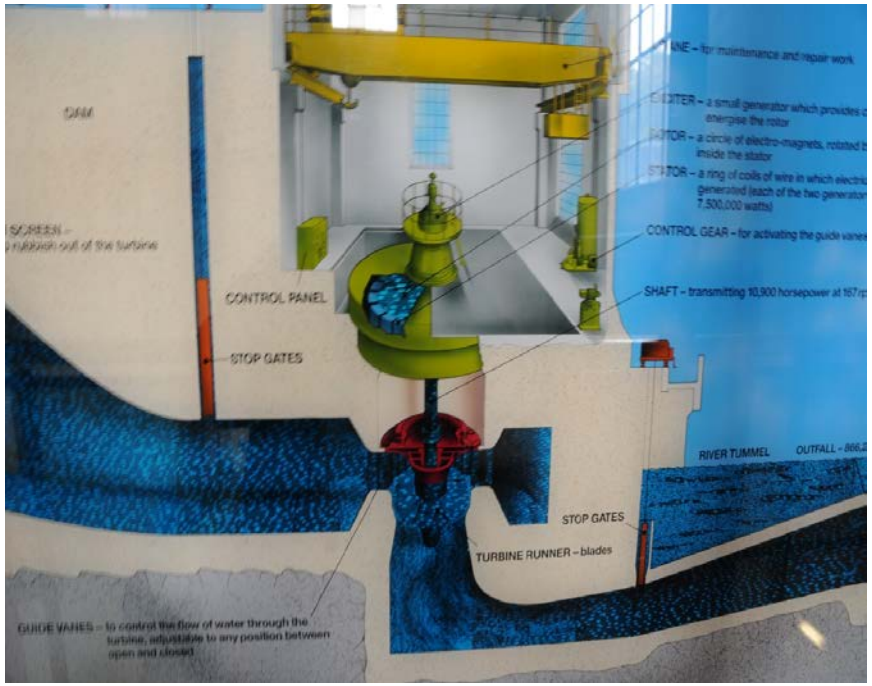
Fluid Mechanics

Chapter 0 Why Fluid Mechanics?



Chapter 0 Why Fluid Mechanics?

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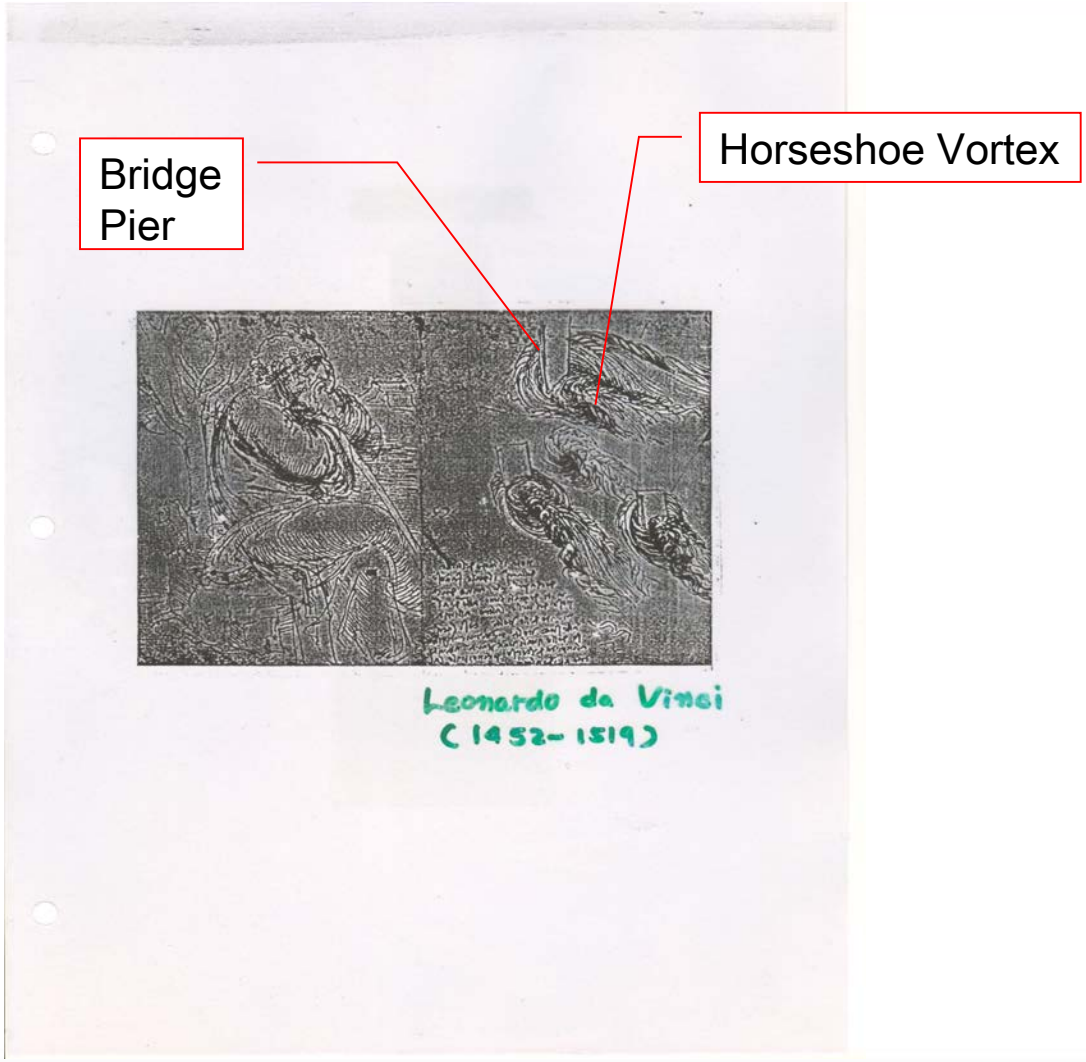
Chapter 0 Why Fluid Mechanics?

Objectives

- Find your motivation to attend this class
- Introduce practical applications of fluid mechanics

0.1 Speculation of Leonardo da Vinci



0.1 Speculation of Leonardo da Vinci

Eddy formation in zones of separation.

Sketch by Leonardo of flow over a contracted weir.

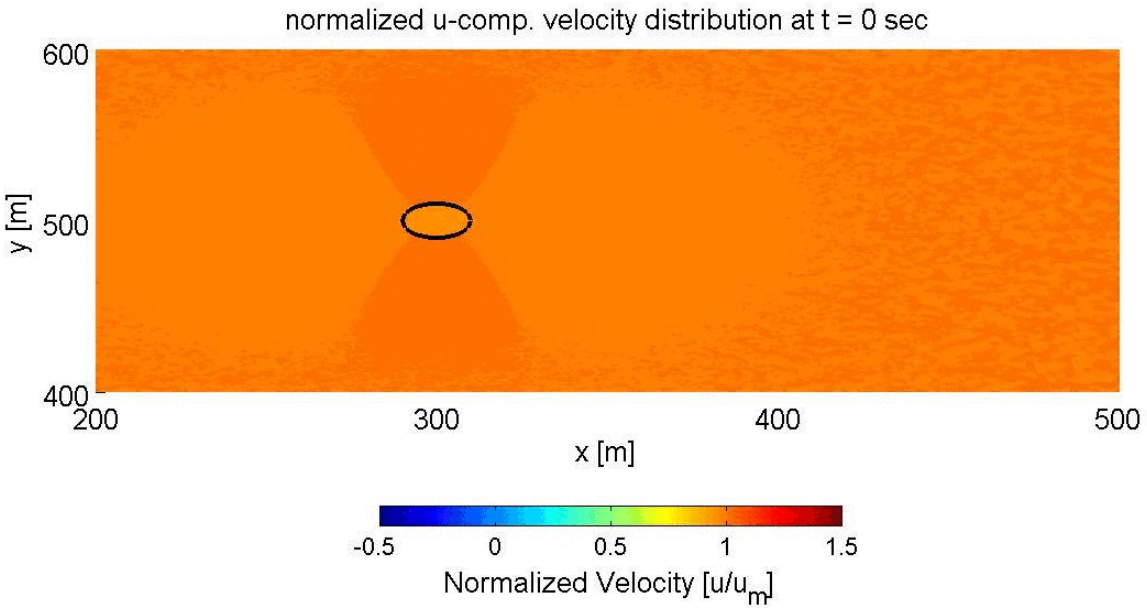
0.1 Speculation of Leonardo da Vinci

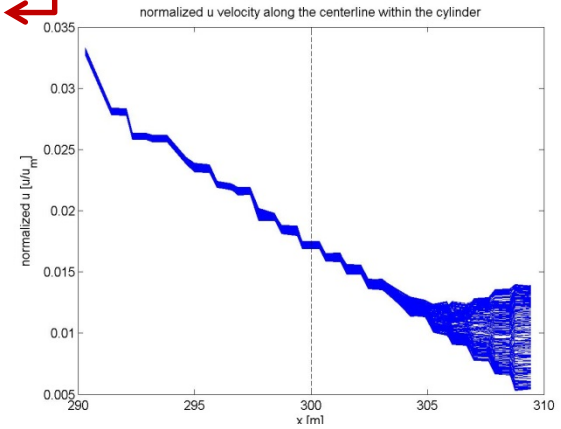
Velocity field around/within a single cylinder

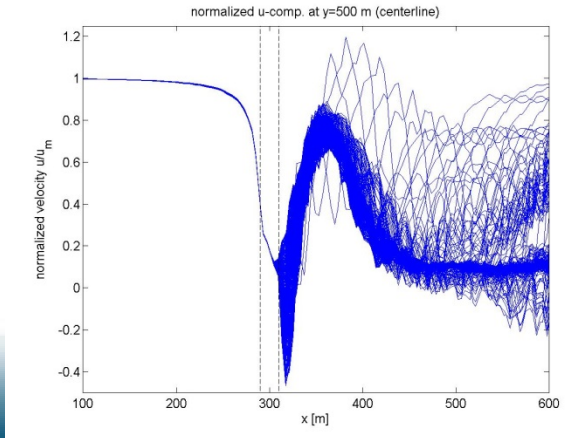
- Momentum reduction by quadratic drag law formulation.
  - Governing equations including the drag law formulation.

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = -g\frac{\partial h}{\partial x} + \nu_H\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right) - C_{DB}\frac{\sqrt{u^2+v^2}}{H}u + F_{D,x}$$

$$F_{D,x} = -\frac{\alpha C_D (u^2+v^2)^{1/2}}{D}u,$$



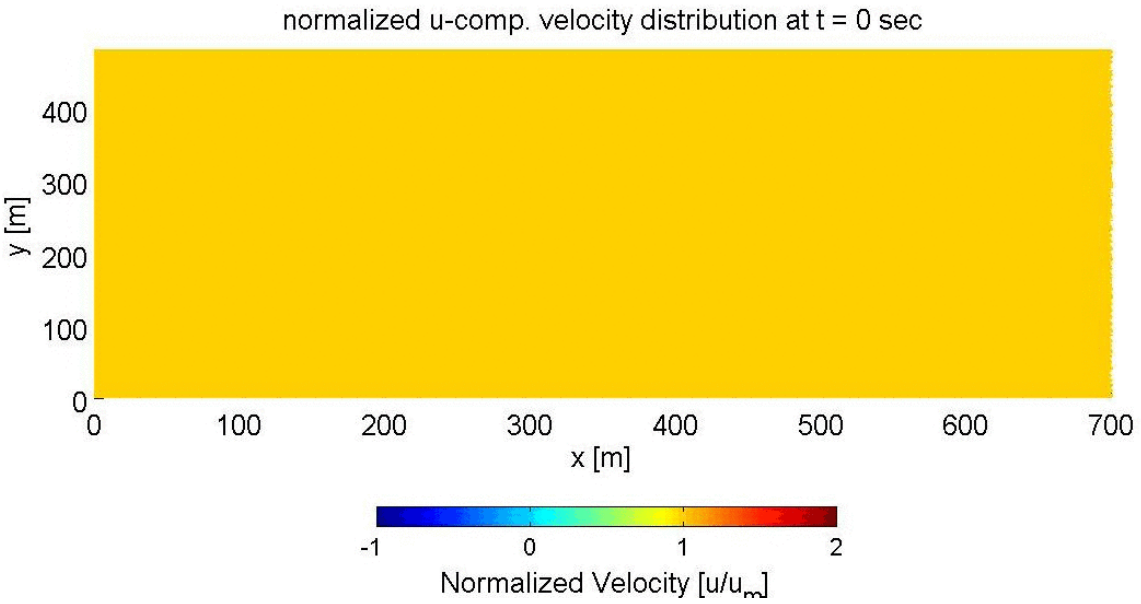




Velocity fields

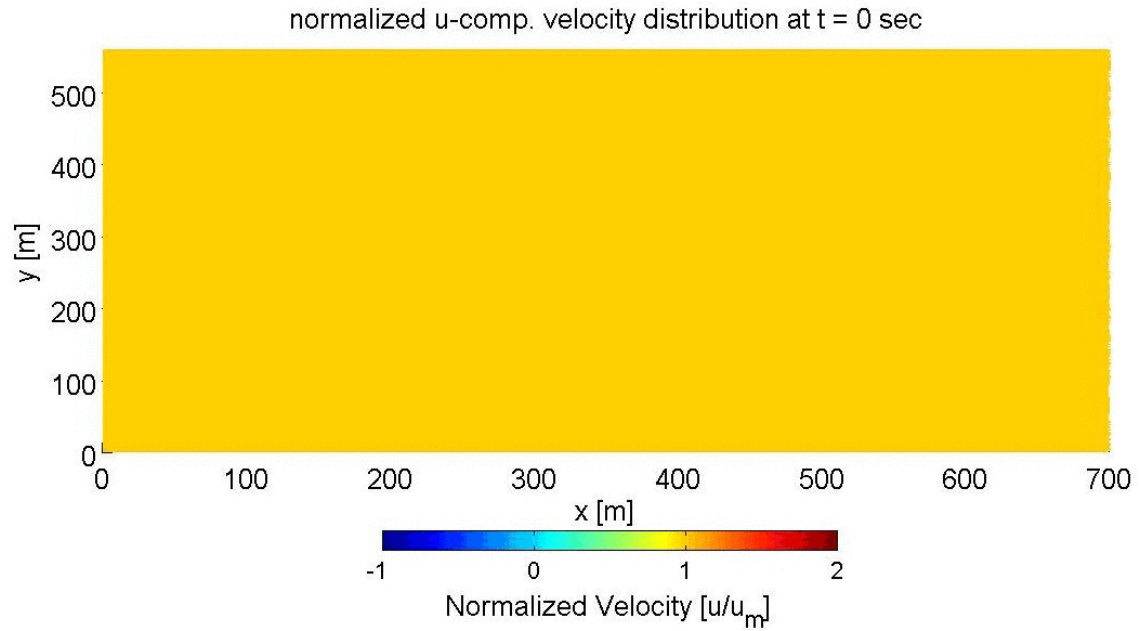
$L_G/D = 2$

$L_T/D = 2$

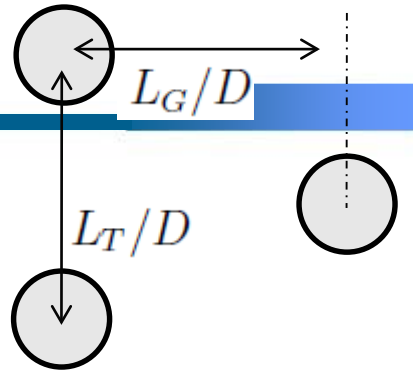


$L_G/D = 2$

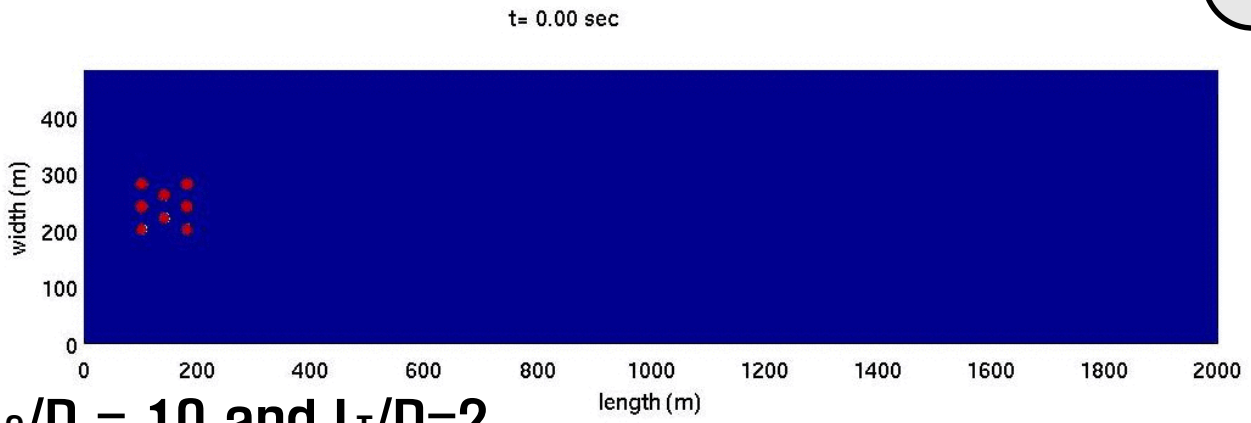
$L_T/D = 4$



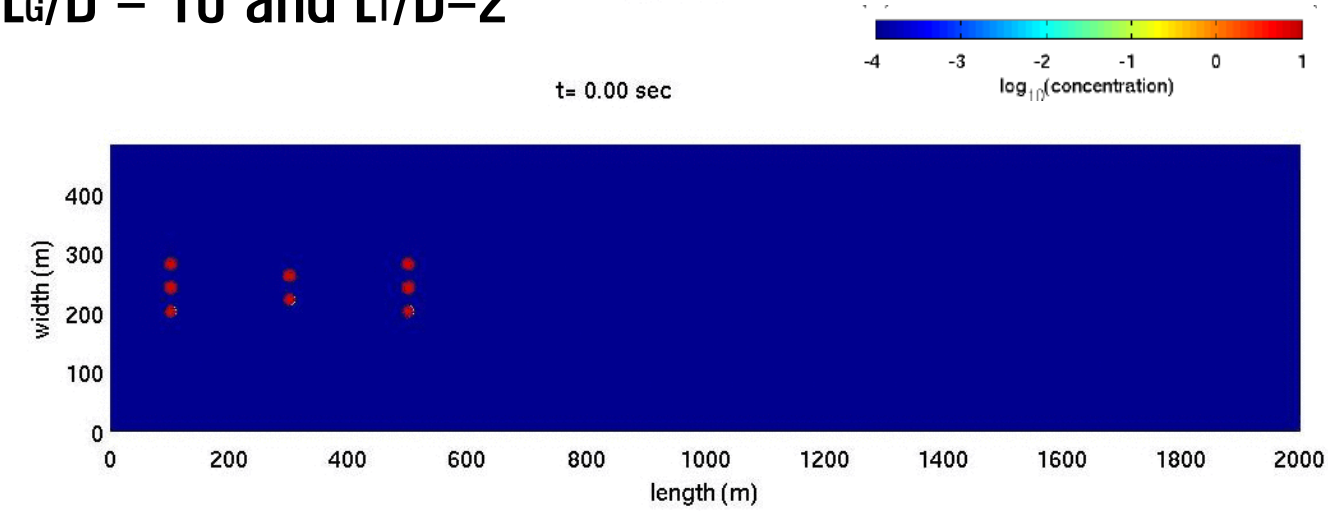
Staggered array cases



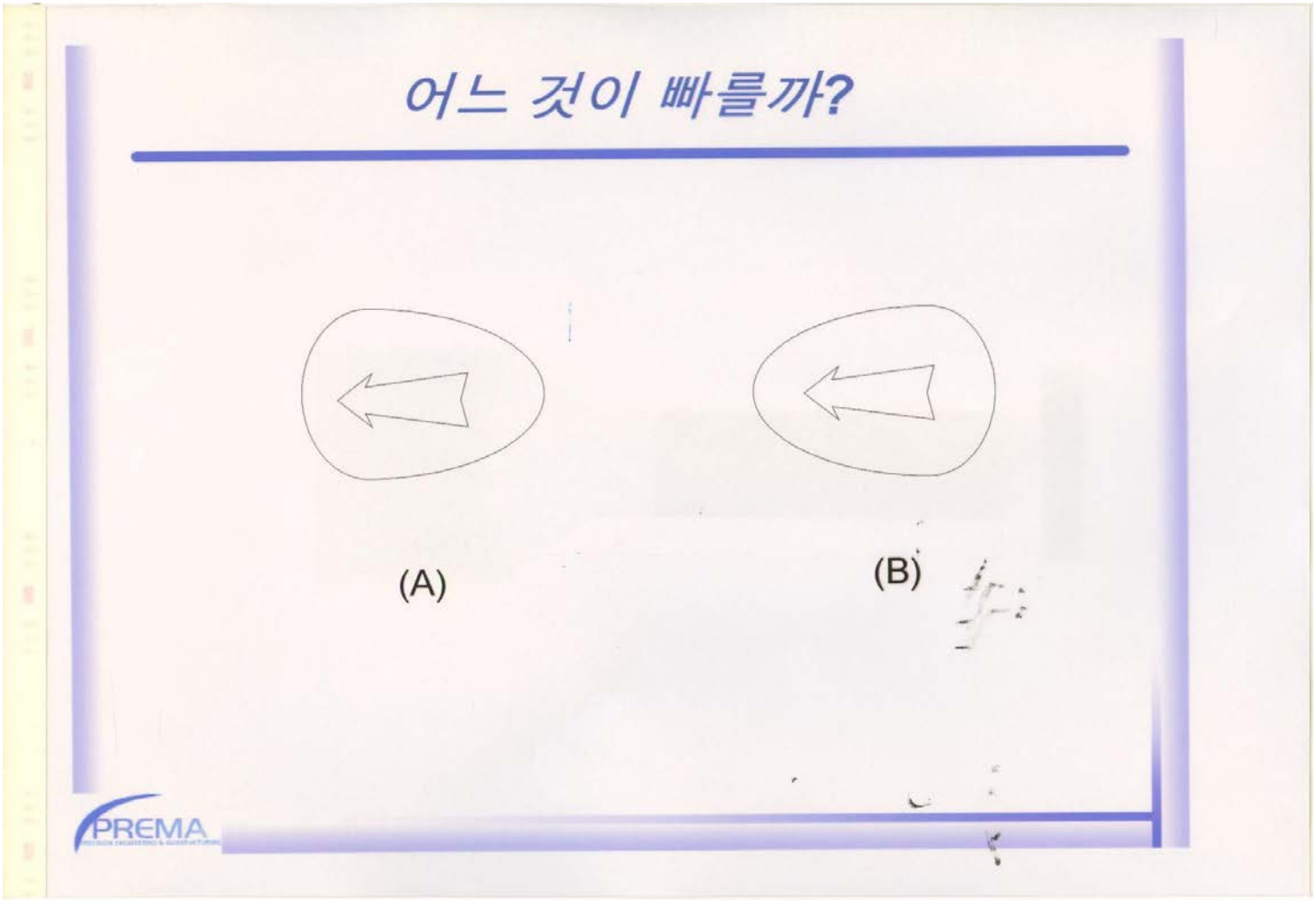
- Mixing around staggered arrays
  - L_G/D = 2 and L_T/D=2



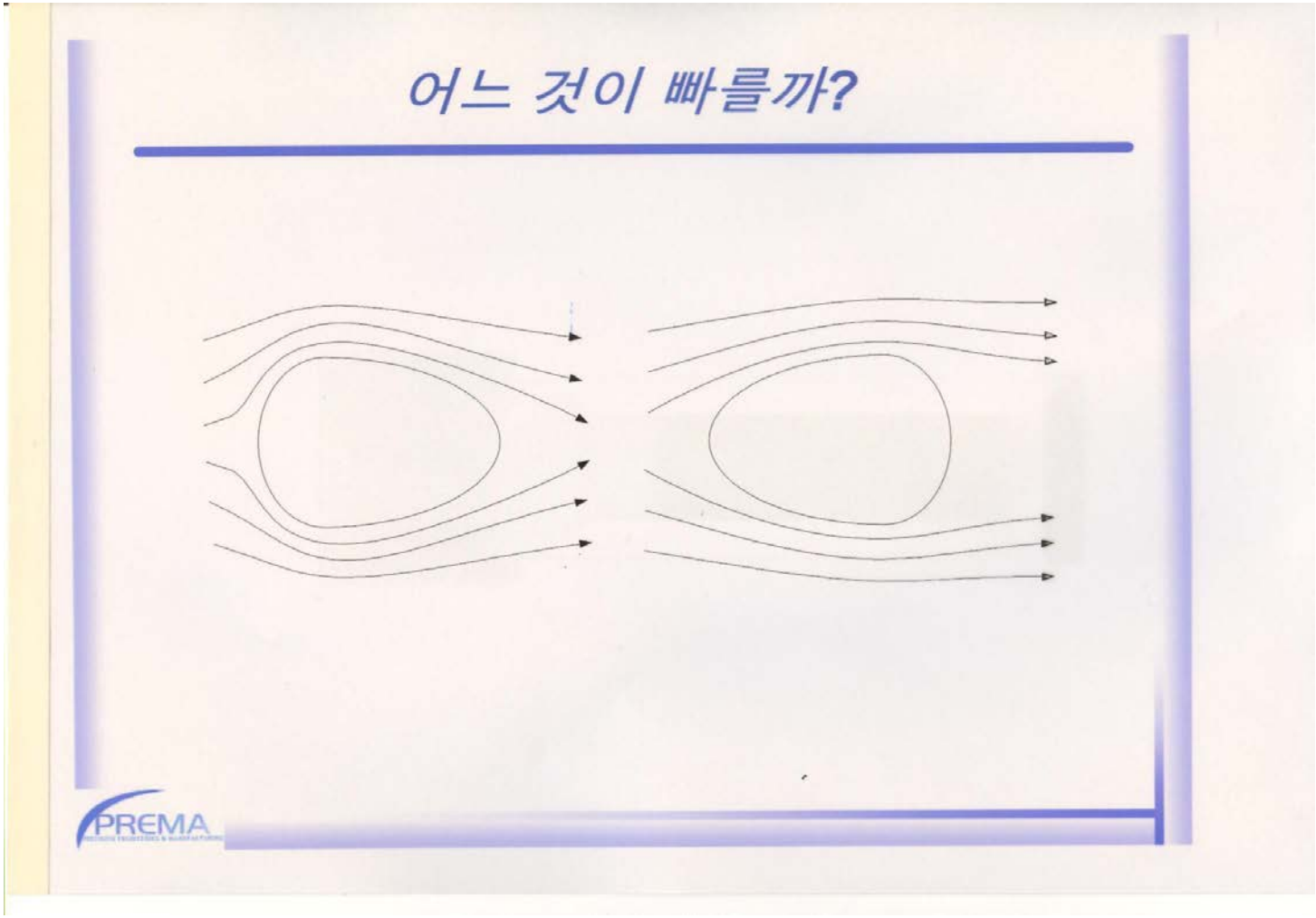
  - L_G/D = 10 and L_T/D=2



0.2 Physics of Golf



0.2 Physics of Golf



0.2 Physics of Golf

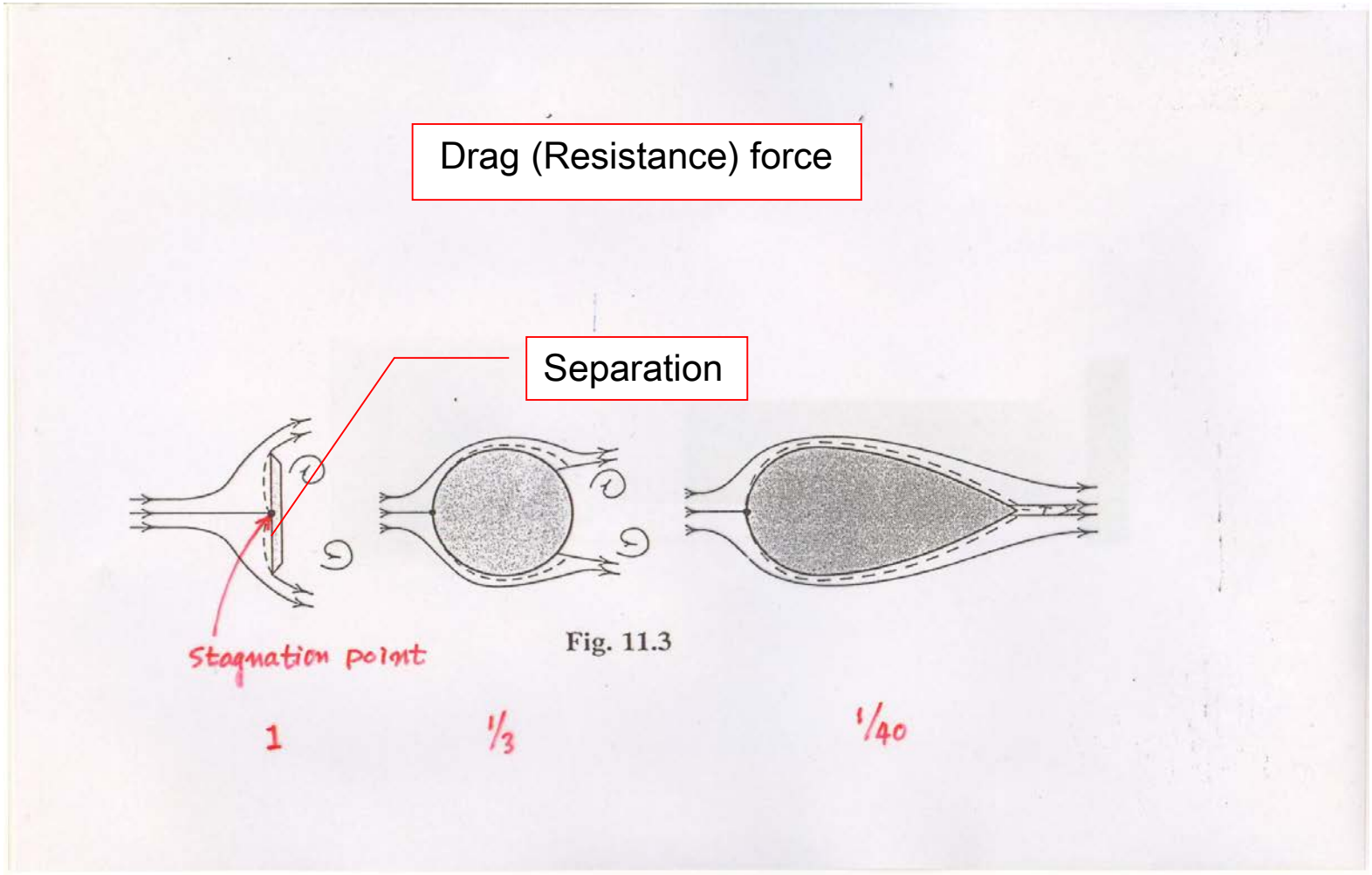
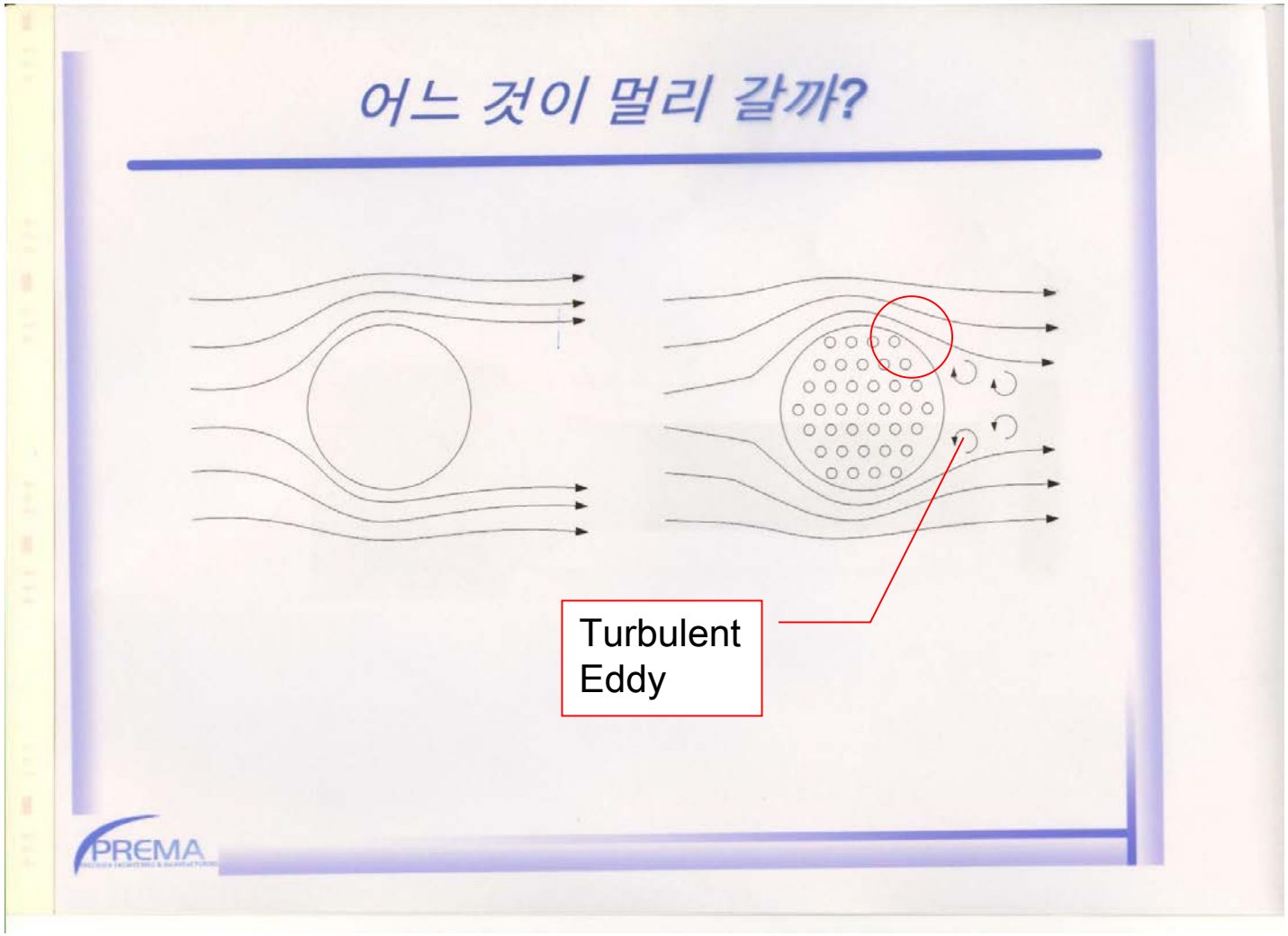


Fig. 11.3

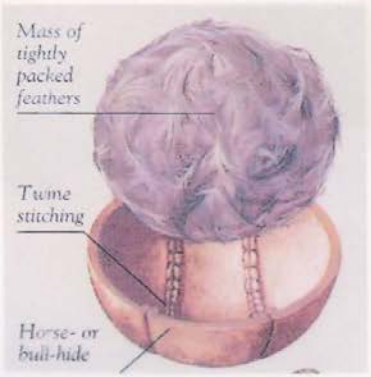
0.2 Physics of Golf

0.2 Physics of Golf



0.2 Physics of Golf

Feathery Ball



Last feathery made by Robertson, in 1852

PREMA

0.2 Physics of Golf

Guttie Ball

Smooth ball made by Robertson in 1852

Red, hand-hammered guttie for use in snow

Hand-hammered Robertson guttie from the 1850s

Guttie ball stamped with a distinctive circle marking

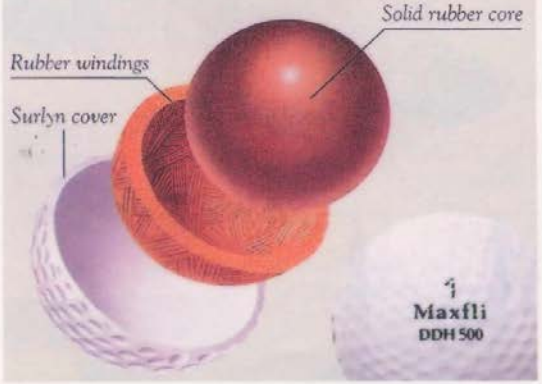
PREMA

0.2 Physics of Golf

Rubber-core Ball

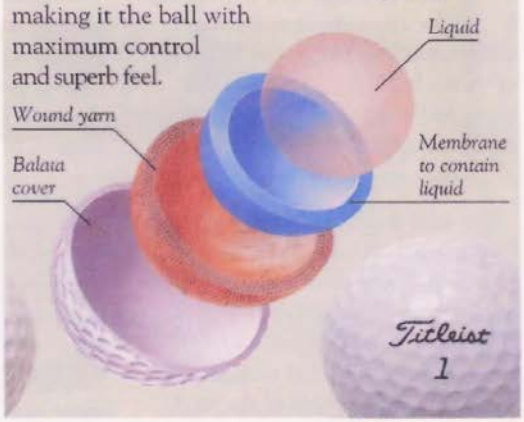
THREE-PIECE (SURLYN COVER)

This version of the three-piece wound ball has a solid rubber core over which rubber yarn is wound for good control. The cover is made from Surlyn, a thermoplastic resin that is harder than balata and is thus considerably more durable; it is virtually uncuttable.



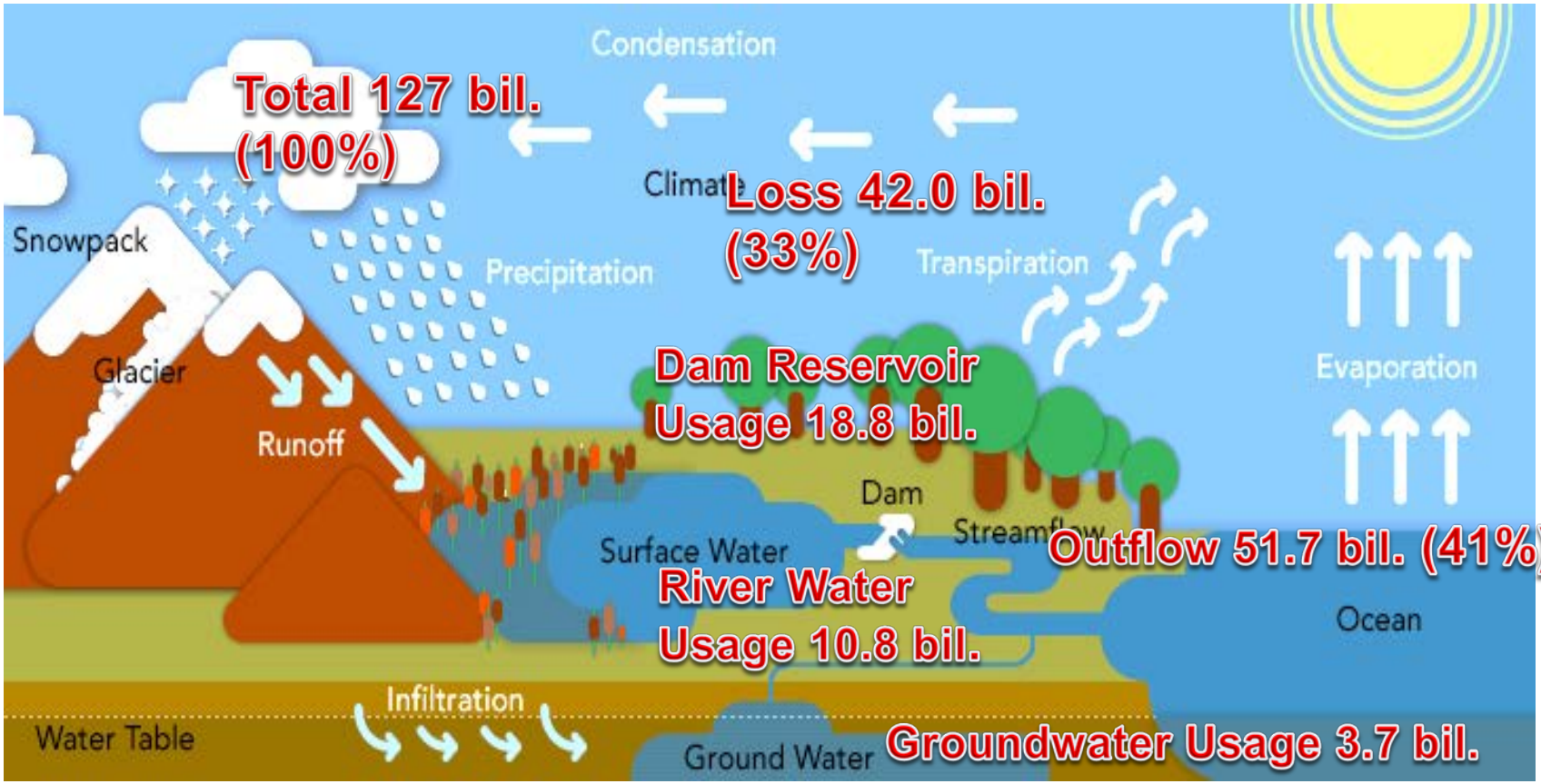
THREE-PIECE (BALATA COVER)

The balata-covered, liquid-centred three-piece ball might be described as the most advanced of golf balls. The wound construction over a liquid centre, combined with a soft, synthetic balata cover, produces the highest spin rate, making it the ball with maximum control and superb feel.



PREMA

03 Water Resources



Total water usage 33.3 bil. (26%)

0.4 Dams

<충주댐>

높이 97.5미터, 길이 464미터
총저수량 27.5억톤㎥
발전출력: 400,000 kW

0.4 Dams

<대청댐>
높이 72m; 길이 495m
유효 저수용량 14.9억㎥

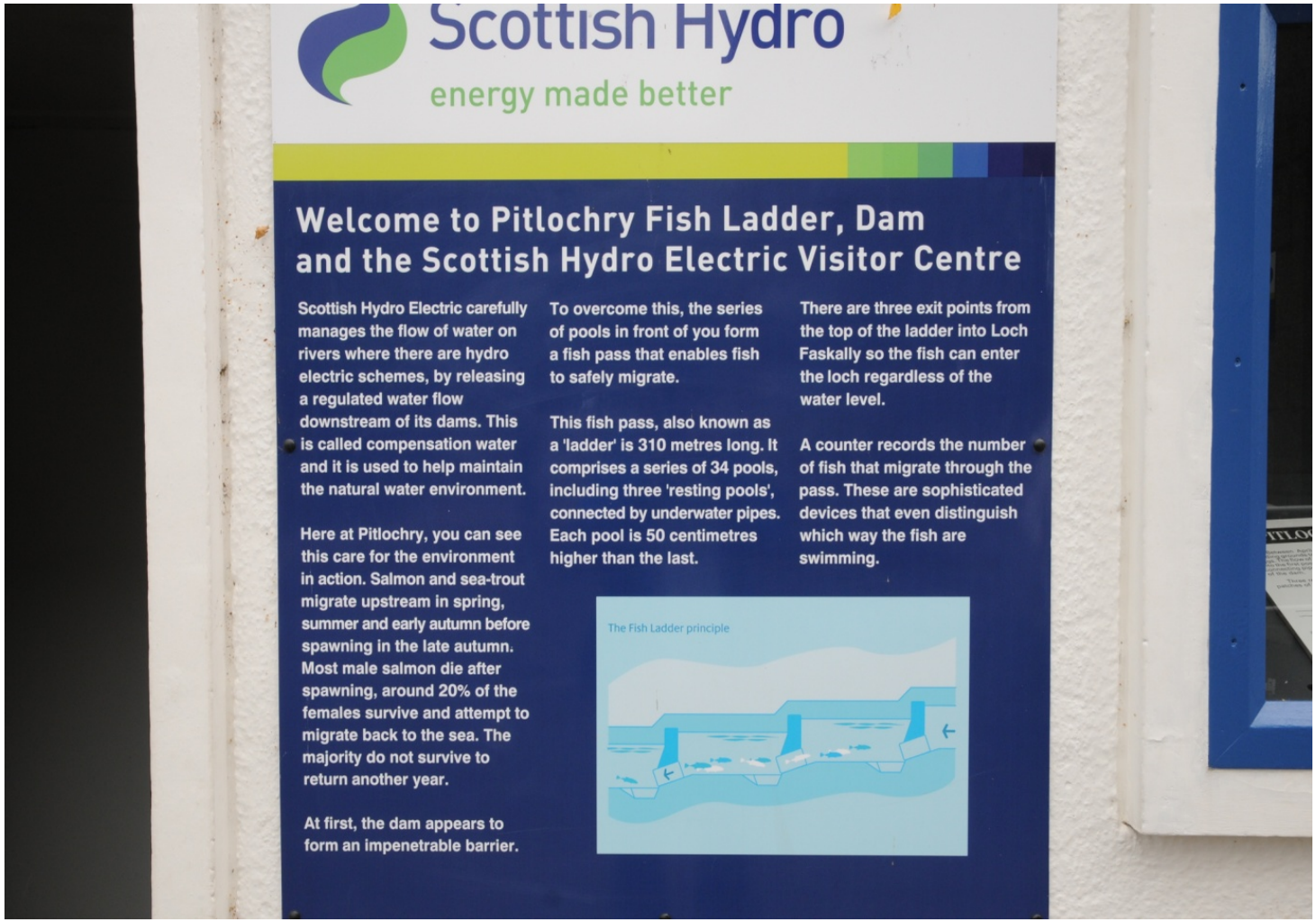
<소양강댐>
높이 123미터, 길이 530미터
총저수량 29억톤㎥

0.4 Dams

유바리댐:
높이: 110 m
길이: 390 m
저수용량: 4억3천만 m^3
발전출력: 26,000 kW

<일본 홋카이도 유바리댐>

0.5 Hydropower Plants



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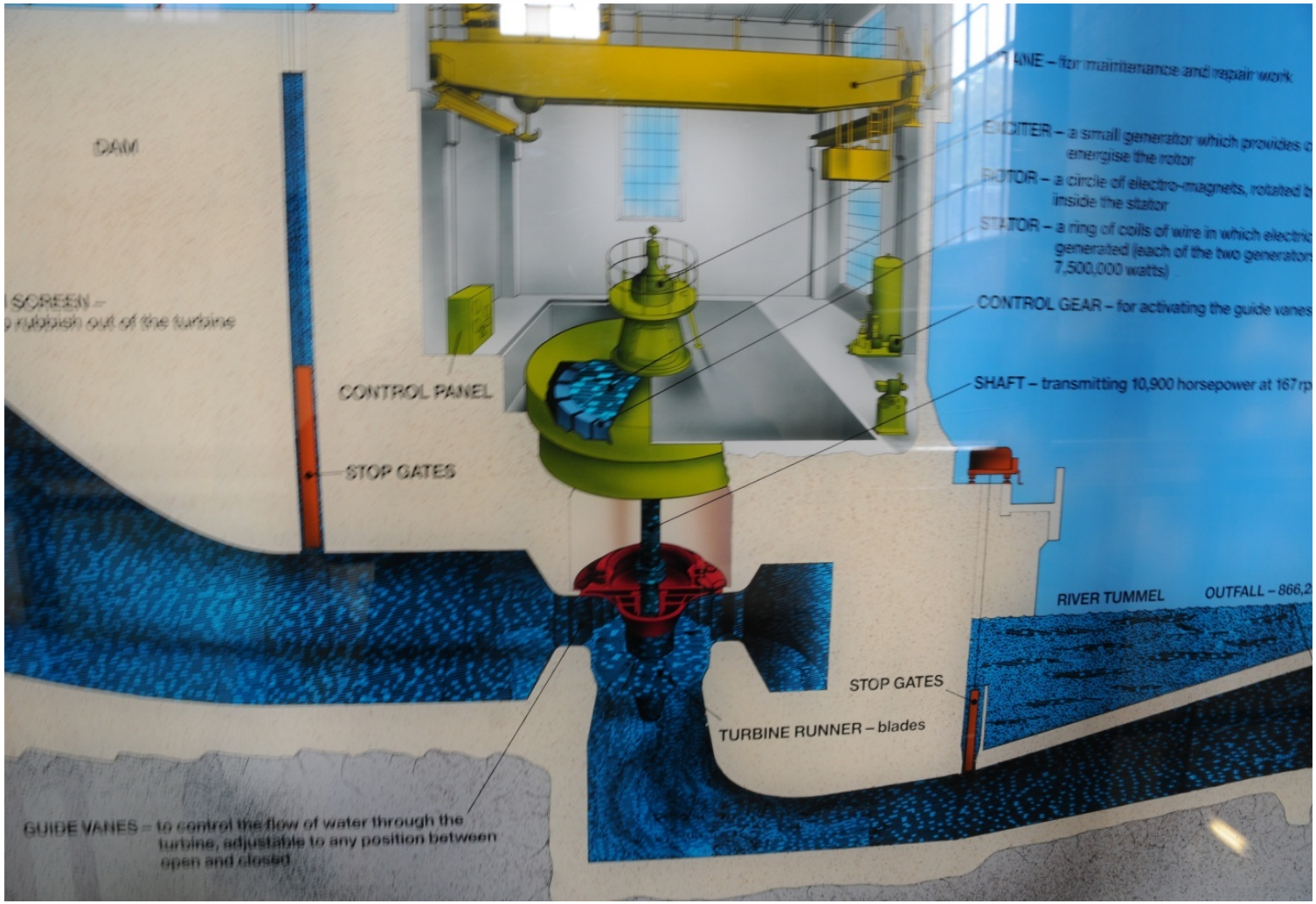

0.5 Hydropower Plants

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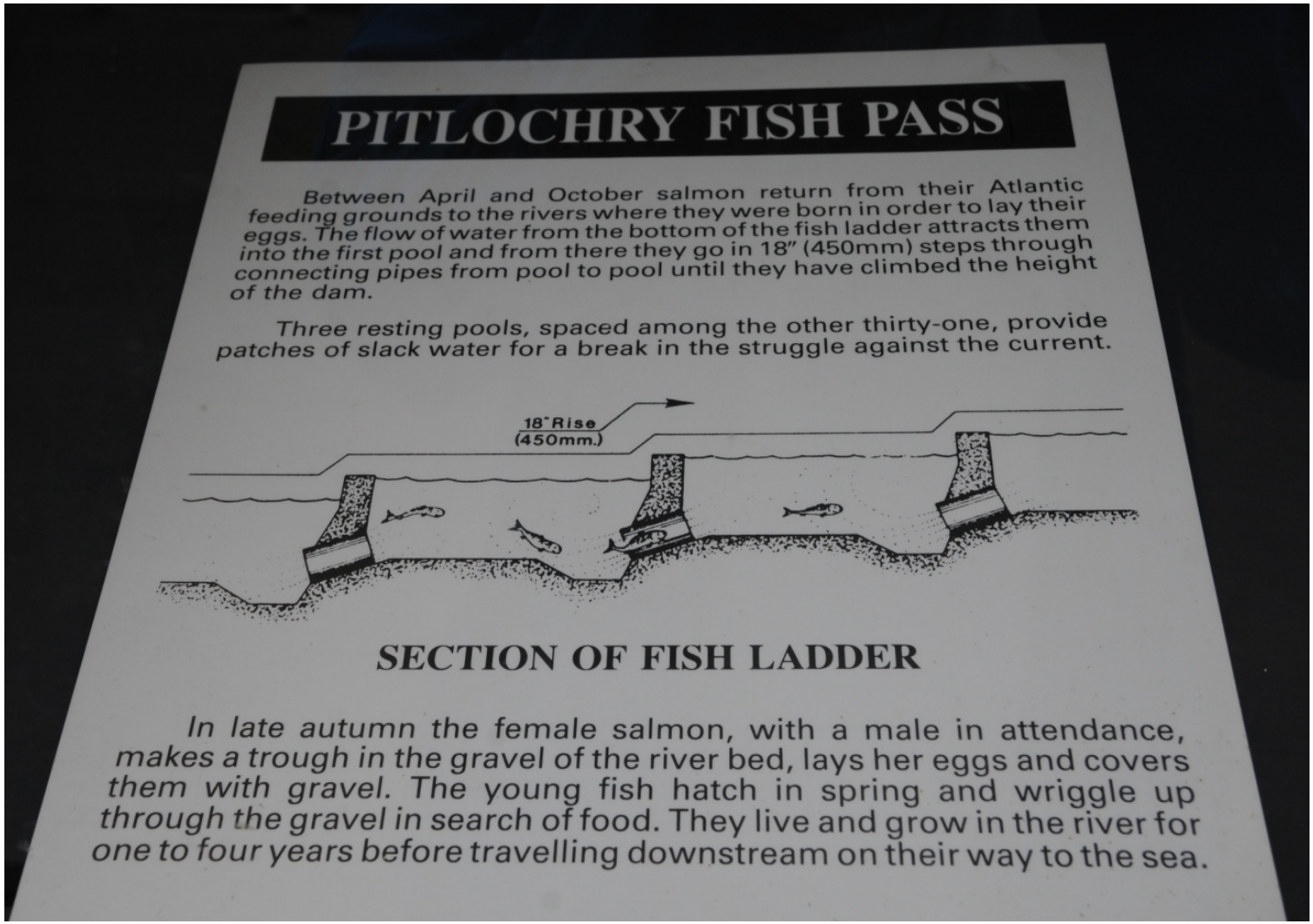


PITLOCHRY FISH PASS

Between April and October salmon return from their Atlantic feeding grounds to the rivers where they were born in order to lay their eggs. The flow of water from the bottom of the fish ladder attracts them into the first pool and from there they go in 18" (450mm) steps through connecting pipes from pool to pool until they have climbed the height of the dam.

Three resting pools, spaced among the other thirty-one, provide patches of slack water for a break in the struggle against the current.

SECTION OF FISH LADDER

In late autumn the female salmon, with a male in attendance, makes a trough in the gravel of the river bed, lays her eggs and covers them with gravel. The young fish hatch in spring and wriggle up through the gravel in search of food. They live and grow in the river for one to four years before travelling downstream on their way to the sea.

0.5 Hydropower Plants

0.6 Floods

1990 Flood

그림3.2
가옥 침수(일산, '90)

Inundation of Houses
(Ilsan, '90)

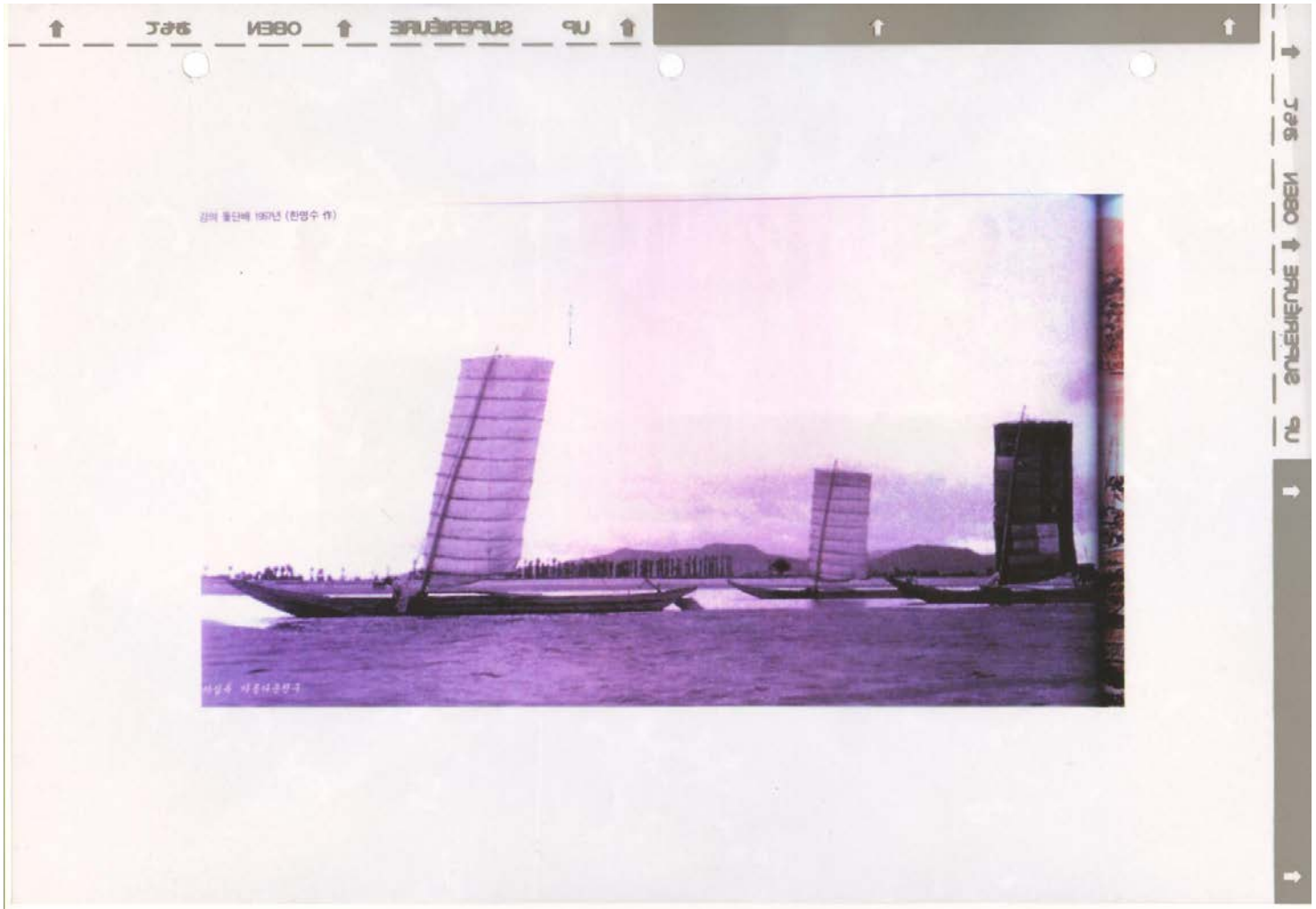
0.6 Floods


1995 Han River Flood
◇흙탕물바다된 올림픽대로
26일 하오 서울 반포대교 남단에서 바라본 잠실쪽 한강변일대. 한강범람위기는 넘겼으나 태풍 재니스의 영향으로 우리나라에는 27일 상오까지 비가 내릴 전망이다. 한강수계의 주요 댐은 26일 저녁까지 방류를 계속했다.
【李鍾哲기자】

0.7 River Navigation


그림2.6
'90년대의 한강(서울)
The Han River in the '90s (Seoul)

0.7 River Navigation

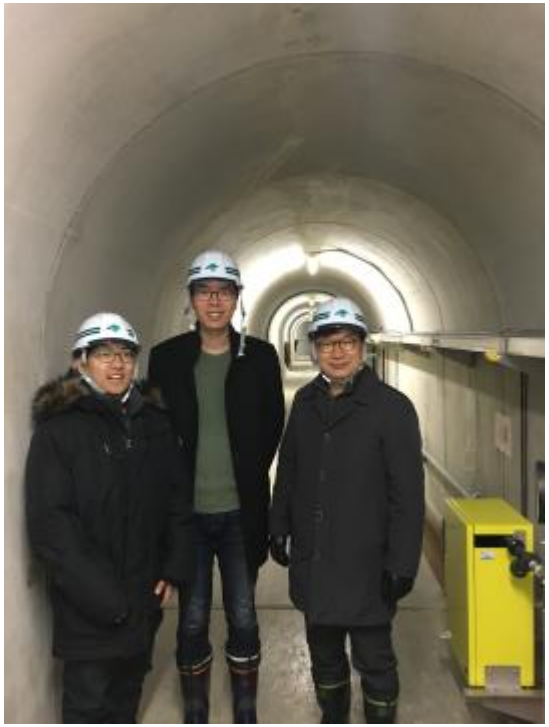


0.7 River Navigation

0.8 River Recreation

Motivation

Motivation



Motivation