## 2 Year MS & MSE Plan

<table>
<thead>
<tr>
<th>Requirement*</th>
<th>Notes</th>
<th>Course #</th>
<th>Credits</th>
<th>Term</th>
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<tbody>
<tr>
<td><strong>Environmental Engineering Core</strong></td>
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<tr>
<td>18CR from the Civil and Environmental Engineering Department</td>
<td>Required: CEE 581, CEE 582, CEE 591, CEE 881 (1st Fall in program)</td>
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<tr>
<td>12CR from within one of the following Environmental Engineering Majors: (courses on next page)</td>
<td>Choose one: A) Ecohydrology, B) Water Quality Process Engineering, C) Water Quality and Resources Engineering</td>
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<tr>
<td>3CR of approved Mathematics</td>
<td>See Env. Eng. dept. requirements and Cognates (3rd page)</td>
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<tr>
<td><strong>SS Core</strong></td>
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<tr>
<td>[SS-specific requirements]</td>
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<tr>
<td>6CR in Systems Analysis for Sustainability</td>
<td>Required: NRE 557/CEE 586, And one course from List 1 (3rd page)</td>
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<tr>
<td>Sustainable Design &amp; Technology</td>
<td>Required: NRE 574, See List 2 for other acceptable courses (3rd page)</td>
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<td>Minimum 3CR</td>
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<tr>
<td>Sustainable Enterprise</td>
<td>See List 3 for acceptable courses (3rd page)</td>
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<tr>
<td>Minimum 3CR</td>
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<tr>
<td><strong>NRE Core</strong></td>
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<tr>
<td>[School-wide requirement]</td>
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<td>NRE 509</td>
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<td>NRE 510</td>
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<td>NRE 580</td>
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<td>10CR in total</td>
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<tr>
<td><strong>Analytics</strong></td>
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<tr>
<td>[School-wide requirement]</td>
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<tr>
<td>3CR in Analytics</td>
<td>NRE 538 or equivalent required: <a href="http://www.snr.umich.edu/sites/snr.e.umich.edu/files/Statistic%20Course%20List.pdf">http://www.snr.umich.edu/sites/snr.e.umich.edu/files/Statistic%20Course\%20List.pdf</a></td>
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<td><strong>Opus</strong></td>
<td>Students are not expected to complete an Opus, but could petition to do a thesis/practicum or project*</td>
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<td>At most 6CR of NRE 700/701</td>
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<td><strong>Cognates</strong></td>
<td>Please see 3rd page for cognate requirement information</td>
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<tr>
<td>[Rackham requirement]</td>
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<td><strong>TOTAL CREDIT HOURS BY SCHOOL</strong></td>
<td>“NRE” – Minimum 25CR</td>
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<td>“CEE” – Minimum 18CR</td>
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<td><strong>TOTAL CREDIT HOURS</strong></td>
<td>Minimum 54 Credit Hours</td>
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Environmental Engineering

A) Ecohydrology

Choose four:
- CEE 428 – Introduction to Groundwater Hydrology
- CEE 520 – Deterministic & Stochastic Models in Hydrology
- CEE 521 – Open Channel Flow
- CEE 522 – Sediment Transport
- CEE 524 – Environmental Turbulence

or

- CEE 525 – Turbulent Mixing in Buoyant Flows
- CEE 527 – Coastal Hydraulics
- CEE 590 – Stream, Lake, and Estuary Analysis
- CEE 593 – Environmental Soil Physics
- CEE 624 – Restoration Fundamentals & Practice in Aquatic Systems

B) Water Quality Process Engineering

Required:
- CEE 580 – Physical Chemical Processes in Environmental Engineering
- CEE 592 – Biological Processes in Environmental Engineering

Choose two:
- CEE 428 – Introduction to Groundwater Hydrology
- CEE 583 – Surface & Interfaces in Aquatic Systems
- CEE 593 – Environmental Soil Physics
- CEE 594 – Environmental Soil Chemistry
- CEE 693 – Environmental Molecular Biology
- Approved CHEM or BIOLCHEM or ChE or AOSS elective

C) Water Quality and Resources Engineering

Choose at least one:
- CEE 521 – Open Channel Flow
- CEE 522 – Sediment Transport

Choose at least one:
- CEE 580 – Physical Chemical Processes in Environmental Engineering
- CEE 592 – Biological Processes in Environmental Engineering

Choose up to two (only one of CEE 524 or CEE 525 may be taken):
- CEE 428 – Introduction to Groundwater Hydrology
- CEE 520 – Deterministic and Stochastic Models in Hydrology
- CEE 524 – Environmental Turbulence

or

- CEE 525 – Turbulent Mixing in Buoyant Flows
- CEE 526 – Design of Hydraulic Systems
- CEE 624 – Restoration Fundamentals & Practice in Aquatic Systems

Natural Resources and Environment

Sustainable Systems

1) Systems Analysis for Sustainability (6 hrs) fulfills Analytics requirement

- NRE 531 (4) Principles of GIS (W)
- NRE 550/STRATEGY 566 (3) Systems Thinking For Sustainable Development (W)
- NRE 557/CEE 586 (3) Industrial Ecology (W)
- NRE 570 (3) Microeconomics with Natural Resource Applications (W)
- NRE 501.086 (3) Topics and Tools in Environ Economics (W TBD)
- NRE 501.092 Environmental Systems Analysis (F)

*Please note that only 1 (one) econ course can be counted under the Systems Analysis requirement
2) Sustainable Design and Technology (3-9hrs)

- NRE 574/PUBPOL 519 (3) Sustainable Energy Systems (F)
- NRE 576/UP 576 (3) Ecological Design Approaches to Brownfield Redevelopment (F)
- NRE 605/BA 605 (3) Green Development (W)
- NRE 687 (4) Landscape Analysis and Planning
- NRE 501.036 Sustainable Systems in Developing Countries (W)
- NRE 501.039 (3) Land Use and Global Change (F)
- Arch 575 (3) Building Ecology (F)
- CEE 460 (3) Design of Environmental Engineering Systems (F)
- CEE 582 (3) Environmental Microbiology (F)
- CEE 686/ChE 686 (2-3) Case Studies in Environmental Sustainability (W)
- ME 433 (3) Advanced Energy Solutions (F,W)
- ME 589 (3) Sustainable Design of Technology Systems (F,W)
- EECS 498 (3) Grid Integration of Alternative Energy Sources (TBD)

3) Sustainable Enterprise (3-9 hrs)

- NRE 501.032 (3) Transportation Energy & Climate (W)
- NRE 512/BA 512 (1.5) Ethics Corporate Management (F, W)
- NRE 513/STRAT 564&565 (3) Competitive Environmental Strategy (F)
- NRE 527 (3) Energy Markets and Energy Politics (F)
- NRE 532 (3) Natural Resources Conflict Management (F)
- NRE 533 (3) Negotiating Skills in Environmental Dispute Resolution (W)
- BE 555 (1.5) Non-Market Strategy (F)
- NRE 560/UP 560/HB 710 (3) Behavior and Environment: (F)
- NRE 565 (3) Principles of Sustainability (W)
- NRE 605/BA 605 (3) Green Development (W)
- ENG 521 (3) CleanTech Entrepreneurship (F)
- FIN 637 (2.25) Finance and Sustainable Enterprises (F)
- ES 520 (1.5) CleanTech Venture Opportunities (F)
- STRATEGY 735-739 (1.5) Environmental Management Topics (F, W)

Cognates

SNRE – Minimum 4 credits outside SNRE. Can be fulfilled with CEE coursework.

CEE – 4 credits of non-CEE coursework. Can be fulfilled with one advanced Mathematics course (proper choice of SNRE analytical courses can also satisfy this requirement) and one SNRE course.