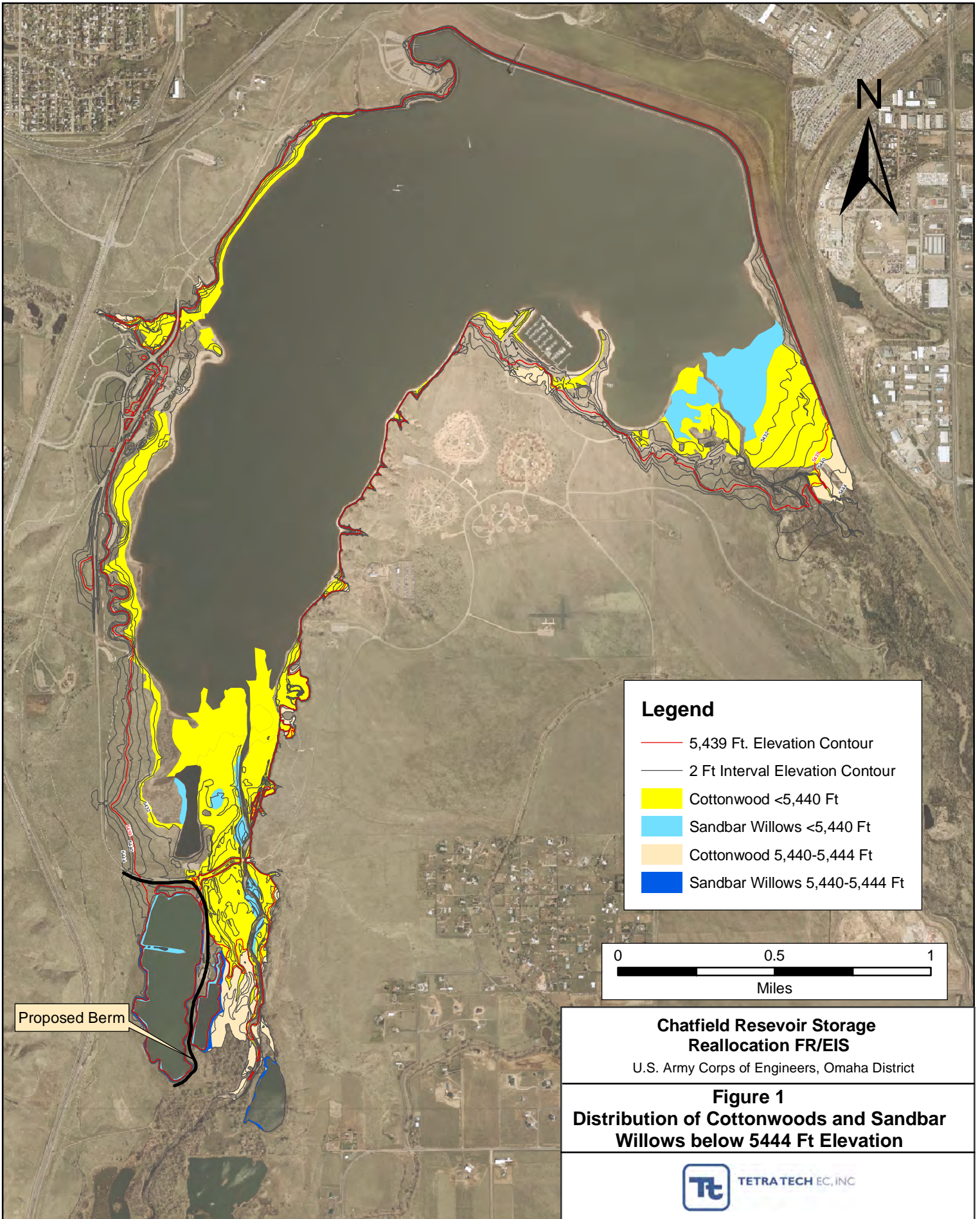
### TAC Rationale:

The appropriate management of trees in the FZ to prevent recreational hazards and operational impacts is consistent with the intent of the CMP in the FR/EIS that recognized refinements to the feasibility level study would be required for implementation of the Project and changing conditions at Chatfield. Taking an adaptive management approach to tree management in the FZ is critical to allowing the storage of CRMC water in the reservoir while minimizing environmental, recreational and operational impacts within the reservoir. Tree management will be addressed by the preliminary design consultants with independent technical review. Tree management designs for all habitat preservation projects will be reviewed by the CPW, TAC and the PCT and evaluated against the requirements.

On behalf of the TAC:

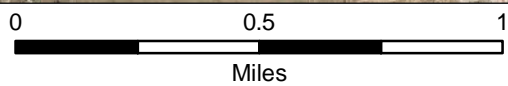
  
\_\_\_\_\_  
Kevin Urie  
Chair

  
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Jennifer Anderson  
Vice-Chair



**Legend**

- 5,439 Ft. Elevation Contour
- 2 Ft Interval Elevation Contour
- Cottonwood <5,440 Ft
- Sandbar Willows <5,440 Ft
- Cottonwood 5,440-5,444 Ft
- Sandbar Willows 5,440-5,444 Ft



Proposed Berm

**Chatfield Reservoir Storage  
Reallocation FR/EIS**  
U.S. Army Corps of Engineers, Omaha District

**Figure 1**  
**Distribution of Cottonwoods and Sandbar  
Willows below 5444 Ft Elevation**





## Memorandum

**To:** *Barbara Biggs, Program Manager  
Steve Lowry, Deputy Program Manager*

**From:** *Ted Johnson, Environmental Mitigation Task Leader*

**Date:** *May 6, 2016*

**Subject:** *CSRP Tree Management in the Fluctuation Zone*

## EXECUTIVE SUMMARY

### Introduction

The management of trees potentially impacted by increased and fluctuating water storage levels in Chatfield Reservoir is described in both the FR/EIS and the Fish, Wildlife and Recreation Management Plan (FWRMP, or 122.2 Plan). The purpose of the plan is to ensure the safety of visitors and boaters as well as protect the operation of the dam. The FR/EIS includes references to trees within the impact zone in Section 4, Environmental Consequences; Appendix K, Compensatory Management Plan (CMP); Appendix Z, Tree Management Plan (TMP); and Appendix GG, Adaptive Management Plan (AMP). The FR/EIS states that tree managements is to be done prior to storing water. Within the FWRMP, tree management is addressed in Section 4.5, Wildlife, Wetlands and Riparian Habitat (See Section 4.5.5, Tree Management Plan) and Table 1, Proposed Mitigations for Proposed Action. Recommendations and requirements of each of these referenced documents is summarized in this memorandum. The memorandum provides a recommended schedule and approach to tree management.

### Summary and Recommendations

Based on the recommendations contained in the FR/EIS (July 2013) and the FWRMP (Jan 2014) that was prepared after the FR/EIS, the issue of tree management in the fluctuation zone has evolved over time, from one of clearing and grubbing of the zone to a more selective approach that recognizes the unknowns associated with tree mortality from a fluctuating water surface and the ecological benefits that can be derived from standing dead wood and stabilized woody debris (i.e., anchored downed trees). This adaptive management approach between 5,432 ft-msl and 5,444 ft-msl also relies on monitoring of mortality and annual removal of dead wood and debris that poses a hazard to reservoir use and operation.

Recommendations for moving forward on tree management include the following:

**Table 1. Fluctuation Zone Tree and Management Schedule**

Date	WSA Year	Actions	Approximate Maximum Pool Elevation (ft-msl)
May 2016	2	<ul style="list-style-type: none"> <li>• Present tree management recommendations to TAC</li> <li>• Review FR/EIS and FWRMP recommendations and requirements and develop detailed plans for monitoring, managing and removing trees and debris in the fluctuation zone below el. 5,444;</li> <li>• Develop an approach to preserving and securing dead standing wood and large woody debris in the fluctuation zone that can provide aquatic and riparian zone habitat benefits.</li> <li>• Address the issue of meeting the CMP and WSA schedule within the current adaptive management requirements. The schedule requires that tree management and securing of debris takes place before the reservoir level is raised.</li> <li>• Begin tree management coordination with CPW and USACE. Continue coordination throughout tree management activities.</li> </ul>	5,432
June 2016	2	<ul style="list-style-type: none"> <li>• Develop a detailed adaptive tree management plan that includes specific direction and recommendations regarding tree monitoring, debris removal and stabilization of dead wood that can provide avian and aquatic habitat benefits.</li> <li>• This plan can be developed by the EM2 consultant and incorporated into the EM2 preliminary design, with direction from the PGM.</li> </ul>	5,432
Summer 2016	2	EM2, CPW to identify dead or dying trees and trees or debris that may pose a hazard to boaters, recreational users or reservoir operations that may need to be removed.	5,432
September 2016	2	Identify Preble's hibernacula areas within the inundation/fluctuation zone.	5,432
November 2016	3	Complete procurement of a tree management contractor to begin tree and debris removal.	5,432
Winter 2016 – 2017	3	Begin removal of identified trees and debris, and securing of debris and dead standing trees to be preserved within each of the prospective elevation zones with particular emphasis on the 232.5 acres of trees below El 5435.5 so that initial filling can commence in October, 2017.	5,432
Summer 2017	3	Identify additional dead or dying trees that may need to be removed below el 5435.5 before initial fill.	5,432
October 9, 2017	3	Begin CSRP storage	5,435.5

**Table 1. Fluctuation Zone Tree and Management Schedule**

<b>Date</b>	<b>WSA Year</b>	<b>Actions</b>	<b>Approximate Maximum Pool Elevation (ft-msl)</b>
Winter 2017 – 2018	4	Identification of at-risk trees below El 5437.5 with emphasis on 271 acres of fluctuation zone between El 5435.5 to El 5437.5, to address the 4th year inundation zone, removal of dead trees and debris not to be preserved for habitat purposes within the inundation zone below el 5437.5.	5,435.5
October 9, 2018	4	Increase CSRP storage	5,437.5
Winter 2018 – 2019	4	Identification of at-risk trees below El 5439 with emphasis on the year 5 fluctuation zone from El 5437.5 to El 5439 to address the 5th year inundation zone (by Oct 29, 2019), removal of dead trees and debris not to be preserved for habitat purposes within the inundation zone below El 5440.	5,437.5
October 9, 2019	5	Increase CSRP storage	5,439
Winter of 2019 – 2020	5	Identification of trees below elevation 5,444 with emphasis on the year 6 fluctuation zone from elevation 5,439 to 5,444 to address the 6th year inundation zone (by May 29, 2020), removal of dead trees and debris not to be preserved for habitat purposes within the inundation zone below elevation 5,439.	5,439
October 9, 2020	6	Increase CSRP storage allocation	5,442
Winter 2020 – 2021	6	Identification of trees below elevation 5,444 to address the 7th year inundation zone, removal of dead trees and debris not to be preserved for habitat purposes within the inundation zone below elevation 5,444.	5,442
October 9, 2021	7	Increase CSRP storage allocation	5,442
Post 2021	7-11	Identification and removal of dead trees and debris not to be preserved for habitat purposes within the inundation zone below elevation 5,444.	5,442 - 5,444 Depending on percentage of EFUs achieved

This schedule is based on the inundation schedule shown in Table 6-4 in Exhibit B of the WSA

## BACKGROUND

The following summarizes the applicable information in the FR/EIS and the 122.2 Plan.

## FR/EIS

A fluctuating water surface between elevations 5,432 ft-msl and 5,444 ft-msl will result in the loss of trees that can present a hazard to visitors, boaters and dam safety as well as an increase in nutrient and phosphorous loading that can have an adverse impact on water quality.

### Section 4 Environmental Consequences

Table 4-1 in Section 4 of the FR/EIS states that vegetation below 5,439 ft-msl is to be removed to minimize the introduction of nutrients associated with inundation, Table 4-1 further states (italicized text is direct quotation):

*Under Alternative 3, as proposed in the TMP, the majority of trees between 5,432 ft msl (the current high water elevation) and 5,439 ft msl would be removed prior to raising the pool elevation.*

Uncertainties identified in Table 4-1, Summary of Adaptive Management Measures to Address Potential Impacts and Uncertainty, associated with this impact include:

- *The degree of tree survival below the new high water elevation of 5,444 ft msl;*
- *The exact area and location of trees to be cleared;*
- *Locations and size of tree stands to be retained below 5,439 ft msl;*
- *Locations of where downed trees will be used for aquatic habitat enhancement;*
- *Locations of where downed trees will be used for Preble's habitat enhancement; and*
- *The degree of new tree establishment in the upper portions of the new fluctuation zone.*

Table 4-1 identifies the following actions that will be used to adaptively manage uncertainties that can affect implementation of the TMP:

- *Monitor the trees between 5,439 and 5,444 ft msl, and any trees retained below 5,439 ft msl, for signs of severe stress and mortality, and remove unhealthy and dead trees from this area on an as needed basis when they pose a significant risk to visitor, boater or dam safety.*
- *Monitor the trees between 5,439 and 5,444 ft msl, and any trees retained below 5,439 ft msl, to determine if adjustments to impact estimates and mitigation are needed.*
- *The Corps and CPW will work together to identify areas where trees will need to be removed prior to storing water in the reallocated conservation pool to eliminate significant risks to visitor, boater or dam safety.*
- *The Corps and CPW will work together to identify areas where removed trees will be placed to enhance aquatic habitat prior to storing water in the reallocated conservation pool. Methods to secure the trees and eliminate significant risks to visitor, boater or dam safety will also be determined.*



- *The Corps, CPW, and FWS will work together to identify areas where removed trees will be placed to enhance Preble’s habitat.*
- *The Corps and CPW will evaluate trees within the reallocated pool after water has been stored and trees have been inundated, and based on their evaluation will notify the Chatfield Reservoir Mitigation Company of the trees that need to be removed based on significant risks to visitor, boater, or dam safety/operations.*
- *Monitor the establishment of cottonwoods and willows above and below the new high water line of 5,444 ft msl.*

Based on the Table 4-1 actions, the CPW and USACE are responsible for identifying tree removal, disposal and replacement locations. In practice, the CRMC and the PgM will be coordinating this effort.

**Appendix Z - Tree Management Plan**

The TMP recommends the removal of all woody vegetation up to 5,439 ft-msl for water quality purposes. For areas between 5,439 ft-msl and 5,444 ft-msl, an adaptive management approach is recommended that entails leaving trees in place and monitoring them for signs of severe stress and mortality and, removing unhealthy and dead trees from this elevation zone on an as-needed basis to eliminate potential risks to visitors, boaters and dam safety.

Table 2 of the TMP summarizes the acreage of trees at each elevation between elevations 5,432 ft-msl and 5,444 ft-msl. This table identifies 357.4 total acres of trees impacted within the fluctuation zone, 296.3 acres below elevation 5,439 ft-msl and 147.2 acres of trees below elevation 5,432 ft-msl.

Figure 1 of the TMP identifies the distribution of tree communities within the fluctuation zone that may be affected by the CSRP.

**Table 2. Number of Acres of Trees at Each Elevation Interval**

Elevation Interval (ft msl)	Vegetation Types			Total Acres of Trees in this Elevation Interval (3)	Cumulative Total Acres of Trees at this Elevation (3)
	Cottonwoods (1)	Mix with Cottonwoods (2)	Sandbar Willow		
<5432	94.5	10.2	42.5	147.2	147.2
5432-5434	53.5	0.6	2.2	56.3	203.6
5434-5436	35.6	0.9	1.7	38.2	241.8
5436-5438	33.5	0.0	5.4	38.9	280.7
5438-5439	14.5	0.0	1.1	15.6	296.3
5439-5440	14.0	0.0	1.0	15.0	311.3
5440-5442	19.7	0.0	3.0	22.7	334.0
5442-5444	20.3	0.0	3.1	23.5	357.4
Total =	285.7	11.7	60.0	357.4	

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- (1) Includes GIS vegetation layers designated as "plains cottonwoods", "narrowleaf cottonwoods", and "cottonwood seedlings" ("Vegetation Assessment Report, Chatfield State Park", Colorado State Parks, 2001).
  - (2) Includes GIS vegetation layers designated as including cottonwoods and at least one non-cottonwood species such as grasses, weeds, and willows.
  - (3) Includes all - "Cottonwoods", "Mix with Cottonwoods", and "Sandbar Willow".

#### **TMP Recommendations**

From Section 3 of the TMP, recommended tree removal actions include:

- *Tree stumps would need to be ground or removed to eliminate hazards to boaters.*
- *To minimize impacts to water quality an effort should be made to remove all woody vegetation from the area below 5439 ft msl, including woody debris already on the forest floor and wood waste generated from felling trees and grinding stumps.*
- *CSFS indicated that there is not a significant market for the cottonwood and willow trees. Therefore the cut trees, mulch, and debris would need to be hauled and disposed of off-site.*

*Based on these conditions, a clearing and grubbing operation was identified as the most appropriate approach for removing the trees and preparing the area for inundation.*

Although the TMP recommends off-site disposal of all trees, mulch and debris, the 122.2 Plan recommends that some of this material should be considered for inclusion in on-site Preble's mitigation areas, if needed.

#### **TMP Schedule**

The TMP states:

*The tree removal plan recommends integration of the area to be cleared and grubbed with the phased schedule for filling the pool that is contingent on the completion of environmental mitigation milestones. The area to be cleared would coincide with the elevation approved for filling. In addition, the schedule would be coordinated with the construction schedule for the recreation modification and mitigation to minimize disruption to Park activities and visitors. The TMP would be carried out in compliance with the Migratory Bird Treaty Act to avoid impacts to migratory birds during migration and breeding periods at Chatfield. In addition, tree removal would be performed to minimize potential impacts to Preble's mouse during their active season, as well as during hibernation. Depending on the number of crews working simultaneously, the project could be completed in approximately one to three months.*

Important considerations for scheduling tree management activities include avoidance of:

- Migratory bird impacts, which can be assumed to mean removal activities should occur between the end of the migration season in the fall and the beginning of the migration season in the spring, roughly between November and February;
- Raptor impacts, generally nesting, between the months of February and July, although this season can vary by species.

- Preble’s active season, which can be assumed to be between February and November and avoidance of areas where hibernacula have been identified or can be expected to occur;
- Disruption of Park activities and visitors, and
- Floating woody debris that presents a structural hazard to the dam and other reservoir structures.

These requirements indicate that the four-month period from November to April should be the time when selective removal of dead standing wood and woody debris can occur. In addition, this removal activity should be conducted per plans agreed to by the CPW, who may require certain types of removal and specific removal periods within the general 4-month period.

**TMP Cost**

The TMP used RS Means and local data sources prior to 2010 to develop tree management costs. Cost information is provided in Table 3.

**Table 3. Tree Management Plan Cost Estimate**

Item	Unit	Quantity	Unit Cost	Total Cost
Clearing and Grubbing, up to 12 inch diameter	acre	269.5	\$3,950	\$1,064,525
Clearing and Grubbing, above 12 inch diameter	acre	26.8	\$7850	\$210,380
<b>Subtotal (rounded)</b>				<b>\$1,280,000</b>
Hauling	cubic yard	40,000	\$6	\$240,000
Planning and monitoring	lump sum	1	\$80,000	\$80,000
<b>Subtotal</b>				<b>\$320,000</b>
<b>TMP Total</b>				<b>\$1,600,000</b>

The TMP states:

*There is some uncertainty in the number of acres that would need to be cleared and grubbed, and the total cost would vary accordingly. A cost of \$6 per cubic yard was assumed for hauling tree waste off-site, based on information from facilities in the Denver area that generate mulch products from wood waste. The volume of tree waste was estimated based on general assumptions of tree density*

**Compensatory Mitigation Plan FR/EIS Appendix K**

Published in 2013 as a part of the FR/EIS, the Compensatory Mitigation Plan (CMP) presents an approach and schedule is presented here for background purposes and is representative of the beginning of the development of an approach to tree management.

Table 13 of the CMP provides an implementation schedule for achieving a maximum pool elevation of elevation 5,442 over a six-year period.

**Table 13. Compensatory Mitigation Implementation Schedule and Reallocated Storage Milestones.**

Year Following Approval	Milestone	Estimated EFUs Gained Per Milestone	Estimated Running Total of EFUs Gained Per Milestone	Estimated % of EFUs Gained of Total EFUs Needed	% of Reallocated Storage Available	Approximate Maximum Pool Elevation (ft) <sup>4</sup>
3	Complete implementation of all on-site compensatory mitigation, including on-site mitigation in critical habitat <sup>1</sup>	85	85	9	10	5,433.0
3	Complete implementation of all off-site mitigation of impacts to Preble's critical habitat on the South Platte River arm	-- <sup>2</sup>	-- <sup>2</sup>	-- <sup>2</sup>	20	5,435.0
3	Complete implementation of off-site mitigation to gain 100% of needed Preble's EFUs in the West Plum Creek CHU including implementation of 25% of off-site mitigation	178	263	26	25	5,435.5
4	Complete implementation of 50% of off-site mitigation	178	441	44	45	5,437.5
5	Complete implementation of 70% of off-site mitigation	142	583	59	60	5,440.0
6	Complete implementation of 90% of off-site mitigation <sup>3</sup>	142	725	73	80	5,442.0

The CMP references FR/EIS Appendix Z, the Tree Management Plan that proposes the removal of trees to 5,439 ft-msl and adaptive management from 5,439 ft-msl to 5,444 ft-msl to monitor and remove unhealthy and dead trees to eliminate potential risks to visitor and dam safety.

**Comparative Review of Reservoir Fluctuation Zone Chatfield Reallocation Project, FR/EIS Appendix HH**

Tree impacts will occur within the Fluctuation Zone (FZ). Appendix HH of the FR/EIS summarizes a comparative study of fluctuation zone characteristics within 7 Front Range reservoirs from Pueblo to Greeley. This study addresses vegetation characteristics within the FZ including woody vegetation. Viable stands of cottonwoods and willows have been identified in the FZ at all 7

reservoirs. In addition, the study identifies the existence of the noxious woody species saltcedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*) in several of the reservoir's.

The Fluctuation Zone study concludes:

*It is challenging to estimate if vegetation will become established within the expanded fluctuation zone of Chatfield Reservoir due to the variation observed at the reservoirs reviewed. Prolonged drawdowns may lead to the establishment of cottonwoods and willows at the water's edge for a few years that will then be inundated and killed as seen at Pueblo Reservoir. Consistent drawdowns during the growing season that provide moist soils could produce well developed vegetation within the fluctuation zone as seen at Barr Lake. The most common situation observed at the reservoirs reviewed was the majority of the fluctuation zone void of vegetation with pockets of vegetation at inlets and deltas. It is likely this will also be the situation at Chatfield Reservoir.*

## SECTION 122.2, FWRMP

The 122.2 Plan was prepared after the Tree Management Plan in Appendix Z of the FR/EIS was written and represents further discussions of an adaptive management approach to tree management primarily between the State and the CRMC. The following are the significant differences noted:

- The 122.2 Plan does not refer to clearing and grubbing as a method required for tree removal.
- The 122.2 Plan does not require initial removal of all vegetation below 5,439 ft-msl.
- The 122.2 Plan does require removal of trees that are likely to be killed by inundation (5,439 ft-msl according to App Z of the FR/EIS)
- The 122.2 Plan does require removal of dead and downed trees, with exceptions for habitat. Dead wood to be preserved as habitat must be secured so that it cannot float into active areas of the reservoir.
- The 122.2 Plan does not refer to trees below El 5,432 ft-msl, nor does it provide any direction as to the fate of these trees.
- The 122.2 Plan is less prescriptive as to when tree management is to take place and does not state that it has to be prior to storing water. Because of its reference to an adaptive management approach to tree management and removal or preservation of dead wood, tree removal does not appear to be a requirement for CRMC storage.

The 122.2 Plan was published in January, 2014, approximately 6 months after the FR/EIS, was prepared in accordance with the provisions of C.R.S. §37 60 122.2. Although not explicitly stated, recommendations contained in the 122.2 Plan are intended to refine those contained in the FR/EIS.

Excerpts from the 122.2 Plan are provided below with comments.

From FWRMP Table 1:

## CSRP Tree Management

May 6, 2016

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- *CMP and Tree Management Plans detail mitigation for wildlife viewing and shade.*
- *Tree management plan modified to leave trees down to 5432 and use of adaptive management to remove dead or dying trees within the fluctuation zone.*

The second bullet from Table 1 is of particular importance as it relies on the Adaptive Management Plan to modify the FR/EIS recommendation to clear and grub for total tree removal from the FZ below 5,439 ft-msl; instead recommending monitoring and selective removal of non-viable trees down to elevation 5,432.

FWRMP Section 3.0, Benefits of the Project further states:

- *As some trees in the inundation area are left standing, herons and cormorants will benefit from the creation of a more secluded area of trees surrounded by water, providing new nesting habitat; cavity nesting birds will benefit.*
- *Keeping fallen trees as anchored fish structures would create positive shallow water habitat, so long as they are appropriately marked to prevent being boating hazards.*

These statements further modify the recommendations contained in the FR/EIS, including the CMP and TMP, by recognizing the fact that dead trees provide aquatic and avian habitat and those that do not present a hazard to boating be kept in place in such a way that they will remain in place and not become floating debris that can present recreational and structural hazards. A determination of which trees represent a hazard to recreational use or operation of the reservoir can be made as a part of the EM2 preliminary design with review and concurrence from CPW and the Corps.

FWRMP Section 4.5.5, Tree Management Plan:

Section 4.5.5 of the FWRMP provides a summary of the FR/EIS Tree Management Plan including its recommendations for tree removal and adaptive management. It continues with a summary of the Adaptive Management Plan (Appendix GG of the FR/EIS):

*The USACE Adaptive Management Plan ... allows the Tree Management Plan to be more flexible. Understanding that trees and other vegetation below 5439 ft above msl may not necessarily be inundated to a point of killing the trees and other vegetation, Project Participants and CPW agree that Project Participants may first seek to operate their storage space in a manner that minimizes the length of inundation between elevations 5,444 and 5,439 ft above msl.*

If the trees between 5,432 and 5,439 ft-msl are not cleared and grubbed, Project Participants would need to:

- *Remove the dead and down trees along with all other debris on the ground;*
- *Perform selective thinning to provide a healthier environment and ease of access for implementation of BMP's;*
- *Require a yearly evaluation and monitoring of trees from 5,432 to 5,444 ft. above msl; and*

- *Increase debris removal in the reservoir, as needed, and provide funds to offset additional operational costs. Debris will need to be removed and taken off site.*

*These activities will provide a more pleasing aesthetic look at lower water levels, more bird habitat and possibly new rookery areas. In addition, the activities will maintain or increase watchable wildlife opportunities and possibly decrease required mitigation including off site mitigation.*

The term *debris* is used in these requirements and is open to interpretation. Debris typically refers to fragments resulting from the destruction of something natural or man-made. In this case the assumption can be made that debris refers to woody material that could pose a hazard to reservoir structures or recreational safety. Large woody debris, a term that is often used in riverine and reservoir design and analysis, has been defined as larger than 4-inch diameter and longer than 3 feet; however, opinions from the CPW and Corps should be obtained regarding the definition of debris.

FWRMP Section 4.5.6, Adaptive Management for the Tree Clearing within the Fluctuation Zone states:

*Adaptive Management ... will be implemented on an "as needed" basis and as informed by the monitoring of impacts and mitigation on an ongoing basis to ensure the core mitigation objectives are met. Monitoring will be concluded when all of the core mitigation objectives are met, which will ultimately be decided by the USACE.*

*The core objectives for the tree clearing within the fluctuation zone are:*

1. *Limit tree clearing to areas where trees have a high likelihood of being killed by inundation as determined by CPW;*
2. *Leave trees in selected areas below 5,439 ft msl for fish and wildlife habitat, to the degree practicable and safe;*
3. *Decisions on trees removed (including stumps) and trees retained, must also consider dam, boater and visitor safety;*
4. *Maximize the use of downed trees for fish and wildlife habitat; and*
5. *Remove downed woody material from the area below 5,439 ft msl to minimize impacts to water quality except as placed or retained for aquatic and wildlife habitat.*

These sections of the FWRMP clearly provide recommended refinements to those contained in the FR/EIS, TMP and AMP. The intent of these refinements is to minimize land disturbance, preserve living trees to the maximum extent possible, and preserve dead trees that can provide mammalian, avian and aquatic habitat without posing a risk to recreational use of the reservoir or structural integrity of the dam. In addition, dead wood and debris that does pose such a risk shall be removed.

## **Weed Management**

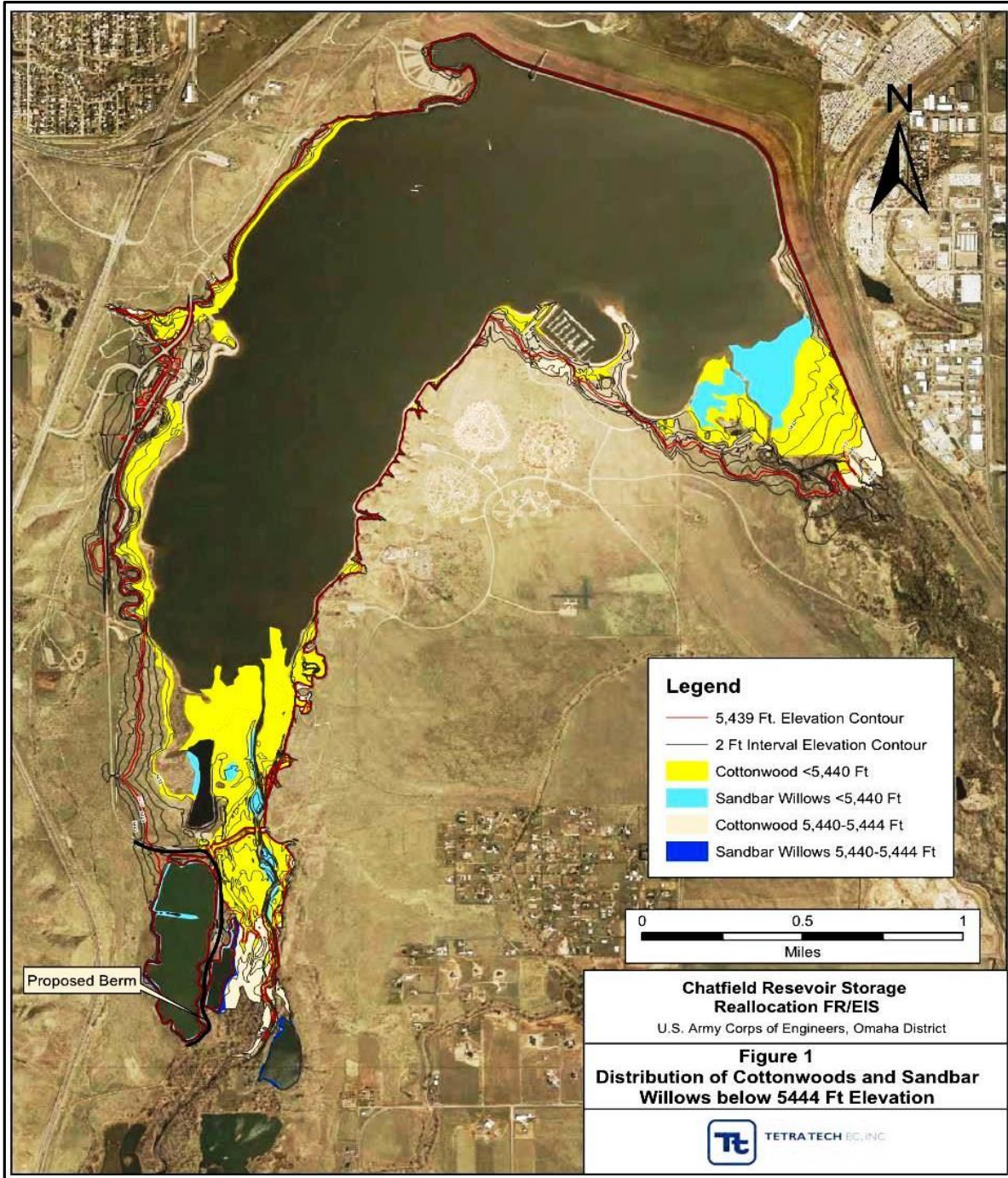
Any land disturbance within CSP presents the opportunity for colonization of noxious weeds. Removal of trees whether in the Fluctuation Zone or elsewhere represents such a disturbance and weed management during removal operations needs to be taken into consideration.

Monitoring in the fluctuation zone (FZ) should include identification of weed and invasive species that have been identified by CPW for control and/or eradication. Invasive species introduction can be minimized by minimizing land disturbance during tree and debris removal actions. This monitoring and potential eradication should be coordinated with on-going CPW weed management activities and conducted prior to, during and following tree removal activities.

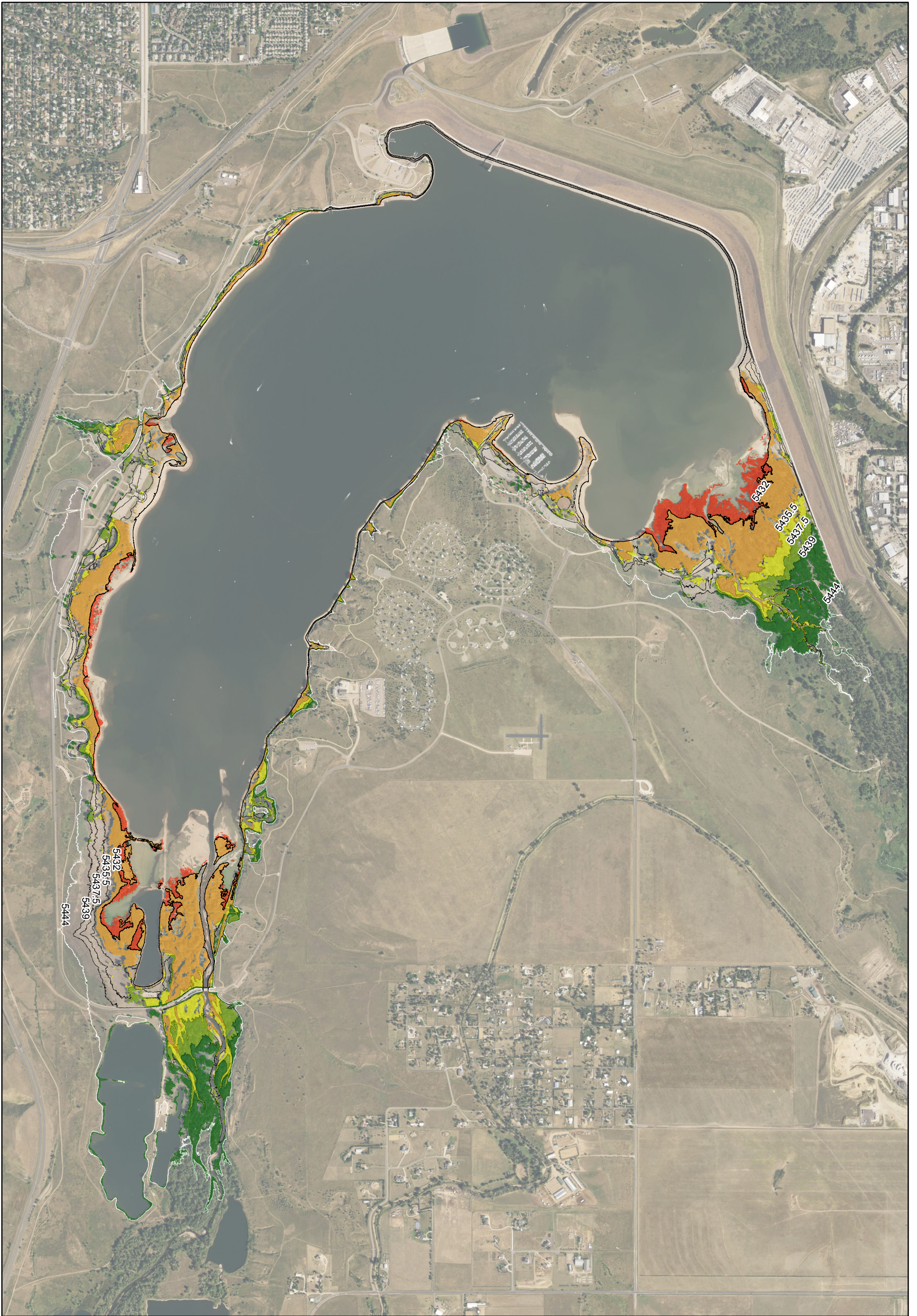
## **Raptor Nest Monitoring**

Monitoring of raptor nests is an important issue associated with tree management. Species specific buffer zones are required for construction activities that may disturb nesting raptors. The CPW has issued specific protocol for monitoring raptor nests and active and inactive nests have been identified in the park that could be impacted by CSRP mitigation activities, including within the Fluctuation Zone. A separate memorandum has been developed that summarizes possible protocol and CSP nest locations. This memorandum should be reviewed, monitoring measures developed and nests identified that could be impacted by mitigation activities prior to implementation of the activities. The monitoring plan and nest locations should be presented to the CPW for review and approval prior to the start of implementation.

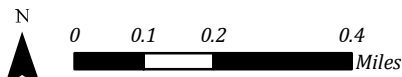




TREE AREA BY ELEVATION ZONES – PREPARED BY CDM SMITH USING LiDAR 2014 DATA



Elevation	Trees by Elevation
Contours	< 5432.0
EI. 5444.0	5432.0-5435.5
	5435.5-5437.5
	5437.5-5439.0
	5439.0-5444.0



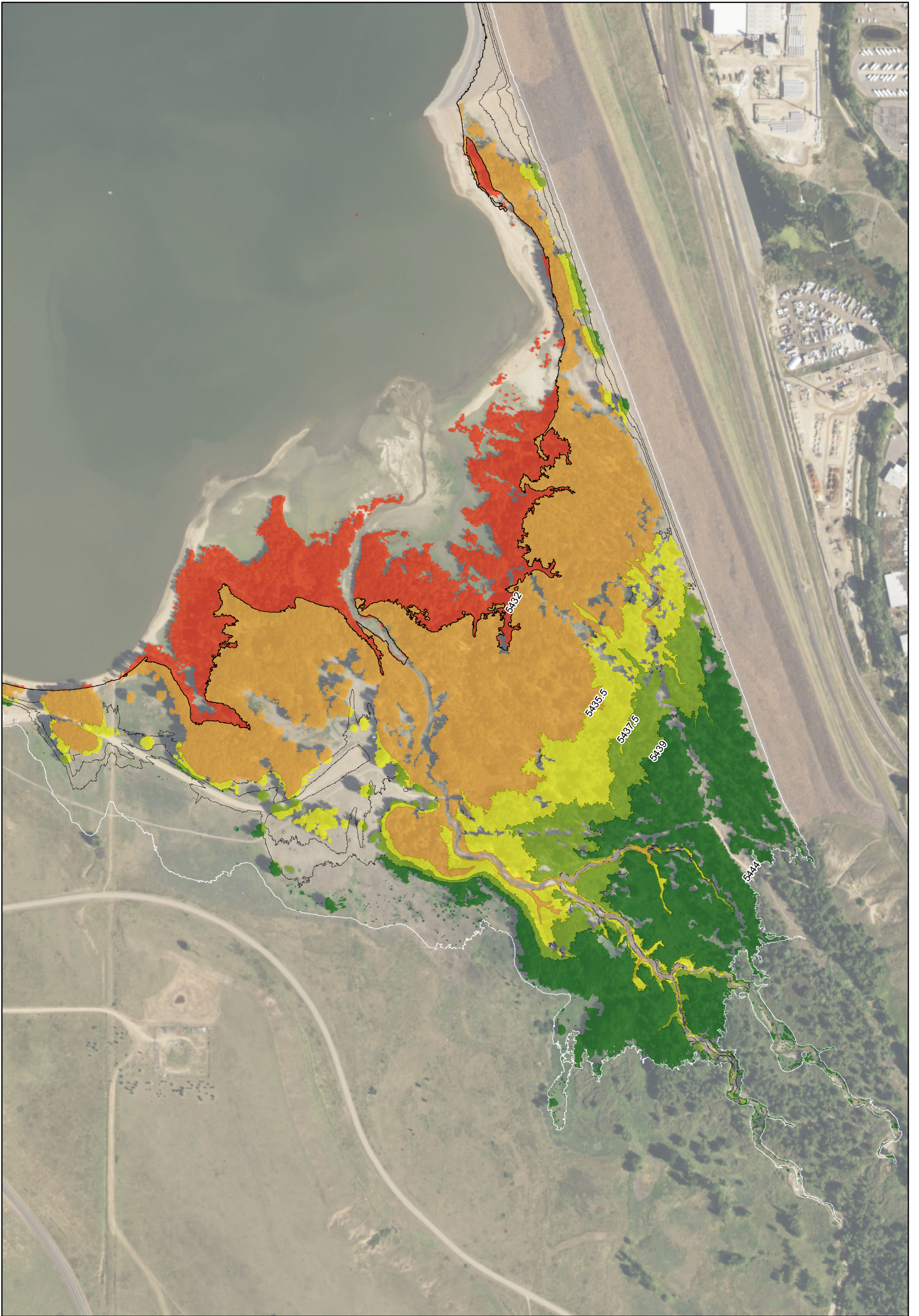
Service Layer Credits: Esri, USDA Farm Service Agency; Colorado Fish Wildlife and Parks; DRCOG

Date: 5/11/2016

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 Tel: (303) 383-2300  
 Fax: (303) 308-3003



Elevation	Trees by Elevation
Contours	< 5432.0
El. 5444.0	5432.0-5435.5
	5435.5-5437.5
	5437.5-5439.0
	5439.0-5444.0



Service Layer Credits: Esri, USDA Farm Service Agency; Colorado Fish Wildlife and Parks; DRCOG

Date: 5/11/2016

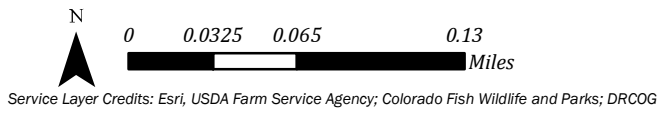
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	5437.5-5439.0
	5439.0-5444.0



Date: 5/11/2016

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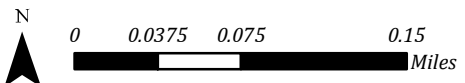
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	5437.5-5439.0
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Service Layer Credits: Esri, USDA Farm Service Agency; Colorado Fish Wildlife and Parks; DRCOG

Date: 5/11/2016

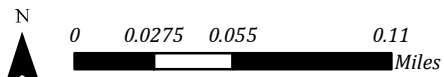
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	5437.5-5439.0
	5439.0-5444.0



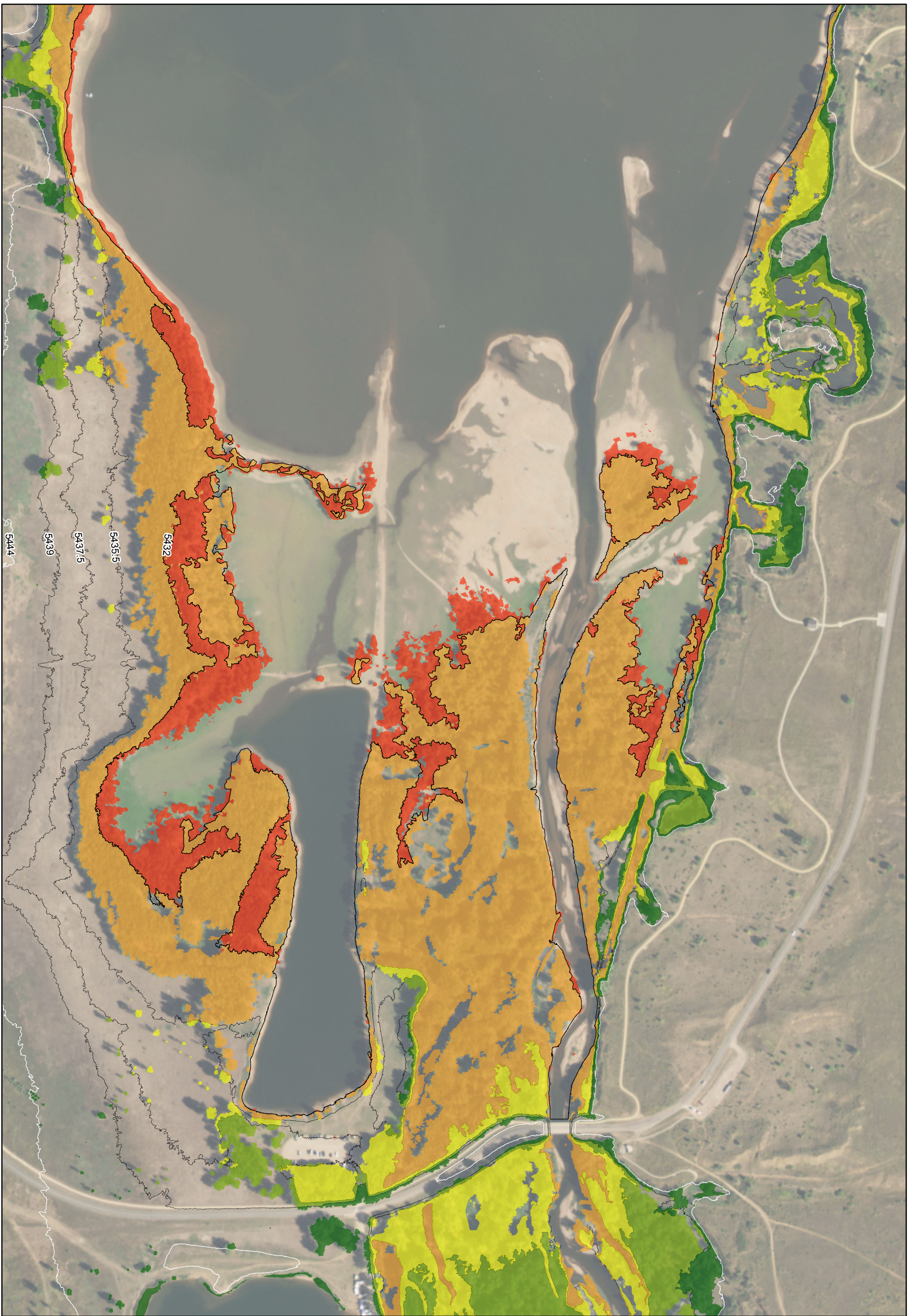
Service Layer Credits: Esri, USDA Farm Service Agency; Colorado Fish Wildlife and Parks; DRCOG

Date: 5/11/2016

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**CDM  
Smith**

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Elevation	Trees by Elevation
Contours	< 5432.0
EI. 5444.0	5432.0-5435.5
	5435.5-5437.5
	5437.5-5439.0
	5439.0-5444.0



Service Layer Credits: Esri, USDA Farm Service Agency; Colorado Fish Wildlife and Parks; DRCOG

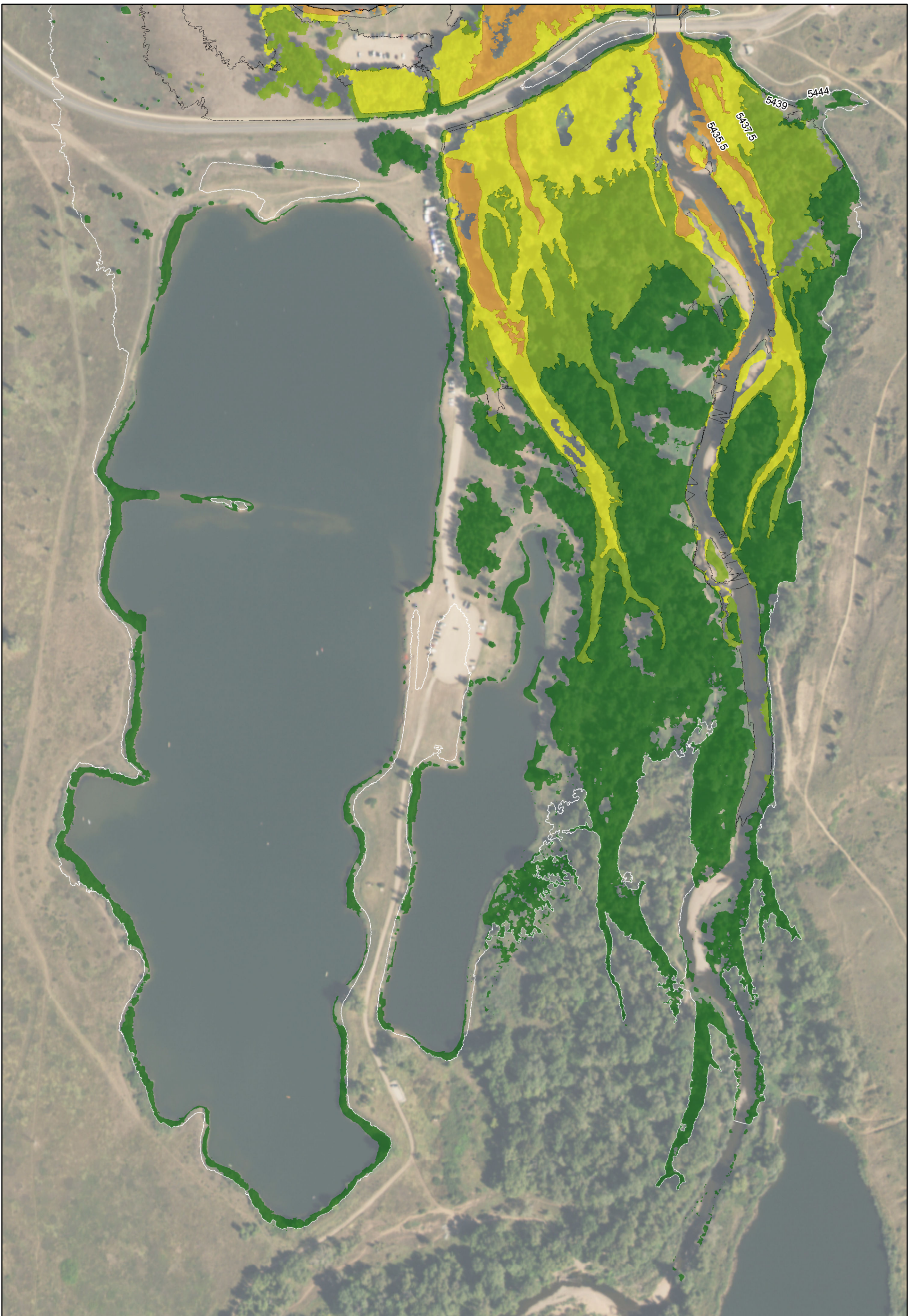
Date: 5/11/2016

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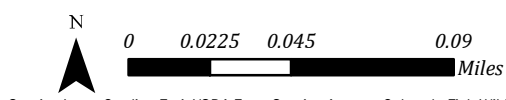

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**Table 1 Tree Acres Comparison**

Elevation	Forested Acres (Appendix Z)	Forested Acres (LiDAR derived)	Difference
<5432	147	39	108
5432-5434	56	83	-27
5434-5436	38	51	-12
5436-5438	39	38	1
5438-5439	16	18	-3
5439-5440	15	15	0
5440-5442	23	27	-4
5442-5444	24	23	0
Total	357	295	62

**Table 2 Tree Acres by Elevations in Water Storage Agreement**

Elevation	Forested Acres (LiDAR derived)
<5432	39
5432-5435.5	124
5435.5-5437.5	37
5437.5-5439	29
5439-5444	66
Total	295