

Chapter 4: The Design of Culverts for Fish Passage	1
Objectives and Purpose	1
Definitions	<u>1</u>
Current methods for designing culverts	<u>2</u>
Traditional Method of Culvert Design	<u>2</u>
Designing Culverts for Stream Simulation -Don's guidelines	<u>2</u>
Observations by author	<u>2</u>
General Guidelines for all embedded pipes	<u>3</u>
Considerations for stream simulation	<u>3</u>
Design Procedure for Embedded Culverts	<u>4</u>
Pipe Arch Culverts with Herringbone Design Rock collectors	<u>5</u>
The herringbone rock collector design	<u>5</u>
Design Recommendations	<u>6</u>
Design Features of Herringbone Rock Collectors	<u>6</u>
Designing with Baffles	<u>9</u>
Appendix A Steam Simulation Design- State of Washington	<u>10</u>
Full Stream Simulation Option	<u>10</u>
Appendix B- Stream Simulation Design- State of Oregon	<u>16</u>
Streambed Simulation using sunken or embedded Culverts	<u>16</u>
Appendix C- No slope design State of Washington	<u>20</u>
No Slope Method- WDFW	<u>20</u>
Appendix D- No slope Design State of Oregon	<u>22</u>
Culverts Placed Essentially Flat or up to 0.5 % grade Commentary by ODFW	<u>22</u>
Appendix E- Hydraulic Design- State of Washington	<u>23</u>
Hydraulic Method Proposed by WDFW	<u>23</u>
Length of culvert	<u>24</u>
Fish passage requirements: Species and size of fish	<u>24</u>
Appendix F- Designing with Baffles- State of Oregon	<u>25</u>
Baffles-ODFW	<u>26</u>
Appendix G- Designing with Baffles- State of Washington	<u>28</u>
Appendix H- Channel Reconstruction- State of Washington	<u>30</u>
Channel Reconstruction - WDFW	<u>30</u>
Appendix I Back watering of Culverts -State of Oregon	<u>32</u>
Culvert with back watering at outlet- ODFW	<u>32</u>