### Dual-Master’s Degree Program

#### Summary of Requirements for a Master of Science (Aquatic Sciences) and a Master of Science in Engineering (Environmental Engineering)

<table>
<thead>
<tr>
<th>Requirement*</th>
<th>Notes</th>
<th>Course #</th>
<th>Credits</th>
<th>Term</th>
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</thead>
<tbody>
<tr>
<td><strong>Environmental Engineering Core</strong></td>
<td>18CR from the Civil and Environmental Engineering Department</td>
<td>Required:</td>
<td>CEE 581</td>
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<td></td>
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<td>CEE 582</td>
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<td>CEE 591</td>
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<td></td>
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<td>CEE 881 (1st Fall in program)</td>
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<td></td>
<td>12CR from within one of the following Environmental Engineering Majors: (courses on next page)</td>
<td>Choose one:</td>
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<td></td>
<td></td>
<td>A) Ecohydrology</td>
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<td>B) Water Quality Process Engineering</td>
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<td>C) Water Quality and Resources Engineering</td>
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<td></td>
<td>3CR of approved Mathematics</td>
<td>See Env. Eng. dept. requirements and Cognates (next page)</td>
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<tr>
<td><strong>AS CORE</strong></td>
<td>9-12CR in Aquatic Sciences (courses on next page)</td>
<td>One course each from:</td>
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<td>1) Organismal Biology</td>
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<td>2) Ecosystem Ecology</td>
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<td>3) Ecosystem Modeling</td>
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<tr>
<td><strong>EAS Core</strong></td>
<td>EAS 509</td>
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<td>EAS 510</td>
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<td>[IAMS Requirement] Two courses; 3CR minimum</td>
<td>Please see page 3 for approved</td>
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<tr>
<td><strong>Analytics</strong></td>
<td>2 Analytics courses</td>
<td>EAS 538 or approved alternate and one additional Analytics course</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>
<td>At most 6CR of EAS 700/701</td>
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<td><strong>Cognates</strong> (Rackham requirement)</td>
<td>Please see next page for cognate requirement information</td>
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| **TOTALS** | MINIMUM CREDIT HOURS BY SCHOOL | "EAS" – Minimum 25CR | | |
| | "CEE" – Minimum 18CR | | | |
| | TOTAL CREDIT HOURS | Minimum 54 Credit Hours | | |

*Any waiver or substitution of degree requirement must be approved by the appropriate faculty and submitted to OAP.

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Last revised 12/11/2019
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 501.041 – Decentralized Water Supply, Hygiene, and Sanitation
CEE 520 – Deterministic and Stochastic Models in Hydrology
CEE 524 – Environmental Turbulence
or
CEE 525 – Turbulent Mixing in Bouyant Flows
CEE 526 – Design of Hydraulic Systems
CEE 573 – Data Analysis
CEE 597 – Environmental Organic Chemistry
CEE 624 – Restoration Fundamentals & Practice in Aquatic Systems

Natural Resources and Environment Aquatic Sciences
1) Organismal Biology
Choose one:
EAS 409 – Ecology of Fishes OR
EEB 486 – Biology & Ecology of Fishes (UMBS)
EAS 422 – Biology of Fishes
EEB 457 – Algae in Freshwater Systems
EAS 516 – Aquatic Entomology
2) Ecosystem Ecology
Choose one:
EAS 476 – Ecosystem Ecology
3) Ecosystem Modeling

Choose one:
EAS 534 – GIS and Landscape Modeling
EEB 401 – Interrogating Data with Models

Integrated Analytic Methods and Skills Requirement

Students are required, at some point during their time enrolled in the program, to take 2 courses composing at least 3 credits from a faculty-approved list of courses that focus on integrative analytic methods and skills. The faculty-approved existing courses that satisfy this requirement are listed below:

**Fall**

447 – Forest Ecology Management
501 – Ecological Restoration Applications
523 – Ecological Risk Assessment
530 – Decision-Making for Sustainability
531 – Principles of GIS
533 – Negotiation Skills
536 – Mediation Skills
552 – Ecosystem Services
553 – Diverse Farming Systems
564 – Localization Seminar
567 – Social Vulnerability & Adaptation to Environ Change
572 – Environmental Impact Assessment
570 – Environmental Economics
576 – Sustainability Finance
578 – Urban Stormwater
597 – Environmental Systems Analysis
677 – Climate Adaptation Seminar
687 – Landscape Planning

**Winter**

501 – Science and Management of the Great Lakes
501 – The Hydrologic Cycle and Water Res Mgmt
501 – Climate Economics & Policy
541 – Remote Sensing
545 – Applied Ecosystem Modeling (Winter B)
549 – Analysis and Modeling of Ecological Data
550 – Systems Thinking for Sustainable Development
557 – Industrial Ecology
569 – Stakeholder Network Analysis
581 – Advanced Education for Environment and Sustainability
589 – Ecological Restoration
610 – Advanced LCA Methods and Software Tools
641 – Interdisciplinary Research Methods
787 – Metro Studio (MLA only)