Designing Sustainable Splash Pads

- Duration: 1:15
- Question & Answer
Course Content

- Setting the Stage
  - Industry trends
  - What municipalities are concerned with

- Impact of Splashpads

- Designing sustainable splash pads – a balancing act
  - Water Management Systems
  - Others influencing factors

- Case Studies
Popularity of Splash pads

• “In North America, Splash pads have been at the top of the list for planned additions at facilities of all kinds for several years running.”

• “They also are the most commonly planned addition among municipal parks today”

Source: 2011 Recreation Management
Industry Trends

• Splash pads are a fundamental amenity in parks
• Cities have adopted splash pads into their park & rec program
• Increasing multi-splash pad communities
• Leveraging to promote community
Municipalities are concerned with:

- Cost
- Health & Safety
- Universal accessibility
- Overall quality of life
- Sustainability
How Splash Pads Address Concerns

- **Cost**
  - Low operational cost of ownership
  - Low capital cost with high impact
  - Flexible and expandable in size and budget
- **Health & Safety**
  - Active free play
  - Child development (physical, social, emotional)
  - Zero-depth = zero drowning risk
  - Water quality options
- **Universal Accessibility**
  - Inclusive play
  - Play for all ages & abilities
- **Overall quality of Life**
  - High recreation value
  - Community pride
- **Sustainability**
  - Responsible resource conservation solutions
Designing – a Balancing Act

The first thing to consider when designing a sustainable splash pad is:

Minimizing environmental and economic impacts
while maximizing the Value of Play
Impact of Splash Pads

- Materials
- Water usage
- Wastewater creation
- Energy
- Maintenance
Sustainable Design Practices

Materials

• Select materials that
  • Contain a high recycled content
  • Are recyclable
  • Have a long life cycle
  • Require low maintenance

• Stainless steel & brass
  • Corrosion resistance, strength, UV resistance, 80% recycled material
  • Vandal-resistant

• Recycled polymers
Sustainable Design Practices
Water Management Systems

Splash Pad Water Management

- Water efficiency
- Wastewater creation
- Energy efficiency
- Maintenance
- Chemical consumption
Sustainable Design Practices

Water Management Systems

Recirculation

- Command Center
- Splash Pad
- Debris Trap
- Filtration & Disinfection
- Reservoir

Flow-Through (Potable Water Systems)

- Water source
- Command Center
- Splash Pad
- Effluent Water Management
- Wastewater
- Repurpose
Water Management Systems
Recirculation

How it works

- Water is then filtered and disinfected by the WQMS before being distributed once again to the play features
Water Management Systems

Recirculation

- Dome Pack
- WQMS
- Chemical Containment
- UV Transformer
- Water Containment
- Debris Control & Rain Diversion
- BF & PR
Recirculating splash pad

Sustainable Design Tips

- **Water**
  - Recirculated
- **Wastewater**
  - Rainwater diverter
  - Consider backwashing to percolation system
- **Energy**
  - Variable frequency driven pumps
  - Optimize pump sizing – use spray sequencing and product selection
  - On-demand automation
- **Chemical and Maintenance**
  - Reduce debris (eliminate sources near the play area and provide designated entrances)
  - Incorporate an appropriately sized debris control system
Sustainable Design Practices

Water Management Systems

Recirculation

Command Center → Splash Pad → Debris Trap

Filtration & Disinfection → Reservoir

Flow-Through (Potable Water Systems)

Water source → Command Center → Splash Pad → Effluent Water Management

Wastewater → Repurpose
Water Management Systems
Flow-through (Potable Water System)

How it works

1. Wastewater system
2. Repurpose:
   - Irrigation
   - Replenish
   - Percolate

How it works
- A user touches the Activator, sending a signal to the Command Center
- The Command Center releases water to the play products based on preset sequences and timing
- Water passes through the Drain and becomes effluent water
- Effluent water can:
  - Drain into municipal sewer system
  - Be captured and repurposed
Flow-through (Potable Water) Splash Pad
Sustainable Design Tips

• Water
  • Automation – on demand + spray sequencing
  • High efficiency nozzles
  • Proper product selection

• Energy
  • On demand activation
  • Most FT splash pads require very little energy

• Maintenance
  • Durable materials
  • Reliable water management systems

• Wastewater
  • Rainwater diverter
  • Consider alternatives for waste water management

50% less water
80% less water
Why? Innovations in Water Management

• Sustainability is in higher demand
  • Water Shortages
  • High Water and Sewer Bills
  • Demand on infrastructure (water and sewer)
  • Ongoing Maintenance - time and materials

• Technology and research have given rise to next generation of water management systems
Governance

• Environmental Protection (EPA)
• State Health Departments
• Building Codes
• New Standards – NSF 350
## Advantages of Repurposing Systems

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Water is re-used (Dual Use)</td>
<td>• Water is repurposed for other municipal uses</td>
</tr>
<tr>
<td>• Water is conserved and ultimately returned to source</td>
<td>• Water does not enter the sanitary system</td>
</tr>
<tr>
<td>• No chemicals required</td>
<td>• Lower maintenance cost</td>
</tr>
<tr>
<td>• Low energy consumption</td>
<td>• Lower operating cost</td>
</tr>
</tbody>
</table>
Repurpose Water Management Systems
Percolation

How it works
• Water percolates from the reservoir through the soil to rejoin the natural groundwater.
• A user touches the Activator, sending a signal to the Command Center.
• The Command Center releases potable water to the play products based on preset sequences and timing.
• Water passes through the Drain, is strained for debris, and transferred to the Modular Water Containment System.
Repurpose Water Management Systems
Percolation Sustainable Design Tips

Balanced system

- **Water source**
- **Command Center**
- **Splash Pad**
- **MWCS (Percolation)**

**Average Flow Rate**
70% of the total flow for the operating time

**Splash Pad Daily Water Volume**
80% of reservoir capacity

**Design**
Product selection
Product quantity

**Reservoir Size/Geometry**
Water table depth
Soil percolation
Available area
Climate
Repurpose Water Management Systems
Modular water containment system

- Higher void ratio than conventional pipe and aggregate trenches
- Efficient use of land (small footprint)
- Cost-effective installation (lightweight, simple)
- Easy transport (no large pipes or tanks to ship)
- Constructed from 100% recycled polypropylene
Modular water containment system
Flexibility advantages

Low water table

High water table

Grade

Water Table
Modular water containment system
Modular water containment system
Repurpose Water Management Systems
Sub-surface Irrigation

How it works

- The irrigation pumping station draws water from the reservoir at the onset of scheduled irrigation.
- A user touches the Activator, sending a signal to the Command Center.
- The Command Center releases water to the play products based on preset sequences and timing.
- Water passes through the Drain, is strained for debris, and transferred to the Modular Water Containment System.
- Water nourishes the vegetation and returns to nature.
Repurpose Water Management Systems
Surface Irrigation

How it works

- A user touches the Activator, sending a signal to the Command Center.
- The Command Center releases potable water to the play products based on preset sequences and timing.
- Water passes through the Drain, is strained for debris, and transferred to the Effluent Water Holding Tank.
- It is then sent through the Filtration & Disinfection System.
- Treated water is transferred to the Modular Water Containment System.
- The Irrigation Pumping Station draws treated water from the reservoir at the onset of scheduled irrigation.
- Water nourishes the vegetation and is returned to nature.
Repurpose Water Management Systems
Irrigation Sustainable Design Tips

• Balance

Water source → Command Center → Splash Pad → MWCS → Irrigation

- **Average Flow Rate**: Daily water volume divided by daily operating time
- **Splash Pad Daily Water Volume**: 80% of reservoir capacity
- **Reservoir Size/Geometry**: Water table depth, Available area
- **Daily Water Demand**: Climate, Soil conditioning, Plant type

**Design**
- Product selection
- Product quantity
## Capture and Repurpose Requirements

<table>
<thead>
<tr>
<th>Treatment</th>
<th>EPA</th>
<th>Arizona</th>
<th>California</th>
<th>Florida</th>
<th>Hawaii</th>
<th>Nevada</th>
<th>Texas</th>
<th>Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary treatment, filtration, and disinfection</td>
<td>Secondary treatment, filtration, and disinfection</td>
<td>Oxidized, coagulated, filtered, and disinfected</td>
<td>Secondary treatment, filtration, and high level disinfection</td>
<td>Oxidized, filtered, and disinfected</td>
<td>Secondary treatment and disinfection</td>
<td>NS (1)</td>
<td>Oxidized, coagulated, filtered, and disinfected</td>
</tr>
<tr>
<td>BODs</td>
<td>10 mg/l</td>
<td>NS</td>
<td>NS</td>
<td>20 mg/l CBODs</td>
<td>NS</td>
<td>30 mg/l</td>
<td>5 mg/l</td>
<td>30 mg/l</td>
</tr>
<tr>
<td>TSS</td>
<td>5.0 mg/l</td>
<td>NS</td>
<td>NS</td>
<td>5.0 mg/l</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>30 mg/l</td>
</tr>
<tr>
<td>Turbidity</td>
<td>2 NTU (Avg)</td>
<td>2 NTU (Avg)</td>
<td>2 NTU (Avg)</td>
<td>NS</td>
<td>2 NTU (Max)</td>
<td>3 NTU</td>
<td>2 NTU (Avg)</td>
<td>5 NTU (Max)</td>
</tr>
<tr>
<td></td>
<td>5 NTU (Max)</td>
<td>5 NTU (Max)</td>
<td>5 NTU (Max)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fecal</td>
<td>Fecal</td>
<td>Total</td>
<td>Fecal</td>
<td>Fecal</td>
<td>Fecal</td>
<td>Fecal</td>
<td>Fecal</td>
<td>Total</td>
</tr>
<tr>
<td>Coliform</td>
<td>None detectable (Avg)</td>
<td>None detectable (Avg)</td>
<td>2.2/100 ml (Avg)</td>
<td>75% of samples below detection</td>
<td>2.2/100 ml (Avg)</td>
<td>2.2/100 ml (Avg)</td>
<td>20/100 ml (Avg)</td>
<td>2.2/100 ml (Avg)</td>
</tr>
<tr>
<td></td>
<td>14/100 ml (Max)</td>
<td>23/100 ml (Max)</td>
<td>23/100 ml (Max)</td>
<td>25/100 ml (Max)</td>
<td>23/100 ml (Max)</td>
<td>75/100 ml (Max)</td>
<td>23/100 ml (Max)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>pH = 6-9, 1 mg/l Cl₂ residual (min)</td>
<td>NS</td>
<td>NS</td>
<td>Min. size of 0.1 MGD</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Monitoring</td>
<td>1/day, 1/day chlorine and turbidity measured continuously</td>
<td>1/day in a certified lab, chlorine and turbidity measured continuously</td>
<td>1/day, chlorine and turbidity measured continuously</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Water Management Systems

Recap

Facebook.com/vortexintl
# Sample Splashpad® Lifecycle Costs – Parameters and assumptions

<table>
<thead>
<tr>
<th></th>
<th>Smartflow</th>
<th>Percolation</th>
<th>Irrigation</th>
<th>WQMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallons per day used</td>
<td>29,400</td>
<td>29,400</td>
<td>29,400</td>
<td>1,200</td>
</tr>
<tr>
<td>Cost of water per gallon</td>
<td>$0.0037</td>
<td>$0.0037</td>
<td>$0.0037</td>
<td>$0.0037</td>
</tr>
<tr>
<td>Cost to sewer per gallon</td>
<td>$0.0094</td>
<td>$0.0094</td>
<td>$0.0094</td>
<td>$0.0094</td>
</tr>
<tr>
<td>Maintenance labor cost per hour</td>
<td>$75</td>
<td>$75</td>
<td>$75</td>
<td>$75</td>
</tr>
<tr>
<td>Daily maintenance time required</td>
<td>30 Minutes</td>
<td>45 Minutes</td>
<td>45 Minutes</td>
<td>90 Minutes</td>
</tr>
<tr>
<td>Seasonal maintenance hours</td>
<td>2 Hours</td>
<td>2 Hours</td>
<td>6 Hours</td>
<td>20 Hours</td>
</tr>
<tr>
<td>Operating hours per day</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Days in season</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>% time pad running</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>Max flow all on</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Sequenced flow</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

*Estimate for 70 GPM Splashpad®*
# Sample Splashpad® Lifecycle Costs

<table>
<thead>
<tr>
<th></th>
<th>Smartflow</th>
<th>Percolation</th>
<th>Irrigation (average)</th>
<th>WQMS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated Initial Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Project Capital Cost</td>
<td>$110,000</td>
<td>$150,000</td>
<td>$240,000</td>
<td>$400,000</td>
</tr>
<tr>
<td><strong>Estimated Annual Maintenance and Operating Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Costs</td>
<td>$16,317</td>
<td>$16,317</td>
<td>$0</td>
<td>$666</td>
</tr>
<tr>
<td>Sewer Costs</td>
<td>$41,454</td>
<td>$0</td>
<td>$816</td>
<td>$1,692</td>
</tr>
<tr>
<td>Maintenance Costs</td>
<td>$5,700</td>
<td>$8,588</td>
<td>$8,888</td>
<td>$18,375</td>
</tr>
<tr>
<td>Normal Parts Costs</td>
<td>$1,250</td>
<td>$1,000</td>
<td>$1,875</td>
<td>$2,000</td>
</tr>
<tr>
<td>Chemical Costs</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>Electrical Costs</td>
<td>$300</td>
<td>$300</td>
<td>$525</td>
<td>$2,250</td>
</tr>
<tr>
<td><strong>Total Annual Operating Costs</strong></td>
<td>$65,021</td>
<td>$26,205</td>
<td>$12,103</td>
<td>$27,233</td>
</tr>
<tr>
<td><strong>Estimated Cost YTD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost: 5 years</td>
<td>$435,105</td>
<td>$281,023</td>
<td>$300,517</td>
<td>$536,165</td>
</tr>
<tr>
<td>Total Cost: 10 years</td>
<td>$760,210</td>
<td>$412,045</td>
<td>$361,034</td>
<td>$672,330</td>
</tr>
<tr>
<td>Total Cost: 20 years</td>
<td>$1,410,420</td>
<td>$674,090</td>
<td>$482,067</td>
<td>$944,660</td>
</tr>
</tbody>
</table>

*Estimate for 70 GPM Splashpad®*
TCO Overview by Water Management System

<table>
<thead>
<tr>
<th>System</th>
<th>Initial cost</th>
<th>5 years</th>
<th>10 years</th>
<th>20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartflow (Flow-through)</td>
<td>$1.5 M</td>
<td>$1.25 M</td>
<td>$1 M</td>
<td>$0.75 M</td>
</tr>
<tr>
<td>Percolation</td>
<td>$1.25 M</td>
<td>$1 M</td>
<td>$0.75 M</td>
<td>$0.5 M</td>
</tr>
<tr>
<td>Irrigation (Avg Surface &amp; Sub)</td>
<td>$1 M</td>
<td>$0.75 M</td>
<td>$0.5 M</td>
<td>$0.25 M</td>
</tr>
<tr>
<td>WQMS (Recirculation)</td>
<td>$1 M</td>
<td>$0.75 M</td>
<td>$0.5 M</td>
<td>$0.25 M</td>
</tr>
</tbody>
</table>

Estimate for 70 GPM Splashpad®
**Case studies**

**Percolation**

- Mill Lake - Abbotsford, BC
- Pumps water from a well and sprays to splash pad
- The drains return water to Mill Lake which percolates water back through the soils, acting as a natural bio-filter into the aquifer
Case studies

Percolation

• Hanford California
• Potable Water System
• Sprays approximately 50,000 gallons per day
• Water is collected in Vortex Percolation tanks and percolated back to the soil
• Saves the City $28,000 a year in sewer fees and returns the water back to the water table for potential future use
• 18 month payout on investment
Cases Studies
Surface irrigation

• Lost Hills Park – County of Kern, California
• A modular Vortex reservoir captures 15,000 gallons per day which is then repurposed to irrigate the turf
• 4000 Square foot Splashpad – flows less than 35 GPM through feature selection, nozzle selection and sequencing
Cases Studies

Surface irrigation

- Colton California
- A modular reservoir captures 100,000 gallons per day which will repurpose to irrigate the turf on 5 ballfields
Cases Studies

Sub-Surface irrigation

- Dos Lagos Shopping Center - Corona, California
- With a capture & repurpose 6,000 gallon reservoir, water is used to subsurface irrigate all their plants and trees
Potential LEED Credits

• Water-efficient landscaping
  • Wastewater recovery for irrigation
  • Rainwater collection for irrigation
• Innovative wastewater technologies
  • Reducing potable water to sewage conveyance
  • Replenishing aquifer
• Recirculating water
• Questions ?