



## CONSERVATION ENHANCEMENT ACTIVITY

# CONSERVATION STEWARDSHIP PROGRAM

### E666A

## Maintaining and improving forest soil quality.

### Conservation Practice 666: Forest Stand Improvement

**APPLICABLE LAND USE:** Forest

**RESOURCE CONCERN:** Soil, Air

**ENHANCEMENT LIFE SPAN:** 10 Years

#### Enhancement Description

Adopts guidelines for maintaining and improving soil quality on sites where forest management activities are practiced. These guidelines will increase soil organic matter content, improve nutrient cycling, and increase infiltration and retention of precipitation. Avoiding soil compaction will allow for greater root development and tree growth, limit windthrow, and reduce drought stress. Increasing carbon storage on site will maintain the soil microbial community and provide wildlife benefits.

#### Criteria

- States will apply general criteria from the NRCS National Conservation Practice Standard Forest Stand Improvement (Code 666) as listed below, and additional criteria as required by the NRCS State Office.
- Update or modify the Forest Management Plan to include the following guidelines for forest soil quality management, as appropriate for the site.
  - Limit the area of compacted soils
    - Operate equipment on established roads and trails and minimize travel into the general forest area
    - Operate equipment on woody debris (slash) in areas with sensitive or wet soils
    - Sequence forest management activities (back to front) to limit the number of equipment passes

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- Use smaller and lighter equipment, track equipment, low PSI tires, and lighter loads. Where appropriate, use mules, draft horses or other animals for moving harvested trees
- Restore heavily compacted areas (e.g., by sub-soiling or other mechanical method)
- Limit impacts of roads and landings
  - Avoid disturbing natural drainage channels (e.g., design road locations to minimize stream crossings and diversions)
  - Roads and landings occupy 5% or less of total wooded acreage
  - Establish cover on roads and landings that are not in use
- Limit soil disturbance and control erosion
  - Avoid disturbing forest litter and the soil surface
  - Protect roads using water bars/rolling dips
  - Establish cover on disturbed areas
  - Retain downed tops and other unharvested materials for ground cover, nutrient recycling, and organic matter retention
- Maintain favorable conditions for forest growth
  - Control the amount of road use, and off-road travel, to prevent erosion, compaction, and disturbance of the soil surface
  - Establish cover on any disturbed areas
  - Monitor the forest area for signs of insect damage, tree diseases, invasive plants, or other impacts on forest growth and health
- Retain and enhance carbon storage to support soil ecologic functions
  - Follow stocking guidelines to maintain tree canopy cover (i.e., between the A and B lines of stocking guides at a minimum; preferably closer to the A line). See the stocking chart shown below.
  - Add woody material to the soil by girdling or cutting non-merchantable trees or trees of undesired species
  - Use extended rotations to keep carbon on the site for a longer period



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- Retain fallen trees, branches, snags, downed tops and other unharvested materials for ground cover, nutrient recycling, and organic matter retention, in quantities as specified below, or by the NRCS State Office.

▲ For western conifer forests, maintain coarse woody residue:

- that is greater than 3” in diameter,
- left lying on the soil surface, and
- which meets the post-harvest target levels of the following chart:

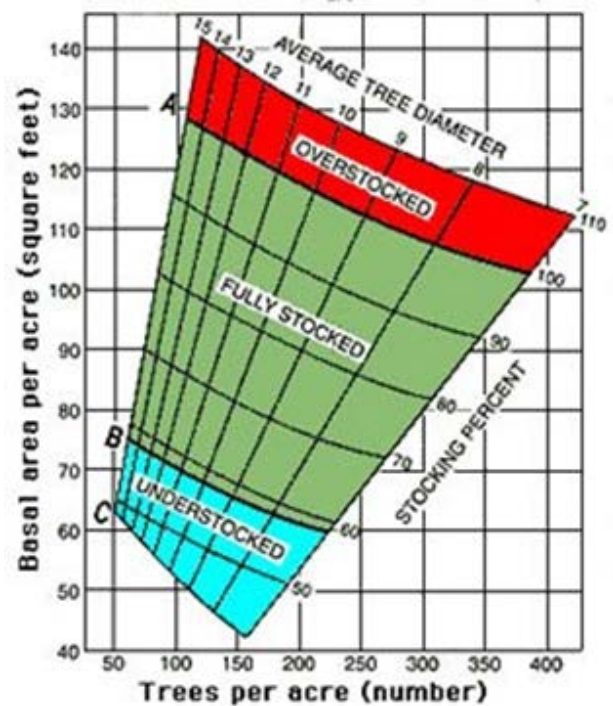
|               | Habitat Type          | Target tons per acre of coarse woody debris |
|---------------|-----------------------|---|
| Dry Forests   | Ponderosa pine types  | 5-13 tons/acre                              |
| ↕             | Douglas-fir types     | 7-14 tons/acre                              |
|               | Grand fir types       | 7-14 tons/acre                              |
| Moist Forests | Western hemlock types | 16-33 tons/acre                             |

- Maintain soil productivity by soil testing and fertilization if needed (including options for fertilizing with manure, biochar, or other organic materials).
- Identify and retain preferred tree and understory species to achieve all planned purposes and landowner objectives.
- Use available guidelines for species and species groups to determine spacing, density, size-class distribution, number of trees, and amount of understory species to be retained. Schedule treatments to avoid overstocked conditions using approved silvicultural/ stocking guides.
- Describe the current and desired future condition of each stand that will be treated. Include the species, cover type, and size-class distribution. Stocking will be described in terms of crop trees per acre, basal area per acre, trees per acre, between-tree spacing, or by any other appropriate and professionally accepted density or stocking protocol.

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- Refer to WIN-PST criteria in NRCS Conservation Practice Standard Integrated Pest Management (Code 595) and comply with applicable State and local laws if an herbicide will be used.
- Time tree girdling or felling to avoid buildup of insect or disease populations.
- Implement forest stand improvement activities in ways that avoid or minimize soil erosion, compaction, rutting, and damage to remaining vegetation, and that maintain hydrologic conditions.
- Protect site resources by selecting the method, felling direction and timing of tree felling, and heavy equipment operation. For temporary access use NRCS Conservation Practice Standard Forest Trails and Landings (Code 655) to protect soil and site resources from vehicle impacts. Use NRCS Conservation Practice Standard Access Road (Code 560), for more heavily used roads associated with forest stand improvement activities.

**Figure 1: Stocking Chart** showing tree size and density scales indicating when forests are overstocked (too crowded), fully stocked (providing good growth), and understocked (trees do not fully utilize the site). Stocking guides were developed by Gingrich (1967).





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## Documentation and Implementation Requirements:

### Participant will:

- Prior to implementation, review the NRCS Conservation Practice Standard Forest Stand Improvement (Code 666) conservation practice standard or appropriate state Job Sheet and use this information to meet the criteria of this enhancement.
- Prior to implementation, have a current or updated Forest Management Plan (FMP) that includes activities required to implement this enhancement. The FMP will include guidelines for rehabilitating existing soil resource damage including compaction, ruts, puddling, erosion, downslope soil movement, exposed mineral soil, and depletion of the forest floor. It will also address rehabilitation for any water resource concerns such as diverted streams or intermittent flows. It will assess road layout and provide guidance on practices to correct any erosion or hydrologic impacts. Have the FMP available for NRCS review.
- Prior to implementation, arrange for soil tests to be conducted, one per each five acres. The FMP will include guidance for correcting any significant nutrient deficiencies.
- Prior to implementation, arrange for a forestry specialist to evaluate the stand and perform site-specific marking of areas to be seeded with cover plantings, locations where water control is needed, and trees that are to be girdled for snag creation.
- Prior to implementation, be aware of the state’s Forestry Best Management Practices (BMP’s) so they can be followed to protect the site and maintain soil and water quality.
- Prior to implementation, be aware of the current stocking level of trees on the site and the target level of stocking to maintain as part of this enhancement. This information should be detailed in the Forest Management Plan.
- During implementation, maintain the stand in a fully stocked condition using the appropriate stocking chart, between the A and B lines (see figure 1). The target stocking level should be between the A and B line, but closer to the A line.
- During implementation, follow state BMP guidelines and any additional guidance from the NRCS State Office to protect trails, roads and landings from soil loss or damage. Re-vegetate these disturbed areas or close them off to traffic to allow natural vegetation to grow on these areas.



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- During implementation, spread tops and limbs across the site during any tree reduction operations to protect the soil.
- After implementation, provide the following information to NRCS; dates completed, methods used, representative post-treatment photos, and a map delineating the treated acres.

### **NRCS will:**

- Prior to implementation, aid with interpretation of a current or updated FMP on acres targeted by this enhancement.
  - Prior to implementation, provide and explain the following NRCS Conservation Practice Standards as they relate to implementing this enhancement.
    - Forest Stand Improvement (Code 666)
    - Integrated Pest Management (Code 595)
    - Forest Trails and Landings (Code 655)
    - Access Road (Code 560)
- As needed, prior to implementation, NRCS will provide technical assistance in:
  - Preparing specifications for applying this enhancement for each site using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation, and will discuss the details with the participant.
- Prior to implementation, discuss the requirement to follow the state's Forestry Best Management Practices (BMPs).
- During implementation, provide technical assistance if requested by the participant.
- During implementation, evaluate any planned changes to verify they meet the enhancement criteria.
- After implementation, verify that the enhancement was completed according to the NRCS Conservation Practice Standard Forest Stand Improvement (CPS 666) specifications and the enhancement criteria.



**NRCS Documentation Review:**

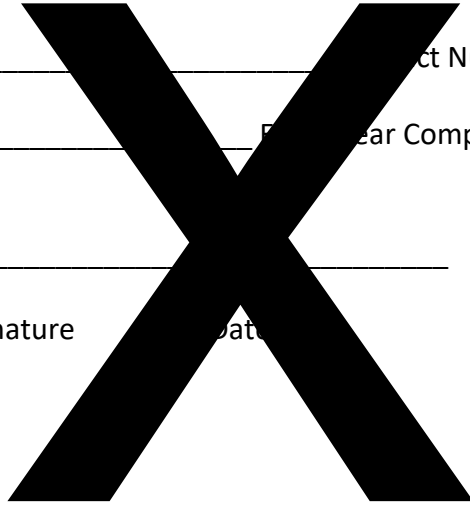
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I have reviewed all required participant documentation and have determined the participant has implemented the enhancement and met all criteria and requirements.

Participant Name \_\_\_\_\_ Project Number \_\_\_\_\_

Total Amount Applied \_\_\_\_\_ Fiscal Year Completed \_\_\_\_\_

\_\_\_\_\_  
NRCS Technical Adequacy Signature \_\_\_\_\_ Date \_\_\_\_\_





Oregon SUPPLEMENT TO  
CONSERVATION ENHANCEMENT  
ACTIVITY  
E666A

CONSERVATION  
STEWARDSHIP  
PROGRAM

**MAINTAINING AND IMPROVING FOREST SOIL QUALITY**

Additional Criteria for Oregon

In addition to the criteria specified in the National job sheet E666A the following additional criteria apply in Oregon:

- **Limit the area of compacted soils:**
  - Operate equipment on woody debris (slash) in areas with sensitive or wet soils.

*Sensitive and wet soils are defined as:*

*(For compaction):* Soils are defined as “sensitive” that have < 60% coarse fragments in the upper 12” of the soil profile, and that that are moderately fine textured to clayey textured in the upper 12” of the soil profile.

Sensitive soils are most prone to compaction during periods of time when the soil profile is moist\* (between 50-75% of the available moisture capacity) in the upper foot, and/or when the soil is not frozen, and when equipment is used that is conducive to compaction (e.g. using machinery with high psi tracts or tires, when repeated trips are made over the same land, or when the soil surface is unprotected). Using problematical equipment or operating procedures in stands with these conditions will be avoided when the combination of compaction prone soils and risk conditions exist.

*Wet soils:* These are imperfectly drained, flooded or ponded soils during a period of inundation, or other well or moderately well drained, moderately fine through clayey textured soils that at or nearly at field capacity (>85% of the available water holding capacity). Mechanized management on these types of soils and conditions will be avoided as serious rutting or other displacement would occur.

*Woody debris (including “slash mats”) as mentioned in the national enhancement is an alleviating measure only when debris or slash mats will eliminate the likelihood of resource degradation during periods when external risk factors are present (that is, when wet, non-frozen, flooded, etc.).*





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*\*Reference:* To determine when the soil is “moist”, refer to “Estimating Soil Moisture by Feel and Appearance”: NRCS program aid 1619 (click [here](#))

o **Limit the area of compacted soils:**

- Restore heavily compacted areas (e.g., by sub-soiling or other mechanical method).

*Heavily compacted areas* are those areas comprised of sensitive soils which have been compacted by past management activities.

Identify compacted soils by field examination and delineate those areas on a map. Compaction is identified by one of two available techniques:

1. Soils that exceed 300 psi within the upper soil surface foot, as measured by a DICKEY-john™ soil compaction tester, or
  2. Soils that are in a USFS Soil Disturbance “post-harvest/burn disturbance” Class 2 or 3 for the compaction elements (see Attachment 1, and refer to USFS “SoLo” soil quality monitoring website for additional guidance (click [here](#)).
- ✓ Compacted areas must be contiguous and must be  $\geq 1,000$  ft<sup>2</sup> in size and  $\geq 16$  feet wide to be eligible for treatment, and
  - ✓ Restoration treatment can only occur on slopes that are  $\leq 20\%$  steep, and
  - ✓ The restoration of the heavily compacted areas must reduce the post-restoration area of compaction to 15% or less of the total forest acreage.
- Establish cover on disturbed areas.

Naturally established cover of desirable vegetation is acceptable, in addition to active seeding.

- Retain downed tops and other unharvested materials for ground cover, nutrient recycling, and organic matter retention.

Harvest activities will be done by bole only yarding (where only logs are yarded; trees are limbed and bucked where they fall). In harvest activities, as well as in forest stand improvement activities, retain 50% of the needles and fine twigs on site through the first over-winter period for grand fir, and 25% of the needles and fine twigs for all other species with the exception of Ponderosa pine (no retention is required). Coordinate with IDL for slash requirements under the Idaho Forest Practice Act and adapt mitigation measures as feasible to achieve those target levels.



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○ **Maintain favorable conditions for forest growth:**

- Monitor the forest area for signs of insect damage, tree diseases, invasive plants, or other impacts on forest growth and health.

When this criteria is used, the forest management plan has been updated at the beginning of the contract period by a professional forester and includes an assessment of the current forest health.

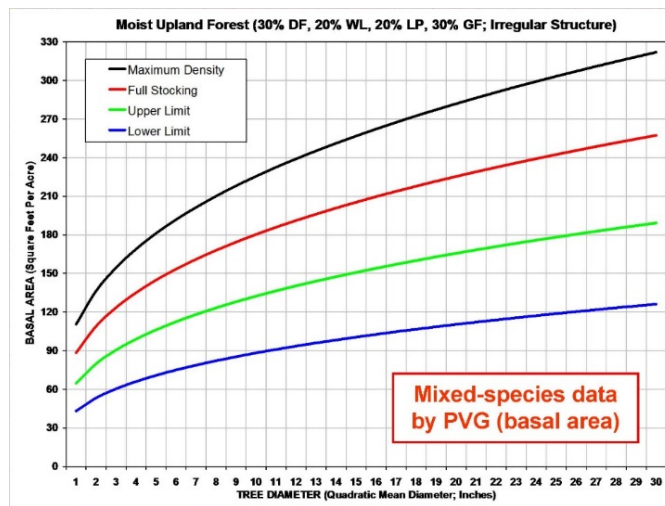
*Monitoring* will be done throughout the life of the contract on a bi-annual basis (late spring and early fall) and will include, at a minimum, documentation and mapping of newly occurring mortality and damaging agents as mandated in the national enhancement (above). When newly developing threats to forest growth and health are encountered, the landowner will seek advice from a professional forester and will document treatment actions taken as needed to alleviate the recently developed threats.

The stocking chart shown in the national guide is for hardwoods and therefore does not apply to conifer dominated forestlands in Oregon. For Oregon, professionally recognized density and stocking charts, “D+X” protocol, Stand Density Index (SDI) methodology, or other silviculturally sound stocking system can substitute for the stocking chart referred to in the National Criteria. The specific stocking method that is used will be described the Forest Management Plan. (Note: Stocking is a relative term used to describe the adequacy of a given stand density in meeting the management objective—it is not strictly production based)



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**EXAMPLE:** This following stocking example is specific for the stand conditions described as “Moist Upland Forest”. The chart that is shown below is for a western conifer forest. Managing between the green and red line would be similar to the hardwood stand chart shown in the national criteria:



## Attachment 1: Disturbance Classes

### Post-harvest/burn disturbance class definitions.

|   |   |
|---|---|
| <p><b>Class 0 – Undisturbed Natural State</b></p> <p>Soil surface:</p> <ul style="list-style-type: none"> <li>• No evidence of past equipment operation.</li> <li>• No depressions or wheel tracks evident</li> <li>• Forest floor layers present and intact</li> <li>• No soil displacement evident</li> </ul>   | <p><b>Class 1 – Low soil disturbance</b></p> <p>Soil surface:</p> <ul style="list-style-type: none"> <li>• Faint wheel tracks or slight depressions evident and are &lt;15 cm deep.</li> <li>• Forest floor layers present and intact</li> <li>• Soil surface has not been displaced and shows minimal mixing with subsoil.</li> <li>• Some evidence of burning impacts include a mosaic of charred and intact forest floor layers to partially consumed surface OM with blackened surface soil. Root crowns and surface roots of grasses are not consumed.</li> </ul> <p>Soil resistance to penetration with tile spade or probe:</p> <ul style="list-style-type: none"> <li>• Resistance of surface soils may be slightly greater than observed under natural conditions. Concentrated in the top 0-10 cm.</li> </ul> <p>Observations of soil physical conditions:</p> <ul style="list-style-type: none"> <li>• Change in soil structure from crumb or granular structure to massive or platy structure, restricted to the surface 0-10 cm.</li> </ul>  |
| <p><b>Class 2 – Moderate disturbance</b></p> <p>Soil surface:</p> <ul style="list-style-type: none"> <li>• Wheel tracks or depressions are &gt;15 cm deep.</li> <li>• Forest floor layers partially intact or missing</li> <li>• Surface soil partially intact and may be mixed with subsoil</li> <li>• Burning consumed forest floor, root crowns, and surface roots of grasses. Surface soil is blackened.</li> </ul> <p>Soil resistance to penetration with tile spade or probe:</p> <ul style="list-style-type: none"> <li>• Increased resistance is present throughout top 10-30 cm of soil</li> </ul> <p>Observation of soil physical condition:</p> <ul style="list-style-type: none"> <li>• Change in soil structure from crumb or granular structure to massive or platy structure, restricted to the surface 10-30 cm.</li> <li>• Platy structure is generally continuous</li> <li>• Large roots may penetrate the platy structure, but fine and medium roots may not.</li> </ul> | <p><b>Class 3 – High disturbance</b></p> <p>Soil surface:</p> <ul style="list-style-type: none"> <li>• Wheel tracks and depressions highly evident with depth being &gt;30 cm deep.</li> <li>• Forest floor layers are missing</li> <li>• Evidence of topsoil removal, gouging, and piling</li> <li>• Soil displacement has removed the <i>majority</i> of the surface soil. Surface soil may be mixed with subsoil. Subsoil partially or totally exposed.</li> <li>• Burning consumed the forest floor, root crowns and surface roots of grasses. Evidence of severely burned soils (mineral soil red in color)</li> </ul> <p>Soil resistance to penetration with tile spade or probe:</p> <ul style="list-style-type: none"> <li>• Increased resistance is deep into the soil profile (&gt; 30 cm)</li> </ul> <p>Observations of soil physical conditions</p> <ul style="list-style-type: none"> <li>• Change in soil structure from granular structure to massive or platy structure extends beyond the top 30 cm</li> <li>• Platy structure is continuous</li> <li>• Roots do not penetrate the platy structure.</li> </ul> |

Attachment 1, continued. Field inventory form-disturbance  
class determination

**Soil Disturbance Severity Class**

| Project ID                  |                     |   | Name of Observer:   |  |
|-----------------------------|---------------------|---|---|--|
| Unit ID                     |                     |   |   |  |
| GPS Location                |                     |   | Date:   |  |
| Unit History                | No Previous Entry   | Faint Signs of Entry  | Obvious Signs of Entry  | Transect Points (track each pt)<br>1 2 3 4 5 6 7 8 9 10  |
| Severity Class              |                     |   |   |  |
| Disturbance Type            | 0                   | 1   | 2   | 3  |
| Wheel tracks or depressions | Natural conditions. | Faint or slight (<2 in deep).   | Tracks >2 in.   | Obvious tracks > 4 in.   |
| Penetration and resistance  | Natural conditions. | Slight resistance of surface soil.  | Increased resistance throughout the top 12 in.                                  | Packed (major skid trail or landing).  |
| Soil Physical Condition     | Natural conditions. | Change in soil structure from crumb or granular to platy in the surface.  | Change in soil structure to greater depth up to 12 in.                          | Change in soil structure > 30 cm.  |
| Forest floor                | Natural conditions. | Present and intact.   | Partially missing or patchy.  | Bare soil.   |
| Mineral soil                | Natural conditions. | Soil surface has no cover.  | Mineral topsoil shows some mixing with subsoil (different soil colors present). | Obvious topsoil removal, gouging, piling. Subsurface soil exposed.   |
| Erosion                     | Natural conditions. | Slight evidence (sheet erosion) of soil movement but some litter present. | Rills present.  | Gullies evident.   |
| Burning                     | Natural conditions. | Lightly charred residues.   | Litter consumed but soil is not visibly changed.                                | All woody material consumed and soil visibly altered - white ash present - soil may appear orange and powdery. |
| Number of Occurrences       |                     |   |   |  |

Directions:

Complete form by circling the best answer 0, 1, 2, or 3 at each point along a 10 point transect. Make a mark in each box as you collect the 10 points and then tally the results at the bottom to determine the number of class 0, 1, 2, and 3 for the sample area.

**Design Approvals & Acknowledgements:**

| <b>Design Approval</b> | <b>Date</b> | <b>Job Approval Authority</b> |
|------------------------|-------------|-------------------------------|
| Designed by:           |             |                               |
| Approved by:           |             |                               |

**Client's Acknowledgement Statement:**

The client acknowledges:

- I have received a copy of the specification and understand the contents and requirements.
- It is my responsibility to obtain all necessary permits and/or rights and to comply with all ordinances and laws pertaining to the application of this practice.
- I will not begin installation of this practice until I have received appropriate approval to do so. I understand NRCS also has Federal and state laws to comply with that may take some time to address (e.g. cultural resources).

| <b>Client's</b>  | <b>Date</b> |
|------------------|-------------|
| <b>Signature</b> |             |

**Certification Documentation:**

|   |  |
|---|--|
|   | Field Evaluation: Post-treatment inventory, measurements, notes, as-built, and supporting documentation (document completion in conservation plan), as required. |
|   | Map(s): Including field numbers, fields treated, and units treated (may document on conservation plan map), as required.   |
|   | Photos or other supporting documentation (e.g., seed tags, soil tests, receipts, invoices, spray records, fertilizer records, etc.)                              |
| Brief Description of Work Accomplished (types of equipment used, date of application, extents and quantities installed, etc.) |  |
|   |  |

**Certification Statement:**

The employee certifies the implementation of this conservation practice:

- Meets the purpose, general criteria, and any required additional criteria as documented in the conservation practice standard and/or enhancement sheet.
- Meets the specifications contained herein and is complete.
- Conforms to my existing Job Approval Authority controlling factors and levels.

| Name | Date | Job Approval Authority |
|------|------|------------------------|
|      |      |                        |

| <b>Field Level Certification</b> – For multiple applications of this design. |      |         |                  |           |
|--|------|---------|------------------|-----------|
| Land Unit/ Contract Item Number  | Date | Unit(s) | Amount Installed | Certifier |
|  |      |         |                  |           |
|  |      |         |                  |           |
|  |      |         |                  |           |
|  |      |         |                  |           |
|  |      |         |                  |           |