Water management and challenges in Norway

Geir Stene-Larsen
Ministry of Health and Care Services
Ministries and directorates involved in freshwater management

Ministry of Health and Care Services
- Drinking water quality
  - Norwegian food safety authority
  - Norwegian Directorate of Health

Ministry of the Environment
- Protection of watersources
  - Directorate for Nature Management
  - Climate and Pollution Agency

Ministry of Petroleum and Energy
- Water power and regulation
  - Norwegian Water Resources and Energy Directorate

Ministry of Local Government and Regional Development
- Infrastructure
  - Norwegian Building Authority

Regional and local authorities
It is established many types of intersectional working relations between authorities, different trades, NGO’s and other interest groups. The model used in implementing the Water Framework Directive is one example.

Experience:

- Many-sided but very important.
- Make better result.
- Commit the parties.
- Time consuming.
- Frustrating.
- Hard to agree with some sectors.
- Some never show up.
11 River basin region

Norway

Precipitation 470 671
Evapotranspiration 112 000

Runoff to the sea 362 454

Before runoff 369 000
From neighbors 10 329
To neighbors 6546

May supply 5 billions people before runoff

5 % of total land area is water

- City area
- Forest
- Farmland
- Wetland
- Mountain
- Glacier
- Lakes / Rivers
Ecological status for Norway
- Based on about 25000 surface waters

Classified according to EU Water Framework Directive

- Very good
- Good
- Moderate
- Poor
- Very poor
- Undefined
Ecological status - all lakes and rivers in Rogaland county

Risk not to obtain good status

<table>
<thead>
<tr>
<th>Tilstand</th>
<th>Antal</th>
<th>Prosent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Svært god</td>
<td>1</td>
<td>0,1</td>
</tr>
<tr>
<td>Antatt svært god</td>
<td>39</td>
<td>3,3</td>
</tr>
<tr>
<td>God</td>
<td>5</td>
<td>0,4</td>
</tr>
<tr>
<td>Antatt god</td>
<td>385</td>
<td>32,6</td>
</tr>
<tr>
<td>Moderat</td>
<td>3</td>
<td>0,3</td>
</tr>
<tr>
<td>Antatt moderat</td>
<td>450</td>
<td>38,1</td>
</tr>
<tr>
<td>Dårlig</td>
<td>4</td>
<td>0,3</td>
</tr>
<tr>
<td>Antatt dårlig</td>
<td>208</td>
<td>17,6</td>
</tr>
<tr>
<td>Svært dårlig</td>
<td>1</td>
<td>0,1</td>
</tr>
<tr>
<td>Antatt svært dårlig</td>
<td>42</td>
<td>3,6</td>
</tr>
<tr>
<td>Uklassifisert</td>
<td>44</td>
<td>3,7</td>
</tr>
</tbody>
</table>
Ecological status - all lakes and rivers in Møre og Romsdal county

Risk not to obtain good status

Tilstand

Tilstand | Antal | Prosent
--- | --- | ---
Svært god | 8 | 0,5
Antatt svært god | 13 | 0,8
God | 8 | 0,5
Antatt god | 1003 | 61,7
Moderat | 16 | 1
Antatt moderat | 357 | 22
Dårlig | 4 | 0,2
Antatt dårlig | 173 | 10,6
Svært dårlig | 2 | 0,1
Antatt svært dårlig | 28 | 1,7
Uklassifisert | 14 | 0,9

Possible

Very good
Possible good
Good
Possible good
Moderate
Possible moderate
Poor
Possible poor
Very poor
Possible very poor
Unclassified
### Bathing water quality in the Oslofjord - summer 2010

#### Badevannskvalitet Oslofjorden 2010

(Tabell satt opp geografisk: fra vest mot øst, øyene til slutt)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sollere stranden</td>
<td>1</td>
<td>11</td>
<td>400</td>
<td>65</td>
<td>47</td>
<td>45</td>
<td>33</td>
<td>&gt;1500</td>
<td>55</td>
<td>230</td>
<td>140</td>
<td>150</td>
<td>11</td>
<td>4</td>
<td>67</td>
</tr>
<tr>
<td>Hyllestad</td>
<td>5</td>
<td>20</td>
<td>200</td>
<td>3</td>
<td>14</td>
<td>35</td>
<td>3</td>
<td>500</td>
<td>15</td>
<td>11</td>
<td>130</td>
<td>79</td>
<td>3</td>
<td>9</td>
<td>95</td>
</tr>
<tr>
<td>Bygdøy sjøbad</td>
<td>60</td>
<td>5</td>
<td>65</td>
<td>9</td>
<td>24</td>
<td>14</td>
<td>36</td>
<td>390</td>
<td>33</td>
<td>16</td>
<td>90</td>
<td>19</td>
<td>14</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Hotel ved restaurant</td>
<td>110</td>
<td>0</td>
<td>7</td>
<td>22</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>Solstrand, Huk</td>
<td>6</td>
<td>2</td>
<td>9</td>
<td>17</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>90</td>
<td>15</td>
<td>15</td>
<td>40</td>
<td>10</td>
<td>21</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Paradisbukta</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Ormsund</td>
<td>1</td>
<td>10</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>28</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>9</td>
<td>16</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>Solvik (Malmøy)</td>
<td>11</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Skinnerbukta (Malmøy)</td>
<td>7</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Ulvøya</td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Nordstrand bad</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Katten</td>
<td>8</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>89</td>
</tr>
<tr>
<td>Fiskervollbukta</td>
<td>140</td>
<td>42</td>
<td>0</td>
<td>34</td>
<td>1</td>
<td>100</td>
<td>6</td>
<td>68</td>
<td>44</td>
<td>18</td>
<td>8</td>
<td>12</td>
<td>370</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Hvenverbukta</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>52</td>
<td>4</td>
<td>100</td>
<td>48</td>
<td>5</td>
<td>53</td>
<td>66</td>
<td>5</td>
<td></td>
<td>120</td>
</tr>
<tr>
<td>Hovedøya</td>
<td>52</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Grønsholmen</td>
<td>51</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Rambergøya</td>
<td>11</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Langeøyene</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

#### Utmerket

- Very good: TKB / 100 ml vann < 250
- God: TKB / 100 ml vann 251-500
- dårlig: TKB / 100 ml vann > 500

TMB = Termotolerante koliforme bakterier

Ved dårlig vannkvalitet tas det omprøver. Disse publiseres direkte på informasjonside og legges til som egen kolonne (B) denne tabellen.
Main sources for water pollution in Norway

- Agriculture drainage
- Sewage from 5 million persons
- $10^6$ tonn salmon in 2010 = 10 million persons
About 2700 sewage treatment plants > 50 pe are serving more than 80% of the population.
Stormwater + Combined sewers = Increased discharges

- Stormwater to combined sewers will lead to
  - Increased overflow discharges
  - Increased leakages from sewers
  - Reduced treatment capacity
33 outbreaks in 2002-2011 possible due to water.
- More than 5000 persons has been registered sick.
Small water supply systems serving 50-500 persons are the dominating size.
More than 80% of the population are connected to drinking water systems that serve more than 5000 persons each.
A large portion of the population are connected to a drinking water supply system. But what about the rest?
Population served by drinking water

- Surface water: 90%
- Groundwater: 10%
% population with good drinking water quality
Important highlights from the Norwegian drinking water regulation

✓ Water supply systems serving more than 50 persons shall be approved by Mattilsynet.
✓ Risk analysis must be done.
✓ Internal control system shall be followed.
✓ All surface water shall at least be disinfected.
✓ The water system shall have multiple barriers.
✓ Safety plans shall exist.
✓ Water quality shall be according to the regulation.
✓ Results shall be reported to Mattilsynet.
Assemble the team to prepare the water safety plan

Document and describe the system

Undertake a **hazard assessment** and **risk characterization** to identify and understand how hazards can enter into the water supply

Assess the existing proposed system (including a description of the system and a flow diagram)

Identify **control measures** – the means by which risks may be controlled

Define **monitoring** of control measures – what limits define acceptable performance and how these are monitored

Establish procedures to **verify** that the water safety plan is working effectively and will meet the health-based targets

Develop **supporting programmes** (e.g., training, hygiene practices, standard operating procedures, research and development, etc.)

Prepare **management procedures** (including corrective actions) for normal and incident conditions

Establish **documentation** and **communication** procedures

---

The Norwegian drinking water regulation

§ 5

§ 14

§ 10

Table 7 and table 4

§ 5

§ 5

§ 11

§ 5
Risk for backflush in drinking water systems

Potensial risk

Low risk
Materials in drinking water pipelines - outdoor

- 0%
- 3%
- 5%
- 23%
- 36%
- 33%

- Asbestos
- Iron/Steel
- PVC
- PE
- GUP
- Other
Leakage from drinking water pipelines

% of total production

Danmark 2002
USA
Tyskland 1999
Finland 1999
Sverige 2004
UK 2000
Spania 1999
Slovakia 1999
Frankrike 1997
Italia 2001
Romania 1999
Tjekkia
Irland 2000
Ungarn 1995
Slovenia 1999
Norge 2002
Bulgaria
 Drinking water pipelines - outdoor

About 0.8% of the pipelines were renewed in 2011.
Summary

• Cooperating is important but also challenging.
• Many water sources with good quality but also local pollution in some areas.
• Many small water supply system with unknown status.
• Inadequate treatment of both sewage and drinking water.
• Leakage and low renewal factor for pipelines.
• Risk for bacterial contamination of the water.