

Exhibit D

SUFFICIENT SURVEY EVIDENCE WAS NOT RECOVERED TO ESTABLISH THE POSITION OF THE BOUNDARY LINES SHOWN HEREON. THE BOUNDARY REPRESENTED ON THIS MAP IS BASED ON COMPILED RECORD DATA AND BEST FIT ONTO EXISTING IMPROVEMENTS. IT IS POSSIBLE FOR THE LOCATION OF THE SUBJECT PROPERTY TO SHIFT FROM THE PLACEMENT SHOWN HEREON WITH ADDITIONAL FIELD WORK AND RESEARCH. THEREFORE, ANY SPATIAL REFERENCE MADE OR SHOWN BETWEEN THE RELATIONSHIP OF THE BOUNDARY LINES AND EXISTING GROUND FEATURES, EASEMENTS OR LEASE AREA SHOWN HEREON IS INTENDED TO BE APPROXIMATE AND IS SUBJECT TO VERIFICATION BY RESOLVING THE POSITION OF THE BOUNDARY LINES.

NOTE: SUBJECT PARCEL IS AN UNSURVEYED ALIQUOT PART OF SECTION 22. THE PRECISE BOUNDARIES AND ACERAGE HAS NOT BEEN DETERMINED.



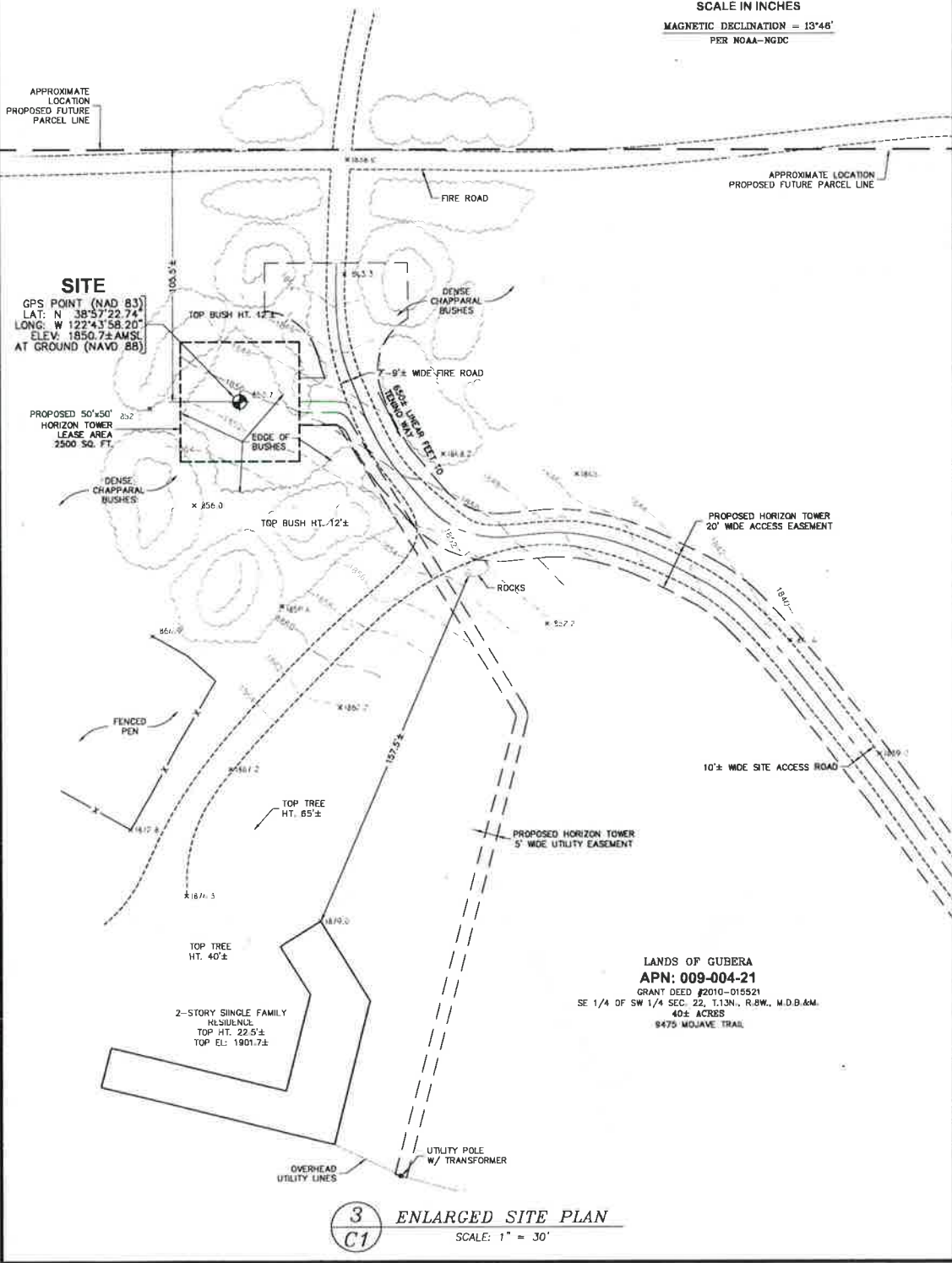
QUIET RIVER

Land Services Inc.

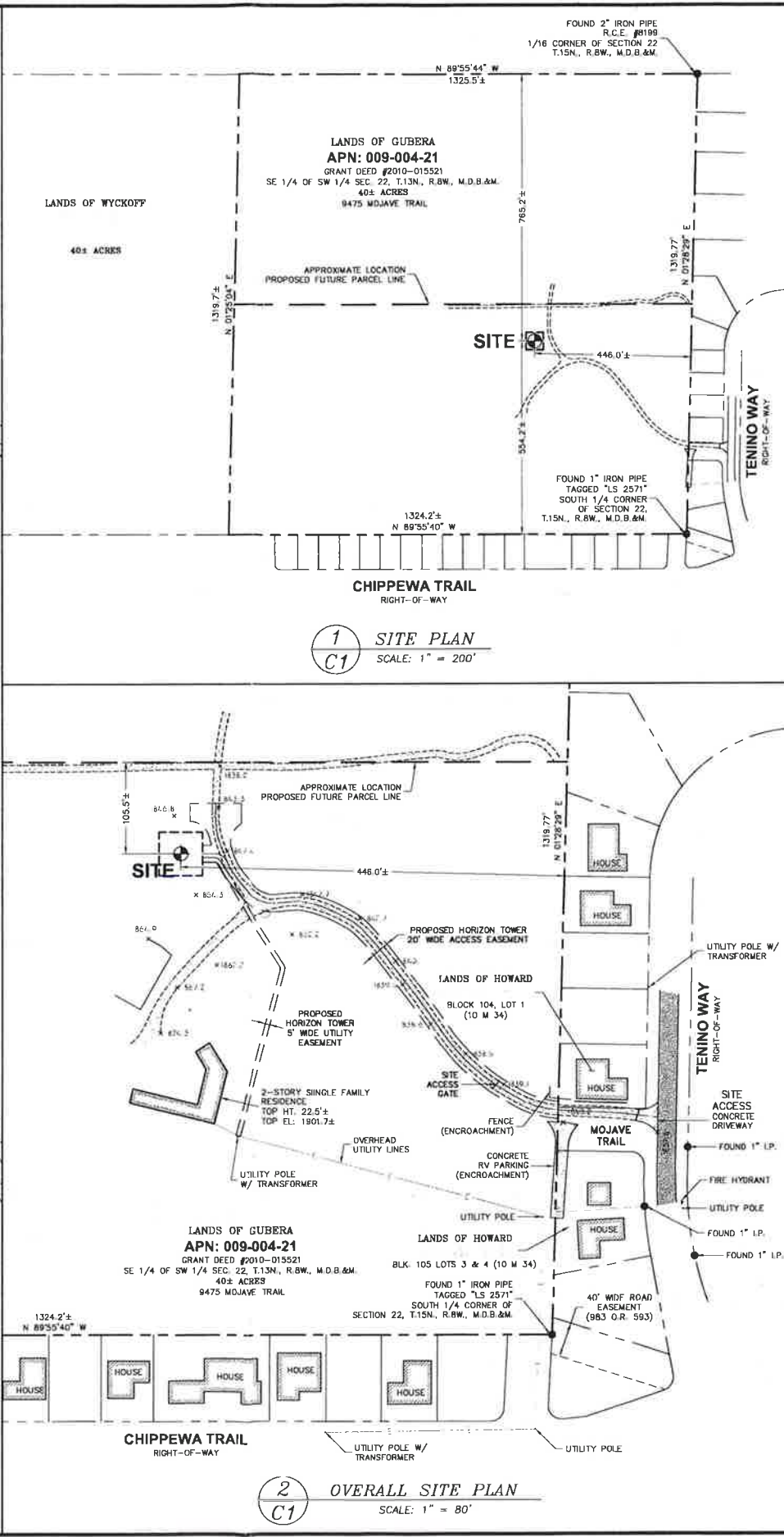
SCALE IN INCHES

MAGNETIC DECLINATION = 13°46'

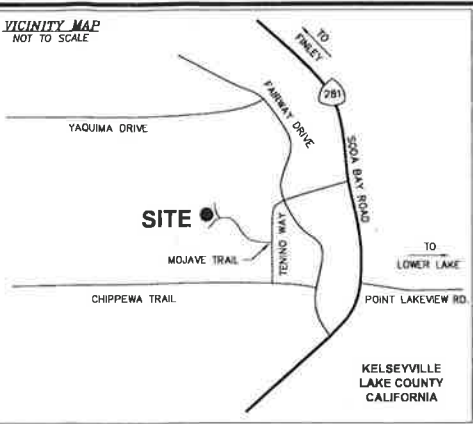
PER NOAA-NGDC



3 ENLARGED SITE PLAN
C1
SCALE: 1" = 30'



2 OVERALL SITE PLAN
C1
SCALE: 1" = 80'



PROPERTY INFORMATION

Owner: RICHARD & SHERRY GUBERA
Address: 9475 MOJAVE TRAIL
KELSEYVILLE, CA 95451

Site: CA4043 / KELSEYVILLE
Address: 9475 MOJAVE TRAIL
KELSEYVILLE, CA 95451

Assessor's Parcel Number: 009-004-21

Height of Building/Tower: N/A

Title Report:
TITLE REPORT FOR THIS PROPERTY WAS PROVIDED BY FIDELITY NATIONAL TITLE COMPANY, REPORT NO. FSNX-101801819L, DATED AS OF JULY 6, 2016.

Legal Description:
PROPERTY SITUATED IN THE CITY OF KELSEYVILLE, COUNTY OF LAKE, STATE OF CALIFORNIA.

FEMA FLOOD ZONE DESIGNATION National Flood Insurance Program
County: LAKE Effective Date: SEPTEMBER 30, 2005
Community-Panel Number: 06033C-0678-0
The Flood Zone Designation for this site as plotted by scale is:
ZONE X (no shading) - Areas determined to be outside the 0.2% annual chance floodplain.

SURVEY DATA

NAD 83 Datum:
Lat: N 38°57'22.74" Long: W 122°43'58.20"
Datum Base: NAD 83 Equipment Used: CHICK900-OPUS Receiver (See Note 2)

Site Ground Elevation: 1850.7± AMSL (NAVD88) AT GPS SITE LOCATION

Basis of Elevations:
GLOBAL POSITIONING SYSTEM (GPS)
(SEE NOTE 2)

Basis of Bearings:
MAP OF CLEAR LAKE RIVERA, UNIT NO. 11, FILED FOR RECORD IN BOOK 10 OF MAPS AT PAGE 34, RECORDS OF LAKE COUNTY, AND TWO FOUND MONUMENTS.

Date of Field Survey: SEPTEMBER 7, 2017

NOTES

1.) This is not a boundary survey. This is a specialized topographic map with property lines and easements being a graphic depiction of various information gathered from preliminary title reports, back-up documents of record, maps and available monuments found during the field survey. No property monuments were met. No title research was performed by Quiet River Land Services, Inc.

2.) The latitude, longitude and elevation shown hereon were derived from post-processed L-1/L-2 data collected using Novatel Global Positioning System (GPS) and a CHICK900-OPUS Receiver. CHC Navigation specifications report declimeter level accuracy (horizontally) when data is properly collected and processed (Elevation = ±3.0 feet).

3.) Unless otherwise noted, no underground utility locating service company was contacted prior to this map being prepared; therefore, there may be non-detectable or obscure utilities existing on the property not shown on this map - see CALL BEFORE YOU DIG.

4.) Any electronic digital media provided by Quiet River Land Services, Inc. to our client is a courtesy and is not to be reproduced, distributed, sold, altered, revised, edited or amended without the express written consent of an Officer of Quiet River Land Services, Inc. Further, only the first stamped, signed and dated original "hard copy" version of our survey or map is considered to be our legally recognized product.

SURVEYOR'S STATEMENT

I, the undersigned, a Registered Professional Land Surveyor licensed under the laws of the State of California do hereby state that the information, measurements, assessments, record boundary lines, bearings and distances as shown hereon are based upon a field survey as stated above and upon items of public record and data contained in a title report, as referenced. Furthermore, the latitude and longitude coordinates are reported in NAD 83 Datum and are accurate to within ±15 feet horizontally, and the ground elevation, reported in NAD 1988 Datum, is within ±3 feet vertically. The coordinate values and elevations are within the 1-A Accuracy Code designation as listed in the A.S.A.C. Information Sheet 81-003 and are accurate to the best of my knowledge and belief.

SIGNATURE _____ DATE _____

LEGEND

APN:	ASSESSOR'S PARCEL NUMBER	ASPHALT
CP	CONTROL POINT	CONCRETE
EL	ELEVATION	CONTROL POINT
FH	FIRE HYDRANT	FOUND MONUMENT
FND	FOUND	GPS POINT
HT	HEIGHT	PARAPET/ROOF ELEVATIONS
MON	MONUMENT	SPOT ELEVATION
(M-M)	MONUMENT TO MONUMENT	TEMPORARY BENCHMARK
P.O.B.	POINT OF BEGINNING	
P.O.C.	POINT OF COMMENCEMENT	
PP	POWER POLE	
(TYP)	TYPICAL	

DATE:	JANUARY 31, 2018	
DRAWN BY: MAS		
FILE NO.:	HORT1702	
REVISIONS		
DATE	DESCRIPTION	INITIAL
09/14/17	90% ISSUE	MAS
01/31/18	100% ISSUE	RO

HORIZON

TOWER, LLC

140 TOWN & COUNTRY DRIVE, SUITE E
DANVILLE, CA 94526
PHONE: (925) 314-1113
FAX: (925) 314-1114

QUIET RIVER

Land Services Inc.

6747 Sierra Court, Suite K
Dublin, CA 94568
(925) 734-6788 Phone

EXISTING SITE CONDITIONS

CA4043
KELSEYVILLE

9475 MOJAVE TRAIL
KELSEYVILLE, CA 95451

C1

OF 1 SHEET

would amount to approximately 800 (Min.) to 1,200 (Max.) square feet. If the brush clearing/mulching is done in the dryer summer and fall time of the year, then it is recommended that appropriate fire prevention techniques be utilized during the clearing, and fire-suppression equipment be ready on-site.

Presuming there are even marginal rainfall amounts subsequent to the clearing and site development, it is expected that the proposed cutting/clearing will have very limited short-term effects, and essentially zero long-term negative effects on the health and vitality of the existing chaparral brush and hillside habitat of the Subject Parcel. It is expected and anticipated that periodic future tree trimming/brush clearing will be required to maintain a consistent fire-break distance between the fenced tower compound and the predictable re-growth of the chaparral/brush. Future trimming will also be required at the Hammer-head turn-around areas to ensure they remain clear of encroaching future vegetation growth.

Subsequent to the limited brush cutting and clearing activities, any potential for runoff and/or erosion is expected to be mitigated by the required grading and installation of the Class II aggregate base material in the compound, and the "dust-free all-weather material" for the road surfaces and turn-around. In the unlikely event of any rain-induced runoff escaping from the brush-clearing project before re-growth on any exposed areas, there is approximately six acres of identical down-slope habitat that is expected to capture and absorb that limited runoff.

C.) **Summary:** The project areas proposed to be newly cleared of the small-diameter younger oaks, toyon trees, brush and poison oak is a small and limited area having a maximum surface area of approximately 1,200 square feet. The cut/cleared plant materials will be chipped, reduced and relocated within the Subject Property as compost/mulch. The newly-cleared and graded ground areas are designed/proposed to be resurfaced with new materials - base rock for the tower compound and dust-free all-weather road materials for the access route. The long-term health and condition of the hillside Oak Scrub Community, woody shrubs, brush and habitat is expected to be unaffected by the proposed installation.

Respectfully,
Quiet River Land Services Inc



Kevin M. McGuire
President
California Registered Professional Land Surveyor #6437
kymm@quiet-river.com

Quiet River Land Services, Inc.
6747 Sierra Court, Suite K
Dublin, CA 94568
(925) 734-6788 Phone



April 30, 2018

The following observations and recommendations are offered as response for a Tree and/or Brush Removal Plan proposed for LP 18-01 & IS 18-06. The data contained herein is based on the on-site field survey completed by our Quiet River Land Services Inc.

A.) **Existing Site Conditions:** The general site area in question where the 50' x 50' Horizon Tower lease area and the required access path hammer head turn-around are proposed is situated on a gentle northerly-facing slope of a 40-acre parcel of land having a predominant covering of relatively recent post-clearing, or post-fire, re-growth of "Oak Scrub Community" of a uniform age, size and density. The Oak Scrub Chaparral common on northerly-facing slopes are typically comprised of Interior live oak, Coast live oak and/or Canyon live oak, various Manzanita types, Toyon, Ceanothus (wedgeleaf and whitehorn), and to a limited extent, Chamise, and are all common, co-dominants or associates typical on the drier Lake County hillsides and soil types.

The general composition of the brush/chaparral on this particular site are as described above with a clear predominance of young, live oak tree varieties having trunk diameters of 1/4" to 3 1/2" and being approximately 10 to 12 feet in height. The live oak tree community has within it a limited mosaic of commonly associated woody shrubs that (may) include a limited number of ceanothus, buckbrush, scotch broom, chamise and poison oak, which are mostly located along the more open perimeter/margin areas, and also where there is enough light penetrating the oak overstory to support that underslory growth. Interspersed among the Live Oak in much fewer numbers were observed Toyon and Manzanita of similar trunk diameters and heights. There was no observation of any obvious, unusual conditions or exceptional specimens at the proposed compound site area.

A review of the historic aerial photography of this particular residential parcel of land, starting in 1993 to 2017, show a typical progression of growth and expansion of the said brushy chaparral re-growth over the Subject Parcel. Also observed were various areas of periodic, localized tree/brush clearing and light grading activities by the land owner/occupant for purposes of livestock paddocks & horse arenas, as well as the expansion of several access road pathways/trails and fire breaks through the re-growth Oak Scrub brush over the hillside.

B.) **Proposed Tree and Brush Removal:** The proposed telecommunications installation and required fire vehicle Hammer-head turn-around will require a very limited area of additional tree and brush cutting & clearing from what is already existing. The newly cut, cleared plant material is recommended to be chipped/mulched, reduced and then relocated from the proposed telecommunications site to other areas on the Subject Parcel - the placement of which as desired by the Land Owner. There will also be minor surface grading over those areas where the tower installation and new access/turn-around pathway are proposed. The proposed area of newly cleared brush that remains to be cleared for the proposed tower installation and turn-around

SCALE: NONE

1 TREE AND BRUSH CLEARING PLAN



4255 PARK ROAD
BENICIA, CA 94510



117 Town & Country Drive, Suite A
Danville, CA 94526
Phone: 925-314-1113
Fax: 925-314-1114

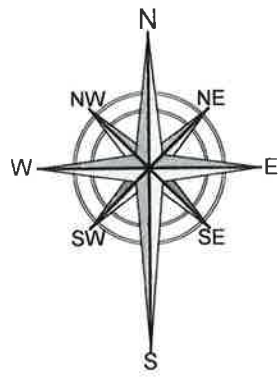
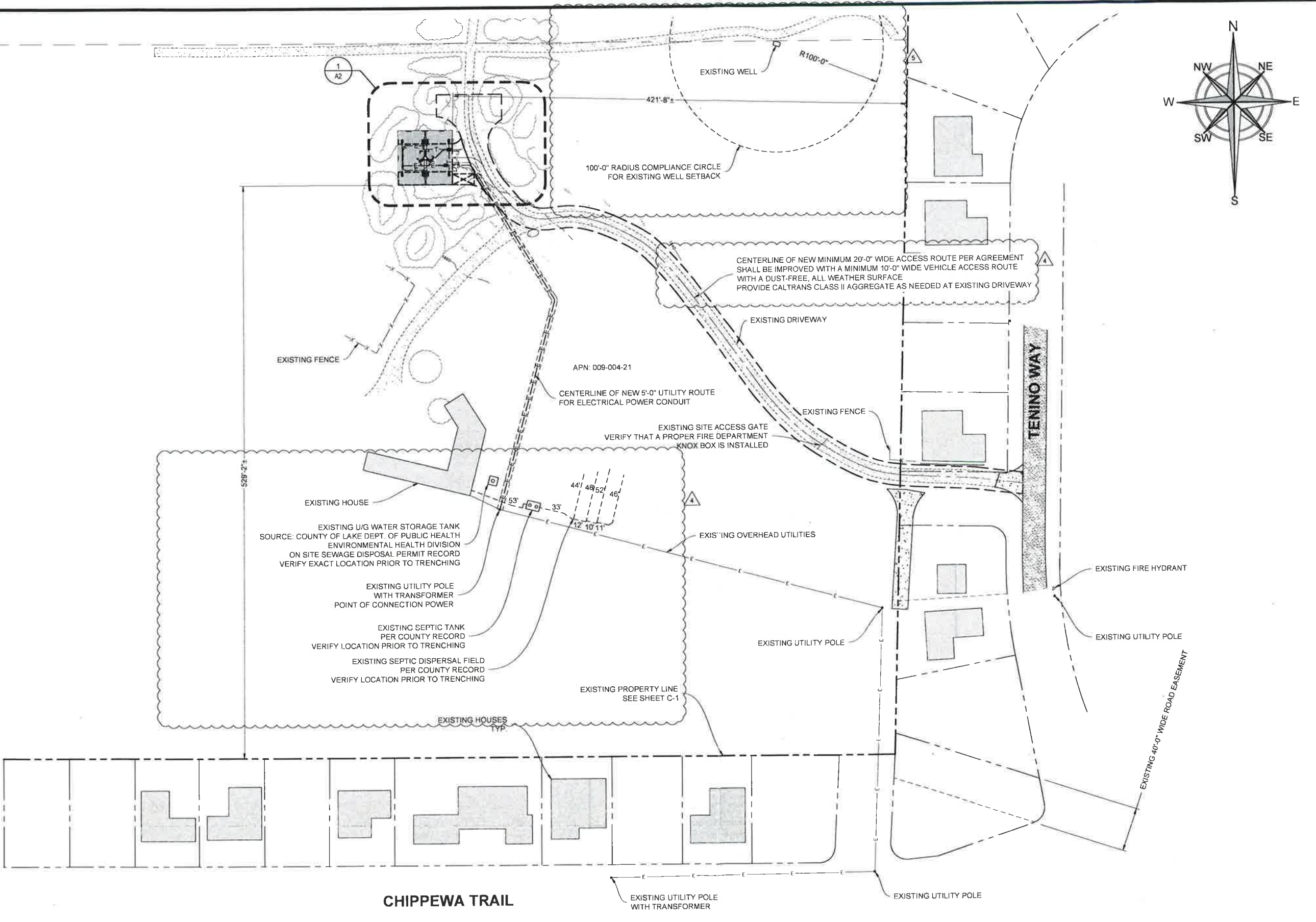
Horizon Tower
CA4043 - Kelseyville
9475 Mojave Trail
Kelseyville, CA 95451

TREE & BRUSH CLEARING PLAN

REVISIONS			DATE
No.	DESCRIPTION		
0	BASELINE		10-24-2017
1	REVISED MONO PINE		11-22-2017
2	REVISED BRANCHES		11-27-2017
3	RESPONSE TO COUNTY		03-05-2018
4	ADDED SEPTIC SYSTEM		03-09-2018
5	ADDED BMP		05-09-2018

Job No.: HT17002
Draw/Check By: LBS / BLL

G1



1 PARTIAL SITE PLAN

SCALE: 1" = 40'-0"

DIAMOND ENGINEERING SERVICES

4255 PARK ROAD
BENICIA, CA 94510

HORIZON TOWER, LLC

117 Town & Country Drive, Suite A
Danville, CA 94526
Phone: 925-314-1113
Fax: 925-314-1114

Horizon Tower
CA4043 - Kelseyville
9475 Mojave Trail
Kelseyville, CA 95451

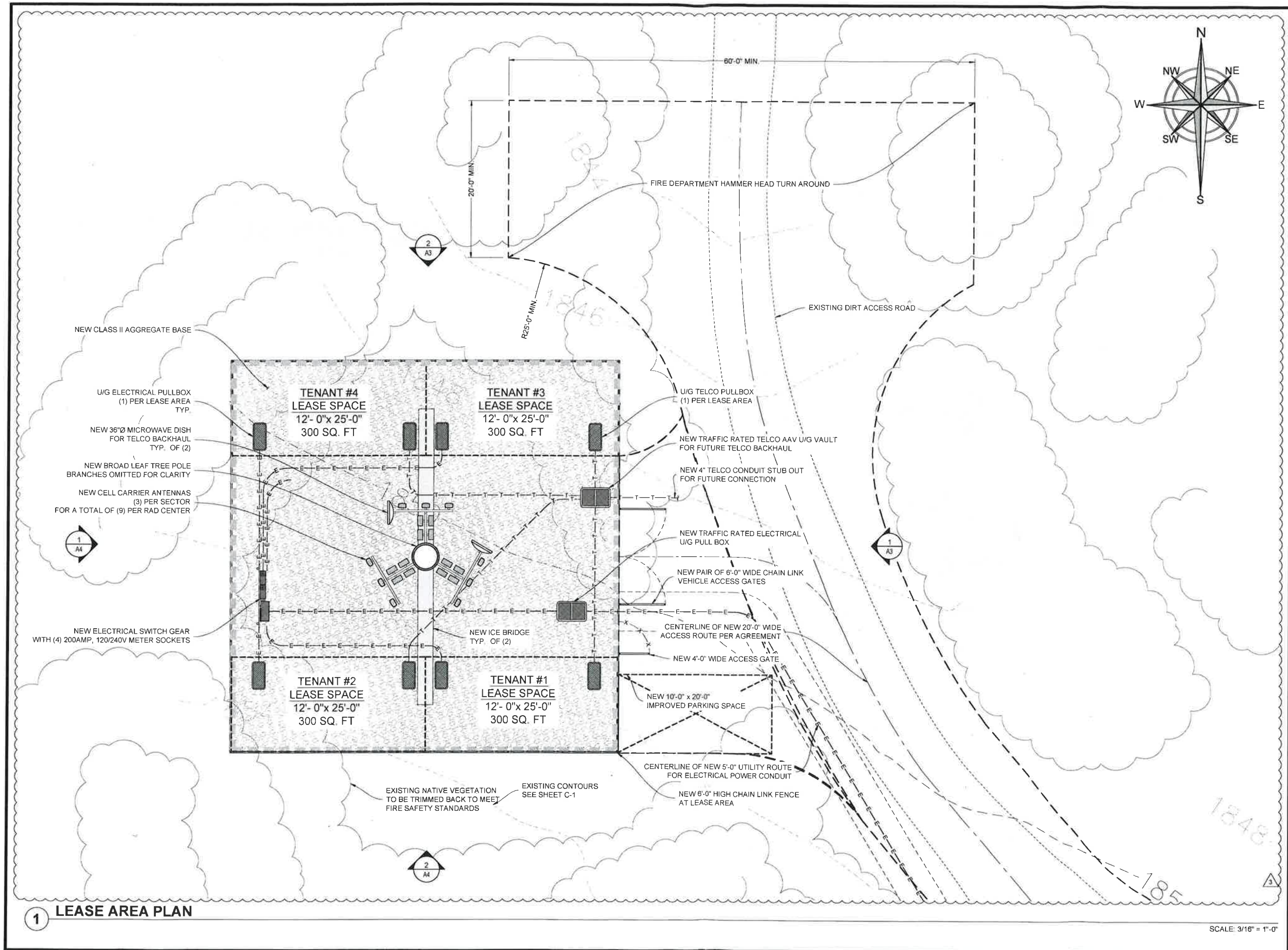
PARTIAL SITE PLAN

REVISIONS		DATE
No.	DESCRIPTION	DATE
0	BASELINE	10-24-2017
1	REVISED MONO PINE	11-22-2017
2	REVISED BRANCHES	11-27-2017
3	RESPONSE TO COUNTY	03-05-2018
4	ADDED SEPTIC SYSTEM	03-09-2018
5	ADDED BMP	05-09-2018

Job No.: HT17002

Draw/Check By: LBS / BLL

A1



1 LEASE AREA PLAN

SCALE: 3/16" = 1'-0"



DIAMOND ENGINEERING SERVICES
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BENICIA, CA 94510



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Fax: 925-314-1114

Horizon Tower
CA4043 - Kelseyville
9475 Mojave Trail
Kelseyville, CA 95451

LEASE AREA PLAN

REVISIONS		DATE
No	DESCRIPTION	
0	BASELINE	10-24-2017
1	REVISED MONO PINE	11-22-2017
2	REVISED BRANCHES	11-27-2017
3	RESPONSE TO COUNTY	03-05-2018
4	ADDED SEPTIC SYSTEM	03-09-2018
5	ADDED BMP	05-09-2018

Job No.: HT17002
Draw/Check By: LBS / BLL

A2



DIAMOND ENGINEERING SERVICES
4255 PARK ROAD
BENICIA, CA 94510



HORIZON TOWER, LLC
117 Town & Country Drive, Suite A
Danville, CA 94526
Phone: 925-314-1113
Fax: 925-314-1114

Horizon Tower
CA4043 - Kelseyville
9475 Mojave Trail
Kelseyville, CA 95451

EAST & NORTH ELEVATIONS

REVISIONS		DATE
No	DESCRIPTION	
0	BASELINE	10-24-2017
1	REVISED MONO PINE	11-22-2017
2	REVISED BRANCHES	11-27-2017
3	RESPONSE TO COUNTY	03-05-2018
4	ADDED SEPTIC SYSTEM	03-09-2018
5	ADDED BMP	05-09-2018

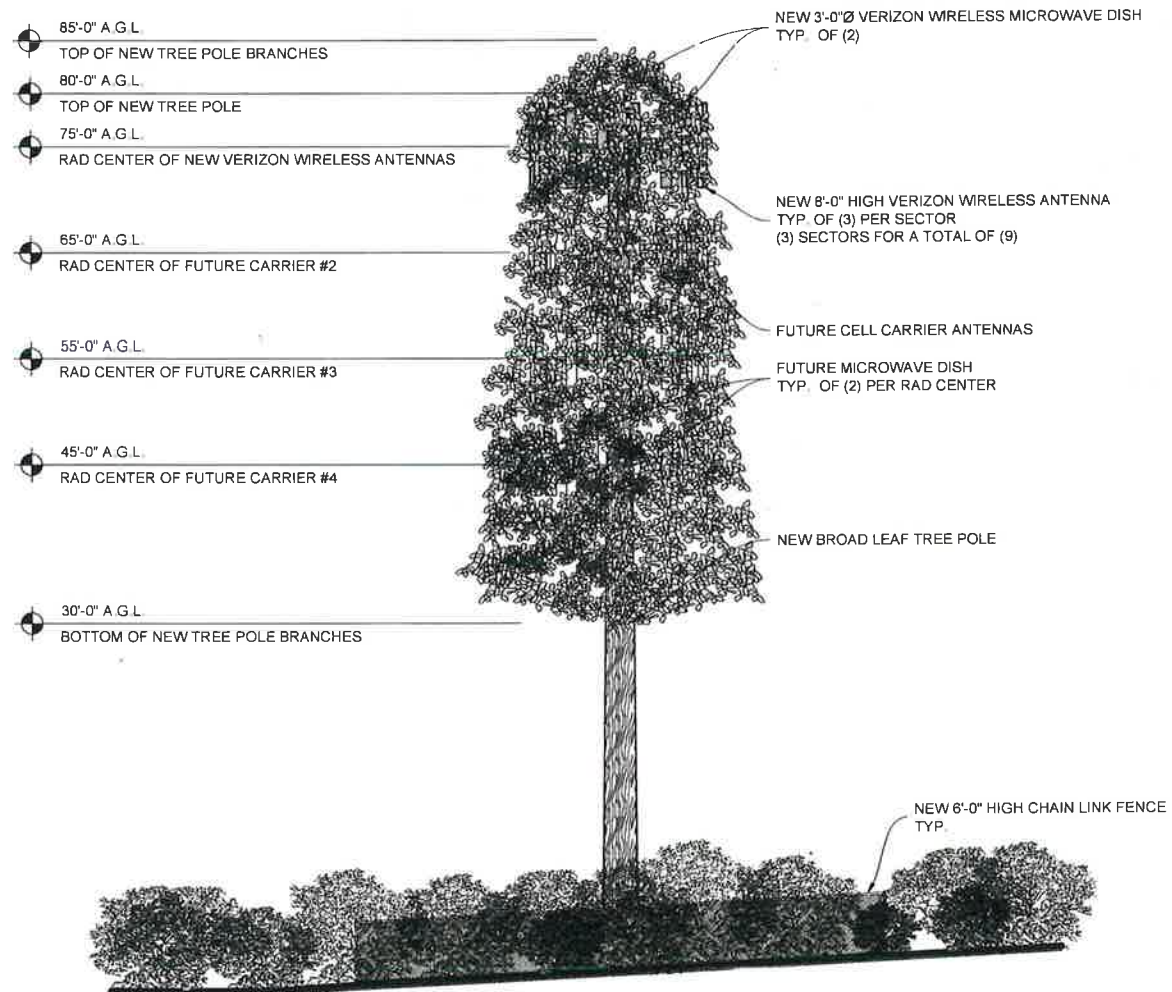
Job No.:
HT17002

Draw/Check By:
LBS / BLL

A3

NOTE:

- TREE POLE AND FOUNDATION TO BE STRUCTURALLY DESIGNED TO CARRY (4) CARRIERS, EACH WITH UP TO (4) SECTORS OF (3) ANTENNAS AND (3) RRUS, (12) ANTENNAS TOTAL AND (12) RRUS TOTAL EACH CARRIER. EACH ANTENNA TO USE STEALTHING ANTENNA SOCKS AND ANTENNA BRANCHES.
- BRANCHES SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE



2 NORTH ELEVATION

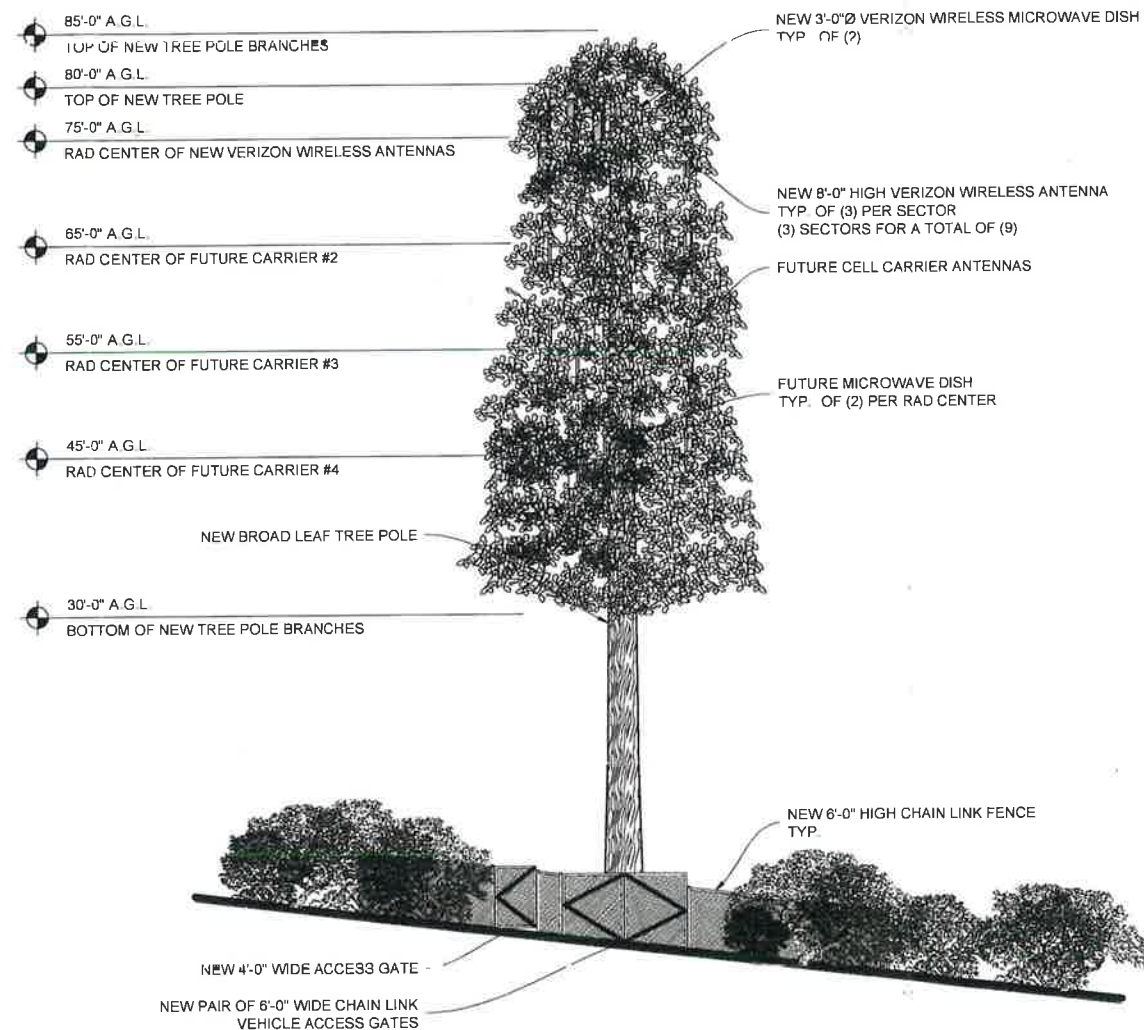
SCALE: 1/8" = 1'-0"

1 EAST ELEVATION

SCALE: 1/8" = 1'-0"

NOTE:

- TREE POLE AND FOUNDATION TO BE STRUCTURALLY DESIGNED TO CARRY (4) CARRIERS, EACH WITH UP TO (4) SECTORS OF (3) ANTENNAS AND (3) RRUS, (12) ANTENNAS TOTAL AND (12) RRUS TOTAL EACH CARRIER. EACH ANTENNA TO USE STEALTHING ANTENNA SOCKS AND ANTENNA BRANCHES.
- BRANCHES SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE





4255 PARK ROAD
BENICIA, CA 94510



117 Town & Country Drive, Suite A
Danville, CA 94526
Phone: 925-314-1113
Fax: 925-314-1114

Horizon Tower
CA4043 - Kelseyville
9475 Mojave Trail
Kelseyville, CA 95451

WEST & SOUTH ELEVATIONS

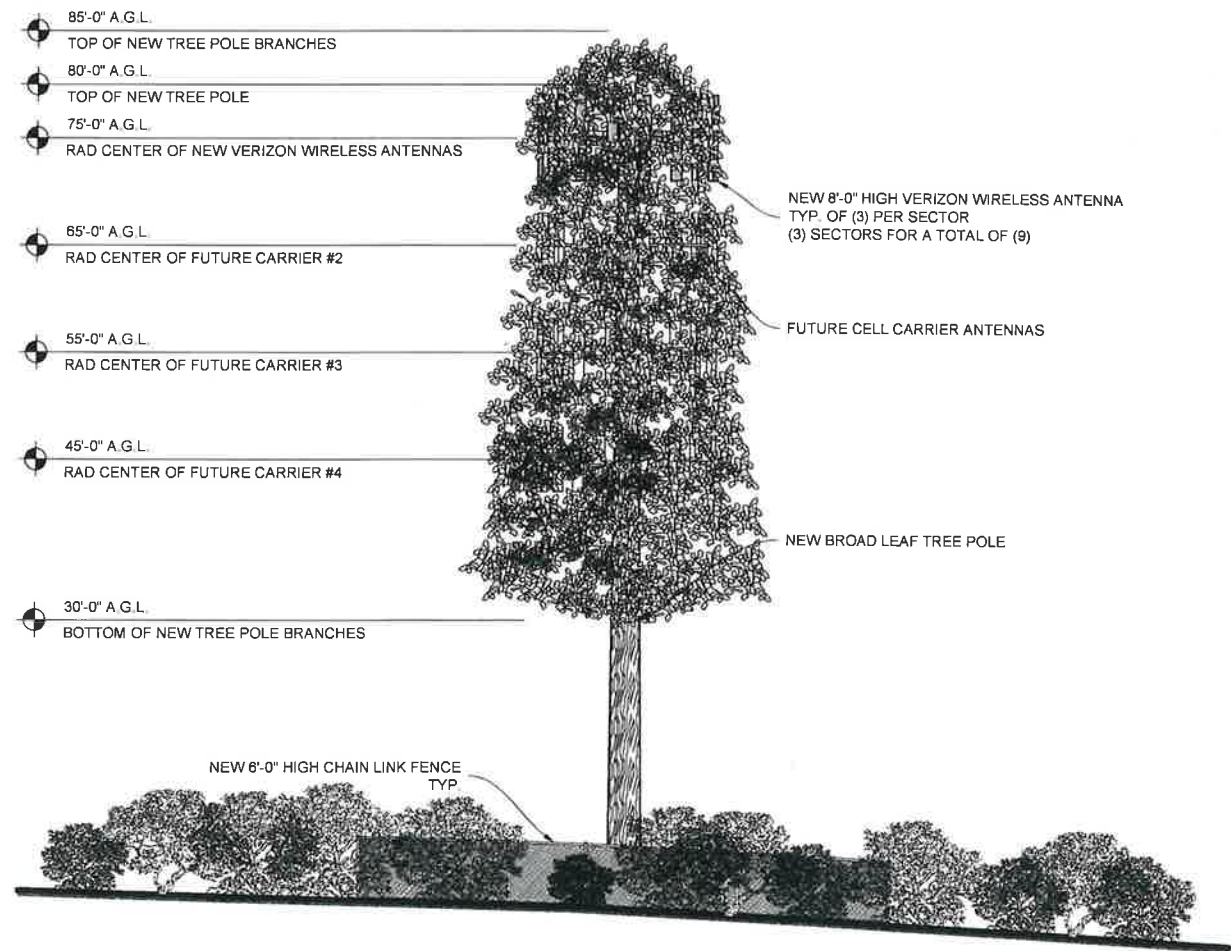
REVISIONS		
No.	DESCRIPTION	DATE
0	BASELINE	10-24-2017
1	REVISED MONO PINE	11-22-2017
2	REVISED BRANCHES	11-27-2017
3	RESPONSE TO COUNTY	03-05-2018
4	ADDED SEPTIC SYSTEM	03-09-2018
5	ADDED BMP	05-09-2018

Job No.: HT17002
Draw/Check By: LBS / BLL

A4

NOTE:

1. TREE POLE AND FOUNDATION TO BE STRUCTURALLY DESIGNED TO CARRY (4) CARRIERS, EACH WITH UP TO (4) SECTORS OF (3) ANTENNAS AND (3) RRUS, (12) ANTENNAS TOTAL AND (12) RRUS TOTAL EACH CARRIER. EACH ANTENNA TO USE STEALTHING ANTENNA SOCKS AND ANTENNA BRANCHES.
2. BRANCHES SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE



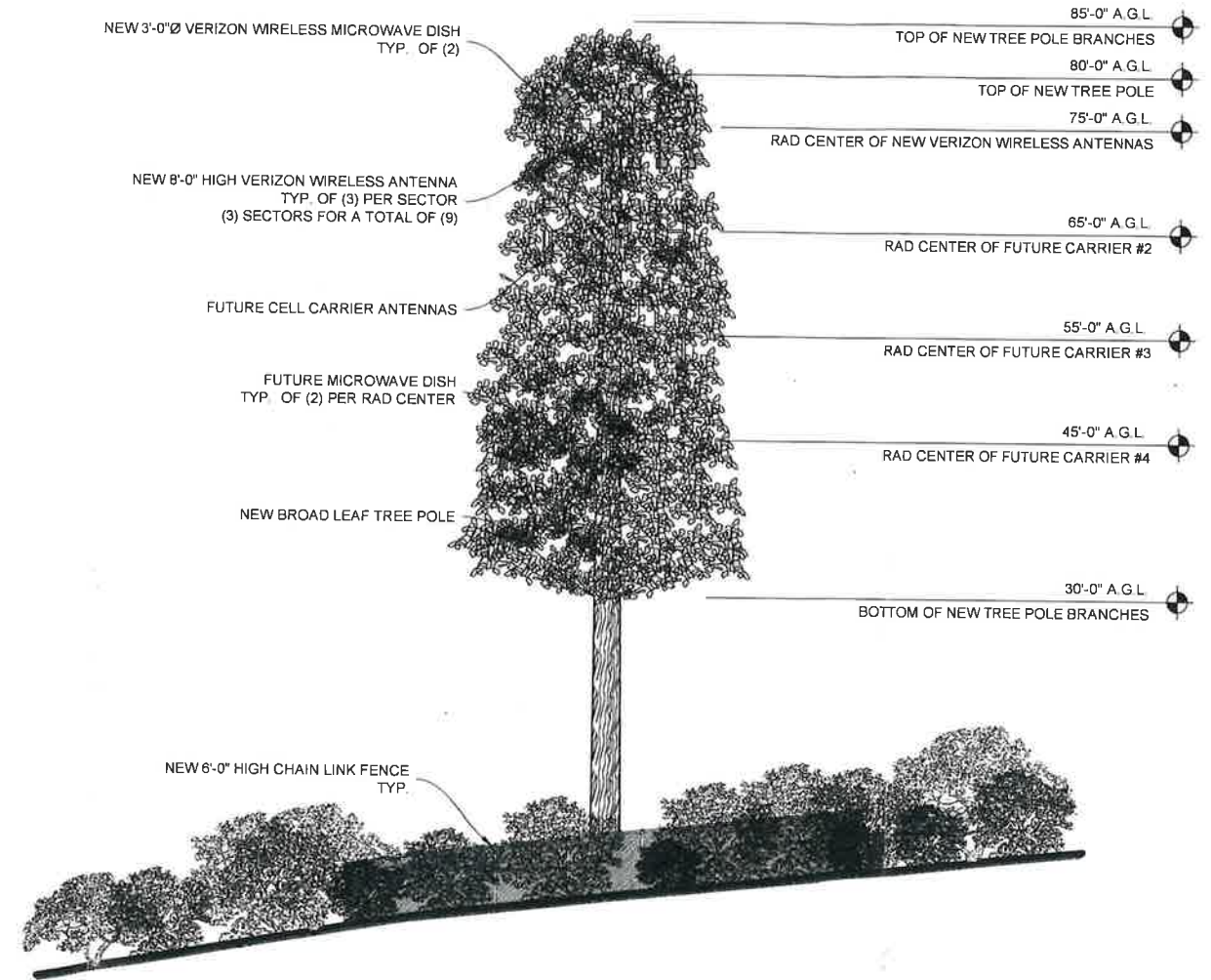
2 SOUTH ELEVATION

SCALE: 1/8" = 1'-0"

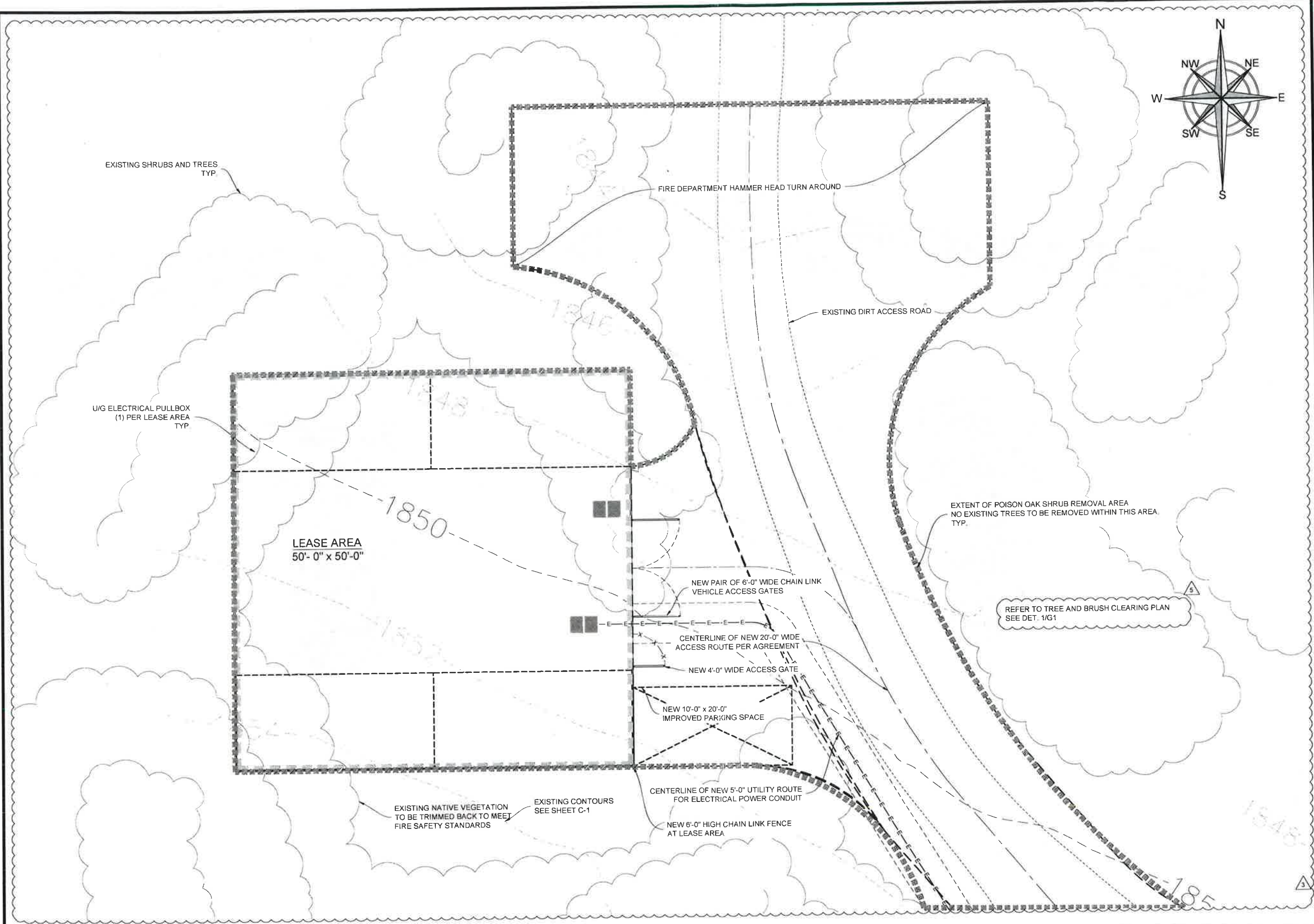
1 WEST ELEVATION

NOTE:

1. TREE POLE AND FOUNDATION TO BE STRUCTURALLY DESIGNED TO CARRY (4) CARRIERS, EACH WITH UP TO (4) SECTORS OF (3) ANTENNAS AND (3) RRUS, (12) ANTENNAS TOTAL AND (12) RRUS TOTAL EACH CARRIER. EACH ANTENNA TO USE STEALTHING ANTENNA SOCKS AND ANTENNA BRANCHES.
2. BRANCHES SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE



SCALE: 1/8" = 1'-0"



DIAMOND ENGINEERING SERVICES

4255 PARK ROAD
BENICIA, CA 94510

HORIZON TOWER, LLC

117 Town & Country Drive, Suite A
Danville, CA 94526
Phone: 925-314-1113
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**Horizon Tower
CA4043 - Kelseyville
9475 Mojave Trail
Kelseyville, CA 95451**

**TREE AND BRUSH
CLEARING AREA PLAN**

REVISIONS	DATE	DESCRIPTION
No	0	BASELINE
1	10-24-2017	REVISED MONO PINE
2	11-22-2017	REVISED BRANCHES
3	11-27-2017	RESPONSE TO COUNTY
4	03-05-2018	ADDED SEPTIC SYSTEM
5	03-09-2018	ADDED BMP

Job No.: HT17002

Draw/Check By: LBS / BLL

A5

Good morning Board members and thank you for giving the residents of the Clear Lake Rivera residential community an opportunity to meet with you this morning. Since you do represent our well-being, as true residents of Lake County, and not the cell companies, we do hope you listen deeply to our profound concerns about this proposed cell tower construction in our neighborhood.

My husband and I live on Chippewa Trail, directly across the street from this proposed development and we will be deeply affected in many ways. Since we do not want to burden you with listening to repetitive arguments against this proposal, it was agreed by members living in this community that we would try and choose just one aspect of this development that would impact all of us. Therefore, we do all agree with all the additional information and research concerns, which the other residents have expressed and will express here this morning.

Our concern is with the devaluation of our most expensive asset and long-term security...our homes. Let me begin by stating that all the many and various studies conducted throughout the US maintain that property values have been and are decreased by 20-25% in areas where cell towers are constructed near their homes. Living in Lake County, notwithstanding the disasters that have afflicted this rural County the real estate environment is depressed and this inappropriate construction will add more distressing fuel to our situations.

I have researched countless studies on this aspect from all across the United States, including in Chicago, New Jersey, Florida, Vallejo, San Francisco, Indiana, Michigan, and North and South Carolina, to name just a few cities in the US, as well as around the world in such places as New Zealand, Canada, Australia, and countries in Africa. They all state the same facts. In order to be succinct, I will use the summary study produced by David Burgoyne, an independent appraiser, of 32 years, who is also a certified Instructor of right-of-way appraisal ethics and standards for the states of Michigan, Indiana, North and South Carolina, titled, "Impact of Communication Towers and Equipment on Nearby Property Values" published on March 7, 2017.

RECEIVED

JAN 24 2018

LAKE COUNTY
PLANNING COMMISSION

Exhibit D Public Input 1

The Burgoyne Appraisal Company, drawing upon 32 years of experience specializes in the detrimental conditions, and adverse impacts and right-of-way finds that:

Generally, **aesthetics**, more than other factors, has a major significant impact on property values for homes of equal age, size, and condition in the same residential areas. The home that will be most affected by the aesthetics will be the home in the immediate vicinity of a tower.

- Visible utility structures **do** adversely affect property values. As a matter of fact, property values are higher where there are no aboveground utility facilities.
- A structure that is **larger** than existing structures has a **greater** impact on property values than a structure similarly sized with the homes.
- Burgoyne stresses that Commissions authorizing approvals of such structures analyze the impacts in **detail**. In fact, he advises that municipalities need to retain regulatory control over these installations in order to minimize impacts and protect the health, welfare, and safety of their residents.

Furthermore, towers are generally not allowed in residential zones or even near residential properties, of which the Clear Lake Riviera is such. There are, in fact , over 144 million parcels in the United States, while there are only 325,000 cell sites, many of which are located on the same parcel with other cells. Those private property owners offering up their parcel for a cell tower are located in industrial zones. Again, I want to reiterate that the residents of the Riviera are not opposed to an erection of a cell tower, except that the chosen location is in a residential community where the impacts will be felt for years . There are other more appropriate locations on which a tower could be located, such as in a vineyard or on the top of Konocti, or another commercial or industrial zone where other tall structures are located, away from people.

According to Sandy Bond, a senior member of the New Zealand Property Institute, and a past president of the Pacific Rim Real Estate Society, who has worked as an appraiser in both New Zealand and London,

found most persons are concerned about the loss of future property values and aesthetics, which are incurred on the homes nearest a constructed tower. In the case study, "Impact on the Decision to Purchase or Rent" 45% of the persons surveyed said they would pay substantially less for a property near a tower, and 30% of the persons surveyed stated that a tower could decrease any rental income by 20% a month. These facts relate to our future life here.

Lastly, the courts have given the local boards great authority to deny applications, without the burden of having to provide substantial reasoning for the denial. In the Us Supreme Court decision (1.14.2015 T-Mobile South v City of Roswell, GA.) the Court stated" We stress, however, that the reasons need not be elaborate or even sophisticated, but rather the simply clear enough to enable judicial review. The studies providing evidence of 20-25% decline in an already depressed economic area should be a compelling reason for denial of the application. We implore your most profound deliberation on this issue.

Respectfully submitted,
Deborah Harmer
9541 Chippewa Trail

National Association of REALTORS® Lists References including EHTs page on

["Impact of Communication Towers and Equipment on Nearby Property Values"](#) prepared by Burgoyne Appraisal Company, March 7, 2017

[The Cost of Convenience: Estimating the Impact of Communication Antennas on Residential Property Values](#) (*Land Economics*, Feb. 2016)

[The Lo Down on Cell Towers, Neighborhood Values, and the Secretive Telecoms\(link is external\)](#) (*The Dissident Voice*, Dec. 19, 2015)

[Cell Towers: Not in My Back Yard](#) (*Tedium Blog*, Aug. 5, 2015)

["Examining invisible urban pollution and its effect on real estate value in New York City"](#) – by William Gati in New York Real Estate Journal September 2017

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Frank B Howard, Enrolled Agent

(707) 245-5565

Enrolled to Practice in all 50 States

*"Enrolled to Practice Before the Internal Revenue Service
In all 50 States"*

County of Lake
Community Development Department
Planning Division
255 N Forbes Street
Lakeport, CA 95453

RECEIVED

JAN 24 2018

LAKE COUNTY
PLANNING COMMISSION

Dear Sirs:

It is with great concern and anguish that I must prepare this correspondence and establish my opposition to this aforementioned Horizon Tower-CA 4043-Kelseyville; Major Use Permit, UP 18-01-Location APN: 009-004-21: Stated Notice of Intent To Adopt A Mitigated Negative Declaration. My opposition to said Intent to Adopt is joined by a group of concerned citizens and residents of the Clearlake Riviera Homeowners Association as well as many other citizens and residents of Lake County in California.

Our opposition is in whole opposition to any and all propositions to erect any cellular tower and the accompanying antennas of ~~so~~ such a varied assortment of signals, to include but not limited to RF (radio frequency), microwave, and electromagnetic radiation. I understand that the obvious stated governmental administrative answer is "there is no scientific evidence that there are harmful affects" or "there is no evidence that there is any relevant or significant impact on home values" from the construction of such a tower, and the radiation or other signals emitted from same. I must again oppose such positions by the county and its administrative staff. Must such governmental organizations continually oppose its own citizenry and partner with any and all large conglomerated corporate entities in the sole search for power and financial gain? This appears to be the incessant nature of our political and geographical authorities.

In all factual guidance and ethical or other moral considerations, these citizens and residents of the impacted community should be the first concern of your political schemes. They are the constituents of your administration and of the local, county and state governing authorities and as such your views should be permanently and continually the well being of your constituent population. Actions of this manner propel citizens into protest movements and other methods of consternation against the elected or otherwise positioned officials of such authoritative organizations. This could be circumvented simply by listening and acting in accordance with the wishes of the populace, rather than taking

action based upon other limited viewpoints as financial or other nefarious means of decision making.

This action seems to be that you have already made your decision without consulting the citizenry of the county or of the residential population of the impacted community. The mere title of your action oriented notice "Intent to Adopt" indicates the commitment and objective of your agency as it was written into ordinance and as it is committed to action by your very own department. The community and entire county of residents and citizenry should be allowed more time to form together, form research groups to discover and comprehend the issues involved and as set forth in a previous paragraph, the aesthetic and financial values of their very own homes, and the potential of medical and other mutagen related transformation of the cellular composition within the human body, as such the brain, nervous system, circulatory system, ears, eyes, and all other organ and glandular formations of the miraculous human being. Whereas further research is required by the citizen groups involved, and further research upon the indigenous birds, animals and other creatures inhabiting this beautiful county and specifically any inclusion as to the harmful impact on the Anderson Reserve or native birds and game that may have strayed or wandered into the surrounding communities to assure that the Bald Eagle and other great birds of this region have not taken up nesting in these surrounding areas. Such an impact as may be learned at a later date may impair the continuing professional status of all administrators making such a decision without even the merit of additional required research.

I personally took notice that these corporate entities have been working on this matter for over 1 ½ years, without any notification to the citizens of the county or the impacted communities. This is impartial and predisposed discrimination against those same stated citizens. In reading many federal, state and local statutes or ordinances I have found many various forms of legal misdirection, deceit and other forms of composing such legislation to embed many different configurations of language parameters in order to offer a piece of legislation to appear to be one thing though in all legal manners to mean something entirely different. In this matter, it appears that the organizations, in general the large corporate entities with the wealth and power are most assuredly given advantages in development whereas they work for years, and the local citizenship are allowed 30 days. This is precisely a misdirected point of legal considerations. The actual adoption should be more in the favor of those already inhabiting such communities, after all without the communities, yourself and all other county officials and administrators do not even have a job or profession.

I am asking now, for all of the citizens of the county and the community impacted to be given an opportunity to perform more research as mentioned above and the opportunity to

Frank B Howard, Enrolled Agent

(707) 245-5565

Enrolled to Practice in all 50 States

research and determine all potential impacts on the lives and financial matters of each member of the community and county. This, in fact, should be the standard practice of all elected and appointed officials of a county in any regard. The welfare of the citizenship should be placed above all other considerations in any magnitude of change relating to their personal lives and their financial domain.

I would like to make a few final comments with relationship to the house on the corner of Mohave Trail and Tenino Way, which happens to be my own. The road you have mentioned regarding your intent to widen to 20 feet does not appear to have that kind of latitude. At this moment it is already outside of county ordinances regarding the placement of residences or fences in relationship to a county road. In addition to the location of my home, there is also a PG&E easement on the other side. This road is perhaps 12 feet wide at this time allowing for only 8 feet from the side of the road to the exterior walls and windows of my home.

Prior to receiving this notice of intent, I was in the motions of preparing an official complaint to all involved including the County of Lake, the Planning Division and the owner of the property involved with the cell tower plan. Currently, as stated in the paperwork provided by your department as well as the facts as they stand, there is a single residence on one of the 10 acre parcels. At the current time, during my waking hours I have counted as many as 17 to 39 trips up and down this small and most inhibiting dirt road. These cars and trucks travel at speeds up to 25 and 30 mile per hour. This has been causing many dire problems with the standing of my home. With so much traffic, and the impact on my home, as well as the fact that soon the weight, speed and other forces of this amount of traffic will cause the crumbling of the small retaining wall 3 feet from my home and approximately 5 feet from the side of this ongoing traffic. Over the past 28 years, these matters did not impose such measures upon our quality of life, nor upon the building structure of my home and the retaining wall. Not to mention being capable of keeping said traffic off of the side property of my own lot, which brings it even closer to the retaining wall and my home. These matters impose severe consequences to my life and limb as well as property as related to the structure and location of my home.

During the last year, I have been gathering evidence of the damages done to my home to date. These issues include the constant bombardment of my home with mud, rocks, sticks and other debris. I have taken pictures of the side of my home located near this road. I can no longer get the marks off of my stucco with a power washer. Last year was the worst, with

5227 Tenino Way

Kelseyville, CA 95451

the obvious pummeling of my home shown on the exterior wall facing south. Additionally I have just replaced all screens, since they were torn and destroyed by such continual impact of the bombardment. Most of the damage occurs during the winter months, as last year I shoveled gravel into some of the holes closest to my house, only to find that the bombardment continued only with small rocks. At any length, with more traffic to include heavy trucks, trailers and equipment, this relationship with my home and the road is untenable. If this matter is to go forth, certain damages must be contemplated to either make my home tenable again, or pay for my house and relocation of myself. Since I received this notification of hearings, I have not pursued my complaints with the assault on my home and my life. I will await any further developments, though I truly pray that the county and the organization filing for this permit do not carry forward without appropriate consideration of the matters which I have brought forth. Any further neglect of these matters that pose direct and untended harm to my life, limb, property, peace and security will result in the filing of actions within the legal realm of the courts of jurisdiction.

These traffic problems do abate from time to time, the traffic slows and maintains for short periods, though it always speeds up again as I am sure proper statistics within the road maintenance department, traffic patrols such as CHP, sheriff's department, various city policing agencies, as such all should have considerable information of these such matters. A mere and brief inspection of the south wall of my home will give you appropriate considerations of the danger that I and my family while present are placed under. My peace and security are threatened, since I am awakened by traffic at any hours imaginable, with traffic a mere 8 feet or more from my head, it is simply not an inspiring point of freedom or inner peace and welfare.

I will be 68 years of age next month, and as you well know, many of my neighbors and members of the community are of similar senior vintage. As such, they are one of the most critical need groups of the existing population of the community as well as the nation in whole. This fact has been well researched by the USDA (United States Department of Agriculture), the FDA (Federal Drug Administration), the CDC and many other departments within the federal, state and local governments. This being said, I would think that your department and all elected, appointed or hired officials would take this into consideration in evaluating whether such signals emitted from these towers and the number of dish transmitter or receivers. ^{complete sentence} Further on this development, as most should be aware, this is the beginning of the 5g transmitting technologies, whereas more advanced technology will be developed in the following time and the power and methods of broadcasting most assuredly will change accordingly, therefore being this close to a residential community should not be undertaken while there are so many greater locations throughout our county that are more appropriate considerations that to offer even the slightest potential of

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endangerment to the human lives involved as well as the indigent communities of birds, animals and other creatures living so closely to this intended site.

In as much as your office has directly quoted that there is no scientific evidence that these transmissions have any impact on human life, peace and security. I must offer my objection and more specific to the ages of the seniors living in this impacted community. In fact they may be the most endangered health group of the entire populace, therefore why even take the most remote chance of RF, microwave or electromagnetic radiation on their behalf.

There is much evidence held by the Department of Defense with regard to the harmful radiation of microwaves and electromagnetic radiation. Both of these wave signals have been used in warfare to cause harm and death to opposing troops, in the World Wars and the following wars of nations.

The radio frequency radiation from cellular transmissions have not been around long enough to evaluate in such a scientific manner as to provide evidence whether they are harmful as used in these manners and these doses. These towers have only been constructed within the last 25 years. Since most all other forms of electronic wave transmissions are within the realm of causing significant radiation damage to humans, it is not such an obstacle to understand that these radiations in constant inclusion of the immediate environment of human life will cause harm. In this instance there is scientific evidence to show that the constant inclusion of such waves and the most immediate proximity of human life have been shown to cause harm and even immediate or eventual death from such exposures.

Whereas there are many other considerations as to the location of these towers within our county, such as the same land where the AT&T tower was constructed not too long ago, and if that space is not available, there are so many other vineyard and other agricultural lands available that would welcome the payments offered by the tower owners. In addition to agricultural lands, there are state and federal forest lands, hill top locations and additions to existing towers such as water towers within such impacted residential areas as the Clearlake Riviera Homeowners Association, the cities of Kelseyville, Clearlake, Lakeport, Clearlake Oaks, Lower Lake as well as other areas with similar towers that could be used as the underlying framework. So many other geographic locations exist within this county, it simply makes no sense to fight for a location in which no residents wish to have it constructed.

I shall await your response before I take any further action on the matters set forth herein.

Sincerely,

Frank B. Howard, E.A.

Frank B. Howard, E.A.

JAN 24 2018

LAKE COUNTY
PLANNING COMMISSION

Petition List of Names

Name of petitioner

Address

Phone

Email

Naomi McMurray	9525 Chippewa	707-277-0699	nmac39@sbcglobal.net
Fredrick Arnett	5282 Tenino Way	707-295-4840	arnettdj@mediacombb.net
Marcy Lavelle	9608 Fairway Dr.	707-289-4400	marcyjl56@gmail.com
Sandra Kopp	9150 Chippewa Trail	707-900-8720	sandidodd@att.net
Allen Kopp	9150 Chippewa Trail	707-995-7020	sandidodd@att.net
Kirsten Olson	9339 Palouse Ct.	707-277-0670	
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Barry Wagoner	5410 Cheyenne Dr.	661-803-5569	bwagoner0207@gmail.com
Debbie Arnett	5282 Tenino Way	707-289-4169	arnettdj@mediacombb.net
John & Laurie Calvin	11134 Fairway Dr.	707-349-6235	
Kim Baldwin	9585 Tenaya Way	707-349-7913	
Alex Troast	3410 Toyon Ct.	239-222-3471	
Bob & Debbye Harmer	3541 Chippewa Trail	408-930-0967	rgdaharmer@gmail.com
Lynne Andress	1110 Wheeler Drive	707-277-0151	bankernomma42@aol.com
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Mary A. Munion	5528 Teton Way	707-277-7628	soccerwarden@gmail.com
Sheila Howard	10057 El Capitan	707-277-7614	
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Jack Swedberg	5230 Swedberg Rd.		
Kevin Sweeney	9011 Sado Bay Rd.	707-348-9875	
Phil Kleyn	11406 Konocti Vista Dr.	707-350-5684	klevnphil@gmail.com
Mike Dillingham	10708 Paradise Ct.	707-349-6520	
Victoria Hansen	11444 Konocti Vista Dr.	707-350-3075	
Gary Weeck	4950 Hawaina Way	707-277-2062	
Steve Moore	8250 N. Heights Dr.	650-350-0554	steve.moore1014@gmail.com
Rod Gasser	10199 El Dorado Way	707-277-0281	
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Jim Freitas	9472 Chippewa Trail		jimmied.freitas@gmail.com
Kaleigh Blanton	9460 Chippewa Trail		kaleighblanton@hotmail.com
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Penny Cuadras	3267 Tenino Way		

Petition List of Names

Nicole Profit
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Eric Erex
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Lonny Rittler
Aurelia Johnson
Frank Howard
Gerald Rine
Jackie Calinsky
Rex Johnson
Daniel Conklin
Stephanie Conklin
Harold Hoover
Pete Chappars
Mary Chappars
Robin Nakken
Don Green
Barbara Green
Darryl Didier
Carol & Mark Frost
Nancy Davis
Jeff Hoopes
Scott Thurston
Stacie Robbins
Captain David Cook
Patty Weible
Sharon Higgins
Anne???
Gary ?

9789 Mt. Hood Way
9010 Takelma Way
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9517 Fairway Dr.
4950 Vista
9446 Yaquima Dr.
9403 Yaquima Dr.
9984 El Dorado Way
4819 Marina Dr.
9375 Yaquima Dr.
5227 Tenino Way
5224 Tenino Way
5139 Tenino Way
5139 Tenino Way
5073 Caddo Ct.
5073 Caddo Ct.
5039 Caddo Ct.
9555 Chippewa Trail
9555 Chippewa Trail
5267 Tenino Way
5270 Tenino Way
5270 Tenino Way
9247 Takelma Ct.
4780 Cascade Way
5287 Tewa Ct.
6393 Southlkae Dr.
P.O. Box 935
5351 Sierra Dr.
4721 Hawaina Way
9520 Fairway Dr.
4695 Inya Way
10838 Skyview Dr.
10345 Pebble Beach Way

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707-289-4370
707-245-0974
707-349-3131
707-289-4006

707-277-9046
707-327-8376
707-245-5565
707-701-1683
707-277-0280
707-262-2574
707-263-1000
707-263-1000
707-900-1424
707-350-4330
707-350-4331
707-533-6495
707-277-7905
707-277-7905
707-295-7265
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707-264-9463
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Petition List of Names

Albert ??

John & Cornelia Ioanou

5234 Tenino Way

480-209-4399

coraliagrivas@aol.com

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**LAKE COUNTY
PLANNING COMMISSION**

Name	Address	Phone #	Email
Naomi McMurray	9525 Chippewa	707-277-8699	
Bob Williams			
	Address	Phon#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email

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~~LAKE COUNTY~~

PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Naomi McMurray	9525 Chippewa	707-277-0699	
Rob Williams	9150 Yaguina Dr.	707 813-0001	
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email

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LAKE COUNTY
PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Frederick Arnett	5882 Tenino Ave	(707) 295-4840	
Indira Arnett	Kelseyville		
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
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Name	Address	Phone#	Email

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LAKE COUNTY
PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Marcy LaVelle	9608 Fairway Dr	707-289-4400	marcy156@g-mail.com
Name	Address	Phone#	Email
Alan R Kopp	9150 CHIPPENAW TR	707-995-7020	sandiedodd sandiedodd@att.net
Name	Address	Phone#	Email
SANDRA KOPP Sandra Kopp	9150 CHIPPENAW TR	707-900-8720	sandiedodd@att.net
Name	Address	Phone#	Email
Kirsten Olson K Olson	9339 Palcos Ct Kelseyville, CA 95451	707-277-0670	None
Name	Address	Phone#	Email
Lee Waggoner Lee Waggoner	5410 Cheyenne Dr. Kelseyville, CA	661-296-0221	
Name	Address	Phone#	Email
BARRY WAGONER Barry	5410 CHEYENNE DR KELSEYVILLE, CA	661-803-5569	BWAGONER207@EMAIL.COM
Name	Address	Phone#	Email
Debbie Arnett Debbie Arnett	5282 Tenino way Kelseyville CA	707 289-4169	Arnett dj@mediacombb.net
Name	Address	Phone#	Email

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LAKE COUNTY
PLANNING COMMISSION

Clearlake Riviera residents apposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

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Clearlake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Lynne Andrews	1100 Wheeler Kelseyville CA	277-0151	Banternome 42e ba.com
ALICE M. DOYLE	10205 Highway Dr. Kelseyville, Ca 95451	277-7353	
MARY H MURPHY	5528 Telton Way	277 7628	Soccer warden (at) gmail
Betty Hann	10674 Fairway		
Gina Wheeler	10710 Fairway Dr		RECEIVED
Shelia Howard	10057 EL Capitan way	277-7614	JAN 24 2018 LAKE COUNTY PLANNING COMMISSION
Rose Ann Ingram	11270 Prairie Vista Dr.	707-295-5131	Fore Ann Ingram (at) gmail.com
Corrina Beltoncourt	8990 Fairway Dr Kelseyville Ca 95451	707 772 9034	Corrina Beltoncourt (at) gmail.com

LM

Clearlake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Tack Swedberg	5630 Swedberg Rd		
Kevin Sweeney	9011 Soda Bay RD	349-9875	
Phil Klyn-Schoenel	11406 Konochi Vista Dr. Own lot on Parnet Trail	707 350-5684	klynphil@gmail.com
	Address	Phone#	Email
	Kelseyville, CA	707 349-6520	
Michael D. Dillingham	10708 Paradise Ct		
	Address	Phone#	Email
	11444 Konochi Vista Dr		
	L.L. CA. 95457 707 350-3075		
Judith Hanson			
	Address	Phone#	Email
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	KELSEYVILLE		
NAME GRAY R. DECKER	Address	Phone#	Email
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	KELSEYVILLE, CA 95457		
	Address	Phone#	Email
Bob Hansen	10199 El Dorado Way	277-0281	
	KV, Ca 95457		
NAME ROD GASSER	Address	Phone#	Email

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LAKE COUNTY

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Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95431

Project location: 9475 Mojave trail, Kelseyville, Ca. 95431		LAKE COUNTY PLANNING COMMISSION	
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Elin Porter	9497 Chippewa Trl.		Elin.Porter@gmail.com
JIM FREITAS	9472 CHIPPEWA TR		jimmied.freitas@gmail.com
Valeigh Blanton	9460 Chippewa Trl.		Valeighblanton@gmail.com
Joseph Cuadras	3267 Tenino		Joseph.Cuadras@yahoo.com
Penny Cuadras	3267 Tenino		
Nicole Proffitt	9789 Mt. Hood way		Nicoleproffitt@aol.com
Annette Brayles	9010 Tekeuma way		Cornetteb33@hotmail.com

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

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LAKE COUNTY
PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Eric Ruiz	9981 E OAKWOOD WAY		
Albert Samuels	5234 TENINO WAY		
Lonny R. Hiler Jenny Hiler	4819 MARINA DR KELSEYVILLE 95451	277 9046	lonnyj@comcast.net
Sharon Higgins Sharon Higgins	4695 OLYMPIA WAY KELSEYVILLE 95451		sharons@comcast.net
Anne Feller	10838 SKYVIEW DR		lessandcatt.net
Jeanne Fayon	9730 SODABAY	349 6033	
Mary Egan	10345 PEBBLE BEACH WAY		
			REC-111

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Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Eric Ruiz	9981 El Dorado Way		
Albert Summell	5234 TENINO WAY		
Jenny Foster	4819 Marina Kelseyville 95451	2779046	longjini@ media.com.kelme
Sharon Hession	4695 Skyway Kelseyville 95451		5554544444.com
Anne Foster	10838 Skyview Dr		kessana@att.net
Jenny Fayon	9730 Soda Bay	3496023	
Ray Carr	10345 PEBBLE BEACH WAY		
Name	Address	Phone #	Email
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PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
Frank B. Howard	5227 Tenino Way Kelseyville, Ca 95451	(707) 245-5565	frank@fbhtax.com
GENAID RINE	5224 TENINO WAY KELSEYVILLE CA 95451	707-201-1083	315 PENDER@gmail.com
JACKIE CALINSKY	5139 TENINO WAY KELSEYVILLE	707-211-0280	—
REX JOHNSON	5139 TENINO WAY KELSEYVILLE	707-262-2574	—
DANIEL CONKLIN	5073 Caddo Ct Kelseyville Ca 95453	707 203-1000	Dan Conklin@gmail.com
STEPHANIE CONKLIN	5073 Caddo Ct Kelseyville Ca 95453	707 243-1000	—
HAROLD HOOVER	5079 Caddo Ct Kelseyville Ca	707 900-1474	—
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LAKE COUNTY
PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
PETE & MARY CHAPPARS	9555 CHIAPEWA TR. KELSEYVILLE CA 95451	(707) 350-4330	PCHAPPARS@AOL.COM MCHAAPARSOAT
ROBIN & MARK Naldges	5267 TENINO WAY KELSEYVILLE CA 95453	707 413-3190	
Don & Barbara Green	5270 Tenino Way Kelseyville, Ca. 95451	707 277-7905	familygreen5270@aol.net
DARREL DIDIER	9247 TAKEUMA CT. 9247 KELSEYVILLE CA 95451	707-295-7265	danyldidier@gmail.com
Debbie Annett	5282 Tenino Way Kelseyville 95451	(707) 289-4169	cunnetts@a-mediacom.biz
Carol & Mark Frost	4780 Cascade Way Kelseyville 95451	707 278 7223	markallenfrost@aol.com @gmail.com
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
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JAN 24 2018

LAKE COUNTY
PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

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JAN 24 2018

LAKE COUNTY
PLANNING COMMISSION

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
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Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
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LAKE COUNTY
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Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

	Address	Phone #	Email
Name			
JEFF HOOPES	6393 Southlake Dr.	415 755 0731	Jhoopes@Swinerton.com
Name	Address	Phone#	Email
SCOTT THURSTON	PO Box 935	707-236-0469	BASSKINGS707@GMAIL.COM
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email
Name	Address	Phone#	Email

JAN 24 2018

Exhibit D Public Input 2

LAKE COUNTY
PLANNING COMMISSION

NO 11/15/17

Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
James Cluff	5366 BELLAIR DR	472-6151	
STAN KOBARNS	5351 Sierra Dr KLV	707-264-9463	pudgeandjakem@comcast.net
Captain David Cook	4721 HAWAIIAN WAY Kelseyville, Ca.	707-293-4259	1/ACUPT592 Gmail.com
Diane Bellon	9482 Fairway Dr	707-277-7817	ttmedjey@yahoo.ca
Janis Chicomul	9482 Fairway Dr	707-277-7817	" "
	Address	Phone#	Email
	Address	Phone#	Email
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Clear lake Riviera residents opposed to Horizon cell tower project CA4043

Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

Name	Address	Phone #	Email
STACYN FLYNN	5240 JEROME WAY	707-277-7693	STAWNFL@AOL.NET
Name	Address	Phone#	Email
<i>[Signature]</i>			
Name	Address	Phone#	Email
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Project location: 9475 Mojave trail, Kelseyville, Ca. 95451

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Golden Eagles in California

The golden eagle (*Aquila chrysaetos*) is listed as a fully protected species in California.

Distribution and Abundance

Golden eagles are found throughout North America, but are more common in western North America. Little is known about the eagle abundance, but it is thought that numbers may be declining in some, if not all, parts of their range. Golden eagle abundance in California is unknown.

Biology

Most golden eagles in California are resident (e.g. they stay in the state yearlong), but some migrate into California for winter. Those that stay yearlong may move downslope for the winter, or upslope after breeding season. Golden eagles inhabit a variety of habitats including forests, canyons, shrub lands, grasslands, and oak woodlands.

The golden eagle breeds from late January through August and produces 1-3 eggs. Nests are constructed on platforms on steep cliffs or in large trees. The main prey species for the golden eagle are rabbits, hares and rodents; but eagles will also take other mammals, birds, and reptiles. Carrion (e.g. carcasses found on the landscape) is also a part of the eagle diet, especially during winter months.



Golden Eagle. USFWS Photo.

Threats

Threats to this large bird of prey are varied, and include loss of foraging areas, loss of nesting habitat, pesticide poisoning, lead poisoning and collision with man-made structures such as wind turbines.

Population Status and Trend

Little is known about the population trend for golden eagles. The [Breeding Bird Survey \(http://www.pwrc.usgs.gov/BBS/\)](http://www.pwrc.usgs.gov/BBS/) (BBS) has long-term dataset that can be used to assess general population trends. However, no strong trend exists for the golden eagle in California.

Submission of Golden Eagle Data

The CDFW and USFWS staff led an effort to develop the CA/NV Golden Eagle Database. You can submit data to the Golden Eagle Database by filling in the [CNDDDB Golden Eagle Database Submission Template \(PDF\)](http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=108214&inline) (<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=108214&inline>) and sending directly to [Kate Keiser \(mailto:kate.keiser@wildlife.ca.gov\)](mailto:kate.keiser@wildlife.ca.gov). In addition to a blank spreadsheet to submit data, this template also provides detailed instructions, field definitions and values, sample data, and references. For general inquiries related to the database you may contact [Carie Battistone \(mailto:Carie.Battistone@wildlife.ca.gov\)](mailto:Carie.Battistone@wildlife.ca.gov).

You may also submit golden eagle data using the [CNDDDB Online Field Survey Form \(http://www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp\)](http://www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp). This form is an internet application that allows users to map an observation of a rare species, including but not limited to golden eagles, and submit the location and associated data in a single step. First time users will need to set up an account but will not need a CNDDDB subscription to submit data.

— Prepared by Carie Battistone
Nongame Wildlife Program, Wildlife Branch.

Wildlife Branch - Nongame Wildlife Program (<https://www.wildlife.ca.gov/Explore/Organization/WLB/Nongame>)

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Golden Eagle. USFWS Photo.

Submitting Golden Eagle Data

- [CNDDDB Golden Eagle Database Submission Template \(PDF\)](http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=108214&inline) (<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=108214&inline>)
- [CNDDDB Online Field Survey Form](http://www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp) (http://www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp)

Related Information

- [California and Nevada Golden Eagle Working Group](https://www.wildlife.ca.gov/Conservation/Birds/Golden-Eagles/GEWG) (<https://www.wildlife.ca.gov/Conservation/Birds/Golden-Eagles/GEWG>)
- [WHR Range Map \(PDF\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=1682&inline) (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=1682&inline>)
- [Interim Golden Eagle Inventory and Monitoring Protocols: and Other Recommendations \(PDF\)](http://www.fws.gov/southwest/es/oklahoma/documents/te_species/wind%20power/usfws_interim_goea_monitoring_protocol_10march2010.pdf) (http://www.fws.gov/southwest/es/oklahoma/documents/te_species/wind%20power/usfws_interim_goea_monitoring_protocol_10march2010.pdf)
- [Protocol for Golden Eagle Occupancy, Reproduction, and Prey Population Assessment - Driscoll, 2010 \(PDF\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83955&inline) (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83955&inline>)
- [Golden Eagle Mortality Investigation and Carcass Submission Protocol - USFWS 2014 \(PDF\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83951&inline) (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83951&inline>)

Contact

Carie.Battistone@wildlife.ca.gov (<mailto:Carie.Battistone@wildlife.ca.gov>)

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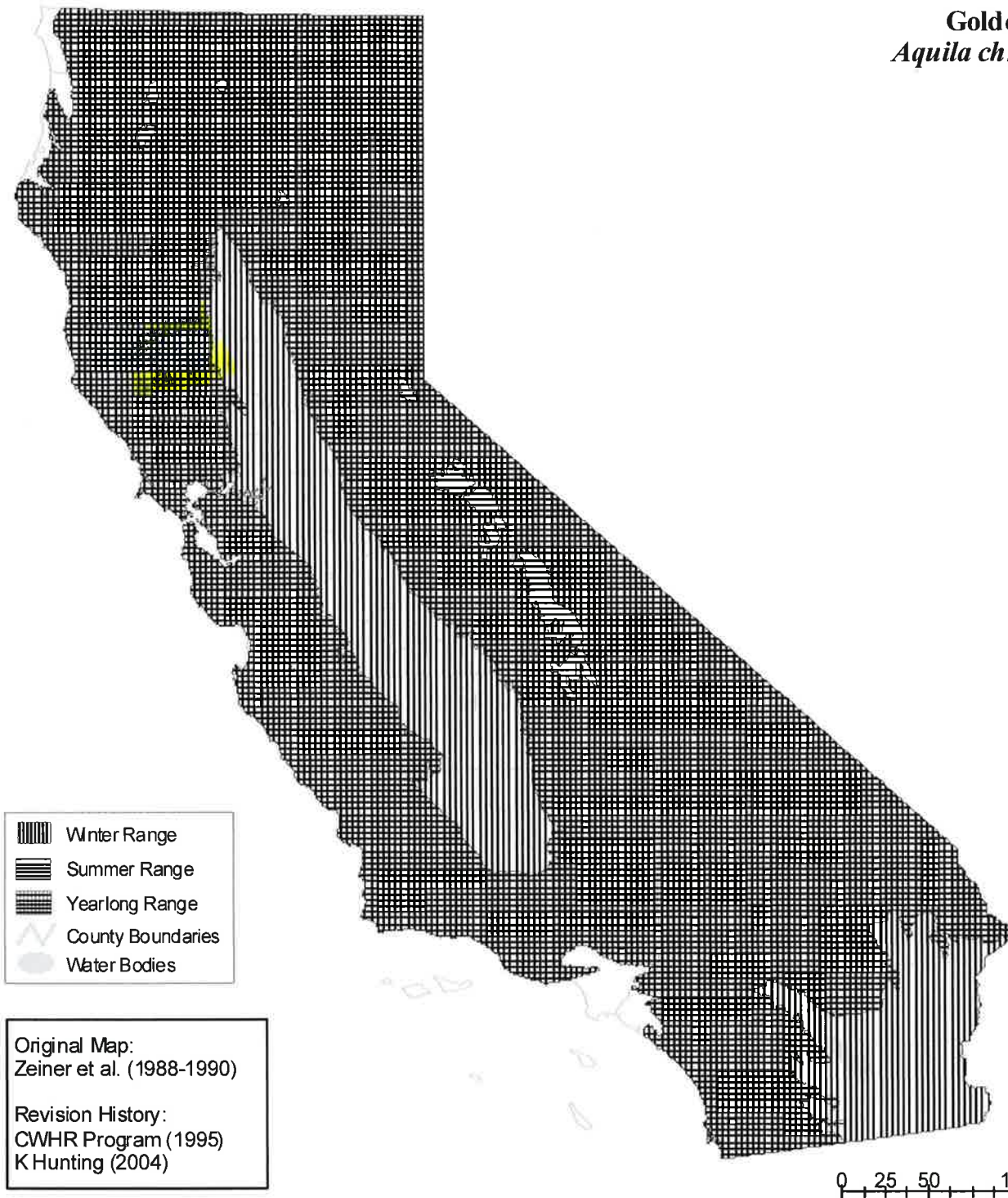
California Wildlife Habitat Relationships System

California Department of Fish and Wildlife

California Interagency Wildlife Task Group

Range
map

Golden Eagle
Aquila chrysaetos
B126



Range maps are based on available occurrence data and professional knowledge. They represent current, but not historic or potential, range. Unless otherwise noted above, maps were originally published in Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988-1990. California's Wildlife. Vol. I-III. California Depart. of Fish and Game, Sacramento, California. Updates are noted in maps that have been added or edited since original publication.

Wildlife Branch - Nongame Wildlife Program

(<https://www.wildlife.ca.gov/Explore/Organization/WLB/Nongame>)

1812 9th Street, Sacramento, CA 95811

(916) 445-0411

129 sightings



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Submitting Data

- **California Peregrine Falcon Nesting Territory Survey Form (PDF Form)**
(<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=158313>)
- **CNDDDB Online Field Survey Form (/Data/CNDDDB/Submitting-Data)**

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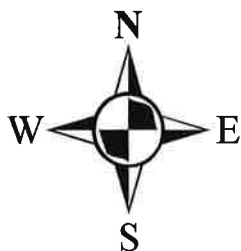
Live video of Nesting Peregrines

Map of Known Peregrine Falcon Nesting Territories 1953-2017



 Peregrine Falcon Territory

Channel Island nests not shown



0 50 100 200 300 400
 Kilometers

0 30 60 120 180 240
 Miles



American Peregrine Falcons in California

The Peregrine Falcon (*Falco peregrinus*) was listed as endangered in 1970 under the federal Endangered Species Act, and listed as endangered in 1971 under the California Endangered Species Act. Due to diligent conservation and recovery efforts, the species was federally delisted in 1999 and in delisted in California in 2009. The Peregrine Falcon remains a fully protected species in California ([see Fish and Game Code, Section 3511 \(http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=FGC§ionNum=3511\)\)](#))

Distribution

The Peregrine Falcon is one of the most widely distributed raptors. Its [full range \(https://birdsna.org/Species-Account/bna/species/perfal/introduction\)](https://birdsna.org/Species-Account/bna/species/perfal/introduction) extends from the tundra to the tropics and contains a wide range of habitats from wetlands, deserts, forests and islands. In California, breeding habitats include a variety of locations from cliffs in uninhabited areas to tall buildings or bridges within the urban landscape. Peale's falcon (*F. p. pealei*) is a year-round resident of the Pacific Northwest, while the American peregrine falcon (*F. p. anatum*) occurs throughout much of North America from Alaska and Canada south to Mexico. Both subspecies can be found in California, with Peale's falcons being more limited to the northern portion of the state.

Biology

Peregrine Falcons weigh 530-1600 grams with a wingspan of 39.4-43.3 inches (100-110 cm). The females are larger than the males but both sexes have similar plumage with long pointed wings and a long tail. Adults are blue-gray above and have light breast feathers, barred flanks and a dark head with thick sideburns, whereas juveniles more brownish overall and have heavy vertical streaks instead of horizontal bars on the breast. They are known as the fastest bird in the world, capable of reaching 150 to 200 mph in their dives and their average cruising speed is 24 to 33 mph and can increase to 67 mph when chasing prey.

Peregrines do not build nests like most other birds, instead they lay their eggs in a "scrape" or shallow indentations high a cliff side, or human-made structure, such as a building or bridge. Occasionally they will use old nests of other birds, such as ravens. The breeding season for Peregrine Falcons in California generally starts around late-February and early-March, and concludes after the young leave the nest between May and June; however, onset and completion of breeding can vary depending on a variety of factors.

Peregrines mostly prey typically prey on small to medium sized birds, such as songbirds, shorebirds, ducks, doves, and pigeons. Other prey taken includes small reptiles, mammals and occasionally bats.



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History and Problems

Historically, Peregrine Falcons were once prevalent across North America and the rest of the world. Prior to World War II the breeding population in the United States was estimated at 3,875 pairs. In the early 1900s Peregrine Falcons experienced loss of habitat, were indiscriminately shot, their eggs were taken by egg collectors. The most impactful threat to the population was the widespread use of the pesticide DDT (dichlorodiphenyltrichloroethane). Shortly after World War II, DDT was used extensively to control mosquitoes and other insects. It was later determined that DDT and its metabolite DDE were poisoning Peregrine Falcons causing egg shell thinning that resulting in many failed nesting attempts. The widespread use of DDT also affected other species such as the Bald Eagle ([/Conservation/Birds/Bald-Eagle](#)) and Brown Pelican. By the mid-1960s there were no Peregrine Falcon in the eastern United States and populations were declining in the west. By 1970 the breeding pairs in had dropped by about 95%. By 1975 there were only about 324 known pairs in the United States.

Recovery Efforts

DDT was banned in the United States in 1972 due to its negative effects on wildlife species. With the help from carious conservation partners (e.g. [Santa Cruz Predatory Bird Research Group](#) (<https://www2.ucsc.edu/scpbrg/>), [Institute for Wildlife Studies](#) (http://www.iws.org/species_peregrine.html), [Peregrine Fund](#) (<http://www.peregrinefund.org/explore-raptors-species/Peregrine%20Falcon>) and other volunteers) state and federal wildlife agencies successfully implemented recovery projects for the Peregrine Falcon, including a breeding and reintroduction program. The population began to increase once again as a result.

Population Status and Trend

As noted above, the Peregrine Falcon experienced steep declines throughout its range, including in California. Today, migration and breeding survey data in the western U.S. indicate an increasing population trend. This upward trend can largely be attributed to the effort of dedicated biologists and volunteers across the United States. Today, we have documented over 400 breeding pairs in California ([see map of known territories \(PDF\)](#) (<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=158463&inline>).



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Submission of Peregrine Falcon Data

The California Department of Fish and Wildlife maintains a database on the annual status of all known breeding territories. Data are submitted annually by various partners using the Peregrine Falcon Nesting Territory Survey Form (PDF Form) (<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=158313&inline>).

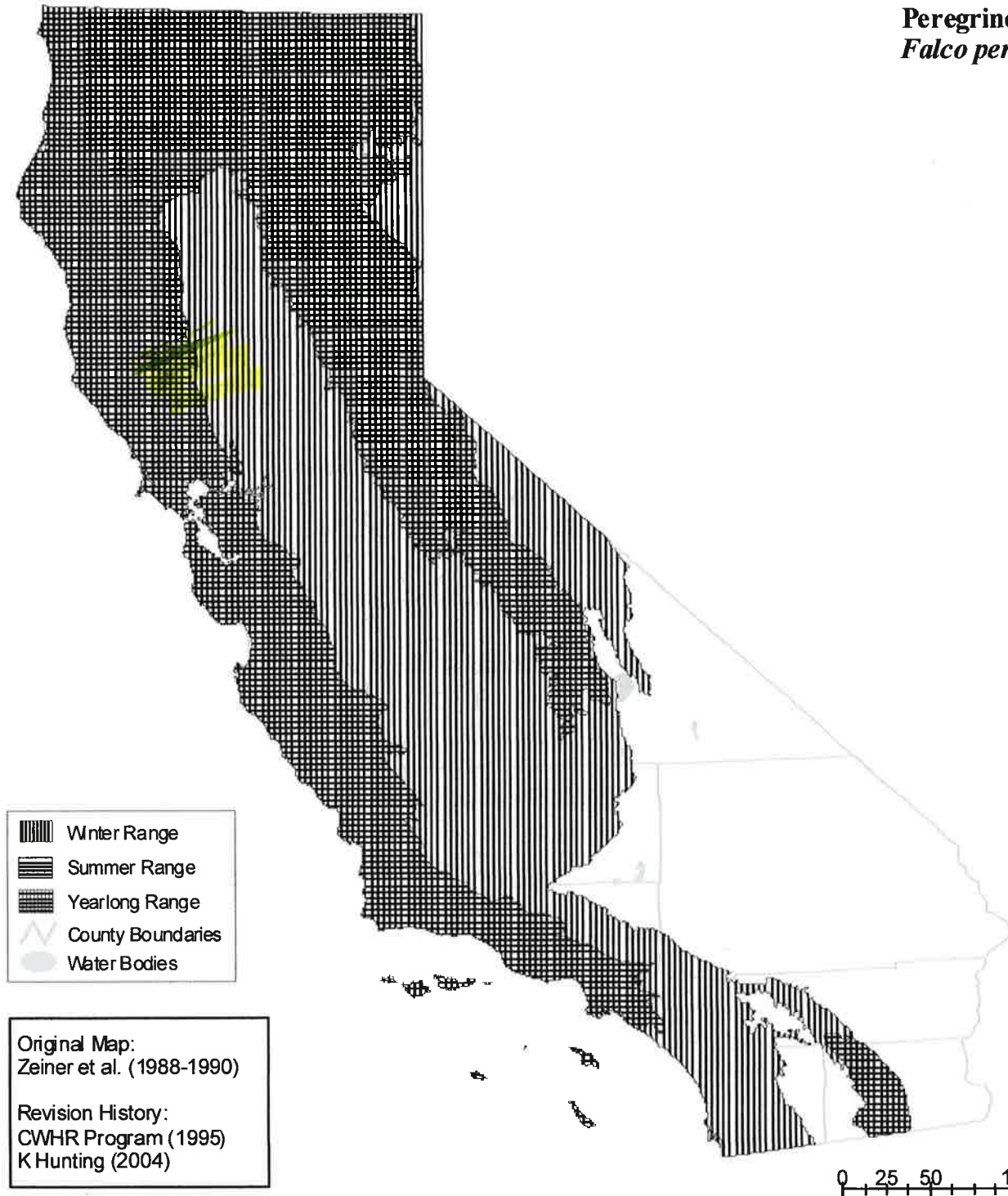
You may also submit Peregrine Falcon data using the CNDDDB Online Field Survey Form (/Data/CNDDDB/Submitting-Data). This form is an internet application that allows users to map an observation of a rare species, including but not limited to golden eagles, and submit the location and associated data in a single step. First time users will need to set up an account but will not need a CNDDDB subscription to submit data.

California Wildlife Habitat Relationships System

California Department of Fish and Wildlife

California Interagency Wildlife Task Group

Peregrine Falcon
Falco peregrinus
B129



Range maps are based on available occurrence data and professional knowledge. They represent current, but not historic or potential, range. Unless otherwise noted above, maps were originally published in Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988-1990. California's Wildlife. Vol. I-III. California Depart. of Fish and Game, Sacramento, California. Updates are noted in maps that have been added or edited since original publication.

Peregrine Falcon (*Falco peregrinus*)

Species Code: B129



[+ enlarge](#)

Breeding Range Map

The green area shows predicted habitats for breeding only. The purpose of the vertebrate distribution maps is to provide more precise information about the current distribution of individual native species within their general ranges than is generally available from field guides.

The habitats were identified using satellite imagery, other datasets and experts throughout the state, as part of the California Gap Analysis Project.



[Observations Map](#)

Predicted breeding range

[Learn how the map was created.](#)

 = Core Habitat



Fire - loss of habitat

1,250 observations

68 photos

Seen all year long

N-

negative ions EMR
effects of RF signals fields on magnetic
orientation migratory birds

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Bald Eagles in California

Perilously close to extinction in the lower 48 states three decades ago, the bald eagle has made a remarkable comeback, owing to restrictions on contaminants, enforcement of protective laws, and special management programs designed to improve its reproductive success and survival.

The bald eagle (*Haliaeetus leucocephalus*), our national symbol and one of North America's largest birds, weighs about 8 to 14 pounds and has a wingspan of 6½ to 8 feet. Females are larger than males, and birds of northern states and provinces tend to be larger than those from the southern portions of the breeding range. Adults are dark brown with a pure white head and tail. Younger birds are mostly brown, mottled with varying amounts of white. They acquire their adult plumage at 4 or 5 years of age.

Distribution

The range of this raptor is wholly within North America, including Alaska, Canada, the lower 48 states, and northwest Mexico. Bald eagles in winter may be found throughout most of California at lakes, reservoirs, rivers, and some rangelands and coastal wetlands. The State's breeding habitats are mainly in mountain and foothill forests and woodlands near reservoirs, lakes, and rivers. Most breeding territories are in northern California, but the eagles also nest in scattered locations in the central and southern Sierra Nevada mountains and foothills, in several locations from the central coast range to inland southern California, and on Santa Catalina Island.

Biology

Some individuals may live for decades in the wild. A breeding pair may remain together until the death of one member, and the surviving bird may soon find a new mate.

Normally, the eagles build their large stick nests in the upper canopy of the tallest trees in the area. The adults may repair the same nest annually, increasing its size over time, or they may build a new nest in their territory or repair one they had used formerly. In many cases, the territory of a pair of eagles may include several nests in addition to the one they most recently used.

In most of California, the breeding season lasts from about January through July or August. One or two eggs (occasionally three) are laid in late winter or early spring, and incubation lasts about 35 days. Chicks fledge when they are 11 or 12 weeks old. In a matter of weeks after leaving the nest, many of the still naive young birds suddenly strike out on their own and rapidly migrate hundreds of miles to the north. In these post-nesting dispersal areas, the young birds join other bald eagles to feed on salmon and other plentiful food. Telemetry studies show that some of these young birds reach northern and western Canada before returning to California a few months later. California's resident breeding pairs remain in California during winter, typically in the vicinity their nesting areas, except when winter conditions are too severe and they must move to lower elevations.

Hundreds of migratory bald eagles from nesting areas in northwestern states and provinces spend the winter in California, arriving during fall and early winter. These wintering birds may remain until February or March, or even into April. In late winter, some adult bald eagles in California have already started nesting, while other eagles have not yet returned to their more nesting territories north or northeast. Some of the adults that winter here have been tracked to their nesting territories in north-central Canada 2,000 miles away.

Bald eagles prey on a variety of small animals, usually fish or waterfowl, and they eat carrion, including salmon, deer, and cattle.

History and Problems

Historically, bald eagles were widespread and abundant in California, but no historical information exists on population size. By the late 1960s and early 1970s, when the bald eagle was listed as an endangered species, fewer than 30 nesting pairs remained in California--all in the northern third of the State. Contaminants across the landscape posed a serious problem for bald eagles.

Shortly after World War II, DDT pesticide was used extensively to control mosquitoes and other insects. It was later determined that DDT and its residues were poisoning bald eagles causing egg shell thinning that resulting in many failed nesting attempts. DDT also affected other species such as peregrine falcons and brown pelicans. DDT was banned in the United States in 1972 due to its negative effects on wildlife species. Another contaminant causing bald eagles deaths is lead. Lead has and is still poisoning bald eagles throughout the United States when eagles inadvertently feed on contaminated prey or carcasses.

The bald eagle was added to the [Federal list of endangered species](http://www.fws.gov/arcata/es/birds/baldEagle/b_eagle.html) (http://www.fws.gov/arcata/es/birds/baldEagle/b_eagle.html) in 1967, and to the [California list of endangered species \(PDF\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline) (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline>) in 1971. The Fish and Wildlife Service removed the bald eagle from the list of threatened and endangered species in August 8, 2007, but remains endangered in California. Although the Fish and Wildlife Service removed the bald eagle from endangered status, the bird will still be protected by the [Migratory Bird Treaty Act](http://www.fws.gov/migratorybirds/mbpermits.html) and the [Bald and Golden Eagle Protection Act](http://www.fws.gov/migratorybirds/mbpermits.html) (<http://www.fws.gov/migratorybirds/mbpermits.html>). Both laws prohibit killing, selling or otherwise harming eagles, their nests, or eggs. The Fish and Wildlife Service has recently revised a final rule on two new permit regulations that would allow for the take of eagles and eagle nests under the [Bald and Golden Eagle Protection Act \(Eagle Act\)](http://www.fws.gov/migratorybirds/baldeagle.htm) (<http://www.fws.gov/migratorybirds/baldeagle.htm>). Also, the bald eagle is classified as a "[fully protected bird](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline) (PDF)" (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline>)" under California law.

The most significant threat to survival of the bald eagle in the 20th century was the widespread use of the pesticide DDT in the decades after World War II, which caused abnormalities in bald eagle eggshells, resulting in widespread nesting failures. Other adverse impacts have included habitat modification from road, housing, and other developments; agriculture; timber harvest; pesticides and contaminants, including lead poisoning; off-road vehicles and other human disturbances; electrocution and collision at power lines; and shooting.

Recovery Efforts

A nationwide ban on most uses of DDT took effect in 1972, and over time, this enabled bald eagle reproduction rates to return to satisfactory levels. However, nesting failures from this source still occur in some areas in California and elsewhere nationally. Local protection of nesting pairs from adverse habitat changes and disturbances, restrictions on the use of lead shot, enforcement of laws prohibiting killing eagles, and other protective measures benefitted the eagles, as well. Populations have been able to thrive and reproduce adequately in most of California. Bald eagles have been able to re-occupy much of their former range.

Many breeding territories are being maintained and protected under local management plans. Key winter habitats are monitored annually. Public land agencies-such as the U.S. Forest Service and county and State parks-provide site protection and public viewing and education opportunities. California Department of Fish and Wildlife protects bald eagle nesting, foraging and wintering habitats in various parts of the State on its Ecological Reserves and Wildlife Areas.

Cooperating agencies and individuals monitor the breeding status of nesting territories in the State. The Department maintains a database on the annual status of all known territories. Data are submitted annually by various partners using the [California Bald Eagle Nesting Territory Survey Form \(PDF Form\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83706) (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83706>). California participates, also, in the [Midwinter Bald Eagle Survey](http://gis.nacse.org/eagles) (<http://gis.nacse.org/eagles>). This annual, nationwide survey is carried out by volunteers and agencies in wintering areas to sample population size and distribution of wintering birds. State and federal agencies and other entities have sponsored biological studies, including intensive ecological investigations undertaken by Pacific Gas and Electric Company, U.S. Forest Service and the Santa Cruz Predatory Bird Research Group.

Since 1980, dozens of birds were translocated to Santa Catalina Island as chicks or eggs from wild nests on the mainland or from captive breeding (Institute for Wildlife Studies). In a second reintroduction effort, 66 eaglets were translocated and released from 1987 to 1995 in the central coast mountains south of Monterey Bay (Ventana Wildlife Society). The first nesting pair from those releases formed in 1993, and many more pairs have established territories in the central coast range counties since then. From 1985 to 2007 the San Francisco Zoo, at its Avian Conservation Center operated captive breeding efforts for bald eagles, hatching and releasing 103 eagle chicks on the Channel Islands of California.

The [Pacific Bald Eagle Recovery Plan \(PDF\)](http://www.fws.gov/montanafieldoffice/Endangered_Species/Recovery_and_Mgmt_Plans/Pacific_Bald_Eagle_Recovery_Plan.pdf) (http://www.fws.gov/montanafieldoffice/Endangered_Species/Recovery_and_Mgmt_Plans/Pacific_Bald_Eagle_Recovery_Plan.pdf), adopted by U.S. Fish and Wildlife Service in 1986, encompasses a seven-state area that includes California. California Department of Fish and Wildlife participated on the Recovery Team that prepared the plan. The following recovery goals were established to guide and measure population recovery: 1) a minimum of 800 breeding pairs, 2) average annual productivity of at least 1 young per active breeding pair, 3) breeding population goals met for at least 80% of management zones, and 4) no decline in major winter concentrations.

Protection of nesting areas, restrictions on use of DDT, and other special wildlife management actions have allowed the population to rebound. The number of breeding pairs in the Pacific states is approaching twice the minimum goal listed in the recovery plan, and progress in meeting the other criteria has been good. The status of the species has generally improved, as well, in the rest of the lower 48 states.

Today bald eagle populations have rebounded across the United States. Numbers in California are on the rise, but population estimates are lacking. Continued monitoring is essential to determine the trend for bald eagles.

Population Status and Trend

The number of breeding pairs known to be occupying territories in California is steadily growing. Along with this growth, the breeding range is expanding in California ([range map \(PDF\) \(https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=112194&inline\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=112194&inline)). In 1977, bald eagles were reported to be nesting in eight counties, and by the mid-1990's, bald eagles were found nesting in 28 of the State's 58 counties. Today, bald eagles are found 41 of the State's 58 counties. Reintroduction programs have fostered the establishment of breeding pairs in several of those counties.

The annual, nationwide [Midwinter Bald Eagle Survey \(http://ocid.nacse.org/nbii/eagles/\)](http://ocid.nacse.org/nbii/eagles/) indicates that the State's winter population appears to be at least stable, although varying from year to year, exceeding 1,000 birds some winters. The results of Midwinter Bald Eagle Surveys conducted from 1986-2005 estimates a 1.2% increase in California's wintering bald eagle population. Typically, about half of the State's wintering bald eagles are found in the Klamath Basin along the California-Oregon border, the location of the largest winter concentration of Bald Eagles in the lower 48 states.

The future looks bright for the bald eagle in California and in the nation. The growing population of eagles allows more people to see them. The best time to bald eagles is in the winter, between December and March, when large numbers of migratory and resident eagles congregate at favored feeding areas. Some recreational areas offer eagle viewing tours.

Wildlife Branch - Nongame Wildlife Program (<https://www.wildlife.ca.gov/Explore/Organization/WLB/Nongame>)

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Bald Eagles in California

- [Bald Eagle Viewing Opportunities in California \(/Conservation/Birds/Bald-Eagle/View\)](#)
- [Map of Known Nesting Territories 2000-2016 \(PDF\) \(https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=112194&inline\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=112194&inline)
- [Breeding Population Data for California, 1990-2016 \(PDF\) \(https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=112194&inline\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=112194&inline)

Submitting Bald Eagle Breeding Data

- [California Bald Eagle Nesting Territory Survey Form \(PDF Form\) \(https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83706\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83706)
- [CNDDDB Online Field Survey Form \(/Data/CNDDDB/Submitting-Data\)](#)

Live video of Nesting Birds

(Chiefly Late Winter to Early Summer)

- [NCTC Eagle Cam \(http://www.fws.gov/nctc/cam/eaglecam.htm\)](http://www.fws.gov/nctc/cam/eaglecam.htm)
- [Lake Washington EagleCam \(http://wdfw.wa.gov/wildwatch/eaglecam/\)](http://wdfw.wa.gov/wildwatch/eaglecam/)
- [Friends of Blackwater NWR - Eagle Cam \(http://www.friendsofblackwater.org/camhtm2.html\)](http://www.friendsofblackwater.org/camhtm2.html)
- [Decorah Eagles \(http://www.ustream.tv/decoraheagles\)](http://www.ustream.tv/decoraheagles)
- [Turtle Bay Eagle Cam \(http://www.turtlebay.org/eaglecam\)](http://www.turtlebay.org/eaglecam)
- [Massachusetts \(http://www.nu.com/eagles/default.asp\)](http://www.nu.com/eagles/default.asp)
- [CNN Video: Hatching of bald eagle eggs at the San Francisco Zoo \(http://www.cnn.com/EARTH/9703/22/baby.eagle/\)](http://www.cnn.com/EARTH/9703/22/baby.eagle/)

Other Related Info

History & Problems

- Our national symbol: [The Great Seal of the U.S. \(http://www.state.gov/www/dept.html\)](http://www.state.gov/www/dept.html)
- [Pesticides and Wildlife \(http://www.r6.fws.gov/feature/pesticid.html\)](http://www.r6.fws.gov/feature/pesticid.html)

Recovery Efforts

- U.S. Fish and Wildlife Service's July 1999 [Proposed \(PDF\) \(http://ecos.fws.gov/docs/federal_register/fr3404.pdf\)](http://ecos.fws.gov/docs/federal_register/fr3404.pdf) Rule To Remove the Bald Eagle in the Lower 48 States From the List of Endangered and Threatened Wildlife (.pdf)
- [Summary \(http://www.fws.gov/midwest/\)](http://www.fws.gov/midwest/)
- [Questions and Answers \(http://www.fws.gov/midwest/\)](http://www.fws.gov/midwest/)
- [An American Success Story \(http://www.fws.gov/midwest/\)](http://www.fws.gov/midwest/)

Biology

- [Identification Tips Patuxent Bird Identification InfoCenter \(http://www.mbr-pwrc.usgs.gov/id/framlist/i3520id.html\)](http://www.mbr-pwrc.usgs.gov/id/framlist/i3520id.html)
- [Images U.S. Fish and Wildlife Service \(http://midwest.fws.gov/eagle/viewing/eaglepix.html\)](http://midwest.fws.gov/eagle/viewing/eaglepix.html)
- [California Wildlife Habitat Relationships \(PDF\) \(https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=17512&inline\)](https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=17512&inline)
- [Sounds of the bald eagle \(http://ngm.nationalgeographic.com/ngm/0207/sights_n_sounds/media2.html\)](http://ngm.nationalgeographic.com/ngm/0207/sights_n_sounds/media2.html)

Population Number

- [Population Trend in Number of Bald Eagle Pairs in the Lower 48 States \(http://www.fws.gov/midwest/eagle/population/chtotfrs.html\)](http://www.fws.gov/midwest/eagle/population/chtotfrs.html)

California Wildlife Habitat Relationships System

California Department of Fish and Wildlife

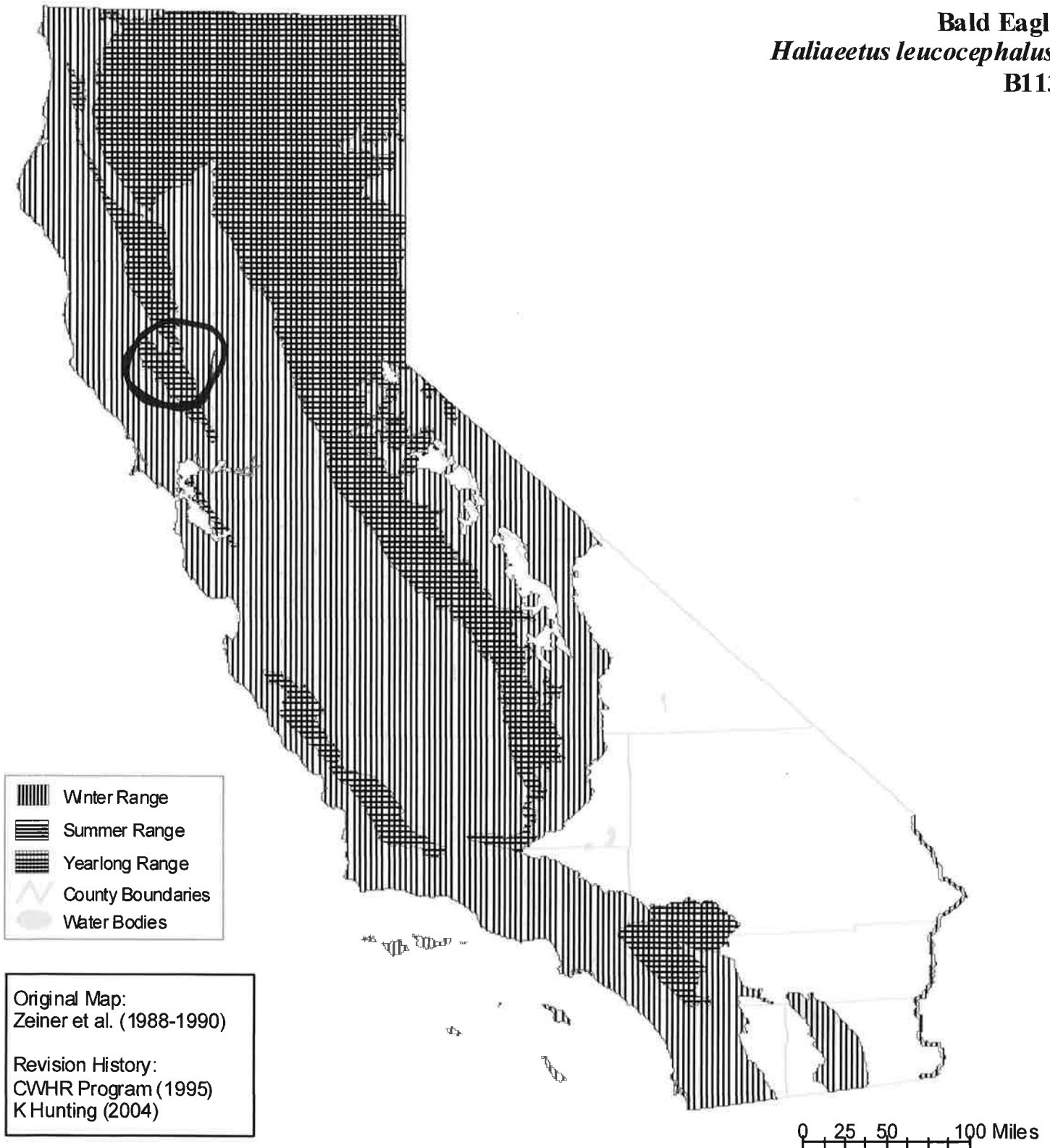
California Interagency Wildlife Task Group

Range
map

Bald Eagle

Haliaeetus leucocephalus

B113



Range maps are based on available occurrence data and professional knowledge. They represent current, but not historic or potential, range. Unless otherwise noted above, maps were originally published in Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988-1990. California's Wildlife. Vol. I-III. California Depart. of Fish and Game, Sacramento, California. Updates are noted in maps that have been added or edited since original publication.

Map of Known Bald Eagle Nesting Territories 2000-2016





United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

FEB - 7 2014



In Reply Refer To: (ER 14/0001) (ER 14/0004).

Mr. Eli Veenendaal
National Telecommunications and Information
Administration
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, D.C. 20230

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PLANNING COMMISSION

Dear Mr. Veenendaal:

The Department of the Interior (Department) has reviewed the above referenced proposal and submits the following comments and attachment for consideration. Because the First Responder Network Authority (FirstNet) is a newly created entity, we commend the U.S. Department of Commerce for its timely proposals for NEPA implementing procedures.

The Department believes that some of the proposed procedures are not consistent with Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, which specifically requires federal agencies to develop and use principles, standards, and practices that will lessen the amount of unintentional take reasonably attributed to agency actions. The Department, through the Fish and Wildlife Service (FWS), finds that the proposals lack provisions necessary to conserve migratory bird resources, including eagles. The proposals also do not reflect current information regarding the effects of communication towers to birds. Our comments are intended to further clarify specific issues and address provisions in the proposals.

The Department recommends revisions to the proposed procedures to better reflect the impacts to resources under our jurisdiction from communication towers. The placement and operation of communication towers, including un-guyed, unlit, monopole or lattice-designed structures, impact protected migratory birds in two significant ways. The first is by injury, crippling loss, and death from collisions with towers and their supporting guy-wire infrastructure, where present. The second significant issue associated with communication towers involves impacts from non-ionizing electromagnetic radiation emitted by them (See Attachment).

In addition to the 147 Birds of Conservation Concern (BCC) species, the FWS has listed an additional 92 species as endangered or threatened under the Endangered Species Act. Together with the bald and golden eagle, this represents 241 species of birds whose populations are in trouble or otherwise merit special protection, according to the varying criteria of these lists. The Department suggests that FirstNet consider preparing a programmatic environmental impact statement (see attachment) to determine and address cumulative impacts from authorizing FirstNet projects on those 241 species for which the incremental impact of tower mortality, when

added to other past, present, and reasonably foreseeable future actions, is most likely significant, given their overall imperiled status. Notwithstanding the proposed implementing procedures, a programmatic NEPA document might be the most effective and efficient method for establishing best management practices for individual projects, reducing the burden to individual applicants, and addressing cumulative impacts.

Categorical Exclusions

The Department has identified 13 of the proposed categorical exclusions (A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14 A-15, A-16, A-17, and A-19) as having the potential to significantly affect wildlife and the biological environment. Given this potential, we want to underscore the importance of our comments on FirstNet's procedural guidance under Environmental Review and Consultation Requirements for NEPA Reviews and its list of extraordinary circumstances in Appendix D.

Environmental Review and Consultation Requirements for NEPA Reviews

To ensure there are no potentially significant impacts on birds from projects that may otherwise be categorically excluded, the Department recommends including the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act to the list of requirements in this section.

Extraordinary Circumstances

To avoid potentially significant impacts on birds from projects that may otherwise be categorically excluded, the Department recommends including species covered under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act to the list of environmentally sensitive resources. Additionally, adding important resources to migratory birds such as sites in the Western Hemisphere Shorebird Reserve Network and Audubon Important Bird Areas to the paragraph on areas having special designation or recognition would help ensure their consideration when contemplating use of a categorical exclusion.

Developing the Purpose and Need

The Department recommends inclusion of language that would ensure consideration of all other authorities to which NEPA is supplemental as opposed to simply the FirstNet mission. As currently written, the procedures are limited to ensuring the purpose and need considers the FirstNet mission. If strictly applied, this approach would severely limit the range of reasonable alternatives, and likely preclude consideration of more environmentally benign locations or construction practices.

Environmental Review Process, Apply NEPA Early in the Process, Where Action is by Non-Federal Entity

The Department recommends that FirstNet be required to coordinate with federal agencies having jurisdiction by law or special expertise on construction and lighting of its network of towers.

Thank you for the opportunity to comment on the draft document. If you have any questions concerning the comments, please contact Diana Whittington, NEPA Migratory Bird lead, at (703) 358-2010. If you have any questions regarding Departmental NEPA procedures, contact Lisa Treichel, Office of Environmental Policy and Compliance at (202) 208-7116.

Sincerely,

A handwritten signature in blue ink, appearing to read "Willie R. Taylor". The signature is fluid and cursive, with the first name "Willie" being the most prominent part.

Willie R. Taylor
Director, Office of Environmental Policy
and Compliance

Enclosure

Literature Cited

- Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, Jr., M.L. Avery, R.C. Crawford, A.M. Manville, II, E.R. Travis, and D. Drake. 2013. Avian mortality at communication towers in the United States and Canada: which species, how many, and where? *Biological Conservation* 158: 410-419.
- U.S. Fish and Wildlife Service. 2008. *Birds of Conservation Concern, 2008*. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA. 85 pages. <http://www.fws.gov/migratorybirds>.

Enclosure A

Background

The placement and operation of communication towers, including un-guyed, unlit, monopole or lattice-designed structures, impact protected migratory birds in two significant ways.

The first is by injury, crippling loss, and death from collisions with towers and their supporting guy-wire infrastructure, where present. Mass mortality events tend to occur during periods of peak spring and fall songbird migration when inclement weather events coincide with migration, and frequently where lights (either on the towers and/or on adjacent outbuildings) are also present. This situation has been well documented in the U.S. since 1948 in the published literature (Aronoff 1949, see Manville 2007a for a critique). The tallest communication towers tend to be the most problematic (Gehring *et al.* 2011). However, mid-range (~400-ft) towers as proposed by the First Responder Network Authority (FirstNet, a newly created entity under the Department of Commerce) can also significantly impact protected migratory birds, as can un-guyed and unlit lattice and monopole towers (Gehring *et al.* 2009, Manville 2007a, 2009, 2013a). Mass mortalities (more than several hundred birds per night) at un-guyed, unlit monopole and lattice towers were documented in fall 2005 and 2011 in the Northeast and North Central U.S. (*e.g.*, Manville 2007a). It has been argued that communication towers including “short” towers do not impact migratory birds, including at the population level (*e.g.*, Arnold and Zink 2011), but recent findings have contradicted that assertion (Manville 2007a, 2013a, Longcore *et al.* 2012, 2013).

The second significant issue associated with communication towers involves impacts from non-ionizing electromagnetic radiation emitted by these structures. Radiation studies at cellular communication towers were begun circa 2000 in Europe and continue today on wild nesting birds. Study results have documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death (*e.g.*, Balmori 2005, Balmori and Hallberg 2007, and Everaert and Bauwens 2007). Nesting migratory birds and their offspring have apparently been affected by the radiation from cellular phone towers in the 900 and 1800 MHz frequency ranges – 915 MHz is the standard cellular phone frequency used in the United States. However, the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today. This is primarily due to the lower levels of radiation output from microwave-powered communication devices such as cellular telephones and other sources of point-to-point communications; levels typically lower than from microwave ovens. The problem, however, appears to focus on very low levels of non-ionizing electromagnetic radiation. For example, in laboratory studies, T. Litovitz (personal communication) and DiCarlo *et al.* (2002) raised concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos – with some lethal results (Manville 2009, 2013a). Radiation at extremely low levels (0.0001 the level emitted by the average digital cellular telephone) caused heart attacks and the deaths of some chicken embryos subjected to hypoxic conditions in the laboratory while controls subjected to hypoxia were unaffected (DiCarlo *et al.* 2002). To date, no independent, third-party field studies have been conducted in North America on impacts of tower electromagnetic radiation on migratory birds. With the European field and U.S. laboratory evidence already available,

independent, third-party peer-reviewed studies need to be conducted in the U.S. to begin examining the effects from radiation on migratory birds and other trust species.

Discussion

Collision Deaths and Categorical Exclusions

Attempts to estimate bird-collision mortality at communication towers in the U.S. resulted in figures of 4-5 million bird deaths per year (Manville 2005, 2009). A meta-review of the published literature now suggests, based on statistically determined parameters, that mortality may be 6.8 million birds per year in Canada and the U.S.; the vast majority in the United States (Longcore *et al.* 2012). Up to 350 species of birds have been killed at communication towers (Manville 2007a, 2009). The Service's Division of Migratory Bird Management has updated its voluntary, 2000 communication tower guidelines to reflect some of the more recent research findings (Manville 2013b). However, the level of estimated mortality alone suggests at a minimum that FirstNet prepare an environmental assessment to estimate and assess the cumulative effects of tower mortality to protected migratory birds.

A second meta-review of the published mortality data from scientific studies conducted in the U.S. and Canada (Longcore *et al.* 2013) strongly correlates population effects to at least 13 species of Birds of Conservation Concern (BCC, USFWS 2008). These are mortalities to BCC species based solely on documented collisions with communication towers in the U.S. and Canada, ranging from estimated annual levels of mortality of 1 to 9% of their estimated total population. Among these where mortality at communication towers was estimated at over 2% annually are the Yellow Rail, Swainson's Warbler, Pied-billed Grebe, Bay-breasted Warbler, Golden-winged Warbler, Prairie Warbler, and Ovenbird. Longcore *et al.* (2013) emphasized that avian mortality associated with anthropogenic sources is almost always reported in the aggregate, *i.e.*, "number of birds killed," which cannot detect species-level effects necessary to make effective and meaningful conservation assessments, including determining cumulative effects. These new findings strongly suggest the need for at least an environmental assessment by FirstNet, or more likely, an environmental impact statement.

Radiation Impacts and Categorical Exclusions

There is a growing level of anecdotal evidence linking effects of non-thermal, non-ionizing electromagnetic radiation from communication towers on nesting and roosting wild birds and other wildlife in the U.S. Independent, third-party studies have yet to be conducted in the U.S. or Canada, although a peer-reviewed research protocol developed for the U.S. Forest Service by the Service's Division of Migratory Bird Management is available to study both collision and radiation impacts (Manville 2002).

As previously mentioned, Balmori (2005) found strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, nesting, and roosting in the vicinity of electromagnetic fields in Spain. He documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. Though these species had historically been documented to roost and nest in these areas, Balmori (2005) did not observe these symptoms prior to construction and operation of the cellular phone towers. Balmori and Hallberg (2007) and Evcract and Bauwens (2007) found similar strong negative correlations

among male House Sparrows. Under laboratory conditions, DiCarlo *et al.* (2002) raised troubling concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos – with some lethal results (Manville 2009). Given the findings of the studies mentioned above, field studies should be conducted in North America to validate potential impacts of communication tower radiation – both direct and indirect – to migratory birds and other trust wildlife species.

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- DiCarlo, A., N. White, F. Guo, P. Garrett, and T. Litovitz. 2002. Chronic electromagnetic field exposure decreases HSP70 levels and lowers cytoprotection. *Journal Cellular Biochemistry* 84: 447-454.
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- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern, 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA. 85 pages. <http://www.fws.gov/migratorybirds>.

Bees, Butterflies And Wildlife: Research On Electromagnetic Fields And The Environment

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Electromagnetic fields from powerlines, cell phones, cell towers and wireless impacts the birds, bees, wildlife and our environment. Below is just a small example of the critical research that has been done on this issue.

"The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."

-The Department of Interior in a 2014 letter on the impact of cell towers (<http://nebula.wsimg.com/e498f8f484d32b310fa2cccec4eb7d28?AccessKeyId=FF4B01FD5B2965093C55&disposition=0&alloworigin=1>) on migratory birds.

REVIEWS OF THE SCIENCE

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Balmori, Alfonso. "Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation."

(<http://www.sciencedirect.com/science/article/pii/S0048969715002296>) *Science of The Total Environment*, vol. 518–519, 2015, pp. 58–60

- The growth of wireless telecommunication technologies causes increased electrosmog. Radio frequency fields in the MHz range disrupt insect and bird orientation.
- Radio frequency noise interferes with the primary process of magnetoreception. Existing guidelines do not adequately protect wildlife. Further research in this area is urgent.

Cucurachi, C., et al. "A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)."

(<http://www.sciencedirect.com/science/article/pii/S0160412012002334>) *Environment International*, vol. 51, 2013, pp. 116–40.

- A Review of 113 studies from original peer-reviewed publications. RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies. Development and reproduction of birds and insects are the most strongly affected endpoints.

Balmori, A. "Electrosmog and species conservation." (<http://www.ncbi.nlm.nih.gov/pubmed/25089692?dopt=Abstract>) *Science of the Total Environment*, vol. 496, 2014, pp. 314-6.

- "Conclusion: At the present time, there are reasonable grounds for believing that microwave radiation constitutes an environmental and health hazard....Concerning the exposure to electromagnetic fields, the precautionary principle is needed and should be applied to protect species from environmental non-thermal effects (Zinelis, 2010). Controls must be introduced and technology rendered safe to the environment, since this new ubiquitous and invisible pollutant could deplete the efforts devoted to species conservation."

Manville, Albert M. "A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don't Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife." (<https://ecfsapi.fcc.gov/file/12270470130362/Manville%207-14-%202016%20Radiation%20Briefing%20Memo-Public.pdf>) *Wildlife and Habitat Conservation Solutions*, 2014.

- "In summary, we need to better understand ... how to address these growing and poorly understood radiation impacts to migratory birds, bees, bats, and myriad other wildlife. At present, given industry and agency intransigence ... massive amounts of money being spent to prevent addressing impacts from non-thermal radiation — not unlike the battles over tobacco and smoking — and a lack of significant, dedicated and reliable funding to advance independent field studies, ... we are left with few options. Currently, other than to proceed using the precautionary approach and keep emissions as low as reasonably achievable, we are at loggerheads in advancing meaningful guidelines, policies and regulations that address non-thermal effects...."

EKLIPSE REPORT, an EU-funded review body dedicated to policy that may impact biodiversity and the ecosystem, looked over 97 studies on how electromagnetic radiation may affect the environment. It concluded this radiation could indeed pose a potential risk to bird and insect orientation and plant health. **EKLIPSE REPORT WEBPAGE** (http://www.eclipse-mechanism.eu/emr_conference)

- Malkemper EP, Tscheulin T, VanBergen AJ, Vian A, Balian E, Goudeseune L (2018). The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Current knowledge overview: a background document to the web conference. (<http://bit.ly/Eclipseoverview>) A report of the EKLIPSE project.
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Bees, Bugs And Butterflies

"Cryptochromes are very badly affected by weak oscillating electromagnetic fields that are orders of magnitude weaker than the Earth's steady magnetic field. This can disrupt both solar and magnetic navigation, which can account for colony collapse disorder in bees."

—Dr. Andrew Goldsworthy



Research clearly shows that Bees and Butterflies are sensitive to electromagnetic fields.

Cammaerts, Marie-Claire. "Is electromagnetism one of the causes of the CCD? A work plan for testing this hypothesis." (<https://www.jscimedcentral.com/Behavior/behavior-2-1006.php>) *Journal of Behavior*, vol. 2, no. 1, 2017, pp. 1006.

- The decline of domestic bees all over the world is an important problem still not well understood by scientists and beekeepers, and far from being solved. Its reasons are numerous: among others, the use of pesticides and insecticides, the decrease of plant diversity, and bee's parasites. Besides these threats, there is a potential adverse factor little considered: manmade electromagnetism.
- The present paper suggests two simple experimental protocols for bringing to the fore the potential adverse effect of electromagnetism on bees and to act consequently. The first one is the observation of bees' avoidance of a wireless apparatus; the second one is the assessment of colonies' strength and of the intensity of the electromagnetism field (EMF) surrounding them. If bees avoid a wireless apparatus, if hives in bad health are located in EMF of a rather high intensity, it can be presumed that bees are affected by manmade electromagnetism. This should enable searching for palliative measures.

Goldsworthy, Andrew. "The Birds, the Bees and Electromagnetic Pollution: How electromagnetic fields can disrupt both solar and magnetic bee navigation and reduce immunity to disease all in one go." (<https://ecfsapi.fcc.gov/file/7520958012.pdf>) 2009.

- Many of our birds are disappearing mysteriously from the urban environment and our bees are now under serious threat. There is increasing evidence that at least some of this is due to electromagnetic pollution such as that from cell towers, cell phones, DECT cordless phones and Wifi. It appears capable of interfering with their navigation systems and also their circadian rhythms, which in turn reduces their resistance to disease. The most probable reason is that these animals use a group of magnetically-sensitive substances called cryptochromes for magnetic and solar navigation and also to control the activity of their immune systems.

Guerra, Patrick A., Robert J. Gegear, and Steven M. Reppert. "A magnetic compass aids monarch butterfly migration." (<http://www.nature.com/articles/ncomms5164>) *Nature Communications*, vol. 5, no. 4164, 2014.

- "Here we use flight simulator studies to show that migrants indeed possess an inclination magnetic compass to help direct their flight equator ward in the fall. Another vulnerability to now consider is the potential disruption of the magnetic compass in monarchs by human-induced electromagnetic noise, which can apparently disrupt geomagnetic orientation in a migratory bird."

Kumar, Neelima R., Sonika Sangwan, and Pooja Badotra. "Exposure to cell phone radiations produces biochemical changes in worker honey bees." (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052591/>) *Toxicol Int.*, 18, no. 1, 2011, pp. 70–2.

- The present study was carried out to find the effect of cell phone radiations on various biomolecules in the adult workers of *Apis mellifera* L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees' behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward "talk mode" cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.

Favre, Daniel. "Mobile phone induced honeybee worker piping." (<http://link.springer.com/article/10.1007%2Fs13592-011-0016-x#page-1>) *Apidologie*, vol. 42, 2011, pp. 270-9.

- Electromagnetic waves originating from mobile phones had a dramatic impact on the behavior of the bees, namely by inducing the worker piping signal. In natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony.

Warnke, Ulrich. "Birds, Bees and Mankind: Destroying Nature by 'Electrosmog'." (<https://ecfsapi.fcc.gov/file/7521097894.pdf>) *Competence Initiative for the Protection of Humanity, Environment and Democracy*, Brochure 1, 2009.

- Bees pollinate approximately 1/3 of all crops and they are disappearing by the millions. Warnke raises the concern that the dense, energetic mesh of electromagnetic fields from wireless technologies may be the cause.

Sharma, V.P. and N.K. Kumar. "Changes in honeybee behaviour and biology under the influence of cellphone radiations." (<http://www.currentscience.in/content/view/full/781013768>) *Current Science*, vol. 98, no 10, 2010, pp. 1376-8.

- We have compared the performance of honeybees in cell phone radiation exposed and unexposed colonies. A significant ($p < 0.05$) decline in colony strength and in the egg laying rate of the queen was observed. The behaviour of exposed foragers was negatively influenced by the exposure, there was neither honey nor pollen in the colony at the end of the experiment."

Briefing Paper on the Need for Research into the Cumulative Impacts of Communication Towers on Migratory Birds and Other Wildlife in the United States." (<http://electromagnetichealth.org/pdf/CommTowerResearchNeedsPublicBriefing-2-409.pdf>) *Division of Migratory Bird Management (DMBM)*, U.S. Fish & Wildlife Service, 2009.

- Of concern to DMBM are the potential impacts of radiation on bird populations. For example, preliminary research on wild birds at cellular phone tower sites in Spain showed strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, feeding, and roosting in the vicinity of the electromagnetic fields.

Harst, Wolfgang Harst, Jochen Kuhn and Hermann Stever. "Can Electromagnetic Exposure Cause a Change in Behaviour? Studying Possible Non-thermal Influences on Honey Bees – An Approach Within the Framework of Educational Informatics." (http://www.next-up.org/pdf/ICRW_Kuhn_Landau_study.pdf) *Acta Systemica-IIAS International Journal*, vol 6, no. 1, 2006, pp. 1-6.

- A pilot study on honeybees testing the effects of non-thermal, high frequency electromagnetic radiation on beehive weight and flight return behavior. In exposed hives, bees constructed 21% fewer cells in the hive frames after 9 days than those unexposed.

Sainudeen, Sahib.S. "Electromagnetic Radiation (EMR) Clashes with Honey Bees." (<http://ipublishing.co.in/jesvol1no12010/EIJES2044.pdf>) *International Journal of Environmental Sciences*, vol. 1, no. 5, 2011.

- Recently a sharp decline in population of honey bees has been observed in Kerala. Although the bees are susceptible to diseases and attacked by natural enemies like wasps, ants and wax moth, constant vigilance on the part of the bee keepers can over come these adverse conditions. The present plunge in population (< 0.01) was not due to these reasons. It was caused by man due to unscientific proliferation of towers and mobile phones."
- Six colonies of honeybees (*Apis mellifera*) were selected. Three colonies were selected as test colonies (T1,T2&T3) and the rest were as control (C1,C2&C3). The test colonies were provided with mobile phones in working conditions with frequency of 900 MHz for 10 minutes for a short period of ten days. After ten days the worker bees never returned hives in the test colonies. The massive amount of radiation produced by mobile phones and towers is actually frying the navigational skills of the honey bees and preventing them from returning back to their hives.
- The study concludes, "More must also be done to compensate individuals and communities put at risk. Insurance covering diseases

related to towers, such as cancer, should be provided for free to people living in 1 km radius around the tower. Independent monitoring of radiation levels and overall health of the community and nature surrounding towers is necessary to identify hazards early. Communities need to be given the opportunity to reject cell towers and national governments need to consider ways of growing their cellular networks without constantly exposing people to radiation."

"The potential dangers of electromagnetic fields and their effect on the environment." (<http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=179948>) *Council of Europe Parliamentary Assembly*, resolution 1815, 2011.

- The potential health effects of the very low frequency of electromagnetic fields surrounding power lines and electrical devices are the subject of ongoing research and a significant amount of public debate. While electrical and electromagnetic fields in certain frequency bands have fully beneficial effects which are applied in medicine, other non-ionising frequencies, be they sourced from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects and animals, as well as the human body when exposed to levels that are below the official threshold values. One must respect the precautionary principle and revise the current threshold values; waiting for high levels of scientific and clinical proof can lead to very high health and economic costs, as was the case in the past with asbestos, leaded petrol and tobacco
- As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly strongly recommends that the ALARA (as low as reasonably achievable) principle is applied, covering both the so-called thermal effects and the athermic or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applied when scientific evaluation does not allow the risk to be determined with sufficient certainty.

Kimmel, Stefan, et al. "Electromagnetic radiation: influences on honeybees (*Apis mellifera*).

(http://www.partecipiamo.it/cultura/renzo_barbattini/api_e_frequenze_elettromagnetiche_002.pdf)" *IIAS-InterSymp Conference*, 2007.

- 39.7% of the non-irradiated bees had returned to their hives while only 7.3% of the irradiated bees had.

Clarke, Dominic, et al. "Detection and Learning of Floral Electric Fields by Bumblebees." (<http://www.sciencemag.org/content/340/6128/66>) *Science*, vol. 340, no. 6128, 2013, pp. 66-9, 5

- "We report a formerly unappreciated sensory modality in bumblebees (*Bombus terrestris*), detection of floral electric fields. Because floral electric fields can change within seconds, this sensory modality may facilitate rapid and dynamic communication between flowers and their pollinators."

Gegear, Robert J. et al. "Animal Cryptochromes Mediate Magnetoreception by an Unconventional Photochemical Mechanism."

(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2820607/>) *Nature*, vol. 463, no. 7282, 2010, pp. 804.

- "A team of neurobiologists that has investigated the mysteries of monarch migration for many years now reports that photoreceptor proteins found in monarch butterflies are linked to animal navigation. Their research finds that two types of photoreceptor proteins not only allow the butterflies to see UV light (light that is less than 420nm long, and thus, is invisible to humans), but also allows them to sense the Earth's geomagnetic field. These photoreceptor proteins are known as cryptochromes."

Oschman, James and Nora Oschman, "Electromagnetic communication and olfaction in insects."

(<https://www.thefreelibrary.com/Electromagnetic+communication+and+olfaction+in+insects.-a0163395921>) *Frontier Perspectives*, 2004.

"Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees." (http://www.moef.nic.in/downloads/public-information/final_mobile_towers_report.pdf) *Ministry of Environment and Forest*, Government of India, 2010.

- This report details the on impacts of communication towers on wildlife including birds and bees submitted to MoEF. It warns of harmful radiation and recommends special laws to protect urban flora & fauna from threats radiation emerging from mobile towers.

Sivani, S., and D. Sudarsanam, "Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem – A Review." (http://www.biolmedonline.com/Articles/Vol4_4_2012/Vol4_4_202-216_BM-8.pdf) *Biology and Medicine*, vol. 4, no. 4, 2012, pp. 202–16.

- There is an urgent need for further research and "of the 919 research papers collected on birds, bees, plants, other animals, and humans, 593 showed impacts, 180 showed no impacts, and 196 were inconclusive studies".
- "One can take the precautionary principle approach and reduce RF-EMF radiation effects of cell phone towers by relocating towers away from densely populated areas, increasing height of towers or changing the direction of the antenna."

Arno Thielens, Duncan Bell, David B. Mortimore, Mark K. Greco, Luc Martens & Wout Joseph, Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120GHz, (<https://www.nature.com/articles/s41598-018-22271-3>) Scientific Reports volume 8, Article number: 3924 (2018)

- Insects are continually exposed to Radio-Frequency (RF) electromagnetic fields at different frequencies. The range of frequencies used for wireless telecommunication systems will increase in the near future from below 6GHz (2G, 3G, 4G, and WiFi) to frequencies up to 120GHz (5G). This paper is the first to report the absorbed RF electromagnetic power in four different types of insects as a function of frequency from 2GHz to 120GHz. A set of insect models was obtained using novel Micro-CT (computer tomography) imaging.
- These models were used for the first time in finite-difference time-domain electromagnetic simulations.
- All insects showed a dependence of the absorbed power on the frequency. All insects showed a general increase in absorbed RF power at and above 6GHz, in comparison to the absorbed RF power below 6GHz. Our simulations showed that a shift of 10% of the incident power density to frequencies above 6GHz would lead to an increase in absorbed power between 3–370%.

Schwarze, S., et al. "Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird (*Erithacus rubecula*) than Strong Narrow-Band Fields." (<http://bit.ly/1YfgUXy>) *Front Behav Neurosci.*, vol. 10, no. 55, 2016.

- Magnetic compass orientation in night-migratory songbirds is embedded in the visual system and seems to be based on a light-dependent radical pair mechanism. Recent findings suggest that both broadband electromagnetic fields ranging from ~2 kHz to ~9 MHz and narrow-band fields at the so-called Larmor frequency for a free electron in the Earth's magnetic field can disrupt this mechanism. However, due to local magnetic fields generated by nuclear spins, effects specific to the Larmor frequency are difficult to understand considering that the primary sensory molecule should be organic and probably a protein. We therefore constructed a purpose-built laboratory and tested the orientation capabilities of European robins in an electromagnetically silent environment, under the specific influence of four different oscillating narrow-band electromagnetic fields, at the Larmor frequency, double the Larmor frequency, 1,315 MHz or 50 Hz, and in the presence of broadband electromagnetic noise covering the range from ~2 kHz to ~9 MHz. Our results indicated that the magnetic compass orientation of European robins could not be disrupted by any of the relatively strong narrow-band electromagnetic fields employed here, but that the weak broadband field very efficiently disrupted their orientation.

Engels, S. et al. "Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird." (<http://www.ncbi.nlm.nih.gov/pubmed/24805233?dopt=Abstract&holding=npq>) *Nature*, vol. 509, 2014, pp. 353–6.

- Scientists found that migrating robins became disorientated when exposed to electromagnetic fields at levels far lower than the safety threshold for humans. "Here we show that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise... These fully double-blinded tests document a reproducible effect of anthropogenic electromagnetic noise on the behavior of an intact vertebrate."

Balmori A. "Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork (*Ciconia ciconia*)."
(<http://www.emf-portal.org/viewer.php?aid=13468&l=e>) *Electromagn Biol Med*, vol. 24, no. 2, 2005, pp. 109-19.

- Interesting behavioral observations of the white stork nesting sites located within 100m of one or several cell site antennas were carried out. These results are compatible with the possibility that microwaves are interfering with the reproduction of white storks and would corroborate the results of laboratory research by other authors. In far away areas, where the radiation decreases progressively, the chronic exposure can also have long term effects. Effects from antennas on the habitat of birds are difficult to quantify, but they can cause a serious deterioration, generating silent areas without male singers or reproductive couples.

Kavokin, K., et al. "Magnetic orientation of garden warblers (*Sylvia borin*) under 1.4 MHz radiofrequency magnetic field." (<http://www.ncbi.nlm.nih.gov/pubmed/24942848?dopt=Abstract>) *Journal of the Royal Society, Interface*, vol. 11, no. 97, 2014.

- "Birds in experimental cages, deprived of visual information, showed the seasonally appropriate direction of intended flight with respect to the magnetic meridian. Weak radiofrequency (RF) magnetic field (190 nT at 1.4 MHz) disrupted this orientation ability."
- "These results may be considered as an independent replication of earlier experiments, performed by the group of R. and W. Wiltschko with European robins (*Erithacus rubecula*). Confirmed outstanding sensitivity of the birds' magnetic compass to RF fields in the lower megahertz range demands for a revision of one of the mainstream theories of magnetoreception, the radical-pair model of birds' magnetic compass."
- "As discussed above, the high sensitivity of the birds' magnetic compass to RF fields, found in [21,22,24] and now confirmed by us, is difficult to explain within the existing radical-pair theory ..."

Cammaerts, M.C. and Johansson, O. "Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some wireless apparatus," (<http://www.ncbi.nlm.nih.gov/pubmed/23977878>) *Electromagnetic Biology and Medicine*, vol. 33, no. 4, 2014, pp. 282-8,

- "the linear and angular speed of ants are immediately altered by the presence of EMF/RF fields. Based on these results, the authors advise users to deactivate the WiFi function of their PC/laptop."

Margaritis, L.H., et al. "Drosophila oogenesis as a biomarker responding to EMF sources."

(<https://www.ncbi.nlm.nih.gov/pubmed/23915130>) *Electromagnetic Biology and Medicine*, vol. 33, no. 3, 2014, pp. 165-89.

- A total of 280 different experiments were performed. Exposure to wireless devices such as WiFi, baby monitors, and phones created statistically significant effects regarding reproduction and cell death apoptosis induction, even at very low intensity levels (0.3 V/m bluetooth radiation), well below ICNIRP's guidelines.

Balmori, A. "Mobile phone mast effects on common frog (*Rana temporaria*) tadpoles."

(<http://europepmc.org/abstract/MED/20560769/reload=0;jsessionid=jv2SP5fEalu2vDSfoszx,24>) *Electromagnetic Biology and Medicine*, vol. 29, no. 1-2, 2010, pp. 31-5.

- Eggs and tadpoles of the common frog were exposed to electromagnetic radiation from cell phone antennas for two months, from the egg phase until an advanced phase of tadpole prior to metamorphosis. Results indicate that radiation emitted by phone masts in a real situation may affect the frogs development and may cause an increase in mortality of exposed tadpoles. "This research may have huge implications for the natural world, which is now exposed to high microwave radiation levels from a multitude of phone masts."

Plants And Trees

Halgamuge, M.N. "Weak radiofrequency radiation exposure from mobile phone radiation on plants,"

(<http://www.ncbi.nlm.nih.gov/pubmed/27650031?dopt=Abstract>) *Electromagnetic Biology and Medicine*, vol. 36, no. 2, 2017, pp. 213-235.

- "Our analysis demonstrates that the data from a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects (89.9%, $p < 0.001$). Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that plants seem to be more responsive to certain frequencies..."

Waldmann-Selsam, C., et al. "Radiofrequency radiation injures trees around mobile phone base stations,"

(<https://www.ncbi.nlm.nih.gov/pubmed/27552133?dopt=Abstract>) *Science of the Total Environment*, vol. 572, 2016, pp. 554-69.

Gustavino, B., et al. "Exposure to 915 MHz radiation induces micronuclei in *Vicia faba* root tips." (<http://1.usa.gov/1OQ4P8N>) *Mutagenesis*, vol. 31, no. 2, 2016, pp. 187-92.

- The increasing use of mobile phones and wireless networks raised a great debate about the real carcinogenic potential of radiofrequency-electromagnetic field (RF-EMF) exposure associated with these devices. Conflicting results are reported by the great majority of *in vivo* and *in vitro* studies on the capability of RF-EMF exposure to induce DNA damage and mutations in mammalian systems. Aimed at understanding whether less ambiguous responses to RF-EMF exposure might be evidenced in plant systems with respect to mammalian ones, in the present work the mutagenic effect of RF-EMF has been studied through the micronucleus (MN) test in secondary roots of *Vicia faba* seedlings exposed to mobile phone transmission in controlled conditions, inside a transverse electromagnetic (TEM) cell.
- Exposure of roots was carried out for 72h using a continuous wave (CW) of 915 MHz radiation at three values of equivalent plane wave power densities (23, 35 and 46W/m²). The specific absorption rate (SAR) was measured with a calorimetric method and the corresponding values were found to fall in the range of 0.4-1.5W/kg.
- Results of three independent experiments show the induction of a significant increase of MN frequency after exposure, ranging from a 2.3-fold increase above the sham value, at the lowest SAR level, up to a 7-fold increase at the highest SAR. These findings are in agreement with the limited number of data on cytogenetic effects detected in other plant systems exposed to mobile phone RF-EMF frequencies and clearly show the capability of radiofrequency exposure to induce DNA damage in this eukaryotic cell system.
- It is worth noticing that this range of SAR values is well below the international limits for localised exposure (head, trunk), according to the ICNIRP guidelines (35) and IEEE std C95.1 (38), which are 10 (8.0) W/kg for occupational exposure and 2.0 (1.6) W/kg for general public exposure respectively.

Halgamuge, Malka N., See Kye Yak and Jacob L. Eberhardt. "Reduced growth of soybean seedlings after exposure to weak microwave radiation from GSM 900 mobile phone and base station."

(<http://onlinelibrary.wiley.com/doi/10.1002/BEM.21890/abstract>) *Bioelectromagnetics*, vol. 36, no. 2, 2015, pp. 87-95.

- The aim of this work was to study possible effects of environmental radiation pollution on plants. The association between cellular telephone (short duration, higher amplitude) and base station (long duration, very low amplitude) radiation exposure and the growth rate of soybean (*Glycine max*) seedlings was investigated.
- The exposure to higher amplitude (41 V m⁻¹) GSM radiation resulted in diminished outgrowth of the epicotyl. The exposure to lower amplitude (5.7 V m⁻¹) GSM radiation did not influence outgrowth of epicotyl, hypocotyls, or roots. The exposure to higher amplitude CW radiation resulted in reduced outgrowth of the roots whereas lower CW exposure resulted in a reduced outgrowth of the hypocotyl. Soybean seedlings were also exposed for 5 days to an extremely low level of radiation (GSM 900 MHz, 0.56 V m⁻¹) and outgrowth was studied 2 days later. Growth of epicotyl and hypocotyl was found to be reduced, whereas the outgrowth of roots was stimulated.
- Our findings indicate that the observed effects were significantly dependent on field strength as well as amplitude modulation of the applied field.

Senavirathna, M.D., et al. "Nanometer-scale elongation rate fluctuations in the *Myriophyllum aquaticum* (Parrot feather) stem were altered by radio-frequency electromagnetic radiation," (<http://www.ncbi.nlm.nih.gov/pubmed/24670369>) *Plant Signal Behav*, vol. 9, no. 3, 2014.

- Statistically significant changes to this plant from a non thermal effect.

Soran, M.L., et al. "Influence of microwave frequency electromagnetic radiation on terpene emission and content in aromatic plants." (<https://www.ncbi.nlm.nih.gov/pubmed/25050479>) *Journal of Plant Physiology*, vol. 171, no. 15, 2014, pp. 1436-43.

- Microwave irradiation resulted in thinner cell walls, smaller chloroplasts and mitochondria, and enhanced emissions of volatile compounds, in particular, monoterpenes and green leaf volatiles (GLV). These data collectively demonstrate that human-generated microwave pollution can potentially constitute a stress to the plants.
- The above is only a small sampling of the research showing biological effects at non thermal levels on living organisms.

Haggerty, Katie. "Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings."

(<https://www.hindawi.com/journals/ijfr/2010/836278/>) *International Journal of Forestry Research*, vol 2010, no. 836278, 2010.

- "This study suggests that the RF background may have strong adverse effects on growth rate and fall anthocyanin production in aspen, and may be an underlying factor in aspen decline."

Additional References:

Effects of EMFs on other animals:

Ernst D.A. and K.J. Lohmann. "Effect of magnetic pulses on Caribbean spiny lobsters: implications for magnetoreception."

(<http://www.ncbi.nlm.nih.gov/pubmed/27045095?dopt=Abstract>). *Journal of Experimental Biology*, vol. 219, pt. 12, pp. 1827-32. 2016

- The Caribbean spiny lobster, *Panulirus argus*, is a migratory crustacean that uses Earth's magnetic field as a navigational cue, but how lobsters detect magnetic fields is not known. Magnetic material thought to be magnetite has previously been detected in spiny lobsters, but its role in magnetoreception, if any, remains unclear. As a first step toward investigating whether lobsters might have magnetite-based magnetoreceptors, we subjected lobsters to strong, pulsed magnetic fields capable of reversing the magnetic dipole moment of biogenic magnetite crystals. Lobsters were subjected to a single pulse directed from posterior to anterior and either: (1) parallel to the horizontal component of the geomagnetic field (i.e., toward magnetic north); or (2) antiparallel to the horizontal field (i.e., toward magnetic south). An additional control group was handled but not subjected to a magnetic pulse. After treatment, each lobster was tethered in a water-filled arena located within 200 m of the capture location and allowed to walk in any direction. Control lobsters walked in seemingly random directions and were not significantly oriented as a group. In contrast, the two groups exposed to pulsed fields were significantly oriented in approximately opposite directions. Lobsters subjected to a magnetic pulse applied parallel to the geomagnetic horizontal component walked westward; those subjected to a pulse directed antiparallel to the geomagnetic horizontal component oriented approximately northeast. The finding that a magnetic pulse alters subsequent orientation behavior is consistent with the hypothesis that magnetoreception in spiny lobsters is based at least partly on magnetite-based magnetoreceptors.

Harkless, Ryan, Muntather Al-Quraishi and Mary C. Vagula. "Radiation hazards of radio frequency waves on the early embryonic development of Zebrafish." (<http://spie.org/Publications/Proceedings/Paper/10.1117/12.2053469>) *SPIE Proceedings*, vol. 9112, 2014.

- With the growing use of wireless devices in almost all day-to-day activities, exposure to radio-frequency radiation has become an

immediate health concern. It is imperative that the effects of such radiation not only on humans, but also on other organisms be well understood. In particular, it is critical to understand if RF radiation has any bearing on the gene expression during embryonic development, as this is a crucial and delicate phase for any organism. Owing to possible effects that RF radiation may have on gene expression, it is essential to explore the carcinogenic or teratogenic properties that it may show. This study observed the effects of RF radiation emitted from a cellular telephone on the embryonic development of zebrafish.

- This study observed the effects of RF radiation emitted from a cellular telephone on the embryonic development of zebra fish. The expression of the gene *shha* plays a key role in the early development of the fish. This gene has homologs in humans as well as in other model organisms. Additionally, several biomarkers indicative of cell stress were examined: including lactate dehydrogenase (LDH), superoxide dismutase (SOD), and lipid peroxidation (LPO).
- Results show a significant decrease in the expression of *shha*, a significant decrease in LDH activity. There was no significant increase in SOD and LPO activity.

Li, Ying, et al. "Extremely Low-Frequency Magnetic Fields Induce Developmental Toxicity and Apoptosis in Zebrafish (*Danio rerio*) Embryos." (<https://link.springer.com/article/10.1007/s12011-014-0130-5>) *Biological Trace Element Research*, vol. 162, no. 1, 2014, pp. 324-32.

- In conclusion, the overall results demonstrated that ELF-MF exposure has detrimental effects on the embryonic development of zebrafish by affecting the hatching, decreasing the heart rate, and inducing apoptosis, although such effects were not mortal threat. The results also indicate that zebrafish embryos can serve as a reliable model to investigate the biological effect of ELF-MF.

Takebe, Arika, et al. "Zebrafish respond to the geomagnetic field by bimodal and group-dependent orientation." (<http://www.nature.com/srep/2012/121011/srep00727/full/srep00727.html>), *Scientific Reports*, vol 2, no. 727, 2012.

- In this study, we found that zebrafish, a model organism suitable for genetic manipulation, responded to a magnetic field as weak as the geomagnetic field.

Magneto-reception in cows and other mammals:

Baker, R.R., J.G. Mather and J.H. Kennaugh. "Magnetic bones in human sinuses." (<https://www.ncbi.nlm.nih.gov/pubmed/6823284>) *Nature*, vol. 301, no. 5895, 1983, pp. 79-80.

- Evidence continues to accumulate that a wide range of organisms, from bacteria to vertebrates, can detect and orient to ambient magnetic fields (for examples see refs 2-4). Since the discovery that magnetic orientation by bacteria was due to the presence within the organism of magnetic particles of the ferric/ferrous oxide, magnetite, the search has begun for other biogenic deposits of inorganic magnetic material and ways in which the possession of such material might confer on the organism the ability to orient to ambient magnetic fields. Such magnetic material, often identified as magnetite, has been discovered in bees, homing pigeons, dolphins and various other organisms, including man. A variety of hypotheses for the use of magnetite in magnetic field detection have been proposed. We report here that bones from the region of the sphenoid/ethmoid sinus complex of humans are magnetic and contain deposits of ferric iron. The possible derivations and functions of these deposits are discussed.

Malkemper, E.P., et al. "Magnetoreception in the wood mouse (*Apodemus sylvaticus*): influence of weak frequency-modulated radio frequency fields." (<http://bit.ly/1zh1J91>) *Scientific Reports*, vol. 4, no. 9917, 2015.

- Wood mice exposed to a 0.9 to 5 MHz frequency sweep changed their preference from north-south to east-west. In contrast to birds, however, a constant frequency field tuned to the Larmor frequency (1.33 MHz) had no effect on mouse orientation. In sum, we demonstrated magnetoreception in wood mice and provide first evidence for a radical-pair mechanism in a mammal. Open Access Paper: <http://bit.ly/1zh1J91>
- In sum, we show that wood mice possess a magnetic sense that they use to position their nests along the NNE-SSW axis relative to the magnetic field. The NNE-SSW preference was not altered by RF fields delivered at the Larmor frequency, but was shifted by approximately 90° by a RF frequency sweep (0.9–5 MHz repeated at 1 kHz) at an intensity of only ~5% that of the Larmor frequency stimulus.
- The results point to the involvement of a radical pair mechanism, the first such evidence for a mammal, although further research is needed to provide a more thorough characterization of the underlying mechanism.
- The RF magnetic fields applied here have peak intensities below the ICNIRP guidelines for general public exposure (63, i.e., $B_{rms} = 0.92 \mu T/f$ [MHz], or $B_{peak} = 1.30 \mu T/f$ [MHz]) considered as harmless for human health. Yet, we show that they are sufficient to affect behaviour in a mammal.

Fedrowitz, Maren. "Cows: A big model for EMF research, somewhere between Vet-Journals and "Nature"." (<https://www.bems.org/node/14835>) *The Bioelectromagnetics Society*, 2014.

- Effects of electromagnetic fields (EMF) on cows have been frequently discussed in public media as well as in specialist journals and meetings with agricultural, veterinary or dairy backgrounds. Indeed, in view of the available literature, it does seem that cows show EMF susceptibilities and respond to environmental exposures of a broad range of frequencies and properties:
- Cows are sensitive to the Earth's magnetic field. Bovine magnetoreception can be influenced by external EMF, e.g. powerlines.
- Several physiological alterations in dairy cows exposed to extremely low frequency (ELF) EMF were reported without major indications for adverse health effects. Notably, the observed effects seem to be dependent on the magnetic field component or on combined electric and magnetic fields rather than on electric field exposure alone.
- Cows are sensitive to earth currents (stray voltage) associated with transients in particular harmonics. Milk production, health, and behavior seem to be negatively affected.
- Bovine responses to radiofrequency (RF) exposure include avoidance behavior, reduced ruminating time, and alterations in oxidative stress. These findings indicate possible adverse health effects. However, most of the studies have critical points (one-herd-case report, logistic problems in study design, lack of appropriate exposure assessment) that confirmation of the observed RF effects is clearly needed, though studies in such big animals are time-, place-, and money-consuming, and exposure assessment and dosimetry are challenging issues.
- Overall, cattle seem to be affected by environmental EMF exposure. Cows align to geomagnetic field lines and are influenced by ELF EMF

Slaby, P., K. Tomanova and M. Vacha, "Cattle on pastures do align along the North-South axis, but the alignment depends on herd density." (<http://www.ncbi.nlm.nih.gov/pubmed/23700176>) *J Comp Physiol A*, vol. 199, 2013, pp. 695-701.

Hart, V., et al. "Dogs are sensitive to small variations of the Earth's magnetic field." (<https://frontiersinzoology.biomedcentral.com/articles/10.1186/1742-9994-10-80>) *Frontiers Zoology*, vol. 10, no. 80, 2013.

Eder, S.H.K., et al. "Magnetic characterization of isolated candidate vertebrate magnetoreceptor cells." (<http://www.pnas.org/content/109/30/12022.abstract>) *PNAS*, vol. 109, 2012, pp. 12022-7.

Cervený, J., et al. "Directional preference max enhance hunting accuracy in foraging foxes." *Biol Lett*, vol. 7, 2011, pp. 355-7.

Hert, J., et al. "No alignment of cattle along geomagnetic field lines found." (<http://link.springer.com/article/10.1007/s00359-011-0628-7>) *J Comp Physiol A*, vol. 197, 2011, pp. 677-82.

Begall, S., et al. "Further support for the alignment of cattle along field lines: reply to Hert et al." *J Comp Physiol A*, vol. 197, 2011, pp. 1127-33.

Cressey, D. "The mystery of the magnetic cows." (<http://www.nature.com/news/the-mystery-of-the-magnetic-cows-1.9350>) *Nature News*, 2011

Burda, H., et al. "Extremely low-frequency electromagnetic fields disrupt magnetic alignment of ruminants." (<http://www.pnas.org/content/106/14/5708.abstract>) *PNAS*, vol. 106, 2009, pp. 5708-13.

Cressey, D. "Return of the B-field bovines." (http://blogs.nature.com/news/2009/03/return_of_the_bfield_bovines.html) *Nature News Blog*, 2009

Cressey, D. "Magnetic cows are visible from space." (<http://www.nature.com/news/2008/080825/full/news.2008.1059.html>) *Nature News*, 2008

Begall, S., et al. "Magnetic alignment in grazing and resting cattle and deer." (<http://www.pnas.org/content/105/36/13451.abstract>) *PNAS*, vol. 105, 2008, pp. 13451-5.

Effects of ELF electric and magnetic fields in (dairy) cows:

Stelletta, C., et al. "Effects of exposure to extremely low frequency electro-magnetic fields on circadian rhythms and distribution of some leukocyte differentiation antigens in dairy cows." (<https://www.ncbi.nlm.nih.gov/pubmed/17624193>) *Biomed Environ Sci*, vol. 20, no. 2, 2007, pp. 164-70.

Burchard, J.F., D.H. Nguyen and H.G. Monardes. "Exposure of pregnant dairy heifer to magnetic fields at 60 Hz and 30 μ T." (<http://onlinelibrary.wiley.com/doi/10.1002/bem.20325/abstract>) *Bioelectromagnetics*, vol. 28, no. 6, 2007, pp. 471-6.

Burchard, J.F., D.H. Nguyen and M. Rodriguez. "Plasma concentrations of thyroxine in dairy cows exposed to 60 Hz electric and magnetic fields." (<https://www.ncbi.nlm.nih.gov/pubmed/16724328>) *Bioelectromagnetics*, vol. 27, 2006, pp. 553-9.

Nguyen, D.H., L. Richard and J.F. Burchard. "Exposure chamber for determining the biological effects of electric and magnetic fields on dairy cows." (<http://onlinelibrary.wiley.com/doi/10.1002/bem.20084/abstract>) *Bioelectromagnetics*, vol. 26, no. 2, 2005, pp. 138-44.

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Burchard, J.F., et al. "Lack of effect of 10 kV/m 60 Hz electric field exposure on pregnant heifer hormones." (<https://www.ncbi.nlm.nih.gov/pubmed/15114640>) *Bioelectromagnetics*, vol. 25, no. 4, 2004, pp. 308-12.

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EMF Safety Network

We envision a world free of EMF pollution where children, communities, and nature thrive! Our mission is to educate and empower people by providing science and solutions to reduce EMFs to improve lives, achieve public policy change, and obtain environmental justice.



US Department of the Interior warns: communication towers threaten birds

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In a
letter

regarding a new nationwide wi-fi deployment (called *FirstNet), the US Department of the Interior states the wireless proposal threatens birds, and is not consistent with current information and laws that protect birds. They called for an environmental review.



with towers.



Two hundred forty one bird species are at mortality risk from both tower collisions and from exposure to the radiation towers emit. This includes birds that are endangered or threatened, Birds of Conservation Concern, migratory birds, and eagles. They estimate up to 6.8 million bird deaths a year may result from collisions

Studies of radiation impacts on wild birds documented nest abandonment, plumage deterioration and death. Birds studied included House Sparrows, White Storks, Collared Doves, and other species. Studies in laboratories of chick embryos documented heart attacks and death.

In their letter, The Dept of the Interior criticizes the FCC's radiation safety guidelines stating, "*the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.*"

For more information see Dept of Interior letter and background:
http://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf



*In 2010 President Obama called for a new nationwide wireless network. FirstNet is that broadband initiative. See [background proposal](#) and [More info on FirstNet](#).

"The world is going wireless and we must not fall behind." President Barack Obama

See this website for a compilation of studies on effects on wildlife
<http://www.emfresearch.com/emf-wildlife/>

📅 April 1, 2014 👤 admin 📁 Birds, Environment, FCC, Government, Resources, wildlife 🔌 cell towers, Nature

18 thoughts on "US Department of the Interior warns: communication towers threaten birds"



Jen

April 2, 2014 at 3:04 pm

I began to notice in 2009 that the songbirds I fed were no longer coming to my yard. Only the larger birds like robins frequented and they too were fewer in number. Now I know that beginning 2009 and on our city has been installing new cell towers, antennas, power line communication, and high frequency antennas and cameras on every street light.



Joel

April 2, 2014 at 5:11 pm

So after the birds are gone should we have our cell phones sing to us? Let's play smart and take care of our birds. Thanks, Joel

Marsha

April 2, 2014 at 6:18 pm

The standards must be changed!!! They are based on thermal heating alone, and not biological responses. Communication companies are hiding behind the "contrived ignorance" of these outdated and inappropriate standards to quite literally get away with murder not only of birds, but humans are also sensitive to electromagnetic radiation. Thousands of biological studies exist showing health effects of animals and humans. Not only communication companies are adding to the problem, but power companies are also adding to the electrosmog with smart meters on your home that broadcast 24/7. So if you value birds, and your own health let's get rid of the electrosmog!

admin 🧑

April 3, 2014 at 10:54 am

YES! We need to take steps to decommission towers, restore the analog meters, and help people recognize the need to use wired and corded connections, and unplug the wireless. President Obama must wake up to the need to use wired internet and stop glorifying wireless.

Pingback: [cell towers threatening bird life - WeeksMD | WeeksMD](#)

Pingback: [U.S. Interior Dept Says Cell Tower Emissions Could Impact Birds – Calls for Environmental Review](#)

Pingback: [Recent Energy And Environmental News – April 14th 2014 | PA](#)

Pingback: Departamento do Interior norte americano adverte: Torres de celular matam as aves. | Poluição Eletromagnética



Natsu Sen

May 9, 2014 at 1:19 am

People are now linking everything that's going wrong with cell towers and cell phones! This is absurd! Cell towers are NOT harmful to human health, many experts from WHO themselves have said this! Also, the state of Kerala in India tested its cell towers and gave a clean chit to them, this must mean something!

Read the article: <http://t.co/7pJuQoxD6t>



admin

May 9, 2014 at 7:11 am

The WHO classifies RF that cell towers and cell phones emit in the same category as DDT, lead and asbestos- as a possible carcinogen. The safety guidelines are set very high, so most cell towers RF will fall under that, but that's no guarantee of safety, and there's no guidelines for children.



Ebenezer

December 2, 2015 at 3:11 pm

Natsu Sen is correct and the house sparrow scare in India was debunked, too:

<http://timesofindia.indiatimes.com/city/guwahati/Cellphone-tower-radiation-not-harming-house-sparrows/articleshow/15455914.cms>

and the W.H.O. report says coffee is just as dangerous as celltowers, BTW.

Look up 'w.h.o. 2B caffeine talcum'

 **Michelle**

March 1, 2016 at 8:36 am

LiFi is a long term solution....and free!

 **Johnnie Allred**

November 16, 2016 at 8:39 am

I live in a small town on the gulf of mexico. I can't find any sparrows anywhere in my area. I can't see nor hear any Mockingbirds singing or any other song bird. I very few birds coming to my 4 feeders. I don't see early morning flocks of anything really..some crows. I don't hear birds singing in the mornings. I see few Cardinals. I've heard a Blue Jay but I haven't actually seen it. All of these birds use to be in my back yard and they've all but disappeared. I counted the birds coming to my feeders this morning from 7am-8am. I counted 14 birds. A few years ago there would have been so many back there you couldn't keep count. I don't see birds in the parking lots anymore hunting bugs on vehicles. I don't see the sparrows getting a drink from the vehicles AC drip line. Except for some crows and buzzards, I don't see birds sitting on the high-line wires. We have an issue that is being ignored.

 **Faith**

October 21, 2017 at 10:37 am

My birds have all left since installation of a "smart" meter — really, shouldn't it be more appropriately named. Several families of birds used to live in a flowering cherry outside my bedroom window and it was glorious in the morning to hear all the songs/activity. It's dead quiet and the seed in my feeders has been abandoned. I'm heartsick and grieving for the beauty and simplicity which is no longer valued or nurtured in this world.

Pingback: Two Headed Snake: A Double-Sided American Crisis – Taiga Quarto



Clint

June 16, 2018 at 7:00 pm

A cell tower was built near our house a few years ago. My wife can hear sounds coming from the tower that no one else can hear. She sometimes walks the floor and cries because the 'noise' she hears is so intense and irritating. She also can feel a magnetic field around our house. Usually bumble bees are all over my front porch but this year most only crawled out their wooden den and died. I haven't even seen a honeybee this year and only a few butterflies. The house wrens, usually in good numbers, have disappeared.

A cardinal nest in our front yard rose bush was the place of birth of three baby birds. They died in the nest when about half grown. I had to take down the bird feeder because it had so few visitors. Migratory cranes have circled the tower and appeared to be confused until they got away from the vicinity of the tower, then they resumed their normal flight pattern.

I have contacted the FCC and EPA about the issue and so far they haven't done anything.

Pingback: Giraffes , Birds , Bees & Agile Beams | cultocracy



Ed

November 26, 2018 at 5:17 am

Since installing HughesNet 2G and 5G in my home a few months ago all my backyard birds have disappeared. I even put in new feeder's and fresh food and it rots in the feeders.

That area is 30 or 40 feet from the Wi-Fi router and so you would think that distance would be sufficient due to the radiation fall off by the square of the distance. Obviously the birds do not like this form of radiation and are staying

away. What to say about the router being only 8 feet from my couch. – very worried!

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Bird Observations

▼ **Date Range:** [Change Date](#)
Jan-Dec, 1900-2019

[Change Location](#) **Lake**

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309 species (+47 other taxa)

[Emperor Goose](#)

[Snow Goose](#)

[Ross's Goose](#)


Snow/Ross's Goose



Graylag Goose (Domestic type)


[Greater White-fronted Goose](#)

[Brant](#)

[Cackling Goose](#)

[Canada Goose](#)


goose sp.


[Tundra Swan](#)


Muscovy Duck (Domestic type)


[Wood Duck](#)

[Garganey](#)

[Blue-winged Teal](#)


Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

[Cinnamon Teal](#)


Blue-winged/Cinnamon Teal


[Northern Shoveler](#)

[Gadwall](#)

[Eurasian Wigeon](#)

[American Wigeon](#)


Mallard			
Mallard (Domestic type)			
Northern Pintail			
Green-winged Teal			
teal sp.			
Canvasback			
Redhead			
Ring-necked Duck			
Tufted Duck			

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Greater Scaup														
Lesser Scaup														
Greater/Lesser Scaup														
Tufted Duck x scaup sp. (hybrid)														
Aythya sp.														
Surf Scoter														
scoter sp.														
Long-tailed Duck														
Bufflehead														
Common Goldeneye														
Barrow's Goldeneye														
Common/Barrow's Goldeneye														
Hooded Merganser														
Common Merganser														
Red-breasted Merganser														

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ruddy Duck														
duck sp.														
Mountain Quail														
California Quail														
Ring-necked Pheasant														
Sooty Grouse														
Wild Turkey														
Pied-billed Grebe														
Horned Grebe														

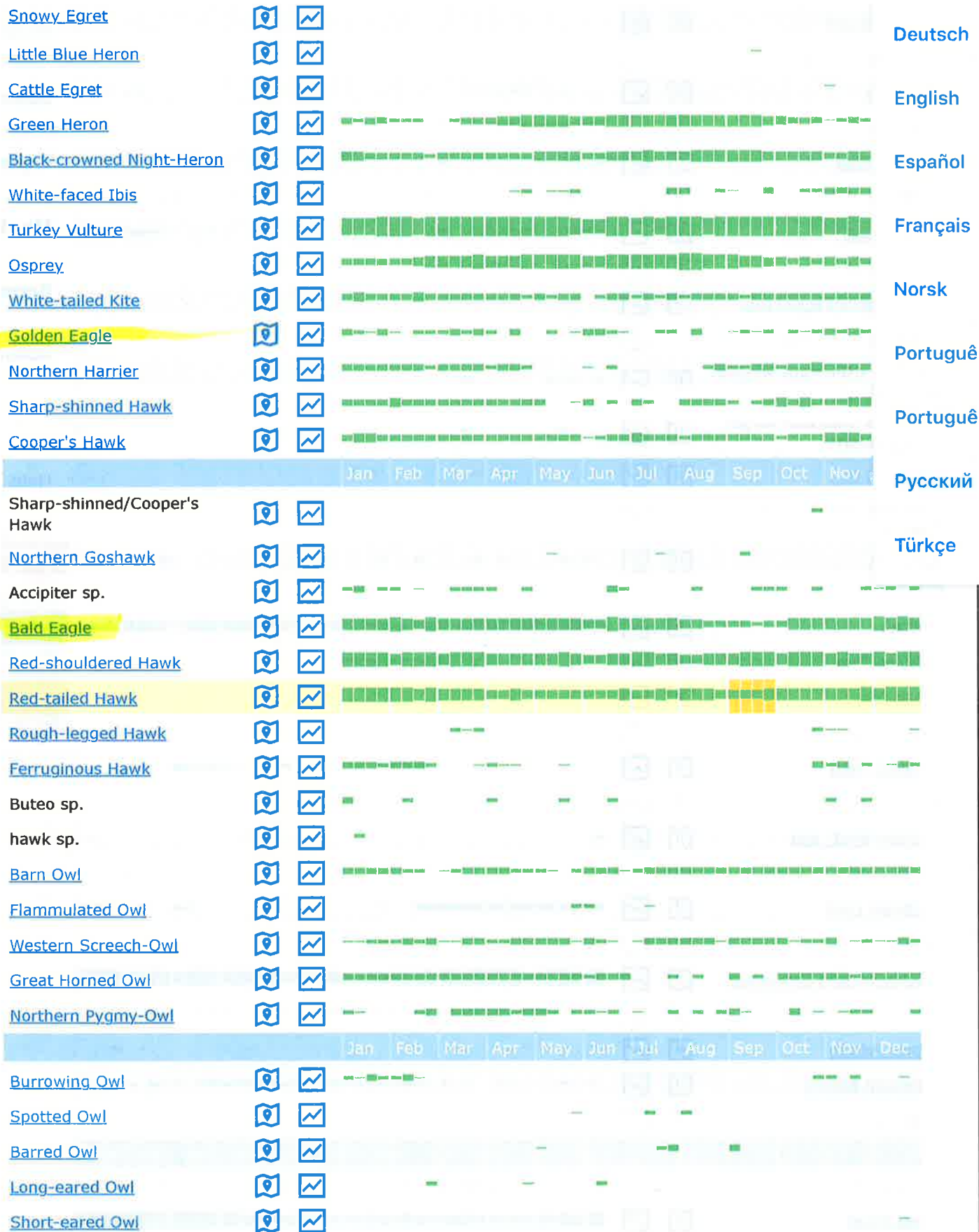






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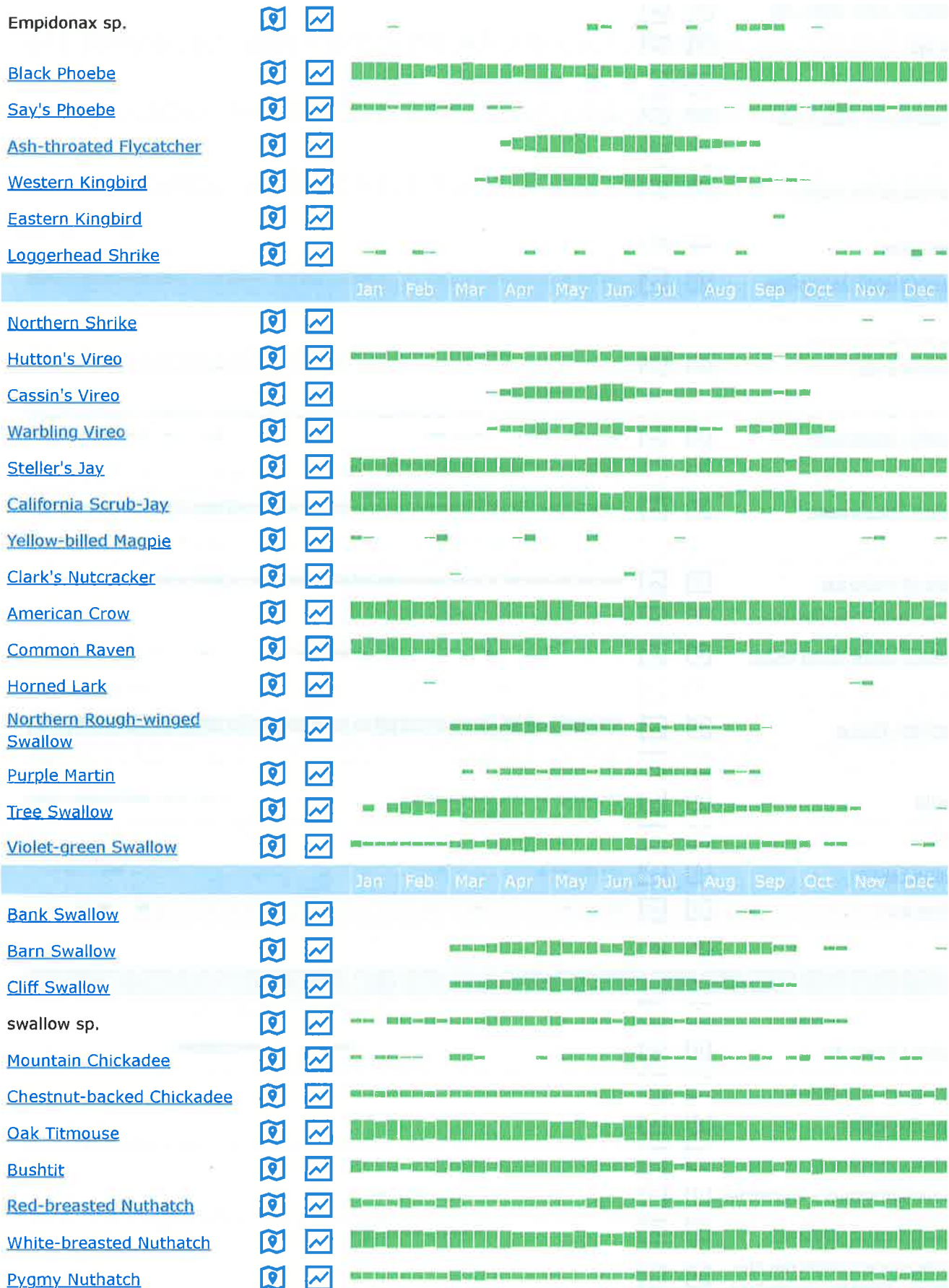
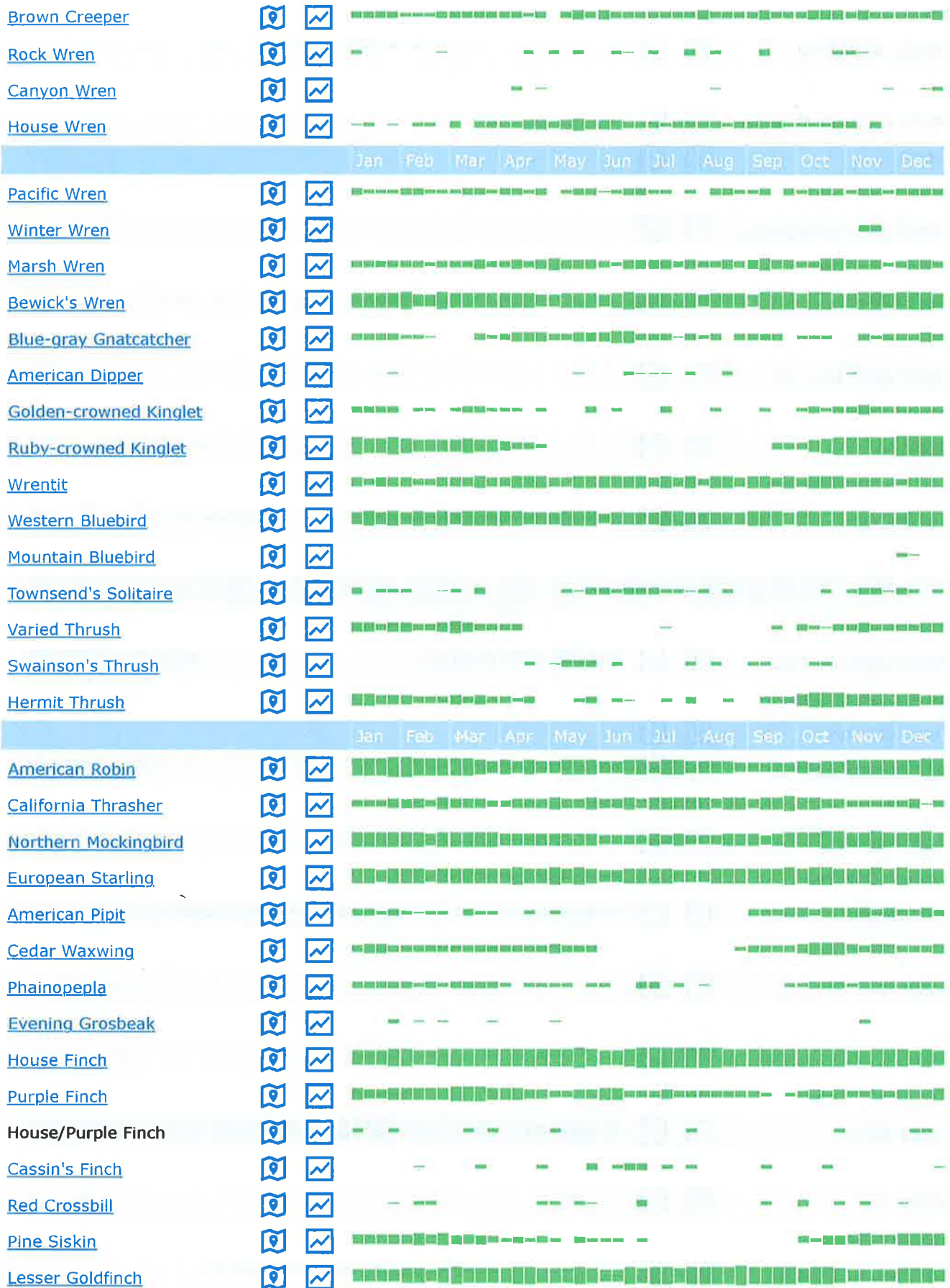


Exhibit D Public Input 4





Western Meadowlark			
Hooded Oriole			
Bullock's Oriole			
Red-winged Blackbird			
Tricolored Blackbird			
Red-winged/Tricolored Blackbird			
Brown-headed Cowbird			
Rusty Blackbird			
Brewer's Blackbird			
Great-tailed Grackle			
blackbird sp.			
Northern Waterthrush			

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Black-and-white Warbler														
Tennessee Warbler														
Orange-crowned Warbler														
Nashville Warbler														
MacGillivray's Warbler														
Common Yellowthroat														
American Redstart														
Northern Parula														
Magnolia Warbler														
Yellow Warbler														
Chestnut-sided Warbler														
Blackpoll Warbler														
Black-throated Blue Warbler														
Palm Warbler														
Yellow-rumped Warbler														

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Black-throated Gray Warbler														
Townsend's Warbler														
Hermit Warbler														
Wilson's Warbler														
Western Tanager														
Black-headed Grosbeak														

[Blue Grosbeak](#)



[Lazuli Bunting](#)



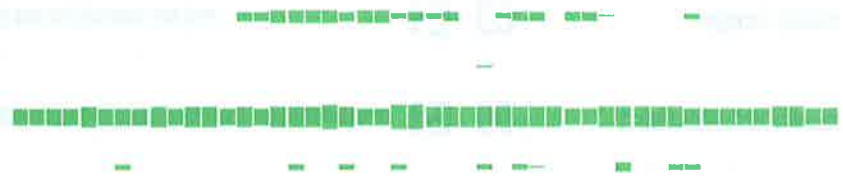
[Indigo Bunting](#)



[House Sparrow](#)



passerine sp.



KEY: | = insufficient data |  = rare to widespread

[Download Histogram Data](#)



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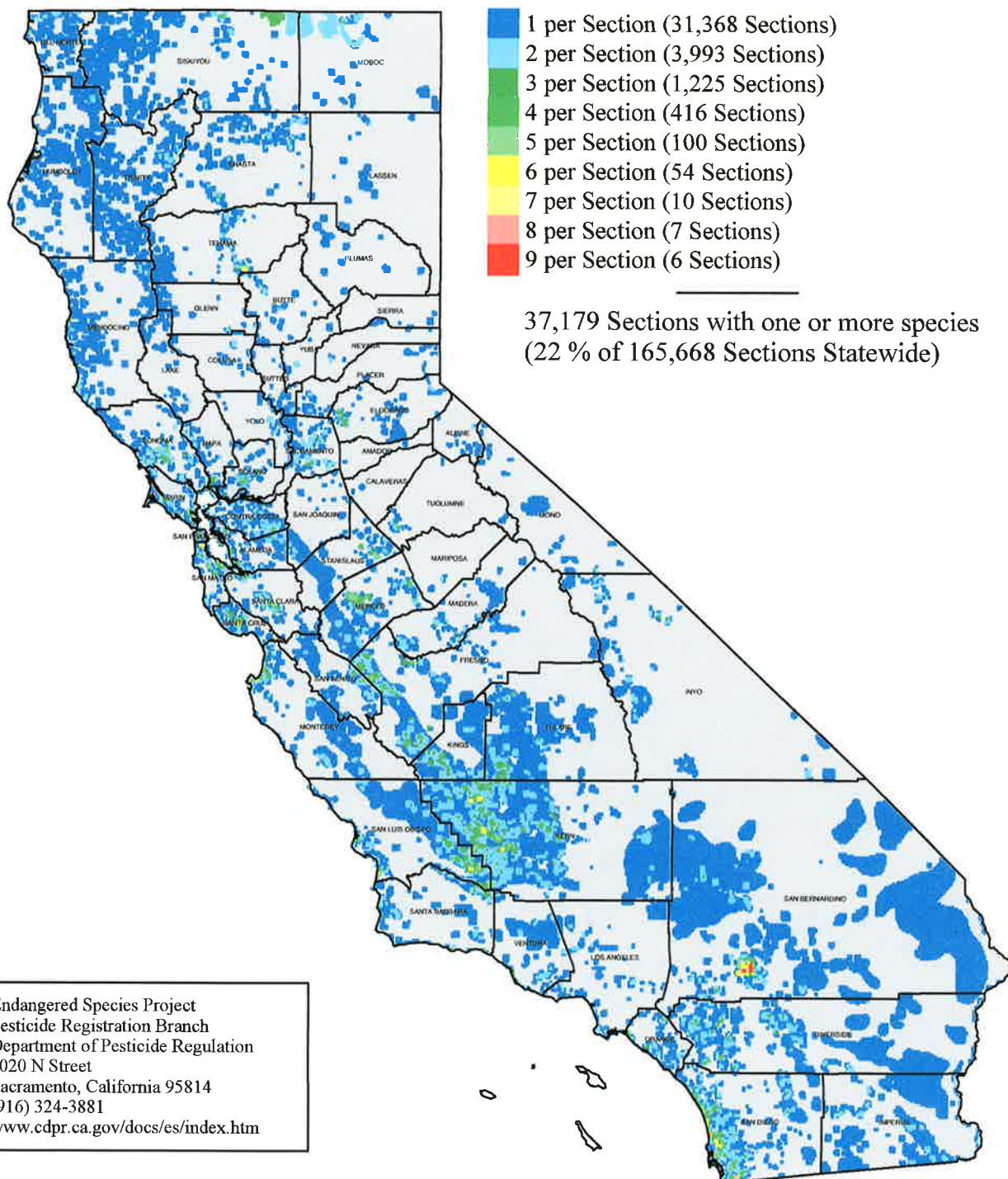
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Federally Listed Species in California

Number of Species* per Section



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Department of Pesticide Regulation
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www.cdpr.ca.gov/docs/es/index.htm

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Threatened and Endangered Mammals

Species Accounts

The list below provides access to species accounts for 31 species and subspecies of mammals listed as either threatened or endangered by the State of California or the federal government. This list is in alphabetical order, by the general name of the animal (for example: fox, rat, whale, etc.).

Each species account contains the latest status report from the Department of Fish and Wildlife's periodic report on the status of these species. Each account also may contain links to additional, available status or life history information.

The list and the accompanying species accounts may not be complete or reflect the current legal status of these mammals because of listing activities more recent than the status accounts in the links below. The current legal status for each species [is provided online \(PDF\)](#) and is updated quarterly.

For more information on the species listed below, use the CDFW's [Species Explorer](#). Please note, the Species Explorer is still being worked on. Not all species might appear in the database.

Common Name	Scientific Name
beaver, Point Arena mountain	<i>(Aplodontia rufa nigra)</i>
fox, Sierra Nevada red	<i>(Vulpes vulpes necator)</i>
fox, San Joaquin kit	<i>(Vulpes macrotis mutica)</i>
fox, island	<i>(Urocyon littoralis)</i>
mouse, Pacific pocket	<i>(Perognathus longimembris pacificus)</i>
mouse, salt-marsh harvest	<i>(Reithrodontomys raviventris)</i>
otter, southern sea	<i>(Enhydra lutris nereis)</i>
rabbit, riparian brush	<i>(Sylvilagus bachmani riparius)</i>
rat, Fresno kangaroo	<i>(Dipodomys nitratoide exilis)</i>
rat, giant kangaroo	<i>(Dipodomys ingens)</i>
rat, Morro Bay kangaroo	<i>(Dipodomys heermanni morroensis)</i>
rat, San Bernardino kangaroo	<i>(Dipodomys merriami parvus)</i>
rat, Stephens' kangaroo	<i>(Dipodomys stephensi)</i>
rat, Tipton kangaroo	<i>(Dipodomys nitratoide nitratoide)</i>

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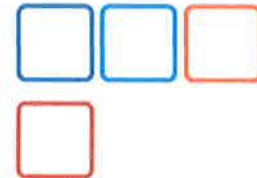
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Cellphone Towers EMR Damaging Biological Systems of Birds, Insects, Humans



BY ANTHONY GUCCIARDI

POSTED ON OCTOBER 25, 2011



The electromagnetic radiation (EMR) emitted from mobile towers is so powerful that it affects the biological systems of birds, insects, and even humans. The study, released by the environment ministry, called for the protection of flora and fauna by law.

"The review of existing literature shows that the EMRs are interfering with the biological systems in more ways than one and there had already been some warning bells sounded in the case on bees and birds, which probably heralds the seriousness of this issue and indicates the vulnerability of other species as well," the study found.

In September of 2010, the ministry established a 10-member committee under Bombay Natural History Society (BNHS) with director Asad Rahmani to study the impact of cellphone towers on birds and bees. The group of experts reviewed 919 studies performed in India and abroad regarding the effects of cellphone towers on birds, insects, animals, wildlife, and humans.

What the group found was quite startling.

Electromagnetic Radiation may Play a Role in the Decline of Animal and Insect Populations

Of the 919 studies, a staggering 593 showed the negative impact of mobile towers on birds, bees, humans, wildlife and plants. The experts even cited an international study that pinpointed cellphone towers as a potential cause in the decline of animal populations. They went on to say that there was an urgent need to focus more scientific attention on the subject before it was too late.

In addition to calling for a law protecting urban flora and fauna from emerging threats of electromagnetic radiation, the experts are also suggesting bold signs and messages on the dangers of cell phone tower and radiation to be posted near the position of cellphone towers.

“To prevent overlapping high radiations fields, new towers should not be permitted within a radius of one kilometre of existing towers. If new towers must be built, construct them to be above 80 feet and below 199 feet ... to avoid the requirement for aviation safety lighting,” it said.

The negative effects of EMR on life is something that has been ignored by health officials and legislators for years. As cellphone subscriptions outnumber the total number of US citizens <<http://naturalsociety.com/cellphone-subscriptions-outnumber-people-in-us-radiation-public-health/>>, more and more mobile phone towers are popping up around the globe. As the experts cautioned, it is extremely pertinent that further independent research is conducted to highlight the dangers of EMR.

Additional Sources:

POST WRITTEN BY

Anthony Gucciardi:

Anthony is a natural health and human empowerment writer, speaker, and entrepreneur whose writings have appeared in #1 USA Today and Wall Street Journal Best-Selling books and top 100 websites. After overcoming Lyme Disease and nerve-related facial paralysis, Anthony's work now reaches several million readers per month through his highly prolific group of social media pages and websites. Focused on self-development techniques and living a healthy lifestyle, Anthony currently sits on the Advisory Board to Natural Society in addition to managing and directing several other companies dedicated to enhancing social good. Anthony's work routinely appears on both alternative and established websites and television programs alike, including Drudge Report, Thom Hartmann, Simple Reminders, RT, Infowars, Michael Savage, Gaiam TV, and many others.



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Cell phone towers may be ultimate cause of bee collapse



Monday, May 16, 2011

by [Mike Adams](#), the Health Ranger

Editor of [NaturalNews.com](#) ([See all articles...](#))

Tags: [honeybees](#), [population collapse](#), [health news](#)



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(NaturalNews) It's one of the signs of the approaching **food collapse** our world will soon be facing: Honeybees are disappearing at a truly alarming rate all around the world. Up to 30 percent of the honeybee population is collapsing in North America every year, and there's no end in sight to "the silence of the bees."

Honeybees, of course, pollinate about a third of all the food consumed by first-world nations. Without them, the global food supply crashes and food prices skyrocket. The human population, not surprisingly, would plummet. Honeybees are absolutely crucial to the chain of life on planet Earth, and they are dying in record numbers.

Efforts to understand the cause of the honeybee population collapse (sometimes called "Colony Collapse Disorder") have so far pointed to **pesticides**, **air pollution** and even GMOs. All of those are no doubt important factors, but new research carried out at the *Swiss Federal Institute of Technology* may have unveiled the real key: **Cell phone signals**.

How cell towers cause honeybee hives to collapse

Researcher Daniel Favre and his colleagues performed **83 experiment** recording the reaction of honeybees to cell phones in their off state, standby state or active talking state. It turns out that when cell phones are in their "active" state (sending or receiving signals), honeybees are strongly disoriented and suffer from widespread miscommunication that causes them to stop seeking out food and begin swarming.

Specifically, their "worker piping" activity increases by **1000 percent** (ten times). This was determined with a detailed scientific approach that's outlined in his paper:

<http://www.kokopelli.asso.fr/documentation/f...>

As Favre explains in his paper, entitled "Mobile phone-induced honeybee worker piping:"

*Worker piping in a bee colony is not frequent, and when it occurs in a colony, that is not in a swarming process, no more than two **bees** are simultaneously active. The induction of honeybee worker piping by the electromagnetic fields of mobile phones might have dramatic consequences in terms of colony losses due to unexpected swarming.*

Favre went on to tell Fast Company: (<http://www.fastcompany.com/1752894/are-cell-...>)

"Among other factors such as the varroa mite and pesticides, signals from mobile phones and masts could be contributing to the decline of honeybees around the world. I am calling the international scientific community for more research in this field."

Of course, by the time additional studies are done, it may simply be too late. If the honeybee population collapse continues for just a few more years, pollination of the global food supply may become nearly impossible. That will lead to the great die-off of human beings.

Funny how that works, isn't it? Imagine the narrative of future historians: Humans multiplied and expanded their cell phone towers to the point where the pollinators all died. Then human civilization collapsed and the cell towers went silent. Within a decade, the honeybees were once again prolific and healthy...

Honeybees don't need humans, you see. But we need them.

The arrogance of science and technology

In Rome, the scientists manufactured the municipal water delivery canals and pipes out of lead, thereby causing the widespread lead poisoning of the population without even knowing it. Science and technology has always come with a heavy dose of arrogance and willful ignorance. Today, the pesticide chemical companies keep producing toxics that poison our planet, and they keep doing it in the name of "scientific agriculture."

See my related documentary - The God Within - to understand just how dark and deep this abandonment of life by the scientific community reality goes:

<http://naturalnews.tv/v.asp?v=E3B38227225F9F...>

Whether it's pesticides, cell towers, GMOs or some other technology, scientists always insist their technologies are harmless to the natural world, even while the **sixth great extinction** is now under way on planet Earth. But no one can deny that the collapse of

the honeybees is indeed taking place, and the beauty of Mother Nature is that when so-called "scientific advancements" get completely out of balance with the natural world and actually become a *threat* to life on Earth, the world has a way of keeping the expansion of the human race in check. It's called **population collapse**. And it's coming soon.

If we could turn off the cell towers, halt the GMOs, stop the spraying of pesticides and end the mass pharmaceutical contamination of our planet, then our honeybees (and other important animal species) might have a chance. But human beings are too shortsighted to understand their role in causing almost anything that impacts the delicate web of life on Earth. So humans will deny any responsibility for their actions, cover up the truth about what's really going on, and even accelerate their own global population collapse.

Science cannot turn a seed into a living food plant

It will all be led by "science" and "technology," of course. And yet **all the science in the world can't create one scrap of real food that will keep you alive**. Only Mother Nature can grow a plant from a seed, pollinate it, produce a flower and then a vegetable or fruit. Only Mother Nature can keep us alive, not science and not technology. And in the end, when the history of our modern world is fully written, it will show how **the scientists nearly wiped out the human race** through their arrogance, their mass poisoning of the world, and their complete disregard for the value of life.

All these things have been carried out under the name of science: Genetically Modified crops, terminator seeds that self destruct, chemical pesticides, cell towers, water fluoridation, mercury fillings, psychiatric drugs and much more. Each one of these, in its own way, threatens the sustainability of life on our planet. And that's why "science" as practiced today has become the pathway to our own self destruction.

The disappearing honeybees are merely a symptom of what's wrong. The real cancer in our civilization is the arrogance and widespread destruction of the scientists

who play God with our world while having absolutely no clue about the consequences of their actions.

Watch my documentary to learn more about the soulless, mindless and utterly insane philosophy that underpins modern-day science: <http://naturalnews.tv/v.asp?v=E3B38227225F9F...>

Sources for this story include:

<http://www.kokopelli.asso.fr/documentation/f...>

<http://www.dailymail.co.uk/sciencetech/artic...>

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He's also of [Native American heritage](#), which he credits as inspiring his "Health Ranger" passion for protecting life and nature against the destruction caused by chemicals, heavy metals and other forms of pollution.

Adams is the founder and publisher of the open source science journal [Natural Science Journal](#), the author of numerous peer-reviewed science papers published by the journal, and the author of the world's first book that published ICP-MS heavy metals analysis results for foods, dietary supplements, pet food, spices and fast food. The book is entitled [Food Forensics](#) and is published by BenBella Books.

In his laboratory research, Adams has made numerous food safety breakthroughs such as revealing rice protein products imported from Asia to be [contaminated with toxic heavy metals like lead, cadmium and tungsten](#). Adams was the first food science researcher to document [high levels of tungsten in superfoods](#). He also discovered [over 11 ppm lead in imported mangosteen powder](#), and led an [industry-wide voluntary agreement](#) to limit heavy metals in rice protein products.

In addition to his lab work, Adams is also the (non-paid) executive director of the non-profit [Consumer Wellness Center](#) (CWC), an organization that redirects 100% of its donations receipts to grant programs that teach children and women how to grow their own food or vastly improve their nutrition. Through the non-profit CWC, Adams also launched [Nutrition Rescue](#), a program that donates essential vitamins to people in need. [Click here](#) to see some of the CWC success stories.

With a background in science and software technology, Adams is the original founder of [the email newsletter technology company known as Arial Software](#). Using his technical experience combined with his love for natural health, Adams developed and deployed the content management system currently driving NaturalNews.com. He also engineered the high-level statistical algorithms that power [SCIENCE.naturalnews.com](#), a massive research resource featuring over 10 million scientific studies.

Adams is well known for his incredibly popular [consumer activism video blowing the lid on fake blueberries](#) used throughout the food supply. He has also exposed "strange fibers" found in Chicken McNuggets, [fake academic credentials](#) of so-called health "gurus," dangerous ["detox" products imported as battery acid](#) and sold for oral consumption, [fake acai berry scams](#), the California raw milk raids, the vaccine research fraud revealed by industry whistleblowers and many other topics.

Adams has also helped [defend the rights of home gardeners](#) and protect the [medical freedom rights of parents](#). Adams is widely recognized to have made a remarkable global impact on issues like GMOs, vaccines, nutrition therapies, human consciousness.

In addition to his activism, Adams is an accomplished musician who has released [over a dozen popular songs](#) covering a variety of activism topics.

[Click here](#) to read a more detailed bio on Mike Adams, the Health Ranger, at HealthRanger.com.

Electromagnetic Radiation Safety

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Scientific and policy developments regarding the health effects of electromagnetic radiation exposure from cell phones, cell towers, Wi-Fi, Smart Meters, and other wireless technology

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Monday, March 24, 2014

Cell Tower Radiation Affects Wildlife: Dept. of Interior Attacks FCC

The Department of Interior charges that the FCC standards for cell phone radiation are outmoded and no longer applicable as they do not adequately protect wildlife.

The Director of the Office of Environmental Policy and Compliance of the United States Department of the Interior sent a letter to the National Telecommunications and Information Administration in the Department of Commerce which addresses the Interior Department's concern that cell tower radiation has had negative impacts on the health of migratory birds and other wildlife.

The Interior Department accused the Federal government of employing outdated radiation standards set by the Federal Communications Commission (FCC), a federal agency with no expertise in health. The standards are no longer applicable because they control only for overheating and do not protect organisms from the adverse effects of exposure to the low-intensity radiation produced by cell phones and cell towers:

"the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."

The Department criticized the Federal government's proposed procedures for placement and operation of communication towers, and called for "independent, third-party peer-reviewed studies" in the U.S. to examine the effects of cell tower radiation on "migratory birds and other trust species."

Following are excerpts from the letter, dated Feb 7, 2014:

"The Department believes that some of the proposed procedures are not consistent with Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, which specifically requires federal agencies to develop and use principles, standards, and practices that will lessen the amount of unintentional take reasonably attributed to agency actions. The Department,

through the Fish and Wildlife Service (FWS), finds that the proposals lack provisions necessary to conserve migratory bird resources, including eagles. The proposals also do not reflect current information regarding the effects of communication towers to birds. Our comments are intended to further clarify specific issues and address provisions in the proposals.

The Department recommends revisions to the proposed procedures to better reflect the impacts to resources under our jurisdiction from communication towers. The placement and operation of communication towers, including un-guyed, unlit, monopole or lattice-designed structures, impact protected migratory birds in two significant ways. The first is by injury, crippling loss, and death from collisions with towers and their supporting guy-wire infrastructure, where present. The second significant issue associated with communication towers involves impacts from non-ionizing electromagnetic radiation emitted by them (See Attachment)."

Enclosure A

"The second significant issue associated with communication towers involves impacts from nonionizing electromagnetic radiation emitted by these structures. Radiation studies at cellular communication towers were begun circa 2000 in Europe and continue today on wild nesting birds. Study results have documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death (e.g., Balmori 2005, Balmori and Hallberg 2007, and Everaert and Bauwens 2007). Nesting migratory birds and their offspring have apparently been affected by the radiation from cellular phone towers in the 900 and 1800 MHz frequency ranges- 915 MHz is the standard cellular phone frequency used in the United States. However, **the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.** This is primarily due to the lower levels of radiation output from microwave-powered communication devices such as cellular telephones and other sources of point-to-point communications; levels typically lower than from microwave ovens. **The problem, however, appears to focus on very low levels of non-ionizing electromagnetic radiation.** For example, in laboratory studies, T. Litovitz (personal communication) and DiCarlo et al. (2002) raised concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos- with some lethal results (Manville 2009, 2013a). Radiation at extremely low levels (0.0001 the level emitted by the average digital cellular telephone) caused heart attacks and the deaths of some chicken embryos subjected to hypoxic conditions in the laboratory while controls subjected to hypoxia were unaffected (DiCarlo et al. 2002). To date, no independent, third-party field studies have been conducted in

North America on impacts of tower electromagnetic radiation on migratory birds. With the European field and U.S. laboratory evidence already available, independent, third-party peer-reviewed studies need to be conducted in the U.S. to begin examining the effects from radiation on migratory birds and other trust species."

Radiation Impacts and Categorical Exclusions

"There is a growing level of anecdotal evidence linking effects of non-thermal, non-ionizing electromagnetic radiation from communication towers on nesting and roosting wild birds and other wildlife in the U.S. Independent, third-party studies have yet to be conducted in the U.S. or Canada, although a peer-reviewed research protocol developed for the U.S. Forest Service by the Service's Division of Migratory Bird Management is available to study both collision and radiation impacts (Manville 2002). As previously mentioned, Balmori (2005) found strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, nesting, and roosting in the vicinity of electromagnetic fields in Spain. He documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. Though these species had historically been documented to roost and nest in these areas, Balmori (2005) did not observe these symptoms prior to construction and operation of the cellular phone towers. Balmori and Hallberg (2007) and Everaert and Bauwens (2007) found similar strong negative correlations among male House Sparrows. Under laboratory conditions, DiCarlo et al. (2002) raised troubling concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos- with some lethal results (Manville 2009). **Given the findings of the studies mentioned above, field studies should be conducted in North America to validate potential impacts of communication tower radiation both direct and indirect - to migratory birds and other trust wildlife species."**

The full text of the letter, the addendum and citations are available at:

<http://1.usa.gov/1jn3CZg>

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Radiation from mobile towers affect birds: MoEF study

Vijay Pinjarkar & Aparna Nair | TNN | Oct 25, 2011, 15:34 IST

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NAGPUR: Ever wondered where the house sparrows have vanished? Blame it on electromagnetic radiation (EMR) from mobile communication towers. A ministry of environment and forests expert committee says that the EMR is largely responsible for the bird's declining numbers. The panel suggested recognizing EMR as a pollutant because of their possible effect on animals and birds. The radiation has also hit honey bee numbers, the study 'A possible impact of communication tower on wildlife

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birds and bees', reveals. The waves decreased egg production in the bees. Studies have shown a drop in the numbers of common house sparrows in Nagpur, Bhopal, Jabalpur, Ujjain and other cities due to an increase in use of mobile phones. The committee recommended regular auditing of EMR levels and creating awareness regarding such a pollution. "The number of mobile users in India is expected to rise

to one billion by 2013. Such a rise will multiply mobile towers which dot the country in a haphazard way," the committee headed by Asad Rahmani, director, Bombay Natural History Society, has said. Environmentalists have been long maintaining a stand against such towers. The MoEF set up an expert committee, comprising Rahmani, Sainuddin Pattazhy, Prakriti Srivastava and others, to study possible impact of communication towers on wildlife including birds and bees. The panel found that EMR being a newly recognized pollutant, not much research is available on the subject, making it difficult to do comparative studies. Most studies are on EMR affects on humans. Some studies have shown long-term impacts on health and environment reporting negative consequences on immunity, health, reproductive success, behaviour, communication and coordination in animals and birds. The report corresponds with ornithologist Maruti Chitampalli's assertion about EMR affecting birds. Chitampalli, who is one of the first to voice concern on radiation, said, "We've been saying this for a long time. Radiations affect all kinds of birds. They affect sparrows in the cities and obstruct migratory birds in their flight."

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One of the studies carried out by Centre for Environment and Vocational Studies, Punjab, 50 eggs of house sparrows were exposed to EMR for 5-10 minutes. It was found that all the 50 embryos were damaged. Nature lover Shrikant Deshpande says, "Guidelines for installation of mobile towers are not followed. Mobile companies increase tower frequencies to avoid putting up more towers which in turn adversely affect birds." There are many spots where setting up of towers have affected birds' movement, he adds. However, Dr Ajay Poharkar, raptor scientist, claimed to have spotted successful hatchings of little spotted dove in the nest

perched on one such mobile tower. "I have also seen beehives on these towers at many places," Dr Poharkar says. Studies say EMRs have adverse impact on bees sparking an unusual phenomenon called colony collapse disorder. The radiations from mobile phones interfere with bees' navigation system, preventing them from

also show that number of bats
effect. After reviewing all the

data available on the subject, the committee made some recommendations with a view to combat this problem which includes recognizing EMFs as a pollutant.

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Study links bee decline to cell phones

By **Sasha Herriman**, CNN
June 30, 2010 9:32 a.m. EDT



What's killing the bees?

STORY HIGHLIGHTS

- Study on effects of mobile phones on bees shows decline in population
- Bees populations in UK and U.S. in decline due to colony collapse disorder
- Parasitic mites, agricultural pesticides and climate change all already implicated in decline

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London, England (CNN) -- A new study has suggested that cell phone radiation may be contributing to declines in bee populations in some areas of the world.

Bee populations dropped 17 percent in the UK last year, according to the British Bee Association, and nearly 30 percent in the United States says the U.S. Department of Agriculture.

Parasitic mites called varroa, agricultural pesticides and the effects of climate change have all been implicated in what has been dubbed "colony collapse disorder" (CCD).

But researchers in India believe cell phones could also be to blame for some of the losses.

In a study at Panjab University in Chandigarh, northern India, researchers fitted cell phones to a hive and powered them up for two fifteen-minute periods each day.

After three months, they found the bees stopped producing honey, egg production by the queen bee halved, and the size of the hive dramatically reduced.

It's not just the honey that will be lost if populations plummet further. Bees are estimated to pollinate 90 commercial crops worldwide. Their economic value in the UK is estimated to be \$290 million per year and around \$12 billion in the U.S.

Andrew Goldsworthy, a biologist from the UK's Imperial College, London, has studied the biological effects of electromagnetic fields. He thinks it's possible bees could be affected by cell phone radiation.

The reason, Goldsworthy says, could hinge on a pigment in bees called cryptochrome.

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"Animals, including insects, use cryptochrome for navigation," Goldsworthy told CNN.

"They use it to sense the direction of the earth's magnetic field and their ability to do this is compromised by radiation from [cell] phones and their base stations. So basically bees do not find their way back to the hive."

Goldsworthy has written to the UK communications regulator OFCOM suggesting a change of phone frequencies would stop the bees being confused.

"It's possible to modify the signal coming from the [cell] phones and the base station in such a way that it doesn't produce the frequencies that disturb the cryptochrome molecules," Goldsworthy said.

"So they could do this without the signal losing its ability to transmit information."

But the UK's Mobile Operators Association -- which represents the UK's five mobile network operators -- told CNN: "Research scientists have already considered possible factors involved in CCD and have identified the areas for research into the causes of CCD which do not include exposure to radio waves."

Norman Carreck, Scientific director of the International Bee research Association at the UK's University of Sussex says it's still not clear how much radio waves affect bees.

"We know they are sensitive to magnetic fields. What we don't know is what use they actually make of them. And no one has yet demonstrated that honey bees use the earth's magnetic field when navigating," Carreck said.

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The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Report of the web conference

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animals might avoid strong radiation sources such as radar and mobile phone towers but the few studies do not allow drawing definite conclusions about ecological implications.

Studies on physiological effects lack theoretical foundation which makes them appear as shots in the dark, a scientific practice which is prone to type I errors (finding effects that are not real). The reported findings range from effects on redox reactions and hormone levels to altered nociception and growth rates and malformations during (embryonic) development. Of these, a reducing effect of repeated exposure to a zero magnetic field on nociception seems to be the most established finding, even though completely independent replications are still needed. While many of the observed effects might be real, only strict hypothesis driven research based on a priori established theoretical models will eventually help to identify the RF real effects and the mechanisms underlying them. Dose-effect relationships are missing but as a rule, longer exposures were more often reported to have an effect. Birds comprise the most studied group of vertebrates followed by small rodents such as mice and rabbits. In sum, the findings of RF influence on physiological parameters in vertebrates can be described as contradictory and inconclusive.

By the far the most advanced theoretical foundation concerns the effects of RF fields on magnetic orientation migratory birds. Currently, there is strong evidence that the sensor is based on radical pair intermediates (perhaps in a protein called Cryptochrome) which are naturally sensitive to magnetic fields in the radiofrequency range. It is established that the magnetic compass of migratory birds can be disrupted by the weak RF background in larger cities (nT-intensities) but it is currently unclear which exact frequencies are most effective. Furthermore, some studies have suggested that fields emanating from power lines also affect the magnetic sense of vertebrates but again it is unclear whether this effect is specific to 50Hz-MF or to harmonics or even electric fields. More and more evidence is accumulating that mammals (e.g. bats and mice) have a magnetic sense which might be based on radical-pairs and as such will likewise be affected by RF. It remains to be tested whether disruption of a magnetic compass has real ecological consequences as animals make use of a variety of mechanisms for orientation.

c. Plants

Mainly Angiosperms. Significant changes have been demonstrated at cellular and molecular levels. Changes in oxidative metabolism are quite often reported: increase in peroxidase activity, membrane state. Exposure to low level of 900 MHz (10 min, 5 V/m) caused a rapid increase in stress-related transcript accumulation in tomato. The role of calcium has been characterized in this model by using chelators and by measuring the calmodulin gene expression. Calcium and a normal behaviour of the plant hormone abscisic acid are required to achieve the stress-related transcripts accumulation that occurred in a systemic way in plants; the energy metabolism is also transiently affected (about 30%). The genotoxicity of EMR is also questioned in some article. However additional data are still needed here since these methods could easily bring false positives. Terpene emission was reported to be enhanced by EMR and could also be considered as a marker of stress perception.

The metabolic and/or gene expression changes were not always related to changes in plant growth and development. It is however an excellent way to realize the integration of the EMR perception and responses in the development of the organism. However, several articles report impact on plants growth and development after exposure to EMR. The growth was reported to be reduced, either soon after the exposure or after a delay of several days, when new organs are created.



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3.4 Knowledge gaps and research needs

a. Invertebrates

There is a dire need for more ecological studies, which measure the effects of EMR on wild communities. Studies which measure the community responses (abundance, diversity and ecosystem functioning) long-term and ideally pre- and post-exposure would be especially valuable. In order for such studies to be conclusive they would have to be carried out over a wide geographical extent and in different natural and anthropogenic systems. In addition, interdisciplinary collaborations that test hypotheses drawing on what is known about insect physiology to test probable biological and ecological impacts (and avoid speculative ad-hoc approach) at field-realistic exposure could give important insights.

We also need studies that assess chronic effects, as these are more likely to be occurring, as well as experiments that examine the potential interplay between EMR exposure and a) foraging ecology and b) other stressors (e.g. pathogens, environmental pollutants/chemicals) affecting nutritional ecology.

b. Vertebrates

In the field of animal magnetic navigation, knowledge about the definite receptor mechanism mediating the perception of the Earth's magnetic field will greatly facilitate the assessment of the effect of man-made magnetic fields on the ecology of wild migrants. Along the same lines, if it turns out that the receptors are also present in non-migratory species, but that they might fulfil a different function (e.g. in circadian rhythms in case of Cryptochromes) it will need to be assessed whether it still retained remnant magnetosensitivity that might be responsible for physiological effects of man-made magnetic field on organisms.

Studies on the effects on long-term exposure (e.g. throughout development) are needed.

Furthermore, real ecological studies are missing. Do electromagnetic fields have an effect on species populations? In order to reduce confounding effects of other factors, such studies should be performed on small vertebrates with fast reproduction rates under highly controlled conditions in outdoor enclosures as well as on whole communities using gigantic coils or antenna systems or perform meta-analyses on established data-sets by taking RF-data into account. To enable such studies in future, the establishment of fixed RF-measurement stations (e.g. at already established geomagnetic observatories) would be beneficial.

c. Plants

There is the need to improve the quality of the exposure system: to stop using telecom devices and prefer TEM/G-TEM cells and other well-defined devices.

Also, to use reliable markers (enzymatic and/or gene expression) which are both inexpensive and allow to report changes in the behaviour of plants. These markers also bring valuable information of molecular events that occur shortly after exposure. They also allow a better link with the exposure than growth studies that may integrate environmental signals other than EMR, leading to misinterpretations.

Ideally, these biochemical/molecular studies should be completed by growth studies to assess changes at the scale of the whole plant. Field experiments should this way relate symptoms observed to biological/molecular changes.

d. General and cross-cutting observations

- EM set up and quality: some technical standards/parameters that have to be included in future studies (to ensure replication)
- Studies on chronic/long-term exposure (with realistic exposure settings mimicking those in the field)
- Studies should be hypothesis driven, i.e. that should be based on a theoretical framework that allows making predictions of the outcome of the experiment
- Thermal- and non-thermal effects need to be clearly distinguished (exposures should not exceed relevant levels that could be encountered by wildlife in the field)
- Exposure systems that can be used in the field should be further developed

4. Conclusions

4.1 Invertebrates

EMR is an environmental cue detectable by invertebrate physiological mechanisms governing orientation or movement [*established but incomplete*].

EMR from anthropogenic sources (e.g. mobile phones) represent a potential risk to such physiological mechanisms [*established but incomplete*], but current evidence is limited, both by the number and quality of studies [*inconclusive*].

There is some evidence that anthropogenic EMR in laboratory experiments can affect behaviour or reproduction of model insect species such as the fruit fly *Drosophila melanogaster*), although effects are often negligible or inconsistent between studies [*unresolved*].

Currently evidence for effects of EMR on the diversity or abundance of invertebrates is very limited. Few ecological studies exist, but when they do, the reported EMR effects are negligible, contrasting, or cannot be separated from other environmental factors (e.g. land-use) [*inconclusive*].

The majority of experimental and field studies suffered from poor scientific method (e.g. zero or under-replicated, lack of covariate measurements), field-unrealistic exposures to EMR sources, or underreporting of scientific or technical details making evaluation difficult.

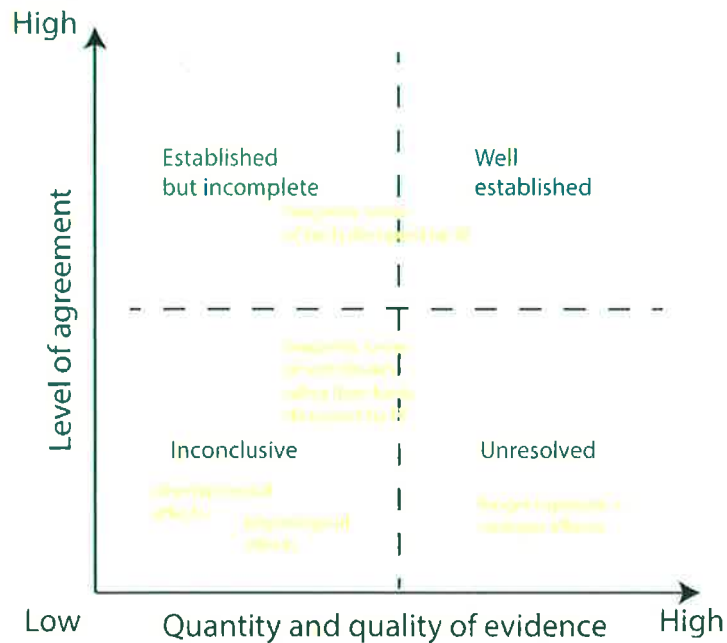


Figure 3 Level of confidence of the statements for the vertebrates

4.3 Plants

Several experiments conducted in laboratory tend to show that plant metabolism is affected by exposure to EMR [*established but incomplete*], particularly the ROS metabolism. However, the diversity of the exposure procedures makes it difficult to construct a clear scheme of what is happening in terms of metabolic changes [*inconclusive/unsolved*] after exposure to EMR. The rationalization of this aspect [*unsolved*] would enable the establishment of consensus by facilitating replications and enrichment of results by different research groups.

The impact of these changes on plant development is generally gathered as a growth reduction [*inconclusive*] but an unequivocal link of these changes with the exposure remains difficult to establish since plant growth integrates many environmental traits that may interfere with the conclusions. This is particularly true for field experiments [*inconclusive*] where the knowledge acquired after laboratory research would help to decipher what kind of symptoms could be truly attributed to EMR effects. Thus, it remains difficult to clearly state the exact impacts of EMR on plants in the real environment with a good level of confidence.

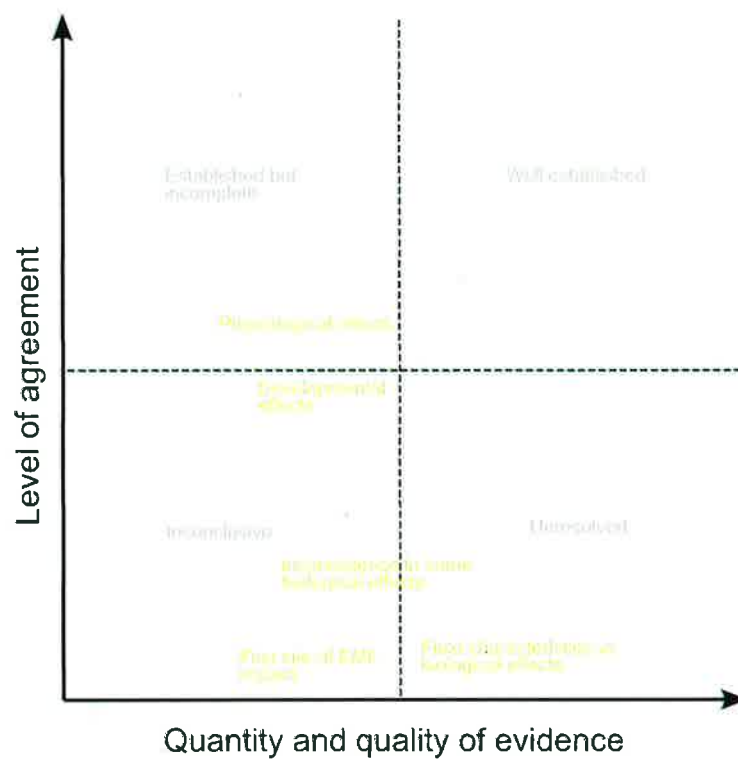


Figure 4 Level of confidence of the statements for the plants

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Appendix I: Members of the Experts Steering Group

Matt Shardlow (requester)

Buglife is the only organisation in Europe devoted to the conservation of all invertebrates, and we are actively working to save Britain's rarest little animals, everything from bees to beetles, worms to woodlice and jumping spiders to jellyfish. There are more than 40,000 invertebrate species in the UK, and many of these are under threat as never before. Invertebrates are vitally important to a healthy planet – humans and other life forms could not survive without them. The food we eat, the fish we catch, the birds we see, the flowers we smell and the hum of life we hear, simply would not exist without bugs. Invertebrates underpin life on earth and without them the world's ecosystems would collapse.

Prof Mario Babilon (expert)

Prof Babilon got his final degree in physics ("Diplom Physiker") in July, 2001 from the Technical University of Darmstadt. Thereafter he graduated in Nuclear Physics. During that time, he spent one year at Wright Nuclear Structure Lab at YALE University in the United States as a visiting assistant in research. He received his PhD in December 2004 and spent about one more year as a post-doc in Darmstadt, before switching to industry. He started a career in the corporate research department of BOSCH. Meanwhile he was giving lectures at the Cooperative State University in Stuttgart. He completely switched to the University in 2011 and since then he is a Professor in Computer Science.

Dr Erich Pascal Malkemper (expert)

Dr Malkemper is a biologist who received his PhD at the University of Duisburg-Essen in Germany. His thesis "The sensory biology of the red fox – hearing, vision, magnetoreception" was awarded the Fritz-Frank-Award of the German Society for Mammalian Biology in 2015. His research focusses on sensory systems, which he studies with behavioural experiments, histology and physiology, to understand ecological adaptations of a given species. He is currently based at the Research Institute of Molecular Pathology (IMP) in Vienna, Austria, where he conducts research on magnetoreception in homing pigeons.

Dr Benoît Stockbroeckx (expert)

Dr Stockbroeckx received the degree of Electrical Engineer from the Université Catholique de Louvain (UCL), Louvain-la-Neuve, Belgium, in 1993. He received his PhD degree in Applied Sciences in 1998 with a thesis on Space waves and surface waves in the Vivaldi antenna. He is involved in EMF exposure assessments since 1998. He is now the head of laboratory division at ANPI in charge of alarm systems, active fire prevention, theft prevention, CE marking (EMC, LVD, CPR), electromagnetic compatibility. He is also expert at the Belgian Health Council for non-ionising radiations.

Dr Thomas Tscheulin (expert)

Dr Tscheulin, holding a PhD in Population Ecology from Imperial College London, is currently an Assistant Professor at the University of the Aegean, Greece. He has a strong track record of collaborative research, both within and between host institutions in three different European countries. His main research interest is to relate assessments of the abundance, diversity, functional structure and trophic interactions of invertebrates, to the impacts of ecosystem disturbances such as agricultural practices, alien species invasion, climate change, wildfires, habitat loss and degradation. He is an associate editor for Animal Conservation and has so far published 36 scientific papers.



Dr Adam J. Vanbergen (expert)

Dr Adam Vanbergen is an invertebrate ecologist who received his PhD on 'Landscape to host-plant scales: bottom-up heterogeneity affects invertebrate diversity & interactions' from Cardiff University. He has been working for the Centre for Ecology & Hydrology since 1998. His research focusses on species interactions, community structure, and the relationship between biodiversity and ecosystem functions and services. He is particularly interested in understanding how anthropogenic disturbance across spatial scales governs diversity and interactions, above and belowground and at trophic levels directly (herbivores, pollinators) and indirectly (predators, parasites) connected to plants.

Prof Alain Vian (expert)

Prof Vian obtained his PhD in plant physiology at the University Blaise Pascal (1995) under the supervision of Dr Marie-Odile Desbiez, working on plant responses to wounding. He then performed a 2-years postdoctoral period in the laboratory of Prof. Eric Davies (North Carolina State University), working on the rapid molecular events following plant flaming. He obtained an assistant professor position at the university Blaise Pascal (Clermont-Ferrand) and rapidly specialized in plant responses to high frequency electromagnetic field, in collaboration with physicists (Profs Françoise Paladian and Pierre Bonnet). In 2008, he obtained a prize from the French Academy of Sciences for this work. He became full professor in 2009 at the University of Angers and since 2012 has worked in the Institut de Recherche en Horticulture et Semences (UMR 1345), studying the effect of environmental factors (mainly nitrogen nutrition) on the regulation of axillary bud outgrowth, a major event in the establishment of plant architecture. He is also continuing his work on the biological effects of high frequency electromagnetic field on plant development.

Appendix II: Tables with number of assessed studies

Quality of the studies in terms of biological or ecological aspects

Table 1: Invertebrates

Total number of studies on Invertebrates	39	
<i>(not including reviews on all taxonomic groups)</i>		
Number of studies assessed	39	100%
Number of studies that were irrelevant/bad quality (0)	7	18%
Number of studies of minimum quality (1)	8	21%
Number of studies of normal/medium quality (2)	15	38%
Number of studies of excellent quality (3)	9	23%

Table 2: Vertebrates

Total number of studies on Vertebrates	20	
<i>(not including reviews on all taxonomic groups)</i>		
Number of studies assessed	20	100%
Number of studies that were irrelevant/bad quality (0)	1	5%
Number of studies of minimum quality (1)	4	20%
Number of studies of normal/medium quality (2)	7	35%
Number of studies of excellent quality (3)	8	40%

Table 3: Plants

Total number of studies on Plants	23	
<i>(not including reviews on all taxonomic groups)</i>		
Number of studies assessed	20	87%
Number of studies that were irrelevant/bad quality (0)	1	4%
Number of studies of minimum quality (1)	2	9%
Number of studies of normal/medium quality (2)	4	17%
Number of studies of excellent quality (3)	13	57%



Quality of the studies in terms of technical aspects

Table 4: Invertebrates

Total number of studies on Invertebrates <i>(not including reviews on all taxonomic groups)</i>	39	
Number of studies assessed	26	67%
Number of studies that were irrelevant/bad quality (0)	7	18%
Number of studies of minimum quality (1)	2	5%
Number of studies of normal/medium quality (2)	5	13%
Number of studies of excellent quality (3)	12	31%

Table 5: Vertebrates

Total number of studies on Vertebrates <i>(not including reviews on all taxonomic groups)</i>	20	
Number of studies assessed	20	100%
Number of studies that were irrelevant/bad quality (0)	2	10%
Number of studies of minimum quality (1)	7	35%
Number of studies of normal/medium quality (2)	4	20%
Number of studies of excellent quality (3)	7	35%

Table 6: Plants

Total number of studies on Plants <i>(not including reviews on all taxonomic groups)</i>	23	
Number of studies assessed	16	70%
Number of studies that were irrelevant/bad quality (0)	2	9%
Number of studies of minimum quality (1)	3	13%
Number of studies of normal/medium quality (2)	1	4%
Number of studies of excellent quality (3)	10	43%

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The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Report of the web conference.

A report of the EKLIPSE project

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Contents

1.	Executive Summary	4
2.	Introduction and context	4
	2.1 Organisers.....	4
	2.2 Context.....	5
	2.3 Introduction to the request.....	5
	2.4 Scoping of the literature	6
	2.5 Analyses by the Experts Steering Group	6
3.	The web conference.....	7
	3.1 Objectives	7
	3.2 Format and organisation	8
	3.3 Participants.....	8
4.	Results	10
	4.1 Introduction session.....	10
	4.2 Session on a specific taxonomic group: Plants	10
	4.3 Session on a specific taxonomic group: Vertebrates	12
	4.4 Session on a specific taxonomic group: Invertebrates.....	14
	4.5 Session on cross-cutting themes.....	17
5.	Conclusions	20
6.	Lessons learnt.....	21
7.	Glossary.....	22
8.	References.....	23
	Appendix I: Members of the Experts Steering Group	24
	Appendix II: Agenda of the web conference	26
	Appendix III: List of participants (who agreed to share their information)	29

List of Figures

Figure 1 Four-box model for the qualitative communication of confidence	7
Figure 2 Number of participants per session	9
Figure 3 Number of participants per country	9
Figure 4 Profile of the participants	10
Figure 5 Results of the voting on research needs	11
Figure 6 Results of the voting on policy recommendations	12
Figure 7 Results of the voting on research needs	13
Figure 8 Results of the voting on policy recommendations	14
Figure 9 Results of the voting on research needs	16
Figure 10 Results of the voting on policy recommendations	17
Figure 11 Average weighting of the assessment of research needs per criteria	19
Figure 12 Graphic representation of the assessment of research needs per criteria	19
Figure 13 Word cloud of recurring themes for policy recommendations	20



Report of the EKLIPSE web conference “The impacts of artificial Electromagnetic Radiation on wildlife – fauna and flora”

Authors: Lise GOUDESEUNE, Estelle BALIAN, Jorge VENTOCILLA.

1. Executive Summary

EKLIPSE received in 2016 a request by Buglife to produce an overview of knowledge relating to the impacts of Electromagnetic Radiation (EMR) on wildlife and answered the request via an interactive web conference.

After evaluating and reformulating the question with the requester, EKLIPSE assembled the most recent literature on the topic and established a group of experts in the field to analyse the publications. They produced a preliminary document assessing the quality of the selected studies, pointing out the gaps, and describing the existing knowledge on the topic.

This document was used as the basis for discussions during the web conference that followed. The event included scientists and other stakeholders and was organised in sessions divided by taxonomic group (plants, vertebrates, invertebrates). The participants commented on the work done by the experts, discussed the findings, and developed a list of key research needs and policy recommendations for each taxonomic group.

Next to the specific knowledge gaps and research needs associated to each taxonomic group, several research needs that were common to the different groups were identified and ranked according to their importance, feasibility and contribution. EKLIPSE also extracted general policy recommendations based on the outputs of the participants.

The general message conveyed during the conference was that there is an urgent need to strengthen the scientific basis of the knowledge on EMR and their potential impacts on wildlife. In particular, there is a need to base future research on sound, high-quality, replicable experiments so that credible, transparent and easily accessible evidence can inform society and policy-makers to make decisions and frame their policies.

This report highlights the different steps leading to the organisation of the web conference, the details of the proceedings of the conference itself, as well as a summary of the main results.

2. Introduction and context

2.1 Organisers

[EKLIPSE](#) is an H2020 funded project that aims to develop an innovative and self-sustaining EU support mechanism for evidence-based and evidence-informed policy on biodiversity and ecosystem services. A major function covered by EKLIPSE is the identification of research needs and emerging issues. This is done by answering requests from policy, civil society and science. These requests then lead to an in-depth knowledge synthesis, a foresight activity (identification of research gaps and emerging issues), or a societal engagement activity – depending in the nature of the topic of the request.

[Buglife](#) is a non-profit organisation in Europe devoted to the conservation of all invertebrates.

Buglife's aim is to halt the extinction of invertebrate species and to achieve sustainable populations of invertebrates.

2.2 Context

Electromagnetic radiations or EMR are a combination of invisible electric and magnetic fields of force that can occur both naturally and due to human activity (anthropogenic EMR).

Anthropogenic EMR are used in a wide range of technologies (namely powerlines, TV/radio broadcasting, Wi-Fi, 2G/3G/4G communications), with their presence expanding in terms of the range of frequencies and the volume of transmissions. An important issue is to explore how current use of EMR is affecting biodiversity and ecosystem services (such as pollination and pest control). A better understanding and awareness of environmental risks from EMR can lead to the development, promotion and implementation of adequate and timely policy frameworks.

The increase of EMR and its potential effects on wildlife has already been identified by an international experts group led by Bill Sutherland as 1 of the 15 emerging issues that could affect global biodiversity but that are not yet well recognised by the scientific community, as reported by their 9th annual horizon scanning exercise for conservation and biodiversity ([Sutherland, 2018](#)).

However, the existing community of experts in this field is still very limited, and research tends to be focussed on only a few specific species or taxa, and certain types of radiations. The technical set up and conditions in which the studies are undertaken are often questionable, and there are no common standards or methodologies that can be used to compare and/or reproduce the experiments.

There are a number of policy documents and regulations published related to the risks and effects of EMR¹ but most of them refer to the impacts on human health, very rarely incorporating the effects on animals or plants.

In 2015, a group of international scientists released an appeal to the U.N. calling on them to better assess the risks and protect humans and wildlife from the effects of EMR ([EMF, 2015](#)). By 2017 this appeal had been signed by over 230 scientists.

2.3 Introduction to the request

EKLIPSE launched a first "Call for request" in September 2016, inviting decision-makers, practitioners and other stakeholders to submit a proposal with questions affecting biodiversity. The request submitted by Buglife on the impacts of anthropogenic EMR on invertebrates was selected to initiate a process for identifying key knowledge gaps and research needs, as well as to formulate recommendations. Because the corpus of research studies on the impacts of EMR on invertebrates specifically appeared limited, and because of the interest in comparing the effects on different types of organisms, the scope of the request was adjusted and extended to the impacts on vertebrates and plants too. However, it was decided to still exclude the impacts on human health, since humans are differently exposed to radiations and the literature – which is also more extensive - is part of the medical field of research.

¹ At European level, the latest one being the Directive 2013/35/EU of the European Parliament on minimum health and safety requirements regarding the exposure to electromagnetic fields ([European Union, 2013](#)). Other policy documents and reports found were mainly published by national agencies.

2.4 Scoping of the literature

A first search for relevant peer-reviewed literature was undertaken by EKLIPSE using ISI Web of Knowledge and Google Scholar using the following combinations of keywords:

- EMR; EMF; electrosmog; electromagnetic field; electromagnetic radiation; electromagnetic

AND

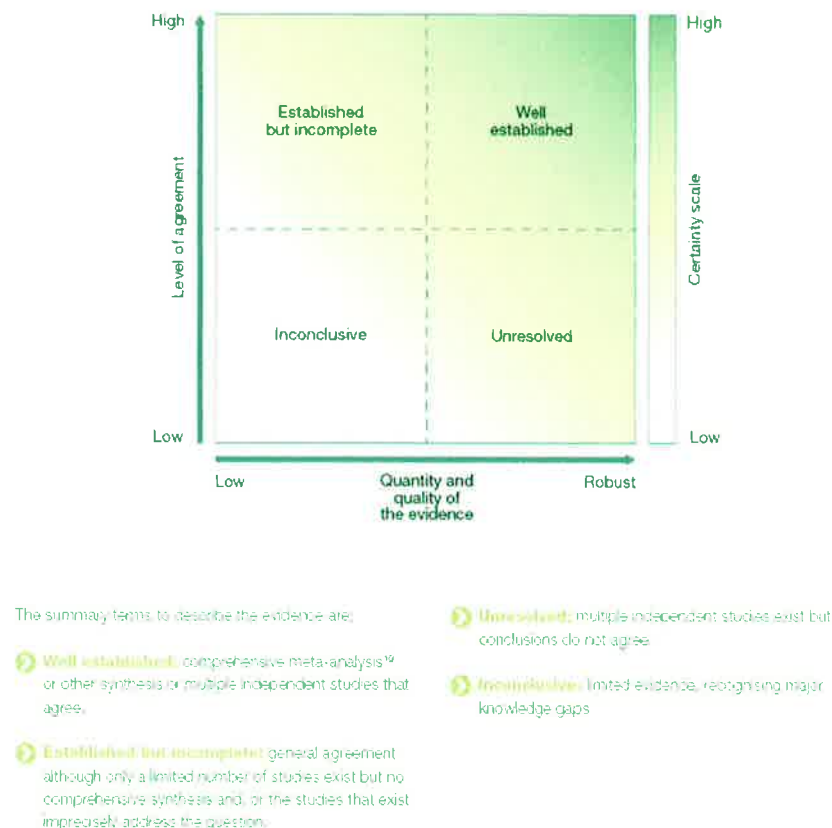
- wildlife; invertebrate(s); vertebrate(s); plant(s); animal(s); insect(s); arthropod(s); bee(s); *Drosophila*; mammal(s); fish; amphibian(s); bird(s); tree(s); flower(s); biodiversity.

Only recent papers (from 2000 onwards) were considered. The publications cited in the identified papers were also examined to complement the list and a further search was done with the names of recurring experts. The aim was not to compile a comprehensive list of references, but to gather a representative set of papers and studies to allow an overview of the current evidence and knowledge gaps. This evidence base was further complemented through a Call for Knowledge to the wider scientific community through the [EKLIPSE KNOW Forum](#).

2.5 Analyses by the Experts Steering Group

EKLIPSE then invited selected scientists to join the Experts Steering Group to analyse the publications and help prepare the organisation of a consultation through a web conference. The Experts Steering Group was multidisciplinary and was composed of four biologists/ecologists specialised in different taxonomic groups, as well as two physicists having worked with electromagnetic field (see Appendix I: Members of the Experts Steering Group).

In total, 97 of the 147 scientific papers or reviews initially identified were used in the analysis (see the Knowledge framework document, Malkemper et al, 2018). The Expert Steering Group conducted the assessment according to their expertise by dividing the work into three main taxonomic groups (Plants, Vertebrates, Invertebrates). They examined the scientific quality and technical set up of the studies and identified research gaps and needs for each taxonomic group. They also assessed the confidence level of the findings and messages reported in the studies through a qualitative “four-box model” (see Figure 1), adopted from the IPBES ([IPBES, 2016](#)), to communicate the level of certainty in knowledge and show how each key message is based on the assessment of the quantity, quality and level of expert agreement in the evidence.



*Confidence increases towards the top-right corner as suggested by the increasing strength of shading.
Source: modified from Moss and Schneider (2000).*

Figure 1 Four-box model for the qualitative communication of confidence

The experts' findings were compiled into a document that has been used as the basis for discussions during the web conference (see Malkemper et al, 2018).

3. The web conference

3.1 Objectives

EKLIPSE organised its online, interactive web conference from Monday 22nd to Thursday 25th of January 2018. A wide range of experts from different disciplines was selected and invited to discuss the current knowledge on the effects of EMR on wildlife.

The aim was to highlight the current state-of-the-art in this field, to identify knowledge gaps related to the impacts on different taxonomic groups, to discuss the technical aspects and methodologies used in current studies, and to identify and prioritize key research needs and policy recommendations.

The specific objectives of the web conference were to discuss the scope of existing studies, weaknesses and gaps as well as major findings; to identify and prioritize key research needs potentially in relation to current policy needs; and to identify policy recommendations based on current knowledge.



3.2 Format and organisation

To achieve its objectives, EKLIPSE used an innovative, collaborative format where the presentations were kept to a minimum. This meant the focus could be on capturing what the participants thought about the topics - which they explored in 15-20 minute, small-group discussions throughout the conference.

What made this conference different from other virtual conferences was that the ideas and insights from the participants' discussions were able to be recorded and integrated, so they formed the key output of the conference. This outcome was enabled by leveraging two online tools together. Zoom was used as a virtual "plenary room" for the presentations and to split participants in virtual, small discussion groups (5-6 people per group). A collaborative group-work tool from [Covision](#) made it possible for the participants to compile, and send to the facilitator, the ideas and insights they had identified during their discussions. The whole group was then able to see the key ideas that were generated and they could prioritize them through the online polling system.

The conference was organised in five sessions spread over four days (see Appendix II: Agenda of the web conference), with daily sessions of 2 hours:

- Monday 22nd at 16:00 CET for the introduction, framing and opening discussions

Invited expert/presenter: Matt Shardlow, Buglife

- Tuesday 23rd at 13:30 CET for group discussion on Plants

Invited expert/presenter: Prof Alain Vian, University of Angers

- Tuesday 23rd at 16:00 CET for group discussion on Vertebrates

Invited expert/presenter: Dr Pascal Malkemper, Research Institute of Molecular Pathology, Vienna

- Wednesday 24th at 16:00 CET for group discussion on Invertebrates

Invited expert/presenter: Dr Thomas Tscheulin, University of the Aegean, and Dr Adam Vanbergen, Centre for Ecology and Hydrology, Edinburgh

- Thursday 25th at 16:00 CET for integration and final plenary recommendations

During the introduction session, a summary of the findings of the experts and the background document were presented, as well as an explanation on the use of the online tools.

The three sessions on each taxonomic group followed the same structure: the appointed expert of the Steering Group presented the findings related to its taxonomic group. The participants were invited to work in small groups three times per session to identify 1/ knowledge gaps (on the basis of the literature review), 2/ research needs, and 3/ policy recommendations. After a process of compiling the key ideas into themes done by EKLIPSE, using the Covision tool, the themes from those discussions were presented back to the participants, so they could vote on what they considered as the most important and relevant elements.

During the final session, a set of transversal research needs/priorities, as well as a set of transversal policy recommendations was compiled by EKLIPSE and presented to the participants who had the opportunity to rank the research needs/priorities according to a selected set of criteria.

3.3 Participants

EKLIPSE conducted a thorough analysis of relevant scientists with direct expertise in the impacts of EMR on wildlife. The scientific community appeared to be rather small and most of the identified researchers had

expertise on a specific taxonomic group but did not specialise on EMR impacts. Nevertheless, EKLIPSE identified over 250 experts who were invited to participate in the web conference. Information about the event was also largely disseminated to the scientific and knowledge community through mailing lists, social media and other communication channels of EKLIPSE and its networks.

During the four days and five sessions of the web conference, a total of 55 participants attended (see Appendix III: List of participants to the web conference), supported by a technical and organisational team of 6 people (see Figure 2).

In total, 19 countries from across the world were represented (see Figure 3).

	TOTAL All sessions	Introduction session 22/1	Plants session 23/1	Vertebrates session 23/1	Invertebrates session 24/1	Closing session 25/1
Participants	61	36	31	35	27	34

Figure 2 Number of participants per session

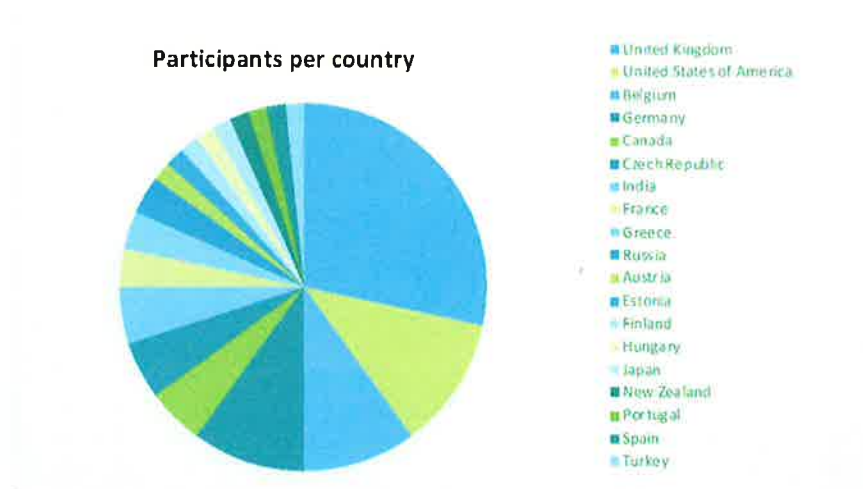


Figure 3 Number of participants per country

From the participants who shared information about themselves (see Figure 4), the large majority identified as scientists, but some also indicated that they work as policy-makers, practitioners, and/or² entrepreneurs on topics related to EMR. The great majority reported being active in the Natural Sciences, compared to only a few experts in Technology/Electrical Engineering, the others being professionals from other fields. A third of them had already at least some experience with studying the effects of EMR, even if mostly the case in the framework of research on specific species or ecosystems of their expertise.

² Participants could indicate more than one field of activity or area of expertise.

Figure 4 Profile of the participants

Current activity		Area of expertise		Experience with EMR	
Scientist/academic	56%	Natural Sciences	69%	Very experienced	25%
Policy-maker	10%	Technology/Electrical engineering	8%	Somewhat experienced	42%
Practitioner	6%	Other	22%	Little experience	11%
Entrepreneur	13%			No experience but interested	22%
Other	15%				

4. Results

4.1 Introduction session

For this first session, the participants were asked to discuss and answer the following question:

“What do you think of the results presented in the background document? What stands out for you? Is there anything missing?”

In general, the participants agreed with the conclusions of the expert group.

The results were compiled into main themes:

- More research is needed on migrating species (e.g. like dragonflies)
- Consider knowledge from local, non-expert people too
- Need for a standardized model and/or standardised criteria for EMR radiation
- Identify the best organisation/people to gather data on EMR effects and agree on a platform to share the knowledge
- Find a way to prioritise the risks related to EMR
- Need for studies that can be replicated to ascertain which results are consistent
- Fill the temporal gap: important research from past decades should be included

4.2 Session on a specific taxonomic group: Plants

The participants were asked to discuss and answer the following question:

“In reviewing the key knowledge gaps in the background document, what stands out for you? Is anything missing?”

The results were compiled into main themes. As a result, the participants pointed out additional knowledge gaps that they perceived should have been included in the background document:

- Older research studies about radar and broadcast transmitters on ecological systems
- Research on the effects on biota of low frequency fields and EM static fields
- To investigate research on positive, stimulating effects of EMR
- Research on synergistic effects of different kinds of EMR in the environment
- Assessments of the effects of "new" frequencies on biodiversity
- More knowledge on the mechanisms of EMR effects on biota

- Overall, more field studies are needed (e.g. to answer questions such as: How do the lab results and EMR relate to the real world? What frequencies are commonly encountered at what power in the real world? How much of a risk?)

Next, participants were asked to discuss and answer the following question:

“Based on the identified knowledge gaps, what do you consider as the most important research needs/priorities?”

The results were compiled into main research needs. After being presented to them, participants were able to vote on the most important ones (up to 3 research needs per participant). The ranking of research needs is shown below with the percentages indicated at the end.

- Standardization and standard methodology for future study designs (21%)
- More and better cooperation between field and lab studies (14%)
- Need to account for confounding/interfering factors in analyses of EMR effects (14%)
- Research on the effects at different levels of biological organisation (ecosystem, population, species) (14%)
- Better understanding of the role of natural EMR as basis for plant growth (10%)
- Research on the impacts of 5G technology and LED lamps (10%)
- Research on the effects of EMR on evolution and co-evolution (7%)
- Research on the impact of EMR on water uptake by plants (5%)
- Study the effects of pulsed radiation (5%)

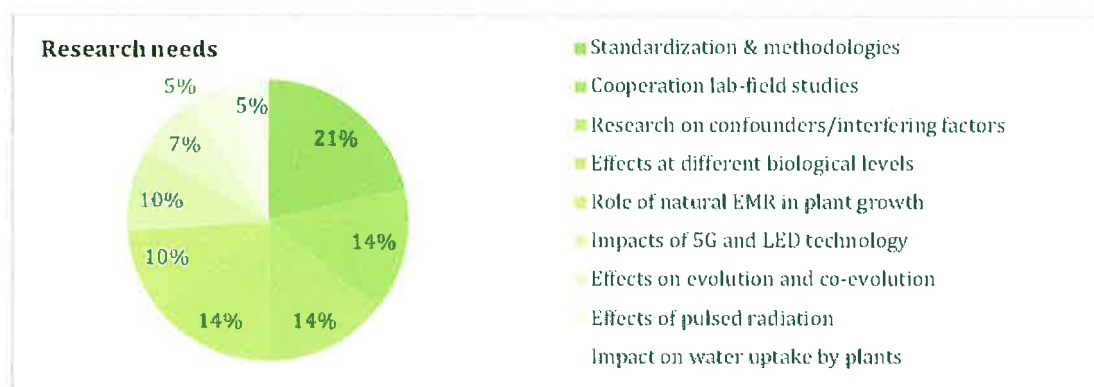


Figure 5 Results of the voting on research needs

Finally, the participants were asked to discuss and answer the following question:

“Based on the knowledge available, what policy recommendations would you propose?”

The results were compiled into main recommendations. After being presented to them, participants were able to vote on the most important ones (up to 2 recommendations per participant). The recommendations are presented below in rank order with percentages indicated.



- Foster cross-institutional/inter-disciplinary collaboration (including leading experts on exposure/dosimetry and biology/ecology) in the studies of EMR effects (46%)
- Define legal limits of EMR (based on scientific results), that will not be harmful to humans and wildlife (25%)
- Ensure knowledge sharing and faster learning through the establishment and use of open databases (14%)
- Use the precautionary principle in relation to EMR and their environmental impacts (14%)
- Develop alternative technology (regarding mobile phones, Wi-Fi) (0%)

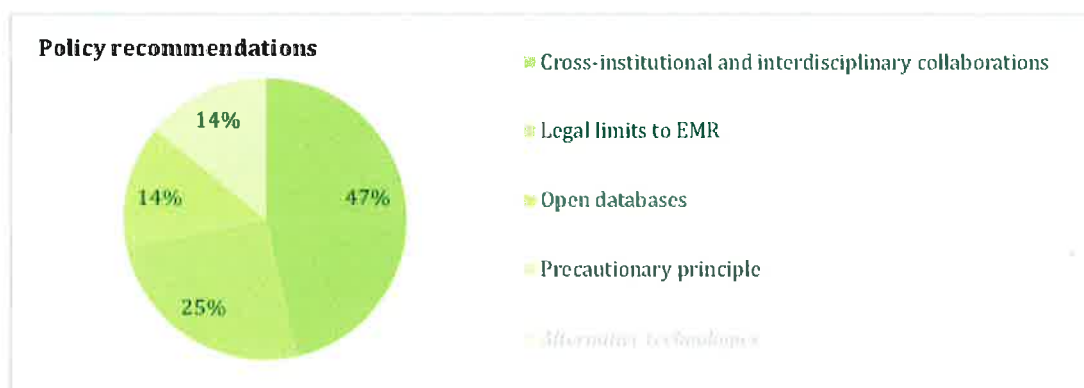


Figure 6 Results of the voting on policy recommendations

4.3 Session on a specific taxonomic group: Vertebrates

The participants were asked to discuss and answer the following question:

“In reviewing the key knowledge gaps in the background document, what stands out for you? Is anything missing?”

The results were compiled into main themes:

Gaps in the background document:

- Studies on lab animals (rodents,...)
- Search with keywords "radio-frequency" and "microwave"
- Older studies (before 2000)

General knowledge gaps:

- Research at the cellular level
- Knowledge about how real-world levels compare to the levels considered in lab experiments
- Studies pertaining to EMR mechanisms & dosimetry of EMR
- Observations from local people

- Rigorous research on animal populations near EMR sources (e.g. cell towers)
- Evidence for population declines of birds that are attributable to EMR

The participants were asked to discuss and answer the following question:

“Based on the identified knowledge gaps, what do you consider as the most important research needs/priorities?”

The results were compiled into main research priorities/needs. After being presented to them, participants were able to vote on the most important ones (up to 4 research needs per participant). The research priorities/needs are presented below in rank order with percentages indicated.

- Better replicated studies and high-quality papers (16%)
- Better understand better the patterns of real world exposure, including dosimetry (14%)
- Organisational coordination to develop standard data models and experimental methodologies, including standard reporting protocol, e.g. around powerful radars (14%)
- Multidisciplinary teams, especially including GIS experts (14%)
- Research of effects of EMR on different levels of biological organisation: at protein level, at genomic level, at assemblage level, etc. (11%)
- Improve understanding of the possible effects of EMR on movement, location and migration of vertebrates in real world situations (9%)
- Inclusion of citizens and consider citizen science approaches to improve knowledge base (7%)
- Research on how different frequencies interact in relation to affecting organisms (5%)
- Standardization of exposure levels and measurements (5%)
- Further explore the research on the Radical-Pair mechanism (4%)
- Establish how the (electro)magnetic sense in birds works (2%)

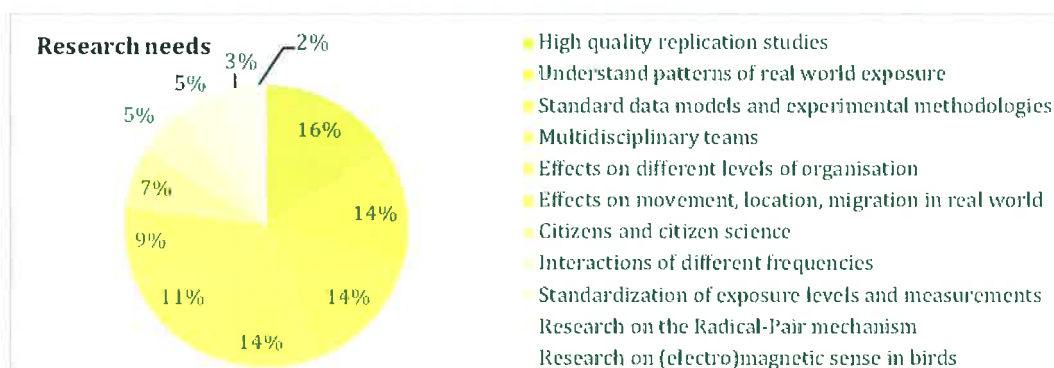


Figure 7 Results of the voting on research needs

Finally, the participants were asked to discuss and answer the following question:

“Based on the knowledge available, what policy recommendations would you propose?”



The results were compiled into main recommendations. After being presented to them, participants were able to vote on the most important ones (up to 4 recommendations per participant). The recommendations are presented below in rank order with percentages indicated.

- More funding available on EMR research (19%)
- Establish a cross-disciplinary platform in order to enhance understanding and foster collaborations between institutions, countries, and disciplines (19%)
- Conduct cross-institutional studies that include cooperation of dosimetry/technical experts and biology experts (13%)
- Find ways to ensure unbiased, independent research preceding deployment (8%)
- Set up advisory groups for governments on research needs and priorities (7%)
- Avoid putting EMR sources (e.g. cell towers) in wildlife areas (7%)
- Apply safe levels and/or exposure limits for EMR exposure (6%)
- Collaborations between nations and encourage young scientists (6%)
- Proper education about the potential risks of EMR, especially in poorer nations (5%)
- Apply the precautionary principle in relation to EMR and their environmental impacts (5%)
- Developers (companies) should fund research, study, and report on the technologies they develop, together with their testing (5%)

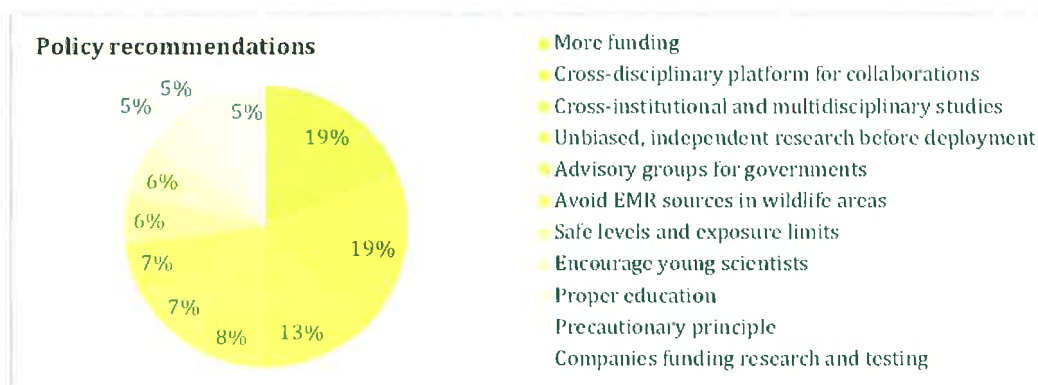


Figure 8 Results of the voting on policy recommendations

4.4 Session on a specific taxonomic group: Invertebrates

The participants were asked to discuss and answer the following question:

“In reviewing the key knowledge gaps in the background document, what stands out for you? Is anything missing?”

The results were compiled into main themes:

Gaps in the background document:

- Literature before the year 2000 had not been included

General knowledge gaps:

- Studies on the effects of EMR on aquatic invertebrates, i.e. molluscs, crustaceans, but also studies on other organisms, e.g. bacteria
- Research on the effects of photovoltaics and solar plants on invertebrates
- Research on the effects of EMR on migratory insects (e.g. dragonflies in Portugal, monarchs in North America, etc.)
- Studies into indirect effects on invertebrates via impacts on the plants that are hosting and/or serve as food supply for them
- More field studies

Then, the participants were asked to discuss and answer the following question:

“Based on the identified knowledge gaps, what do you consider as the most important research needs/priorities?”

The results were compiled into main research needs/priorities. After being presented to them, participants were able to vote on the most important ones (up to 3 needs per participant). The research priorities/needs are presented below in rank order with percentages indicated.

- More funding to study EMR impacts on invertebrates (29%)
- Standardised and agreed research methodologies/protocols to facilitate more comparable data (22%)
- Undertake both - laboratory and field work - iteratively, they are complementary (14%)
- Consider the observations of people who are not scientists, but who collectively observe changes. Anecdotal observations can drive experimental science (14%)
- Better understand the risks from EMR to reproduction, behaviour and populations in the field (11%)
- Identify a clear correlation between new types of EMR sources (e.g. cell towers, smart meters) and insect population abundance (6%)
- Use radar stations to investigate the impacts of high levels of EMR in the field (2%)
- Discern light pollution effects from other EMR effects (2%)

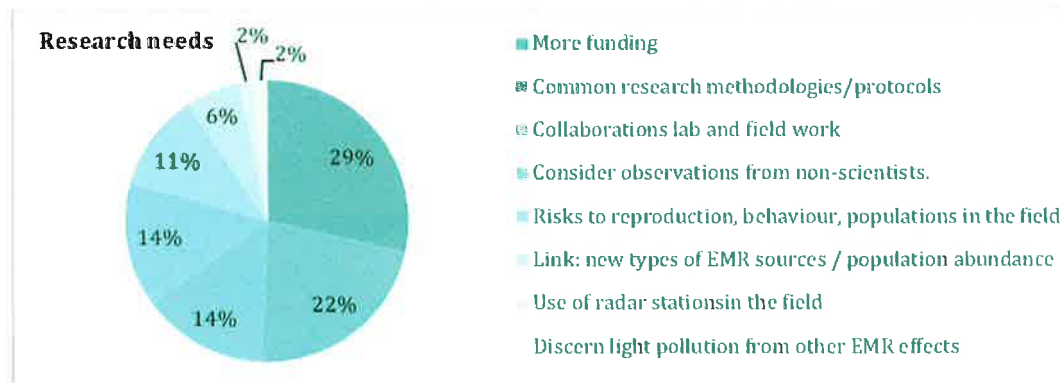


Figure 9 Results of the voting on research needs

Finally, the participants were asked to discuss and answer the following question:

“Based on the knowledge available, what policy recommendations would you propose?”

The results were compiled into main recommendations. After being presented to them, participants were able to vote on the most important ones (up to 3 recommendations per participant). The recommendations are presented below in rank order with percentages indicated.

- Allocate more funding for research on the topic (20%)
- Set up a stakeholders' group, bringing together scientists, industry, etc. to have open discussions on the effects of EMR (17%)
- Use "proof of safety" standards prior to the widespread proliferation/use of new technologies/EMR emissions (13%)
- Prohibit EMR sources such as phone masts in nature reserves (11%)
- Apply the precautionary principle (11%)
- Include EMR when evaluating effects of anthropogenic disturbances (chemicals, pollutants, climate change, etc.) to account for potential negative synergistic effects on invertebrates (11%)
- Identify "No Effect" EMR levels on a range of invertebrates in laboratory conditions and use these to develop Environmental Quality Standards that should not be exceeded (9%)
- Consider ecosystem services provided by invertebrates when developing regulations for EMR (7%)

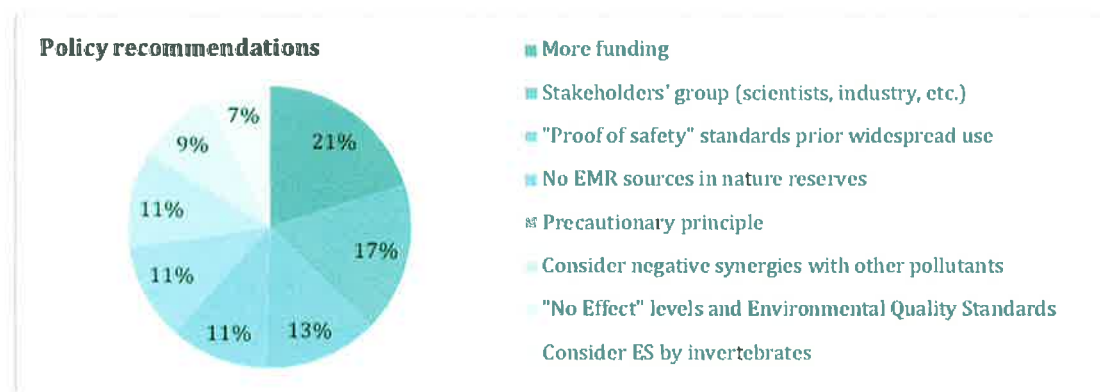


Figure 10 Results of the voting on policy recommendations

4.5 Session on cross-cutting themes

Based on the results of the discussions from the specific sessions, EKLIPSE compiled a list of research priorities and policy recommendations that were highlighted in the different sessions.

Transversal research needs:

- Develop standardization/methodologies/protocols to better design future studies & compare research results, which could include:
 - Standardisation of EMR types, exposure levels and measurements
 - Common data models, experimental methodologies, protocols
 - Specific methodologies for different taxonomic groups/organisms
 - High-quality research and well-replicated studies to ascertain what are the consistent results
- Set up more field studies, more ecological studies & better integration amongst laboratory studies
- Initiate research on the impacts of new technologies, such as:
 - 5G technology, LED lamps, pulsed radiation, cell towers, smart meters, etc.
- Study the impacts of EMR at different biological organisations/levels, including:
 - On whole ecosystems, at populations' levels, etc.
 - At protein level, at genomic level, at the level of assemblages, etc.
- Account for confounding/interfering factors in analysing the effects of EMR & on how different frequencies interact
- Develop more and better cooperation/collaborations, especially interdisciplinary teams, in particular:
 - Cooperation between different countries, teams, etc.
 - Including GIS experts in studies
- Include observations and knowledge from local people & consider citizen science approaches

The participants were then asked to rate them on a scale from 1 to 5 for the three following criteria:

- The general importance or urgency to address the need



- The feasibility or ease to implement such a study (including the financial feasibility)
- The contribution of the expected results to the knowledge base and to support evidence-based decision-making

The results of the polling were presented with the average score for each research priority, per criteria, (see Figure 11) and depicted in a graphic representation (see Figure 12).

Research needs related to the content of the studies (confounding/interfering factors; impacts at different levels; effects of new technologies) and on how studies should be carried on (standard methodologies; more field studies; collaborations and interdisciplinarity) were considered particularly important and urgent (+ 4.0).

The polling reveals that the feasibility of such studies may appear more complicated to implement (3.0-3.8), especially regarding confounding/interfering factors (2.8).

As for the contribution to knowledge, standardization methods and field studies ranked quite high (+4.00), the other proposed research priorities being viewed as average to good (3.3-3.9), with the exception of local knowledge/citizen science which listed particularly low in the ranking (2.8).

		Importance	Feasibility	Contribution
1	Develop standardization/methodologies/protocols to better design future studies & compare research results	4,20	3,70	4,20
2	Set up more field studies, more ecological studies & better cooperation with lab studies	4,30	3,10	4,00
3	Initiate research on the impacts of new technologies	4,00	3,00	3,30
4	Study the impacts of EMR at different biological organisations/levels	4,40	3,40	3,90
5	Collect data on confounding/interfering factors & on how different frequencies interact	4,50	2,80	3,80
6	Develop more and better cooperation/collaborations, especially interdisciplinary teams	4,40	3,80	3,60
7	Include observations and knowledge from local people & consider citizen science approaches	3,40	3,80	2,80

Figure 11 Average weighting of the assessment of research needs per criteria



Figure 12 Graphic representation of the assessment of research needs per criteria

Transversal policy recommendations:

- Provide/release more funds for research on the effects of EMR
- Foster research collaborations at different levels, including:
 - Cross-institutional
 - Interdisciplinary (esp. biology/ecology vs technology/dosimetry experts)
 - Facilitate access for younger scientists
 - Between countries
- Enable data sharing and open discussions, in the form of:
 - Open databases
 - Platform for exchanges
 - Advisory group to governments
 - Stakeholders' group composed of companies, researchers, citizens, etc.
 - Adopt common standards

- Apply the precautionary principle for current and new technologies, for example:
 - Define safe levels and exposure limits
 - Avoid EMR sources in wildlife areas
 - Independent research in impacts before deployment
 - “Proof of safety” before widespread use

A word cloud was produced representing the recurring themes and ideas for recommendations to policymakers, whether in the environmental or other sectors (see Figure 13).



Figure 13 Word cloud of recurring themes for policy recommendations

5. Conclusions

The web conference was a success in terms of organisation, as the innovative, interactive tools used enabled an active participation of a very diverse audience from all over the world.

In terms of content, the participants further discussed the current state of knowledge related to the EMR impacts on wildlife, generally, in line with what the experts' group had identified. They contributed by discussing and providing a significant list of knowledge gaps, research needs or priorities and policy recommendations for each taxonomic group.

The most recurring problem in the current scientific studies (in all taxonomic groups) appeared to be the **lack of standardised and controlled technical set-ups** for the experiments and the monitoring of exposure levels and frequencies. The participants suggested several ways to overcome this shortcoming (standard methodologies, protocols, exposure levels and measures, common data models, etc.) to ensure the comparison and replication of the studies. In addition, it would require the **sharing and accessibility of open data** to the research community at large.

Among the other knowledge gaps, there is a need to address **some species or families that are currently being understudied**, but also to better understand the **interactions at different levels**. The participants also suggested potential improvements in the management of the scientific research itself, citing elements such as the importance of including **observations from local people** and the use of **citizen science**; the need for **collaborations** between areas of expertise, or institutions.

A key policy recommendation refers to the urgent need to allocate **more funding to research** on the topic. Participants also emphasized the importance of **bringing together different stakeholders** (not only scientists,

but also policymakers, businesses, citizens, decision makers, etc.) and to set up advisory groups. Finally, some participants recommended to apply the **precautionary principle**, to define and set **safe limits** to EMR exposure, and to **avoid placing EMR sources in nature reserves/wildlife areas**.

In terms of **science-policy interface**, a next step would be to determine more precisely which EMR frequencies and sources appear to have the most significant effects, to characterise the range of impacts, and to scope the scale of their potential effects on wildlife, so that policy and research priorities can be better framed. The current research needs to be grounded in studies with solid data and background to make sure a message, based on correct and verified knowledge, can be conveyed to decision-makers and the society in general.

6. Lessons learnt

In accordance with the “learning by doing” philosophy behind EKLIPSE, the method used for answering the request was adapted during the process. Instead of only being a support for discussions during the web conference, the analyses of the experts’ group provided much more input and answers to the requesters’ question than was initially expected. The web conference participants provided valuable feedback on the work already done and complemented the experts’ findings with new reflections and policy recommendations.

The community related to research on EMR is very limited, and the topic appeared to be very specific and sensitive. Many non-scientists showed an interest in the web conference and some contributed actively to the discussions. However, this specificity might have been better taken into account in the organisation of and the dissemination on the web conference, as it might explain – at least partly – the relatively low numbers of participants. The timing (January) and length (5 sessions of 2 hours) of the event might also not have been ideal and might also explain why fewer people were available than we had hoped.

The technical online tools were very useful but might not be the best option for a small conference aiming to answer specific questions of a very technical and scientific nature. Rather, with its potential to host hundreds of participants and make them work together in breakout groups, these tools would be a perfect fit for large consultation events where the objectives are to bring together a variety of stakeholders (scientists, policy-makers, citizens, businesses,...) around scientific topics and issues.

7. Glossary

Term	Definition
EKLIPSE	EKLIPSE (Establishing a European Knowledge and Learning Mechanism to Improve the Policy-Science-Society Interface on Biodiversity and Ecosystem Services) is a H2020 funded project that aims to develop an innovative and self-sustainable EU support mechanism for evidence-based and evidence-informed policy on biodiversity and ecosystem services.
Electromagnetic radiation	Electromagnetic fields (EMF) are a combination of invisible electric and magnetic fields of force. They occur both naturally and due to human activity. Naturally occurring EMF are for example, the earth static magnetic field to which we are constantly exposed, electric fields caused by electrical charges in the clouds or by the static electricity produced when two objects are rubbed together as well as sudden electric and magnetic fields caused by lightning, etc. Man-made electromagnetic fields (EMF) are for example generated by extremely low frequency (ELF) sources, such as power-lines, wiring and appliances as well as by higher frequency sources such as radio and television waves and, more recently, cellular telephones and their antennas. ³
IPBES	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is the intergovernmental body which assesses the state of biodiversity and of the ecosystem services it provides to society, in response to requests from decision makers.

³ Source: [Greenfacts, 2018](#).

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Appendix I: Members of the Experts Steering Group

Matt Shardlow (requester)

Buglife is the only organisation in Europe devoted to the conservation of all invertebrates, and we are actively working to save Britain's rarest little animals, everything from bees to beetles, worms to woodlice and jumping spiders to jellyfish. There are more than 40,000 invertebrate species in the UK, and many of these are under threat as never before. Invertebrates are vitally important to a healthy planet – humans and other life forms could not survive without them. The food we eat, the fish we catch, the birds we see, the flowers we smell and the hum of life we hear, simply would not exist without bugs. Invertebrates underpin life on earth and without them the world's ecosystems would collapse.

Prof Mario Babilon (expert)

Prof Babilon got his final degree in physics ("Diplom Physiker") in July, 2001 from the Technical University of Darmstadt. Thereafter he graduated in Nuclear Physics. During that time, he spent one year at Wright Nuclear Structure Lab at YALE University in the United States as a visiting assistant in research. He received his PhD in December 2004 and spent about one more year as a post-doc in Darmstadt, before switching to industry. He started a career in the corporate research department of BOSCH. Meanwhile he was giving lectures at the Cooperative State University in Stuttgart. He completely switched to the University in 2011 and since then he is a Professor in Computer Science.

Dr Erich Pascal Malkemper (expert)

Dr Malkemper is a biologist who received his PhD at the University of Duisburg-Essen in Germany. His thesis "The sensory biology of the red fox – hearing, vision, magnetoreception" was awarded the Fritz-Frank-Award of the German Society for Mammalian Biology in 2015. His research focusses on sensory systems, which he studies with behavioural experiments, histology and physiology, to understand ecological adaptations of a given species. He is currently based at the Research Institute of Molecular Pathology (IMP) in Vienna, Austria, where he conducts research on magnetoreception in homing pigeons.

Dr Benoît Stockbroeckx (expert)

Dr Stockbroeckx received the degree of Electrical Engineer from the Université Catholique de Louvain (UCL), Louvain-la-Neuve, Belgium, in 1993. He received his PhD degree in Applied Sciences in 1998 with a thesis on Space waves and surface waves in the Vivaldi antenna. He is involved in EMF exposure assessments since 1998. He is now the head of laboratory division at ANPI in charge of alarm systems, active fire prevention, theft prevention, CE marking (EMC, LVD, CPR), electromagnetic compatibility. He is also expert at the Belgian Health Council for non-ionising radiations.

Dr Thomas Tscheulin (expert)

Dr Tscheulin, holding a PhD in Population Ecology from Imperial College London, is currently an Assistant Professor at the University of the Aegean, Greece. He has a strong track record of collaborative research, both within and between host institutions in three different European countries. His main research interest is to relate assessments of the abundance, diversity, functional structure and trophic interactions of invertebrates, to the impacts of ecosystem disturbances such as agricultural practices, alien species invasion, climate change, wildfires, habitat loss and degradation. He is an associate editor for Animal Conservation and has so far published 36 scientific papers.

Dr Adam J. Vanbergen (expert)

Dr Adam Vanbergen is an invertebrate ecologist who received his PhD on 'Landscape to host-plant scales: bottom-up heterogeneity affects invertebrate diversity & interactions' from Cardiff University. He has been working for the Centre for Ecology & Hydrology since 1998. His research focusses on species interactions, community structure, and the relationship between biodiversity and ecosystem functions and services. He is particularly interested in understanding how anthropogenic disturbance across spatial scales governs diversity and interactions, above and belowground and at trophic levels directly (herbivores, pollinators) and indirectly (predators, parasites) connected to plants.

Prof Alain Vian (expert)

Prof Vian obtained his PhD in plant physiology at the University Blaise Pascal (1995) under the supervision of Dr Marie-Odile Desbiez, working on plant responses to wounding. He then performed a 2-years postdoctoral period in the laboratory of Prof. Eric Davies (North Carolina State University), working on the rapid molecular events following plant flaming. He obtained an assistant professor position at the university Blaise Pascal (Clermont-Ferrand) and rapidly specialized in plant responses to high frequency electromagnetic field, in collaboration with physicists (Profs Françoise Paladian and Pierre Bonnet). In 2008, he obtained a prize from the French Academy of Sciences for this work. He became full professor in 2009 at the University of Angers and since 2012 has worked in the Institut de Recherche en Horticulture et Semences (UMR 1345), studying the effect of environmental factors (mainly nitrogen nutrition) on the regulation of axillary bud outgrowth, a major event in the establishment of plant architecture. He is also continuing his work on the biological effects of high frequency electromagnetic field on plant development.

Appendix II: Agenda of the web conference

Monday, 22 Jan 2018 // 16:00-18:00 CET // Introduction session

Time	Activity
16:00	Welcome Agenda and concept of the web conference Introduction to EKLIPSE and Buglife Introduction to Covision and the online tools
16:25	Small group discussion: <i>"What expectations do you have for this conference on EMR effects on wildlife?"</i>
16:40	Sharing of the expressed expectations with the audience.
16:50	Presentation of the background document by Lise Goudeseune
17:10	Small group discussion: <i>"What do you think of the results presented in the background document? What stands out for you? Is there anything missing?"</i>
17:30	Sharing of the main ideas with the audience.
17:45	Wrap up and end of the session

Tuesday, 23 Jan 2018 // 13:30-15:30 CET // Session on Plants

Time	Activity
13:30	Introduction
13:35	Presentation of the results of analyses for Plants by Prof Alain Vian
13:55	Small group discussion: <i>"In reviewing the key knowledge gaps in the background document on EMR impacts, what stands out for you? Anything missing?"</i>
14:10	Sharing of the identified knowledge gaps
14:15	Small group discussion: <i>"Based on the identified knowledge gaps, what are the most important research needs/priorities?"</i>
14:40	Small group discussion: <i>"Based on available knowledge, what policy recommendations (environmental or other sectors) would you propose?"</i>
14:55	Sharing of research needs/priorities and voting
15:05	Sharing of policy recommendations and voting
15:15	Summary and closing of the session

Tuesday, 23 Jan 2018 // 16:00-18:00 CET // Session on Vertebrates

Time	Activity
16:00	Introduction
16:05	Presentation of the results of analyses for Vertebrates by Dr Pascal Malkemper
16:25	Small group discussion: <i>"In reviewing the key knowledge gaps in the background document on EMR impacts, what stands out for you? Anything missing?"</i>
16:40	Sharing of the identified knowledge gaps
16:45	Small group discussion: <i>"Based on the identified knowledge gaps, what are the most important research needs/priorities?"</i>
17:10	Small group discussion: <i>"Based on available knowledge, what policy recommendations (environmental or other sectors) would you propose?"</i>
17:25	Sharing of research needs/priorities and voting
17:35	Sharing of policy recommendations and voting
17:45	Summary and closing of the session

Wednesday, 24 Jan 2018 // 16:00-18:00 CET // Session on Invertebrates

Time	Activity
16:00	Introduction
16:05	Presentation of the results of analyses for Invertebrates by Dr Thomas Tscheulin & Dr Adam Vanbergen
16:25	Small group discussion: <i>"In reviewing the key knowledge gaps in the background document on EMR impacts, what stands out for you? Anything missing?"</i>
16:40	Sharing of the identified knowledge gaps
16:45	Small group discussion: <i>"Based on the identified knowledge gaps, what are the most important research needs/priorities?"</i>
17:10	Small group discussion: <i>"Based on available knowledge, what policy recommendations (environmental or other sectors) would you propose?"</i>
17:25	Sharing of research needs/priorities and voting
17:35	Sharing of policy recommendations and voting
17:45	Summary and closing of the session



Thursday, 25 Jan 2018 // 16:00-18:00 CET // Closing session

Time	Activity
16:00	Introduction & summary
16:10	Presentation of the results from the last three sessions
16:25	Presentation of transversal research needs by Lise Goudeseune
16:35	Voting on transversal research needs
16:45	Presentation of transversal policy recommendations by Jorge Ventocilla
16:55	Voting on transversal policy recommendations
17:05	Small group discussion: <i>"What are your final thoughts about the results that have been presented? What should be done next?"</i>
17:20	Sharing of the final thoughts
17:30	Wrap up and closing of the session

Appendix III: List of participants (who agreed to share their information)

Tit le	First name	Last name	Email	Country	Organisation	Position
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Mr	James	BUTLER	emfguy@gmail.com	Canada	HomeSafe	President
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Mr	Siraj Uddin	MAZUMDER	sirajwls@gmail.com	India	Aligarh Muslim University	PhD Student
Mr	Lance	MCKEE	lmckee76@gmail.com	United States of America	No organizational affiliation.	Independent writer and researcher
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Ms	Barbara	PAYNE	barbara.payne@iexistworld.org	Canada	Electromagnetic Pollution Illnesses Canada Foundation (EPIC) [not for profit organization]	President

Dr	Petr	PETRIK	petrik@ibot.cas.cz	Czech Republic	Institute of Botany, The Czech Academy of Sciences	Senior Researcher
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The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Current knowledge overview: a background document to the web conference

A report of the EKLIPSE project



Horizon 2020
European Union Funding
For Research & Innovation
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The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Current knowledge overview: a background document to the web conference.

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** These authors contributed equally to this work.*



Contents

1.	Context and objectives.....	4
	1.1 Organisers.....	4
	1.2 Objectives	4
2.	Knowledge overview methodology.....	5
	2.1 Scoping of the literature	5
	2.2 Structuring of the literature and analyses.....	5
	2.3 Assessment of the confidence levels of the studies	6
3.	Key results: current state of knowledge	8
	3.1 Quality of the studies in terms of technical aspects	8
	a. Invertebrates	8
	b. Vertebrates	8
	c. Plants	9
	d. General and cross-cutting observations	10
	3.2 Quality of the studies in terms of biological or ecological aspects.....	10
	a. Invertebrates	10
	b. Vertebrates	10
	c. Plants	11
	d. General and cross-cutting observations	12
	3.3 Key findings: studied organisms and observed effects	12
	a. Invertebrates	12
	b. Vertebrates	12
	c. Plants	13
	3.4 Knowledge gaps and research needs	14
	a. Invertebrates	14
	b. Vertebrates	14
	c. Plants	14
	d. General and cross-cutting observations	15
4.	Conclusions	15
	4.1 Invertebrates	15
	4.2 Vertebrates	16
	4.3 Plants	17

Appendix I: Members of the Experts Steering Group	25
Appendix II: Tables with number of assessed studies	27

List of Figures

Figure 1 Four-box model for the qualitative communication of confidence	7
Figure 2 Level of confidence of the statements for the invertebrates	16
Figure 3 Level of confidence of the statements for the vertebrates	17
Figure 4 Level of confidence of the statements for the plants	18

List of Tables

Table 1 Categorisation and identification of radiation types	6
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The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Current knowledge overview: a background document to the web conference.

Authors: Erich P. MALKEMPER*, Thomas TSCHULIN*, Adam J. VANBERGEN*, Alain VIAN*, Estelle BALIAN, Lise GOUDESEUNE.

** These authors contributed equally to this work.*

1. Context and objectives

Organisers

[EKLIPSE](#) is an EU funded Coordination Action under H2020, aiming to develop a European Mechanism to answer requests from policy makers and other societal actors on biodiversity related issues.

EKLIPSE had a first "Call for request" in September 2016. The request submitted by Buglife on the impacts of anthropogenic electromagnetic radiation on invertebrates was selected to initiate a process of identifying key knowledge gaps and research needs, as well as to formulate recommendations. The scope of the request has been adjusted and it now extends to the impacts on invertebrates, vertebrates, and plants, and the range of EMR types has been reduced.

After a first scoping to compile a list of publications relevant to the topic, EKLIPSE has invited selected experts to join Experts Steering Group to analyse the publications and help prepare the organisation of a larger consultation through a web conference. The Experts Steering Group is multidisciplinary: it is composed of four biologists/ecologists specialised in different taxonomic groups, as well as two physicists having worked with electromagnetic field (see Appendix I - Members of the Experts Steering Group).

This document provides the results of the first scoping and analysis of available literature by the Experts Steering Group to provide a knowledge overview and identify knowledge gaps. It is a working document and it will lead to a more elaborated report integrating the results of the web conference

Objectives

This overview aims to identify which main taxonomic groups, which types of EMR, and associated effects have been addressed by the existing studies.

It will also assess the level of quality/reliability of the available studies on both technical and biological/ecological aspects.

Based on this overview, key knowledge gaps and assessments of the quality of the studies have been identified and have served as the basis of discussions for the larger consultation (web conference) that was organised by EKLIPSE at the beginning of 2018. This background document should be considered as a technical working report and does not aim to be exhaustive but rather to provide a first step in the analysis of the currently available knowledge and future research needs.

2. Knowledge overview methodology

2.1 Scoping of the literature

The literature used was restricted to peer-reviewed articles. The search for publications was made on the ISI Web of Knowledge platform and it was completed by searches on Google Scholar, using the following combinations of keywords:

- EMR; EMF; electrosmog; electromagnetic field; electromagnetic radiation; electromagnetic

AND

- wildlife; invertebrate(s); vertebrate(s); plant(s); animal(s); insect(s); arthropod(s); bee(s); drosophila; mammal(s); fish; amphibian(s); bird(s); tree(s); flower(s); biodiversity.

The publications cited in the identified papers were also examined to complement the list. A further search was done with the names of recurring experts. Only recent papers (from 2000 onwards) were considered.

The focus was made on wildlife (plants, invertebrates, vertebrates), although a few studies on domestic animals have been included.

The range of EMR types has also been restricted to artificial anthropogenic radiations. For example, it does not include research on the effects of light, the Earth's magnetic field, MRI-strength magnetic field, etc.) Studies that were considered out of this scope were discarded and not used in the analysis.

A Call for Knowledge was launched on the EKLIPSE KNOCK Forum (interactive discussion platform) and additional publications, suggested by the contributors, were added to the list. Finally, the experts from the Experts Steering Group provided a few more relevant sources.

In total, 147 scientific papers or reviews were identified, and 97 of them were used in the analyses (see list of References).

This final list of publications does not aim to be comprehensive, but to compile a representative set of papers and studies to allow an overview of the current knowledge and gaps.

2.2 Structuring of the literature and analyses

The Experts Steering Group structured the analyses in two different axes. On one hand, the biologists/ecologists divided the work amongst them according to three major taxonomic groups: 1/ invertebrates, 2/ vertebrates, 3/ plants. On the other hand, the physicists/engineers have created 15 categories of anthropogenic radiation types based on frequency and exposure identified by codes (see Table 1).



Table 1 Categorisation and identification of radiation types

Category	Identification
Non-specific magnetic fields	Static magnetic field
	Extremely low frequencies (< 1 kHz)
Non-specific electric fields	Static electric field
	Extremely low frequencies (< 1 kHz)
Non-specific radiofrequencies	Between 1 kHz and 6 GHz
Non-specific microwaves	Between 6 GHz and 300 GHz
Non-specific infrared	Between 300 GHz and 430 Thz
Application specific exposure	Power lines magnetic field (50 or 60 Hz)
	Power lines electric field (50 or 60 Hz)
	Analog broadcasting-like signals (TV, radio)
	Digital broadcasting-like signals (TV, radio)
	2G base station-like signals (GSM)
	3G base station-like signals (UMTS)
	4G base station-like signals
	Radar-like signals

Then, an analytical grid was produced with the publications identified per taxonomic group and radiation type. Different comment sections were added to assess the quality of the studies (technological aspects and biological aspects), the conditions of the studies, the results, the knowledge gaps, etc.

The following rating system was used:

1. bad quality
2. minimum quality, with some elements that can be used
3. normal quality, some gaps
4. excellent

2.3 Assessment of the confidence levels of the studies

In this background document, we make an initial attempt to distil the assessment of the published scientific literature into a series of 'key messages', which are succinct statements aimed at conveying important

information to the web conference participants and, ultimately, to decision-makers. The scientific evidence assessed included empirical data, theory, and models.

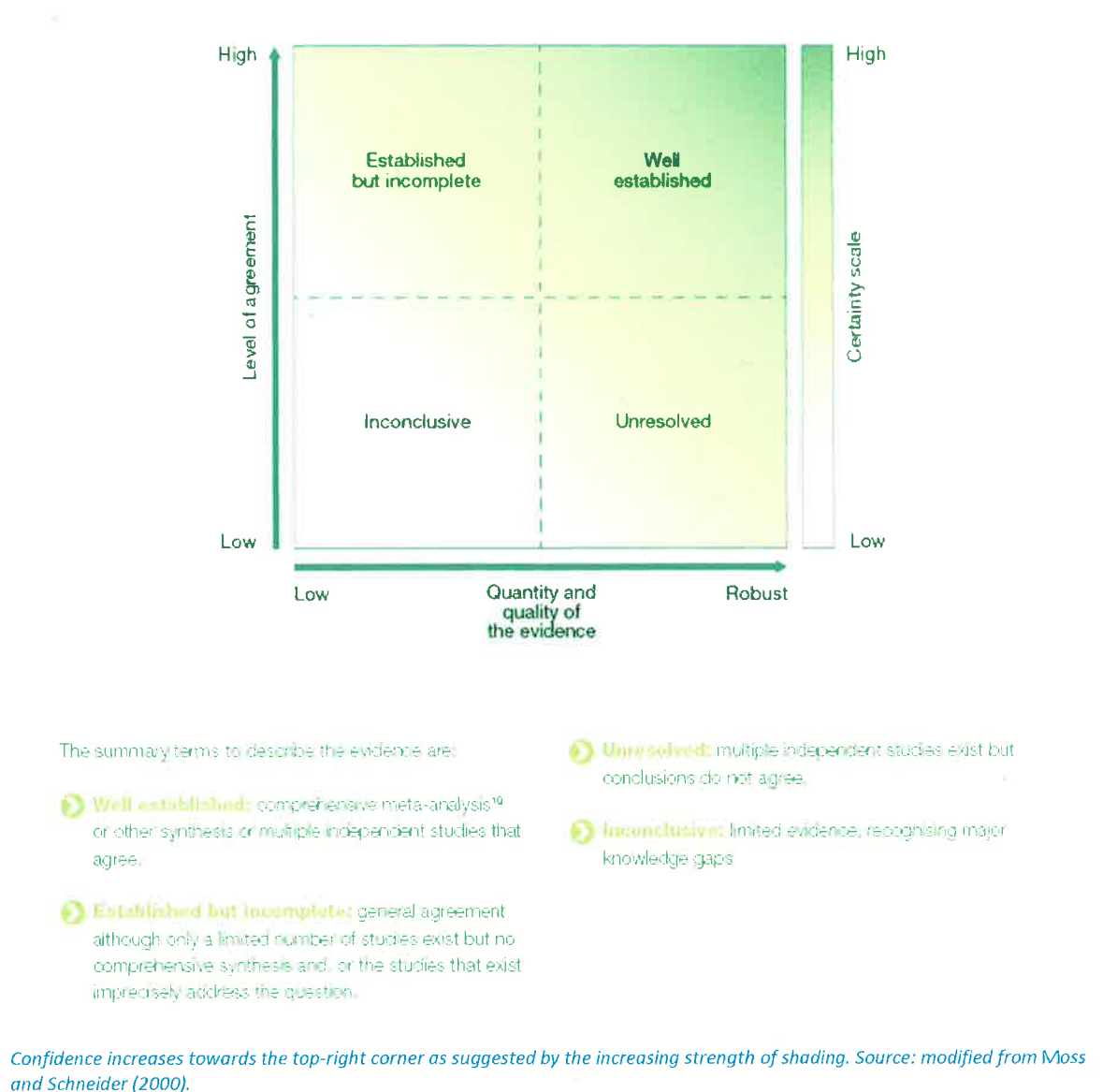


Figure 1 Four-box model for the qualitative communication of confidence.

For scientists and decision-makers to understand the level of the potential problem it is crucial that the degree of confidence in each key message is evaluated and communicated in ways that are effective but simple enough for a range of audiences to understand. In our assessment of the published evidence about the effects of EMR on wildlife we employ a qualitative ‘four-box model’ to communicate the level of certainty in knowledge, this allows us to show how each key message is based on the assessment of the quantity, quality and level of expert agreement in the evidence (see Figure 1). This model follows and is adopted from the Intergovernmental Platform for Biodiversity & Ecosystem Services (IPBES, 2016), which in turn adapted the model from Moss and Schneider (2000), which uses this approach to convey messages of its assessments to intergovernmental policymaking.

3. Key results: current state of knowledge

3.1 Quality of the studies in terms of technical aspects

a. Invertebrates

This document aims to frame the current knowledge about the impacts of EMR on wildlife as based on an assessment of the scientific literature. It is expected that debate and challenge during the web conference will either confirm our assessment of the evidence, the level of certainty, and the knowledge gaps or produce additional evidence that may stimulate a reassessment of the evidence and the resulting key messages to decision makers.

The quality of published studies investigating the impacts of EMR on invertebrates is very mixed. On the one hand, results from studies carried out in the laboratory are often not transferable to real life situations due to an oversimplification of effects and the limited exposure (both in time and space) to EMR of the subjects.

On the other hand, field studies suffer from a multitude of unmeasured potential effects that are indirectly related to EMR levels and can often not be disentangled, thereby confounding analysis. Field studies also often suffer from (very) low replication which makes drawing firm conclusions difficult.

Certain studies of very poor scientific quality (e.g. no or very low replication) employed highly artificial EMR treatments, such as placing a mobile phone either inside or immediately adjacent to honey bee hives. This represented a highly field-unrealistic exposure to a source of EMR and, even putting issues of replication aside, would mean no rigorous conclusions can be reached.

b. Vertebrates

Studies on the effects of time-varying magnetic fields on vertebrates are highly variable in terms of the exposure and the read-outs used to investigate possible effects. The magnetic fields range from extremely low frequency power line fields “applied” in the field to highly controlled gigahertz fields in the laboratory. Study qualities in terms of technical aspects are equally inhomogeneous. Not even half of the studies assessed were given the highest technical ranking (see Appendix II - Tables with number of assessed studies). The often poor design and missing control experiments impair assessment of the validity of the results and are likely to be the main reason for a low number of cross-laboratory replicated results. Unfortunately, the great variability in the qualities of primary research papers is not reflected in many reviews on the topic. Often, these reviews do not report selection criteria for the inclusion of studies. In addition, reviews suffer from the problem of comparing studies with highly variable descriptions of technical details on exposure parameters which hampers condensing similarities among the findings. In our assessment the studies with the lowest ratings in terms of technical aspects were:

1. Not blinding the experimenters
2. Not including appropriate controls
3. Inadequately characterized EMR exposure

We recommend that both laboratory studies and field studies which are equally important should apply to standard methodological criteria which are listed below in 3.1.4. As biologists are usually not experts on RF-physics, collaborations with physicists and engineers are crucial to achieve reliable exposure conditions. Studies on the effects of exposure in the fields should be accompanied by lab studies which simulate the

exposure under normal environmental conditions which some studies did quite well. The currently biggest issue is the time of exposure, as long-term studies are mostly missing. The development of devices to expose wild animals for a long time to controlled RF in the field should be impelled (e.g. coil-collars or large coil systems around enclosures).

c. Plants

Plants are outstanding models to study the impact of EMR on biological systems. Indeed, they are immobile and therefore can't escape from an environmental constraint and keep a constant orientation in the EMR. Their high surface to volume ratio place a high proportion of cells at the direct interface of the environment and are deprived of awareness, thus eliminating the interference with stressful conditions that could be encountered with animal experiments.

The technical aspect of the studies performed on plants ranked from very poor to excellent. The control of the exposure conditions is one of the most difficult to overcome. Concerning the laboratory studies, one could avoid the use of communication devices such as cell phones to expose sample since their automatisms make difficult to control the emitted EMR and the samples are placed near the device in a region where the EMR is not well established (near field) and difficult to control and measure.

The studies conducted in the field are comparatively less abundant and raise two difficulties: i) the first is to efficiently measure the level of EMR in an open environment, where it may vary in nature and amplitude along the day; ii) the second is to avoid / limit or understand the interference with other environmental traits (wind, temperature, pathogens...) that may compromise or make difficult the interpretation of biological responses. The parameters that are used to report the EMR effect on plant are diverse and of unequal value. A high proportion of laboratory experiments concentrate on biochemical or molecular changes that occur shortly after sample exposure. They are using standardized protocols and are generally well conducted, but a greater attention should be paid to control samples. Indeed, most of biological traits vary along the day and changes may reflect natural events rather than responses to EMR if the proper control samples are not performed. Modifications of plant growth after exposure should be conducted with great care since they reveal delayed effects of the exposure and the experiments last for several days during which it can be difficult to avoid interference with other factors that could lead to misinterpretations.

Recommendations for future lab studies could include the use of dedicated devices (TEM-Cell and G-TEM) that offer several advantages, particularly the ability to obtain high EMR amplitude with relatively low injected power, and a very good control of the electromagnetic field characteristics. These devices however only allow the generation of polarized EMR, a situation that is rarely encountered in the true environment, especially in an urban environment, where the signals are reflected and diffracted. The mode stirred reverberation chamber (MSRC), is designed to mimic this situation and has proven to be a very valuable tool as exposure device. However, the cost and complexity has limited the use of this facility.

The field experiments are extremely interesting since plants are still witnesses of their environment and should report long term exposure effects in natural conditions. They are generally using an approach based on the observation of symptoms, linking appearance defects with exposure to electromagnetic fields. Since this approach could be a good starting point, the formal link between the symptoms and the exposure should be established with complementary laboratory studies.

Another key recommendation would be to ensure collaboration with physicists to avoid errors in the set-up of the experimental procedures and/or of the exposure level measurement.



d. General and cross-cutting observations

The studies with the highest rankings set the benchmark for the minimal requirements a future study should meet to be suitable for publication in peer-reviewed journals:

1. Data collection and/or analysis must be conducted in a blinded fashion to minimize observer bias
2. Proper controls for side effects accompanying magnetic exposure, such as vibrations, heat and electric fields need to be accounted for, e.g. by using double-wrapped coils.
3. Whenever magnetic fields are applied it needs to be made sure that all experimental groups are exposed to the same background field by shielding (Faraday cage). In any case the background field needs to be reported through continuous broadband measurements.
4. The magnetic fields used need to be accurately measured and the measurement devices and results reported in detail: Sensitivity of the devices, frequency (-range), intensity, polarization, duration, direction

Collaboration with physicists to better prepare and implement the technical protocols is a major aspect for ensuring technical quality of the studies.

3.2 Quality of the studies in terms of biological or ecological aspects

a. Invertebrates

Physiological and histological studies were usually well replicated and the scientific approach in terms of replication and analysis of the results was satisfactory.

There is a real lack of ecological studies looking at the effect of EMR on species assemblages. One study points out some guilds that seem to be less affected by EMR possibly due to different life history traits that minimise exposure levels at critical life stages. There are no published studies of effects of EMR on species interactions.

From a scientific and technical perspective, the best primary studies (i.e. those receiving a score = 3) tended to be those reporting on the fundamental biology of interactions between insects and naturally occurring electromagnetic fields. Such studies were always laboratory based, well replicated and controlled. Overall the next tier of primary studies (graded as score 2) were more focussed on anthropogenic sources of EMR, such as that produced by mobile phone masts, but were mostly laboratory based. This set of studies was very mixed with respect to scientific quality, sometimes replication appeared at a reasonable and appropriate level. However, a lack or underreporting of the design, replication levels or methods sometimes meant that the study could not be evaluated properly. Of the few field studies, there were either negligible, contrasting effects on behaviour or abundance.

The remaining field and laboratory studies (graded 0 or 1) were anecdotal or flawed from the perspective of scientific design, such as having very low or non-existent levels of replication, pseudoreplication, highly unrealistic treatments, or sometimes a combination of all flaws. Consequently, no statistical analysis can be done and no meaningful information can be gleaned from such studies.

b. Vertebrates

Readouts for effects of EMR on vertebrates span the whole spectrum from hormone levels and other physiological parameters to behaviour. Many of these readouts might have ecological implications (relevant for species survival and thus of interest for conservation efforts) but real ecological studies are extremely

rare. The lack of ecological studies is most probably based on the number of environmental variables that effect ecological communities which makes it hard to identify the influence of EMR in a controlled manner.

The studies focussing on single species often in a laboratory setting suffer from an additional and very general problem: They are not based on hypotheses of how EMR could influence biological structures and thus are not following hypothetico-deductive methodology. Therefore, the effects found are not explainable and no dose-response relationships are revealed. The exposure levels vary dramatically between studies and results are rarely replicated across laboratories.

However, there are two exceptions:

1. Heat effects: It is undisputed that strong EMR fields increase the temperature in tissue and many EMR effects found in (especially older) studies can be explained by hyperthermia. However, the EMR intensities needed to induce the heating are not experienced by wildlife (so far).
2. The magnetic sense of birds: Two main hypotheses for the transduction mechanism are supported by manifold evidence and the influence of EMR can be specifically predicted and tested.

Of the 20 primary research studies rated in this assessment one quarter was of very low quality in terms of the biological aspects (see Appendix II - Tables with number of assessed studies). Of the rest, one half (7) was of mediocre quality while 8 studies were excellent, with clear hypothesis-based predictions that were specifically tested. 62.5% of these excellent studies were from the field of animal magnetoreception.

c. Plants

Angiosperms are by far the main taxonomic group to be studied (only a few used mosses).

The principal point is to achieve a formal link between the exposure and the biological responses, thus the main issue is to avoid the intrusion of environmental factors that may interfere with the conclusions. This point is especially critical for plants since their immobility makes them very sensitive to even minute changes (light, mineral nutrition, wind, etc.). Basically, and apart from the lab/field point of view, studies can be divided in two:

1. those exposing seeds or seedlings and looking at events (biochemical and growth modifications) that follow the exposure. These had the advantage of using «naive» samples (i.e. with no or limited life history before the exposure) that self-feed on their reserves. They however present the disadvantage of incomplete metabolism and/or limited organ development that may limit interaction with EMR.
2. older or adult plants that present the advantage of fully functional metabolism (in particular the photosynthetic apparatus) and well developed vegetative organs to ensure efficient EMR signal pick-up. These models require however careful handling and constant environmental conditions over the exposure, this can only be achieved effectively in the laboratory.

While the experiments could be easily repeated in laboratory, field experiments could suffer from single observations that it may be difficult or impossible to observe a satisfying equivalent. These approaches should avoid such situation and concentrate on samples that are present similar exposure conditions and symptoms.



d. General and cross-cutting observations

Double-blind experimental procedures are ideal for exposures protocols. Anyway, special attention should be paid to set-up adequate controls and to properly evaluate the level of exposure. Also, the use of communication devices as EMR source should be avoided.

Of the reviews, the majority are not systematic or objective but appear to be unbalanced and asserting a particular world view (i.e. that it is a problem for biodiversity) without strong supporting evidence.

Cryptochromes are particularly interesting as they occur across all groups.

3.3 Key findings: studied organisms and observed effects

a. Invertebrates

Organisms studied for impacts of EMR are the western honey bee (*Apis mellifera*), *Drosophila* flies, specific beetle species, ants and in one/few cases wild pollinators (Diptera, Hymenoptera, Lepidoptera, Coleoptera).

Few, often high quality, published experiments on the fundamental biological responses of insects to naturally occurring electromagnetic fields (or experimentally imposed fields closely mimicking nature or their lack) demonstrate how insects detect and orientate with electrical or magnetic fields and the effects (or lack of) on behaviour, physiological function, reproduction. While providing some mechanistic basis for hypothesis testing, such studies do not provide evidence on effects of anthropogenic sources of EMR on invertebrate biodiversity.

The majority of laboratory studies are focussed on physiological or developmental responses to short-term or acute exposure to experimental sources of EMR. There are no studies that examine effects on invertebrates of long-term or chronic exposure to sources of anthropogenic EMR.

Effects on insects tend to be often complex, typically variable in direction or effect size, and only sometimes adverse. Of the few scientifically rigorous laboratory experiments on model species (i.e. *Drosophila*) there is some evidence of exposure leading to cell damage or effects on individual development, locomotion, or reproduction.

There is a dearth of evidence from scientifically robust field studies, those that are available range from deeply flawed investigations that provide no meaningful evidence to a very restricted number of relatively robust studies albeit of limited scope. Of the latter, there have been studies that have shown some evidence that close proximity to EMR (from mobile phones) can affect honey bee colony behaviour, that exposure to mobile phone antennas can elicit idiosyncratic effects on wild pollinator abundance according to taxon, and no effects on reproductive capacity.

b. Vertebrates

In vertebrates, there is not much agreement on the effect of EMR on ecologically relevant parameters. Studies reporting effects are approximately as frequent as those reporting no effects (50-50%).

Few studies exist on direct ecological effects such as species abundance near RF-towers or in cities where background EMR levels are elevated. The descriptive nature of the studies, however, makes it impossible to detangle real EMR effects from other confounders such as light-pollution. There is some evidence that

Table 2
Special-Status Species Potentially Occurring in the Proposed Project Site and Buffer Area

Common Name	Scientific Name	Federal Status	State Status	Habitat/Observances	Potential to Occur on Project Site and Buffer Area
					species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Jepson's navarretia	<i>Navarretia jepsonii</i>	-	List 4.3	Chaparral, cismontane woodland, and valley and foothill grassland. Elevation range: 175 to 855. Blooming period: April to June.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Baker's navarretia	<i>Navarretia leucocephala</i> ssp. <i>bakeri</i>	-	List 1B.1	Cismontane woodland, lower montane coniferous forests, meadows and seeps, valley and foothill grassland, mesic vernal pools. Elevation range: 5 to 1,740. Blooming period: April to July.	None. No habitat in project area.
Few-flowered navarretia	<i>Navarretia leucocephala</i> ssp. <i>pauciflora</i>	FE	CT, List 1B.1	Vernal pools. Elevational range: 400 to 855 meters. Blooming period: May through July.	None. No habitat in project area.
Many-flowered navarretia	<i>Navarretia leucocephala</i> ssp. <i>plieantha</i>	FE	CE, List 1B.2	Found in cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools/mesic. Elevation ranges from 20 to 5710 feet (5 to 1740 meters). Blooms April through July.	None. No habitat in project area.
Porter's navarretia	<i>Navarretia paradoxinota</i>	-	List 1B.3	Meadows and seeps, often drainages. Elevation range: 165 to 840. Blooming period: May to July.	None. No habitat in project area.
Slender orcutt grass	<i>Orcuttia tenuis</i>	FT	CT/List 1B.1	Vernal pools. Elevational range: 35 to 1,760 meters. Blooming period: May through October.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to

Table 2
Special-Status Species Potentially Occurring in the Proposed Project Site and Buffer Area

Common Name	Scientific Name	Federal Status	State Status	Habitat/Observances	Potential to Occur on Project Site and Buffer Area
					the proposed project site (CDFW 2018) (see Figure 3b).
Geysers panicum	<i>Panicum acuminatum</i> <i>var. thermale</i>	*	CE, List 1B.2	Geothermally-altered soil, streamsides, closed-cone coniferous forest, riparian forest, and valley and foothill grassland. Elevation range: 305 to 2,470. Blooming period: June to August.	None. No habitat in project area.
Sonoma beardtongue	<i>Penstemon newberryi</i> <i>var. sonomensis</i>	-	List 1B.3	Found in chaparral (rocky). Elevational range: 700 to 1,370 meters. Blooming period: April through August.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Michael's rein orchid	<i>Piperia michaelii</i>	*	List 4.2	Coastal bluff scrub, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub, and lower montane coniferous forest. Elevational range: 3 to 915 meters. Blooming period: April through August.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Eel-grass pondweed	<i>Potamogeton</i> <i>zosteriformis</i>	*	List 2B.2	Marshes and swamps. Ponds, lakes, and streams. Elevational range: 0 to 1,860 meters. Blooming period: June through July.	None. No habitat in project area.
Lake County stonecrop	<i>Sedella leiocarpa</i>	FE	CE, List 1B.1	Valley and foothill grassland, vernal pools, and cismontane woodland. Blooms April to May. Elevation: 515 -- 640 m.	None. No habitat in project area.
Cleveland's ragwort	<i>Senecio clevelandii</i> <i>var. clevelandii</i>	*	List 4.3	Found in chaparral (serpentine seeps). Elevational range: 365 to 900 meters. Blooming period: June through July.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to

Table 2
Special-Status Species Potentially Occurring in the Proposed Project Site and Buffer Area

Common Name	Scientific Name	Federal Status	State Status	Habitat/Observances	Potential to Occur on Project Site and Buffer Area
					the proposed project site (CDFW 2018) (see Figure 3b).
Marsh checkerbloom	<i>Sidalcea oregano ssp. hydrophila</i>	-	List 1B.2	Meadows, seeps, and riparian forest on wet soils. Blooms June to August. Elevation: 455 – 2,030 meters.	None. No habitat in project area.
Bearded jewelflower	<i>Streptanthus barbiger</i>	-	List 4.2	Found in chaparral (openings), cismontane woodland. Elevational range: 150 to 1,070. meters. Blooming period: May through July.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Socrates Mine jewelflower	<i>Streptanthus brachiatus ssp. brachiatus</i>	-	List 1B.2	Found in chaparral and closed-cone coniferous forest. Elevational range: 545 to 1,000. meters. Blooming period: May through June.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Freed's jewelflower	<i>Streptanthus brachiatus ssp. hoffmanii</i>	-	List 1B.2	Found in chaparral and cismontane woodland. Elevational range: 490 to 1,220. meters. Blooming period: May through July.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Hoffman's bristly jewelflower	<i>Streptanthus glandulosus ssp. hoffmanii</i>	-	List 1B.3	Found in chaparral, cismontane woodland, and valley and foothill grassland. Elevational range: 120 to 475. meters. Blooming period: March through July.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented

Table 2
Special-Status Species Potentially Occurring in the Proposed Project Site and Buffer Area

Common Name	Scientific Name	Federal Status	State Status	Habitat/Observances	Potential to Occur on Project Site and Buffer Area
					within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Green jewelflower	<i>Streptanthus hesperidis</i>	*	List 1B.2	Found in chaparral (openings), cismontane woodland. Elevational range: 130 to 760. meters. Blooming period: May through July.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Three Peaks jewelflower	<i>Streptanthus morrisonii</i> ssp. <i>elatus</i>	*	List 1B.2	Found in chaparral. Elevational range: 90 to 815. meters. Blooming period: June through September.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Kruckeberg's jewelflower	<i>Streptanthus morrisonii</i> ssp. <i>kruckebergii</i>	*	List 1B.2	Cismontane woodland. Elevational range: 215 to 1,035 meters. Blooming period: April through July.	None. No habitat in project area.
Marsh zigadenus	<i>Toxicoscordion fontanum</i>	*	List 4.2	Found in chaparral, cismontane woodland, lower montane coniferous forest, meadows, seeps, marshes and swamps. Elevational range: 15 to 1,000 meters. Blooming period: April through July.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Napa bluecurls	<i>Trichostema ruygtii</i>	*	List 1B.2	Found in chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland, and vernal pools. Elevational range: 30 to 680. meters. Blooming period: June through	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys.

Table 2
Special-Status Species Potentially Occurring in the Proposed Project Site and Buffer Area

Common Name	Scientific Name	Federal Status	State Status	Habitat/Observances	Potential to Occur on Project Site and Buffer Area
				October.	This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Saline clover	<i>Trifolium hydrophilum</i>	-	List 1B.2	Found in marshes, swamps, vernal pools, and valley and foothill grassland. Elevational range: 0 to 300. meters. Blooming period: April through June.	None. No habitat in project area.
Oval-leaved viburnum	<i>Viburnum ellipticum</i>	-	List 2B.3	Found in chaparral, cismontane woodland, and lower montane coniferous forest. Elevational range: 215 to 1,400. meters. Blooming period: May through June.	Potentially present. Potential habitat for this species occurs within the proposed project buffer area. No individuals of this species were observed during surveys. This species has not been documented within the boundaries of or in proximity to the proposed project site (CDFW 2018) (see Figure 3b).
Sensitive Vegetative Communities					
Clear Lake Drainage Resident Trout Stream (Not present in project site or buffer area)					
Northern Basalt Flow Vernal Pool (Not present in project site or buffer area)					
Northern Volcanic Ash Vernal Pool (Not present in project site or buffer area)					
Coastal and Valley Freshwater Marsh (Not present in project site or buffer area)					

Status Codes:

Federal

FE = Federally listed as Endangered
FT = Federally listed as Threatened

FC = Federal Candidate species

State

CE = California listed as Endangered
CT = California listed as Threatened
CR = California listed as Rare
CFP = California Fully Protected
CSC = Species of Special Concern
WL = CDFW Watch List

California Rare Plant Rank (formerly known as CNPS Lists)

California Rare Plant Rank 1A = Plants presumed extinct in California

Table 2
Special-Status Species Potentially Occurring in the Proposed Project Site and Buffer Area

Common Name	Scientific Name	Federal Status	State Status	Habitat/Observances	Potential to Occur on Project Site and Buffer Area
California Rare Plant Rank 1B = Plants rare, threatened, or endangered in California and elsewhere					
California Rare Plant Rank 2A = Plants presumed extirpated from California, but more common elsewhere					
California Rare Plant Rank 2B = Plants rare or endangered in California, but more common elsewhere					
California Rare Plant Rank 3 = Plants about which we need more information; a review list					
California Rare Plant Rank 4 = Plants of limited distribution; a watch list.					
California Rare Plant Rank Rarity Status of .1 = Seriously endangered in California					
California Rare Plant Rank Rarity Status of .2 = Fairly endangered in California					

Status, distribution, and habitat information from the California Department of Fish and Wildlife (CDFW) California Natural Diversity Database RareFind 5 (CDFW 2018); California Native Plant Society, California Rare Plant Electronic Inventory (CNPS 2018); and USFWS Online Endangered Species Database (USFWS 2018).

4.3 SPECIAL-STATUS WILDLIFE SPECIES

The following is a discussion of species having potential to occur on site and/or are species that are prominent in today's regulatory environment. This document does not address impacts to species that may occur in the region but for which no habitat occurs on site.

Pallid Bat - The pallid bat is a California Species of Special Concern. Pallid bats are found in deserts, grasslands, shrublands, woodlands, and forests. It is most commonly found in dry habitats with rocky areas for roosting. They primarily sleep in rock crevices and buildings. Pallid bats are skilled at climbing and crawling.

Pallid bats have larger eyes than most other species of bats in North America and have pale, long, and wide ears. Their fur is generally lightly colored. Pallid Bats are insectivores so they feed on insects such as crickets and scorpions, and are capable of consuming up to half their weight in insects every night. Although they normally catch their prey on the ground, they usually transport their prey to their night roost to eat it. Their large ears allow them to hear the footsteps of insects on the ground and they use their voices to make ultrasonic sounds that bounce back to their ears. The reflected sound waves let them sense flying insects and know the environment they are flying through.

Pallid bats are a unique type of bat because they are both heterothermic and homoeothermic. They have the ability to control their body temperature and equilibrate it with the environment during winter hibernation and whenever they rest.

The mating season ranges from October to February. Female bats gives birth to twins during early June. In four or five weeks they are capable of making short flights. They don't attain adult size until about eight weeks of age, and don't become sexually mature until after approximately two years.

Suitable foraging habitat for the pallid bat was identified primarily within the buffer area of the project site. No potential or known active roosting/maternity sites of these species were observed within the project site or buffer area during biological surveys. No individual bats were observed during biological surveys. No documented sightings of these species have been recorded within the project area (see Figure 3a) (CDFW 2018).

Townsend's Big-Eared Bat - Townsend's big-eared bat is a California Species of Special Concern. This bat species inhabits a wide variety of habitats. It roosts in the open, hanging from walls and ceilings of buildings and structures. During the winter, these bats hibernate, often when temperatures are around 32 and 53°F. Hibernation occurs in tightly packed clusters, which could possibly help stabilize body temperature against the cold. Males often hibernate in warmer places than females and are more easily aroused and active in winter than females. The bats are often interrupted from their sleep because they tend to wake up frequently and move around in the cave or move from one cave entirely to another. During summer, males and females occupy separate roosting sites. Males live a solitary lifestyle away from females. Females and their pups

form maternity colonies, which often number from around 12 to 200.

The mating season for Townsend's big-eared bats takes place in late fall. Courtship rituals are done by the male. Until spring, when ovulation and fertilization begin, the female stores the male's sperm in her reproductive tract. Gestation lasts from 50 to 60 days. When the pup is born, it is pink, naked, and helpless. Only one pup is birthed per female, although 90% of females give birth.

Suitable foraging habitat for the Townsend's big-eared bat was identified primarily within the buffer area of the project site. No potential or known active roosting/maternity sites of these species were observed within the project site or buffer area during biological surveys. No individual bats were observed during biological surveys. No documented sightings of these species have been recorded within the project area (see Figure 3a) (CDFW 2018).

4.4 CRITICAL HABITAT

No critical habitat was identified within the proposed project site or buffer area (USFWS 2018).

4.5 SPECIAL STATUS NATURAL COMMUNITIES

No special-status natural communities were identified within the proposed project site or buffer area during biological surveys within the project area (CDFG 2018 and USFWS 2018).

5.0 Impacts Analysis and Standard Construction Conditions

This section summarizes the potential biological impacts from implementation of the proposed project. The analysis of these effects is based on a reconnaissance-level biological survey of the project site and buffer area, a review of existing databases and literature, and personal professional experience with biological resources of the region. Potential effects to federally- and state-listed special-status animal species may occur from the proposed project. Standard Construction Conditions for these biological impacts are provided below. A synopsis of the species potentially affected is presented in Table 3, and is followed by Standard Construction Conditions to avoid “take” of individuals.

Table 3: Special Status Animal Species Potentially Affected by the Proposed Project

Species	Status (Federal/State)	Habitat Present/ Absent	Avoidance Yes/No
Pallid Bat	-/CSC	Present	Yes
Townsend’s big-eared bat	-/CSC	Present	Yes

Potential Impacts to Common Wildlife and Plant Populations from Project Activities

Direct mortality or injury to common wildlife and plant populations could occur during ground disturbance activities associated with implementation of the project. Small vertebrate, invertebrate, and plant species are particularly prone to impact during project implementation because they are much less to non-mobile, and cannot easily move out of the path of project activities. Other more mobile wildlife species, such as most birds and larger mammals, can avoid project-related activities by moving to other adjacent areas temporarily. Increased human activity and vehicle traffic in the vicinity may disturb some wildlife species. Because common wildlife species found in the project area are locally and regionally common, potential impacts to these resources are considered less than significant. Therefore, no avoidance or minimization measures are proposed at this time.

Potential Impacts to Nesting Special-Status Avian Species from Project Activities

Implementation of the proposed project could potentially impact individual, foraging, and nesting migratory birds and raptor species should they become established within the proposed project site or buffer area prior to project implementation. Impacts to these species could occur through crushing by construction equipment during implementation of project activities. Actively nesting birds could also be affected due to noise and vibration from project activities, if nests are located close enough to project activities. Project related noise and vibration could cause the abandonment of active nest sites. Impacts to these species would be considered significant. In the event that nesting birds become established in the proposed project site or buffer area, the following Standard Construction Conditions measures will be implemented.

If ground disturbing activities occur during the breeding season of migratory avian or raptor species (February through mid-September), surveys for active nests will be conducted by a qualified biologist no more than 10 days prior to start of activities. Pre-construction nesting surveys shall be conducted for nesting migratory avian and raptor species in the project site and buffer area. Pre-construction biological surveys shall occur prior to the proposed project implementation, and during the appropriate survey periods for nesting activities for individual avian species. Surveys will follow required CDFW and USFWS protocols, where applicable. A qualified biologist will survey suitable habitat for the presence of these species. If a migratory avian or raptor species is observed and suspected to be nesting, a buffer area will be established to avoid impacts to the active nest site. Identified nests should be continuously surveyed for the first 24 hours prior to any construction-related activities to establish a behavioral baseline. If no nesting avian species are found, project activities may proceed and no further Standard Construction Conditions measures will be required. If active nesting sites are found, the following exclusion buffers will be established, and no project activities will occur within these buffer zones until young birds have fledged and are no longer reliant upon the nest or parental care for survival.

- Minimum no disturbance of 250 feet around active nest of non-listed bird species and 250 foot no disturbance buffer around migratory birds;
- Minimum no disturbance of 500 feet around active nest of non-listed raptor species;
- and 0.5-mile no disturbance buffer from listed species and fully protected species until breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.
- Once work commences, all nests should be continuously monitored to detect any behavioral changes as a result of project activities. If behavioral changes are observed, the work causing that change should cease and the appropriate regulatory agencies (i.e. CDFW, USFWS, etc.) shall be consulted for additional avoidance and minimization measures.
- A variance from these no disturbance buffers may be implemented when there is compelling biological or ecological reason to do so, such as when the project area would be concealed from a nest site by topography. Any variance from these buffers is advised to be supported by a qualified wildlife biologist and is recommended that CDFW and USFWS be notified in advance of implementation of a no disturbance buffer variance.

Potential Impacts to Special-Status Bat Species from Project Activities

Implementation of the proposed project could potentially impact bat maternity sites if these species are present in the proposed project site or buffer area during implementation of the project and if they have established maternity or roosting sites. Impacts to bat maternity/roost sites would occur primarily from noise and vibration created from project construction

Biological report was done
in May

Lake County stone crop

Cord Hute wildlife biologist
Synthesis planning March 28, 2018.

USFW / Fesa Federal endangered Species

EKIIPSE project
Knowledge & Learning Mechanism
on Biodiversity & ecosystem Services

1. The first step is to identify the problem.

2. Next, we need to gather data.

3. Then, we should analyze the data.

4. After that, we can develop a solution.

5. Finally, we should implement the solution.

6. The last step is to evaluate the results.

7. This process is iterative.

8. It allows us to refine our solution.

9. We can make improvements as we go.

