

Wildlife Exclusion Fence or Directional Control Barrier for Special-Status Small Vertebrates (E-Fence™)

- **Construction Site Wildlife Exclusion Fence**
- **Directional Control in Fragmented Habitat**
- **Perimeter Control for Surveys**

GUIDE SPECIFICATION

PRODUCT:

E-Fence™ (US Patent #8402630, other applications pending)

MANUFACTURER:

ERTEC®
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1.0 Description:

E-Fence™ is a Wildlife Exclusion Fence or Directional Control Barrier for special-status small vertebrates and shall conform to the details shown on the plans and these special provisions. It shall be installed around the perimeter of construction sites and/or survey areas, or as per biologist layout plans to control movement in fragmented habitat as a directional barrier. The primary function of E-Fence is to exclude special-status small vertebrates from construction sites where they can be killed, injured or isolated or provide directional control within fragmented habitat.

2.0 Material:

Provide E-Fence as shown on the plans.

- A. **Product and Installation Sheets.** A copy of the manufacturer's product data sheet together with instructions for installation of specified options shall be furnished to the Engineer 5 days before installation.
- B. **Barrier Configuration.** Furnish E-Fence with a configuration based on the species or combination of species to be controlled as per Table B. Furnish barrier in minimal 100 to 150 foot segments (10" width at 150 feet, 20" width at 150 feet, 24" at 150 feet, 30" width at 150 feet, 40" width at 100 feet, 48" width at 100 feet or 60" width or greater at 100 feet to minimize segment overlaps.
- C. **Barrier Materials & Structure.** Furnish E-Fence manufactured from non-biodegradable materials which are UV and dimensionally stable for a minimum of 5 years. The system shall:
 - a. comprise a monolithic rigid polymer matrix
 - b. be thermally extruded into an apertured sheet with rigid and thermally bonded strands
 - c. be made from virgin or recycled HDPE (high density polyethylene) feedstock which has a readily available recycle stream
 - d. have greater than 50% open Area (POA) to prevent damage from wind and stormwater runoff

- e. be durable, so that it can be reused on several projects
- f. be recyclable at the end of life – zero waste.
- g. conform to the requirements in Table A below

D. Options and Accessories

- a. **No-Trench Ground Seal Options:** No-Trench Ground Seal options are available for soil and or hard surfaces. Submit copy of the manufacturer's installation guidelines for the type of No-Trench Ground Seal option found on plans.
 - i. **Clam-shell style or**
 - ii. **Apron style**
- b. **Sediment Control Panel:** The E-Fence Sediment Control Panel is available in 100' rolls, mates to E-Fence during installation, is installed in the same trench and can eliminate the requirement for a separate silt fence and or wattles (fiber rolls). While Wildlife Exclusion Fence is often installed around the perimeter of the job site, sediment control is required only on the down-stream areas of the project (typically less than half the footage required for exclusion fence). Submit copy of the manufacturer's installation guidelines.
- c. **Climber Barrier Options:**
 - i. 5" Climber Barrier Lip (reptiles/amphibians)
 - ii. 8" Climber Barrier Lip (small mammals)
 - iii. HDPE smooth belly band (small mammals)
- d. **Temporary Gates:**
 - i. Consider entrance opening. For large equipment 16' openings (double 8' swing gates) are required. Personnel gates are 4 or 6' single swing gate. Submit copy of Manufacturer's installation guidelines.
- e. **Exclusionary Gate Panels:**
 - i. Exclusionary Gate panels fit to Temporary Gates and provide seal around the entrance with a ground sweep while at the same time allow opening and closing of the gates. Submit copy of Manufacturer's installation guidelines.

E. **Posts.** Installations requiring metal T-Posts shall use reusable metal T-Posts (0.95 lbs/ft minimum). Posts should be spaced as indicated on installation guidelines (see installation instructions for specific configuration and species). Spacing of posts is dependent on length of time the fence will be installed, the height of the fence and exposure to wind. In general, install posts on 5 foot centers (max) in areas of very high wind or for long-term or permanent installations and on 8 foot centers (max) for majority of installations. Install posts on 10 foot centers (max) when fence height is 40 inches or less. It is permissible to use wooden stakes (1"x2"x36") for E-Fence™ width (height) of 30" or less, on 10 foot centers (max) for projects lasting 2 years or less.

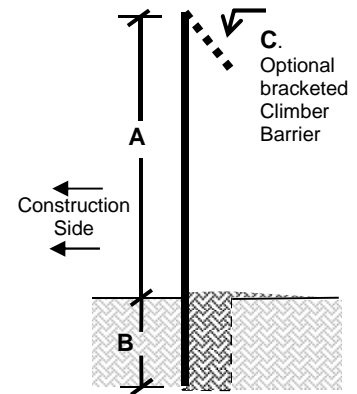
Table A: Barrier Type: E- Fence material property requirements

| Specification | Design Focus | Material Requirements HDPE or Recycled HDPE |
|---|---|--|
| Barrier Height | Specific Animal | See Configuration Table B column 2 |
| Roll Length (for widths 20", 24", 30", 40", 48", 60") (LF) | Minimize joints | 150, 150, 100, 100, 100 |
| Strand Deformation – 0.375" sphere pull-through at 68°F (lbs) (minimum) | Intrusion resistance, entrapment resistance | 38 |
| Distance between strands (in) (maximum) | Intrusion resistance, entrapment resistance | 0.185 |
| Strand thickness (in) (maximum) | Intrusion resistance, entrapment resistance | 0.10 |
| Distance between strand centers (in) (maximum) | Intrusion resistance, entrapment resistance | 0.25 |
| Mass per Unit Weight range (lbs/ft ²) | Installation ease | 0.16 to 0.19 |
| Tensile Strength – machine direction ASTM D4595 (lbs) (minimum) | Dimensional Stability | 400 |
| Tensile Strength – transverse direction ASTM D4595 (lbs) (minimum) | Dimensional Stability | 325 |
| Aperture Size – Cylinder PASS (dimensional range within which a cylinder will pass thru) (in) | Allow wind & water passage | 0.141 - 0.156 |
| Aperture Size – Cylinder NO PASS (smallest dimension that will not pass) (in) | Confine juvenile vertebrates | 0.212 |
| Ultraviolet stability - percent tensile strength retained ASTM D 4355 | Long term property retention | 96% |
| Thickness ASTM 5199 minimum (in) | Deformation and intrusion resistance | 0.115 |
| Life in application minimum (yrs) Black / Orange | Durability, Reusability | 10 / 4 |
| Friction Coefficient (published base polymer data) | Climbing resistance, Resist accumulation of organic materials | <0.3 |
| Shore Hardness (base polymer data) at 68°F | Burrowing resistance | 95 |
| CBR Puncture strength ASTM D 6241 nominal (lbs) | Burrowing resistance, Intrusion resistance | 237 |
| Flow Rate ASTM D 4491 minimum gal/min/ft ² | Washout prevention | 650 |
| Percent Open Area (ASTM D 6767) (min) | Washout prevention | 50% |
| Low Temperature Brittleness (published base polymer data) ASTM D 746 (°F) | Extreme cold weather durability | -106 |
| Operating Temp (base polymer data) range (°F) | All weather durability, Property retention | -30 to 160 |
| Separation of stand planes (distance) (in - nominal) | Climbing resistance | 0.02 - 0.04 |
| Angle of strands (°) | Climbing resistance | 70 to 80 |

3.0 Wildlife Exclusion Fence: Configurations by species –Current Approved Best Practices

Table B: Configuration requirements (Please note: 2 or more special-status-species are often in the same habitat. The design configuration should address the species with the highest capabilities (the design determinate species). If required, please call ERTEC for design guidance (510-521-0724).

| Common Name (Scientific Name) | A. Barrier Height (in) | B. Trench Depth (min) (in) | C. Climber Barrier Type/Size | D. T Post or Wood Post / Depth (min) (in) | E. One-Way Gateway / Funnel (Y/N) | Exclusion Fence Designation EF = E-Fence Digits = Sheet width (in) Letters: L = Climber Barrier, F = Funnel |
|-------------------------------|------------------------|----------------------------|------------------------------|---|-----------------------------------|--|
|-------------------------------|------------------------|----------------------------|------------------------------|---|-----------------------------------|--|



Frog Fence

Notes

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|--|----|---|----|-----|---|-------|--|
| California red-legged frog (<i>Rana draytonii</i>) | 38 | 5 | L5 | T18 | N | EF48L | EF40L is an approved configuration, but most specifiers call for 48" width |
| Foothill yellow-legged frog (<i>Rana boylei</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Northern cricket frog (<i>Acris crepitans</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Chiricahua leopard frog (<i>Rana chiricahuensis</i>) | 38 | 5 | L5 | T18 | N | EF48L | |
| Sierra Nevada yellow-legged frog (<i>Rana sierrae</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Sierra Madre yellow-legged frog (<i>Rana muscosa</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Northern leopard frog (<i>Rana pipiens</i>) | 30 | 5 | L5 | 18 | N | EF40L | |
| Lowland leopard frog (<i>Rana yavapaiensis</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Oregon spotted frog (<i>Rana pretiosa</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Northern red-legged frog (<i>Rana aurora</i>) | 30 | 5 | L5 | T18 | N | EF40L | |

Toad Fence

Notes

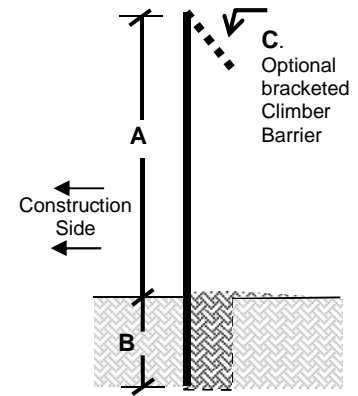
| | | | | | | | |
|---|----|----|---|-----|---|------|--|
| Colorado River toad (<i>Bufo alvarius</i>) | 18 | 12 | N | T24 | N | EF30 | Below are the lowest cost approved configurations for these Toads but designers often call for 4' width and High Visibility Construction Safety. |
| Arroyo toad (<i>Bufo microscaphus californicus</i>) | 25 | 5 | N | W18 | N | EF30 | |
| Boreal toad (<i>Bufo boreas boreas</i>) | 18 | 12 | N | T24 | N | EF30 | |
| Yosemite toad (<i>Bufo canorus</i>) | 25 | 5 | N | W12 | N | EF30 | |
| Coach's spadefoot toad (<i>Scaphiopus couchii</i>) | 18 | 12 | N | T24 | N | EF30 | |
| Western spadefoot toad (<i>Spea hammondi</i>) | 18 | 12 | N | T24 | N | EF30 | |

Turtle/Terrapin/Tortoise Fence

Notes

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|---|----|----|---|-----|---|------|--|
| Western pond turtle (<i>Actinemys marmorata</i>) | 15 | 5 | N | W18 | N | EF20 | Below are the lowest cost approved configurations for these Turtles/Terrapins but designers often call for 4' width and High Visibility Construction Safety. |
| Northwestern pond turtle (<i>Clemmys marmorata marmorata</i>) | 15 | 5 | N | W18 | N | EF20 | |
| Desert tortoise (<i>Gopherus agassizii</i>) | 18 | 12 | N | T30 | N | EF30 | UV Resistant black is best choice for DT Habitat. |

| Common Name (Scientific Name) | A. Barrier Height (in) | B. Trench Depth (min) (in) | C. Climber Barrier Type/Size | D. TPost or Wood Post / Depth (min) (in) | E. One-Way Gateway / Funnel (Y/N) | Exclusion Fence Designation EF = E-Fence Digits = Sheet width (in) Letters: L= Climber Barrier, F= Funnel |
|-------------------------------|------------------------|----------------------------|------------------------------|--|-----------------------------------|--|
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Salamander / Newt Fence

Notes

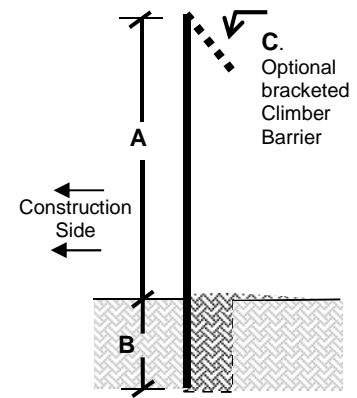
| Common Name (Scientific Name) | A. Barrier Height (in) | B. Trench Depth (min) (in) | C. Climber Barrier Type/Size | D. TPost or Wood Post / Depth (min) (in) | E. One-Way Gateway / Funnel (Y/N) | Exclusion Fence Designation | Notes |
|--|------------------------|----------------------------|------------------------------|--|-----------------------------------|-----------------------------|--|
| California tiger salamander (<i>Ambystoma californiense</i>) | 15 | 5 | N | W18 | Y | EF20F | Below are the lowest cost approved configurations for these Salamanders but designers often call for 4' width and High Visibility Construction Safety. |
| Santa Cruz long-toed salamander (<i>Ambystoma macrodactylum croceum</i>) | 15 | 5 | See note | W18 | Y | EF20F | Install with HDPE Climber Barrier |
| Barton Springs salamander (<i>Eurycea sosorum</i>) | 19 | 5 | N | W18 | Y | EF24F | |
| Austin blind salamander (<i>Eurycea waterloensis</i>) | 19 | 5 | N | W18 | Y | EF24F | |
| Southern torrent salamander (<i>Rhyacotriton variegates</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| California Coast range newt (<i>Taricha torosa</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Inyo Mountain slender salamander (<i>Batrachoseps campi</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Yellow-blotched salamander (<i>Ensatina eschscholtzii croceater</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Large-blotched salamander (<i>Ensatina eschscholtzii klauberi</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Limestone salamander (<i>Hydromantes brunus</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Mt. Lydell salamander (<i>Hydromantes platycephalus</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Shasta salamander (<i>Hydromantes shastae</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Owens Valley web-toed salamander (<i>Hydromantes platycephalus</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Scott Bar salamander (<i>Plethodon asupak</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Del Norte salamander (<i>Plethodon elongatus</i>) | 14 | 6 | N | W18 | Y | EF20F | |
| Coast range Newt (<i>Taricha torosa torosa</i>) | 14 | 6 | N | W18 | Y | EF20F | |

Snake Fence

Notes

| Common Name (Scientific Name) | A. Barrier Height (in) | B. Trench Depth (min) (in) | C. Climber Barrier Type/Size | D. TPost or Wood Post / Depth (min) (in) | E. One-Way Gateway / Funnel (Y/N) | Exclusion Fence Designation | Notes |
|---|------------------------|----------------------------|------------------------------|--|-----------------------------------|-----------------------------|---|
| Alameda Whip Snake (<i>Masticophis lateralis euryxanthus</i>) | 43 | 5 | N | T18 | Y | EF48F | Most designers call for 48" width due to AWS speed and climbing ability |
| San Joaquin Whip Snake (<i>Masticophis flagellum ruddocki</i>) | 43 | 5 | N | T18 | Y | EF48F | Most designers call for 48" width due to SJWS speed and climbing ability |
| Giant Garter Snake (<i>Thamnophis gigas</i>) | 25 | 5 | N | T18 | Y | EF30F | Below are the lowest cost approved configurations for these Snakes but designers often call for 4' width and High Visibility Construction Safety. |
| Southern boa (<i>Charina umbratica</i>) | 25 | 5 | N | T18 | Y | EF30F | |
| Butler's garter snake (<i>Thamnophis butleri</i>) | 25 | 5 | N | T18 | Y | EF30F | |
| San Diego ringneck snake (<i>Diadophis punctatus similis</i>) | 25 | 5 | N | T18 | Y | EF30F | |
| California mountain kingsnake (<i>Lampropeltis zonata</i>) | 25 | 5 | N | T18 | Y | EF30F | |

| Common Name (Scientific Name) | A. Barrier Height (in) | B. Trench Depth (min) (in) | C. Climber Barrier Type/Size | D. TPost or Wood Post / Depth (min) (in) | E. One-Way Gateway / Funnel (Y/N) | Exclusion Fence Designation EF = E-Fence Digits = Sheet width (in) Letters: L= Climber Barrier, F= Funnel | |
|--|------------------------|----------------------------|------------------------------|--|-----------------------------------|--|---|
| Santa Cruz Island gopher snake (<i>Pituophis catenifer pumilis</i>) | 25 | 5 | N | 18 | Y | EF30F | |
| Coast patch-nosed snake (<i>Salvadora hexalepis virgultea</i>) | 25 | 5 | N | 18 | Y | EF30F | |
| Two-striped garter snake (<i>Thamnophis hammondi</i>) | 25 | 5 | N | 18 | Y | EF30F | |
| Santa Catalina garter snake (<i>Thamnophis hammondi</i> ssp.) | 25 | 5 | N | 18 | Y | EF30F | |
| South Coast garter snake (<i>Thamnophis sirtalis infernalis</i>) | 25 | 5 | N | 18 | Y | EF30F | |
| Western hognose snake (<i>Heterodon nasicus</i>) | 25 | 5 | N | 18 | Y | EF30F | |
| San Francisco Garter Snake (<i>Thamnophis sirtalis tetrataenia</i>) | 38 | 5 | L5 | T18 | Y | EF48LF | Always found in same habitat as CA Red legged frog. Determinant species is CRLF. Follow CRLF configuration. |
| Northern red-diamond rattle snake (<i>Crotalus ruber</i>) | 43 | 5 | N | T18 | Y | EF48F | |
| Timber rattlesnake (<i>Crotalus horridus</i>) | 43 | 5 | N | T18 | Y | EF48F | |



Lizard, Skink Fence

Notes

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|--|-----------|-----------|-----------|------------|----------|--------------|--|
| Blunt-nosed leopard lizard (<i>Gambelia sila</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Coachella Valley fringe-toed lizard (<i>Uma inornata</i>) | 24 | 24 | L5 | T36 | N | EF60L | |
| Texas horned lizard (<i>Phrynosoma cornutum</i>) | 13 | 6 | L5 | W18 | N | EF24L | |
| Coast (San Diego) horned lizard (<i>Phrynosoma coronatum blainvillii</i>); | 13 | 6 | L5 | W18 | N | EF24L | |
| Coastal western whiptail (<i>Cnemidophorus tigris multiscutatus</i>) | 30 | 5 | Y | T18 | N | EF40L | |
| Panamint alligator lizard (<i>Elgaria panamintina</i>) | 30 | 5 | L5 | T18 | N | EF40L | |
| Black legless lizard (<i>Anniella pulchra (nigra)</i>) | 19 | 5 | N | W18 | N | EF24 | |

Bird Fence

Notes

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|---|----|---|---|----|---|-------|---------------------------------------|
| Least Tern (<i>Sternula antillarum</i>) | 10 | 5 | Y | 18 | N | EF20L | For Nestling or Fledgling Containment |
|---|----|---|---|----|---|-------|---------------------------------------|

Small Mammal Fence

Notes

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|---|-----------|-----------|----------|------------|----------|------------------|---|
| San Joaquin kit fox (<i>Vulpes mutica mutica</i>) | 60 | 12 | N | 24 | N | EF48+EF30 | The fence can be extended to a height of 5' above ground to exclude SJKF. However, SJKF habitat is typically home to other special-status species. Most designers design to exclude the other species but keep the barrier low enough to allow SJKF to pass both ways. Wood ramps can be placed for cubs to pass. |
| Tipton kangaroo rat (<i>Dipodomys nitratoideus nitratoideus</i>) | 40 | 6 | N | T18 | N | EF48 | |

| Common Name (Scientific Name) | A. Barrier Height (in) | B. Trench Depth (min) (in) | C. Climber Barrier Type/Size | D. TPost or Wood Post / Depth (min) (in) | E. One-Way Gateway / Funnel (Y/N) | Exclusion Fence Designation EF = E-Fence Letters: Digits = Sheet width (in) L = Climber Barrier, F = Funnel | |
|---|------------------------|----------------------------|------------------------------|--|-----------------------------------|---|--|
| | | | | | | | <p>A diagram showing a cross-section of an exclusion fence. A vertical line represents the barrier, with a dashed line above it labeled 'C. Optional bracketed Climber Barrier'. The height of the barrier is labeled 'A'. Below the barrier, there is a trench of depth 'B'. Arrows on the left point towards the barrier, labeled 'Construction Side'.</p> |
| Stephens' kangaroo rat (<i>Dipodomys stephensi</i>) | 40 | 6 | N | T18 | N | EF48 | |
| San Bernardino kangaroo rat (<i>Dipodomys merriami parvus</i>) | 40 | 6 | N | T18 | N | EF48 | |
| Giant kangaroo rat (<i>Dipodomys ingens</i>) | 40 | 6 | N | T18 | N | EF48 | |
| Preble's meadow jumping mouse (<i>Zapus hudsonius preblei</i>) | 30 | 5 | L5 | 18 | N | EF40L | |
| Northwestern San Diego pocket mouse (<i>Chaetodipus fallax fallax</i>) | 30 | 5 | L5 | 18 | N | EF40L | |
| San Joaquin Antelope ground squirrel (<i>Ammospermophilus nelsoni</i>) | 35 | 5 | L8 | 18 | N | EF48L | There's an option to add a smooth HDPE Belly-Band barrier in combination with 8" Climbing Barrier Lip. |
| Mojave ground squirrel (<i>Xerospermophilus mohavensis</i>) | 35 | 5 | L8 | 18 | N | EF48L | There's an option to add a smooth HDPE Belly-Band barrier in combination with 8" Climbing Barrier Lip. |
| Salt Marsh Harvest Mouse (<i>Reithrodontomys raviventris</i>) | 30 | 5 | L5 | 18 | N | EF40L | There's an option to add a smooth HDPE Belly-Band barrier in combination with 8" Climbing Barrier Lip. |
| San Diego desert woodrat (<i>Neotoma lepida intermedia</i>) | 30 | 5 | L5 | 18 | N | EF40L | |
| San Francisco dusky-footed woodrat (<i>Neotoma fuscipes ssp. annectens</i>) | 37 | 6 | L5 | 18 | N | EF48L | There's an option to add a smooth HDPE Belly-Band barrier in combination with 8" Climbing Barrier Lip. |
| Mount Lyell shrew (<i>Sorex lyelli</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Buena Vista Lake shrew (<i>Sorex ornatus relictus</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Monterey shrew (<i>Sorex ornatus salarius</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Southern California salt marsh shrew (<i>Sorex ornatus salicornicus</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Suisun shrew (<i>Sorex ornatus sinuosus</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Santa Catalina shrew (<i>Sorex ornatus willetti</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Salt-marsh wandering shrew (<i>Sorex vagrans halicoetes</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Monterey vagrant shrew (<i>Sorex vagrans paludivagus</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Pygmy rabbit (<i>Brachylagus idahoensis</i>) | 35 | 5 | N | 18 | N | EF40 | |
| Riparian brush rabbit (<i>Sylvilagus bachmani riparius</i>) | 35 | 5 | N | 18 | N | EF40 | |

(Revision Date: January 3, 2017* (check www.ertecsystems.com for most current version))

4.0 Installation:

Contact ERTEC for a consultation or an approved installation diagram and guideline for each species, or combination of species. (510-521-0724 info@ertecsystems.com).

5.0 Maintenance:

Perform maintenance as required. Inspect areas of concentrated rainwater run-off following rainfall events and after high-wind events. Damage to the special-status-species exclusion barrier resulting from weather or the construction site vehicles, equipment, or operations shall be repaired immediately.

Split or torn segments shall be repaired with zip-ties or 16 gauge galvanized wire ties or replaced. Rills, gullies and other evidence of concentrated runoff which has undercut the SSSEB shall be corrected. Locations needing repair shall be repaired or replaced immediately after identifying the deficiency.

6.0 Method of Measurement:

Quantities of E- Fence to be paid for will be determined by the linear foot measured along the centerline of the installed barrier. Where E- Fence segments are joined and overlapped, the overlap will be measured as a single installed strip.

7.0 Basis of payment:

The contract price paid per linear foot for E- Fence shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing the E-Fence, complete in place, including trench excavation and backfill, and maintenance, as shown on the plans, and in these special provisions, and as directed by the Project Manager.