Ecologic Oriented Development (EOD):
A Pattern Book for Site Planning

Site & Infrastructure Planning Studio > Spring 2009
Massachusetts Institute of Technology
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Ecologic Oriented Development (EOD):

GOALS

• To create guidelines for ecologic site and infrastructure design that are derived from a set of site planning objectives

• To address explicit infrastructure principles (example: the use of ecology and natural systems for sewage treatment) and to translate them into design interventions in a variety of conditions, and multiple and scales.

• To create a flexible set of guidelines and typologies that account for site variability rather than providing a single plan.
Ecologic Oriented Development (EOD):
PROCESS

• ANALYSIS of Landscape Units, Mapping and Site Physiography
  Purpose: To establish typical landscape units as a basis for site and housing design.

• ABSTRACTION of Site Characteristics, Natural systems, Infrastructure, Transects
  Purpose: To generate common conditions, constraints, and opportunities for site development.

• FORMATION of Future Scenarios
  Purpose: To address what is unknowable and assume future scenarios as a basis for design decisions.

• DEVELOPMENT of Alternatives Approaches to Site and Infrastructure Technologies
  Purpose: To gain expertise of ‘site scale’ techniques that are crucial to the creation of ecologic development. These technologies included water management, climate mitigation, energy production, information technology, mobility, and agriculture.

• CREATION of Technology Driven Schematic Site Plan Investigations
  Purpose: To create exemplary and ideal site typologies for each alternative technology.

• SYNTHESIS through Neighborhood Site Plans
  Purpose: To utilize the developed typologies on a specific site and showcase possible permutations.
10 Guiding Principles For Ecologic Oriented Development (EOD)

1. COMPLETE WASTE AND WATER CYCLES
2. INTEGRATED INFRASTRUCTURE SYSTEMS
3. DESIGN FOR EFFICIENT ENERGY USE AND GENERATION
4. MAXIMIZE ON-SITE FOOD PRODUCTION
5. ENHANCE MOBILITY AND CIRCULATION
6. RESTORE STREAMS & RIVERS
7. RE-ESTABLISH NATURAL HABITATS and WILDLIFE
8. INCORPORATE INNOVATIVE MATERIALS
9. PRESERVE CULTURE + HERITAGE
10. VALUE EQUITY, HEALTH, + HAPPINESS
Ecologic Oriented Development (EOD):
PROCESS
EXAMPLES
Ecologic Oriented Development (EOD): Analysis and Abstractions transects
Ecologic Oriented Development (EOD):
Alternative Approaches: climate mitigation

Living Skin Materials:
Represented here integrated into a housing typology, towers made from climate sensitive materials would be capable of rain water harvesting where water would be purified, filtered, used and recycled. The skin could even absorb moisture from the air.

Future Technologies

Basic Block Orientation: Wind

Topography and Wind Movements
Ecologic Oriented Development (EOD):
Alternative Technologies Driven Typologies: Example - Greywater

**RURAL_INDIVIDUAL**
Greywater installation: A process exiting the building and immediately entering the natural habitat.

**Pros**
- Applications of tested methods existing today.
- Requires minimal piping to allow water to exit house and surrounding areas.
- Requires little maintenance.
- Surrounding natural habitat will reap benefits of water supply.
- Adaptable to changes of urbanization

**Cons**
- Physical disconnect from community.
- Maintenance work must be conducted by individual owners.

**SUBURBAN_COMMUNITIES**
Greywater installation: Greywater from individual residence is used for communal green spaces, i.e., community gardens, golf courses and natural habitats.

**Pros**
- Tested method applied to communities.
- Requires little piping and maintenance.
- Community benefits from green spaces and gathering places.
- Promotes communal ownership and care for surrounding habitat.
- Surrounding natural habitat will reap benefits of water supply.

**Cons**
- Maintenance must be negotiated between private ownership and community.
- Community ownership and penalties for overuse of water.
- Less adaptable to changes in urban form.

**HILISIDE_TOWNS**
Greywater installation: Due to topography and density, energy consumption can be reduced by using gravity to move the greywater.

**Pros**
- Energy consumptions for greywater movement are low.
- Community benefits from green spaces and gathering places.
- Demonstrates communal patterns of water usage and collective ecological footprint.
- Promotes communal ownership and care for surrounding habitat.
- Maintenance is taken care of by the township.
- Surrounding natural habitat will reap benefits of water supply.

**Cons**
- More manufactured methods of water circulation.
- Requires maintenance to ensure sanitation levels prior to contact with public.
- Community ownership and penalties for overuse of water.
- Difficulty adapting to changes in urban form.

**URBAN_COMMUNITIES**
Greywater installation: High density and building forms allow for use of greywater for semi-private spaces, i.e., roof gardens and central courtyards.

**Pros**
- Tested method applied to urban form at a community level.
- Provides amenities of healthy lifestyles, i.e., fresh air, green spaces within urban context.
- Reduces energy waste by maintaining cool building temperatures.
- Promotes communal ownership and care for green spaces.
- Demonstrates communal patterns of water usage and collective ecological footprint.
- May lead to ecologically competitive districts further benefiting the environment.

**Cons**
- Communities and general public benefit from green spaces and gathering places within an urban setting.
- Provides amenities of healthy lifestyles, i.e., fresh air.
- Promotes communal ownership and care for green spaces.
- Maintenance taken care of by the city.
- Demonstrates communal patterns of water usage and collective ecological footprint.

**URBAN_PUBLIC_SPACES**
Greywater installation: Uses public spaces to enhance our living environments before ultimately nourishing the natural habitat.

**Pros**
- Communities and general public benefit from green spaces and gathering places within an urban setting.
- Provides amenities of healthy lifestyles, i.e., fresh air.
- Promotes communal ownership and care for green spaces.
- Maintenance taken care of by the city.
- Demonstrates communal patterns of water usage and collective ecological footprint.

**Cons**
- Requires maintenance to ensure sanitation levels prior to contact with public.
- Some piping required to incorporate greywater into urban designs prior to reaching natural habitat.
- Difficulty adapting to changes in urban form.
Ecologic Oriented Development (EOD):
typologies matrix
Example:
Synthesis - Scalable Integrated Living Systems Module

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METRICS

TYPICAL HOUSEHOLD CHARACTERISTICS
- 3.5 persons
- 120-150 m2
- 30-35 m2 / person
- 2-storey
- footprint: 75 m2

HOUSEHOLD INPUT-OUTPUT
fruit & vegetable consumption
- 160 kg / person / year
  > 640 kg / household / year
- 20 m2 / person
  > 80 m2 / household
rainwater capture (75 sq.m.)
- min: 4 m3 / month
- max: 16 m3 / month

water needs
- 1-1.5 m3 / day > 30-45 m3 / month
- let's take the worst scenario: 45 m3/month
- toilet: 29% = 12.6 m3 / month
- laundry 17% = 7.65 m3 / month
- kitchen 23% = 10.35 m3 / month
- bath 24% = 10.8 m3 / month
- misc 8% = 3.6 m3 / month

opportunities for water reuse
- Recycle water from bath & misc for toilet use
  > water input reduction: 28%.
- Store rainwater for agriculture and laundry use
  > water input reduction: 17%
- Total savings: 45%

- Total water input after savings: 25 m3
  Total water output after savings:
  - 12.6 m3 blackwater
  - 18 m3 graywater

BROWN WATER TREATMENT
- primary treatment:
  anaerobic digestion
  - bipsoduct 1: methane > cooling
  - bipsoduct 2: solid waste > municipal service
    > fertilizer > agriculture
- secondary treatment:
  subsurface wetland
  ~ 21 m2 / person
  > 85 m2 / household
- tertiary treatment:
  park pond

SYSTEMS DIAGRAM

[Diagram showing rainwater, solar water heater, geothermal power, treatment plant, subsurface wetland, methane production, and waste water]
METRICS (CONT')

GREYWATER TREATMENT
- direct use in tree cultivation
- remaining: park pond (see diagram to the left)

OTHER HOUSE NEEDS
- heating: geothermal energy through underground system
- hot water and electricity: solar water heaters + geothermal
- gas for cooking: (see diagram to the left)
- fertilizer for agriculture: (see diagram to the left)
- other food (meat, fish): local grocery store

CUMULATIVE HOUSEHOLD FOOTPRINT
- building: 75 m²
- crop field: 80 m²
- subsurface wetland: 85 m²
- circulation / landscape: 60 m²
- total: 300 m²

PROPOSED COMMUNITY SIZE
- 1,155 persons = 330 households
Site Plan

- Library
- Medium-density Residential
- Neighborhood Water Drainage
- Light Retail
-(667,953),(755,993)
-(667,953),(755,993)
- Citrus Groves
- Bus Route
- Athletics Fields
- School
- Environmental Education and Community Center
- School
- Light Retail
- Daylighted Stream

3 in 1 Water Management System

Each residential block is an integrated water management unit. The blocks slope slightly towards their interior along with following the site topography as a whole. This allows the water to be used and treated on the block before the excess amount is collected at the neighborhood level.