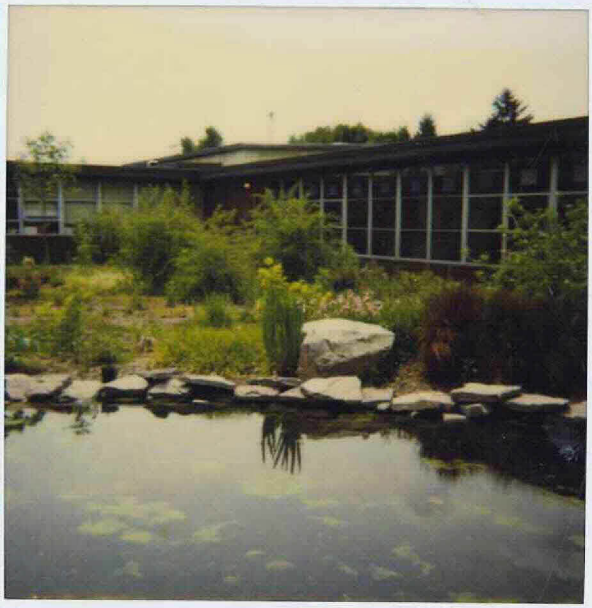


The Courtyard Project, Phase 2
LOJHS
Final Report
June 1999

The Courtyard Project, Phase 2
Lake Oswego Junior High School
Metro Educational Grant
Final Report, June 1999

Summary of project:

This second phase of our courtyard project began a year ago spring, following the development of a restoration-native garden space on our school grounds. With this space now a more usable outdoor classroom, lessons needed to be developed by our teachers to make use of this area by all our science classes. Further enhancements of the grounds would also continue as the shrubs, trees, grasses and pond matured. A grouped of science teachers met last summer to develop lessons and projects that would take all students into the courtyard, infuse these outdoor labs into the ongoing adopted science curriculum and work with the lessons over the course of the 1998-99 school year. Lessons were developed and have been used throughout the year. Additionally, ongoing courtyard clean-up has occurred. All incoming seventh graders took part in an all grade level weed and clean up project on the first day of school last fall under the guidance of language arts teacher, Barbara Soisson. This past May, 1999, the annual courtyard work day coincided with the parent clubs Blooming' Bazaar. Parents, teachers and students spent another morning weeding, spreading bark dust and in general maintenance. Finally, for two days in later May, Mrs. Lonnquist had her block classes continue with the weeding prior to a day of study, using the courtyard as the base for the day's activities.

Our goal of an all school outdoor lab with lessons and projects that support the curriculum and a space for youngsters and teachers to use for study, for relaxation and for fun has been met!

Results:

As we end the second grant phase, we have accomplished the tasks listed above. Numerous classes have used this area for study, the curriculum designed by teachers is in place, and students love spending time in the area.

Our trees are blooming, the pond and native garden areas are attracting ducks and a large variety of birds on a regular basis. We now hold our beginning of the year student, teacher, parent welcome barbecue in the courtyard as it is the most welcoming area on our campus! The aesthetic contribution of the courtyard project to our school is powerful.

We finished our third all school annual courtyard work party on Saturday, May 1, 1999. This tradition will continue as an annual event, a way to involve our community in "community" service, earn some money to continue enhancement and replacement of trees and grasses, pond plants, and bring our groups together in an environmentally friendly project.

Our primary goal, to involve students in learning about the environment, and bring immediate value to service, has been at the heart of all that has been done to

bring the courtyard to life. This educational phase, Phase 2, has kept that goal alive and in focus.

Evaluation:

Thanks to a parent volunteer position on our active Parent Club Executive Board, along with a science curriculum coordinator's position on our schools leadership team, two adults are in place to keep the courtyard an ongoing focus of student involvement and learning. These adults are in positions to work together to maintain the courtyard, fund needed projects (pond filter cleaning, replacement trees) and insure that the outdoor lab lessons are part of the ongoing science curriculum. Additionally, the Parent Club sponsors the beginning of the year all school-family barbecue that is held in the courtyard and runs the annual bazaar fund raiser that is already a Lake Oswego tradition. These two key positions, plus our students delight in being out in the courtyard, guarantee that this space will be used by generations of LOJ sailors!

Revolving responsibility for maintaining the courtyard has been a leadership discussion and part of a writing project Mrs. Loonquist posed to her seventh grade science students this past spring. Several responses are worth noting and are included in the documentation following this report. Students have various interesting ideas about using the areas, who should maintain them and desire to be out there. The fresh ideas generated by kids will be a part of the eighth grade "Building Leaders" training and area of responsibility in August 1999.

I believe we have met our Courtyard Project goals: an area for student leaning and for service. Without the involvement of parents, business partners, students, teachers and Metro, this grassy space would be dry, wasted and unused. Instead, it thrives, it blooms, it changes throughout the seasons and is a focal point of our school.

Photo documentation:

Included with this report are 35mm pictures, a computer representation of the courtyard area and a set of slides showing the courtyard, students studying in the courtyard, even a work party from our May 1st cleanup event.

Finances:

This page shows a break down of the Phase 2, Courtyard Project expenses.

Curriculum:

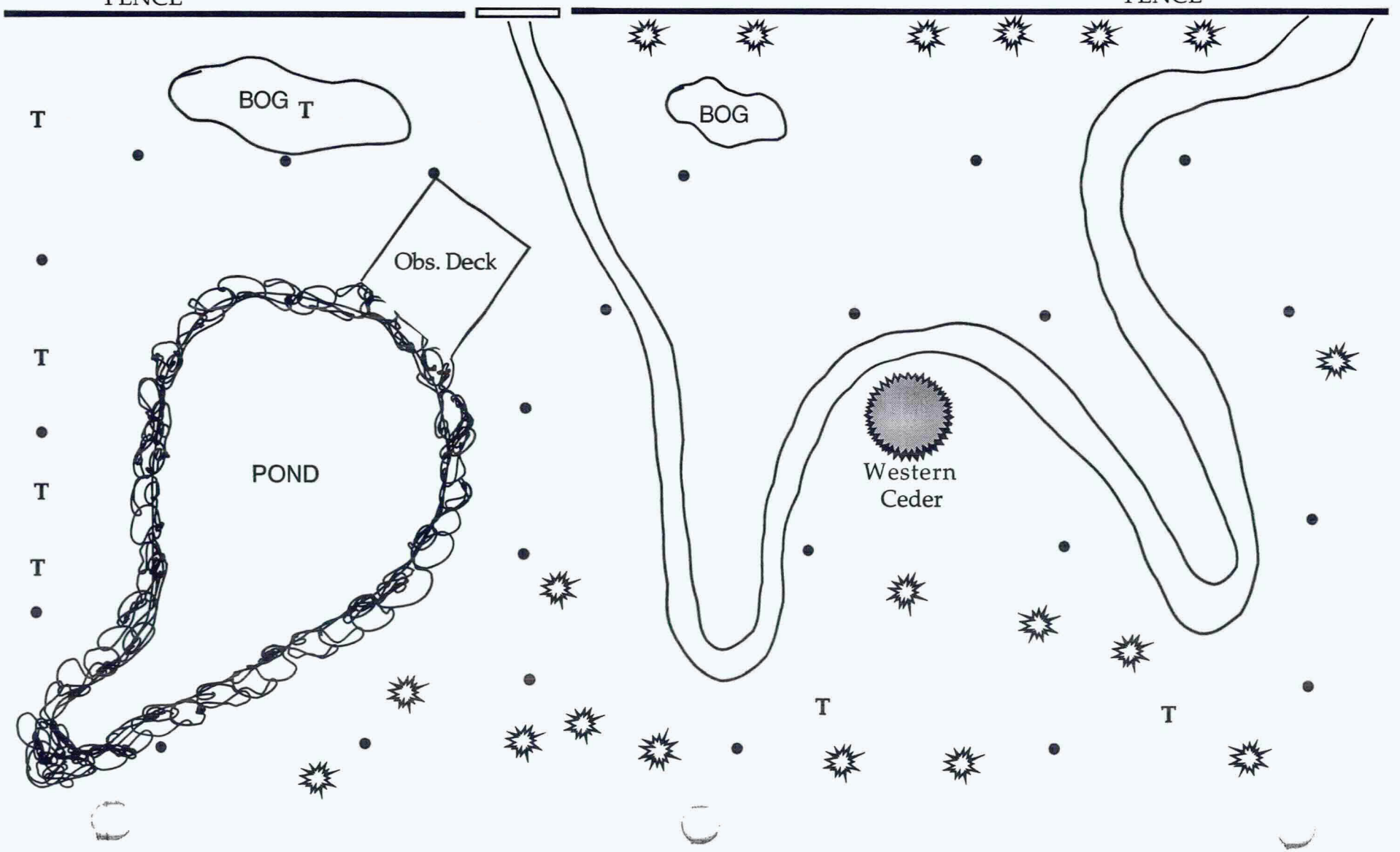
Included in this report is a copy of the curriculum labs and lessons designed and used this year in both our seventh and eighth grade integrated science classes. Additionally, 135 students made suggestions for use and care of the courtyard. Several of these letters are attached.

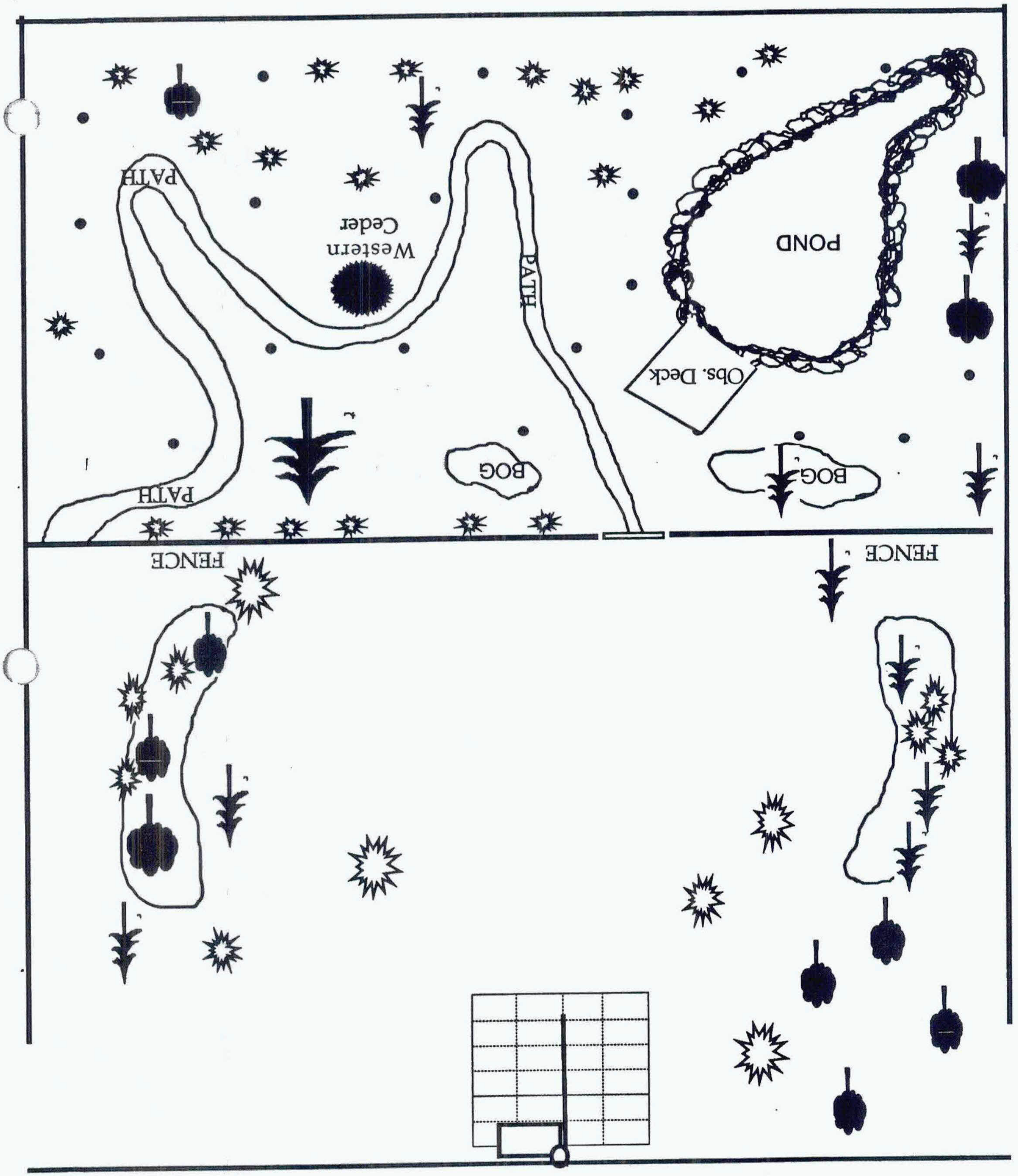
SPRING 1997
Planted 19 trees and 20 bushes.
Completed pond, etc..
Added 60 yards of dirt.
Spread 6 yards of bark dust.
Irrigation added.

FALL 1997
Planted 2 Willows and 1 Cedar

LEGEND
= SHRUB T = TREEs
= SPRINKLER HEADS

1998 GRANT: PHASE II
Observation Deck
Plant additional trees and ground cover.
Scientific Equipment
Teaching Units

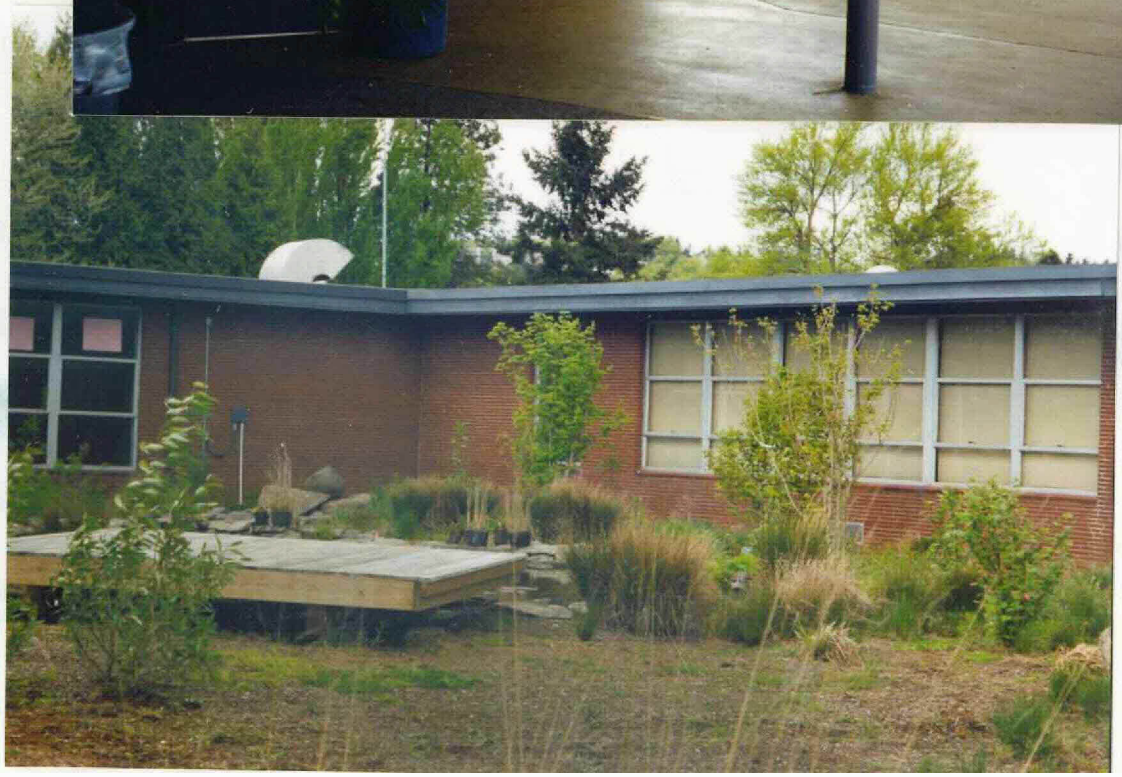




LOJHS Courtyard 5/1999

May 1999 - In Bloom

May 1999
Work Party



May 1999
Work Party and Plant Sale

1999
Annual Plant Sale

May 1999
Berm in Bloom

April 1999
Our weeds they are a-growing....

April 1999
Pre-clean up days

Spring 1999
Courtyard in Bloom

LOJHS Courtyad Project
Phase II

Metro Grant Revenues #920256

- Total requested $5750
- Expenditures:

May 1998	$1584.98	905.00
		45.00
		463.62
		171.36
August 1998	$1377.87	$383.00
		$61.07
		$253.80
November 1998	$140.96	$287.10
		$392.90
May 1999	$548.00	$140.96
		$450.00
		$383.00
		$65.00
		$100.00

- Total spent $4101.81
- Total Metro $1648.19

May 1, 1999 Courtyard Work Party

Name		Time
J. Burgess	4	8AM - 12
Conor McAvoy	3	8:30 am. - 11:35
Frank Gee	3.	8:50 am
Barbara Sorisson	1.5	9:00 a.m. 10:30
Dan Sobick	3	8:55 am - 12:00
Haley Domer	2.5	9:02am - 11:30
Debbie Kane	3	9:00 Am - 12
Christine Fitzpatrick	2	9:05 am - 11:00
Zach Rose	2.5	9:10 - 11:30
Micki Travers	2	9:25 am. - 11:30
Mike Maloney	2	9:30 am - 11:30
Becky Bland	2	9:30am - 11:30
M.E. Isensee	1	11:00 - 12
Martin Mays	3	8:30 - 11:35
Sean Green	3	9:00 - 12:00
Mrs Travers	2	9:30 - 11:30
	39.5	

Martin Mays

Plant sale:

Holly Rodway	7Am - 6pm	11 hrs.
Pearl Rodway	"	11
Shawn Rosenbloom	"	11
Caroline Mays	"	11
Diane Brainerd	"	11
Lisa Schaller	"	11
		66 hrs.
		39.5
		105.5 hrs.

Courtyard May Clean Up
60-75 min. per block class
grade 7 - Science

Courtyard May Clean Up
60-75 Min. Per Block Class
Grade 7 Science
With Mrs Lonnquist

Dates: May 25, 26 & 27

Participant's Signatures:

Megan Hopkins
Elizabeth Harper
Kimber Starling
Molly Day
Sarah Henderson
Andrew Lind
Vincent Camfield
Dan Meehan
Mason Gerber
Devin Stowell
Jeremy Fankboner
Ricci Bouikas
Hannes Gehring
Ryan Johnson

Jack Rubenstein
Peter Schaller
Alex Potwin
Taylor Mumm
Alex Schroeter
Sasha Richter
Tyler Frey
Ashley Locke
Staci Stange
Jenny Jaroskis
Betsy Wells
Rachel Smith
Rebecca Ligon
Caitlyn DeMars

Courtyard May Clean Up
60-75 min. per block class
grade 7 - Science

Courtyard May Clean Up
60-75 Min. Per Block Class
Grade 7 Science
With Mrs Lonnquist

Dates: May 25, 26 & 27

Participant's Signatures:

Annika Lider
DAnna Piro
Erica Greary
Tyler Fairbanks
Elizabeth Mathiot
Jenny Lee
Marissa Skudlarek
Kirsten Kelley
Paul Vilen
Joey Odett
Nicholas Thomas
Audrey Brown
Katie Condon
Jordan Martin
Mike Busbee

Student Formally Known as Connor Barry
Johnny Longyear
Quinn Holmes
Sungwon Kim
RJ Buscemi
Jenny Wiser
Catherine Diamond
Emily Dunham
Desi Duarte
Sammi Melcher
Kelsey Zoretich
Kyle Hummel
Jimmy McDevitt
Mike Tarr
Jeff Mercer

Courtyard May Clean Up
60-75 min. per block class
grade 7 - Science

Courtyard May Clean Up
60-75 Min. Per Block Class
Grade 7 Science
With Mrs Lonnquist

Dates: May 25, 26 & 27

Participant's Signatures:

MIKE Diedrich
Natelie Jones
Aisha Mehmedovic
Dylan Whitehead
Sheena Browning
Kyle Waletich
Nathan Mckay
Julia Ward
Anna Albright
Lindsey Hutchison
Stephanie Mertens
Steven Aaberg
Jordan Kelly
Ryan Johnston

Shawn yah Yapour
Bobby Middleton
Joel Rosenbloom
Erin Rosenfeld
Brittany Contreras
Ellen van Waardenberg
Cara Ratto
Andrea Petersen
Chris Chen
Chris Quattro
Elliot Yi
Price Johnson
Jason Minugh

Courtyard May Clean Up
60-75 min. per block class
grade 7 - Science

Courtyard May Clean Up
60-75 Min. Per Block Class
Grade 7 Science
With Mrs Lonnquist

Dates: May 25, 26 & 27

Participant's Signatures:

Renaud Petre
Stephanie Gillispie
Tess Coffey
Jeff Jackson
Tiffany Behary
Lisa Tongue
Justin Smith
KARI ANDERSON
MARY KLUM
CHRIS FORD
David Macenhimer
Arlen Britt
Catherine Hughes
Robin Flanigan
Victoria Chang

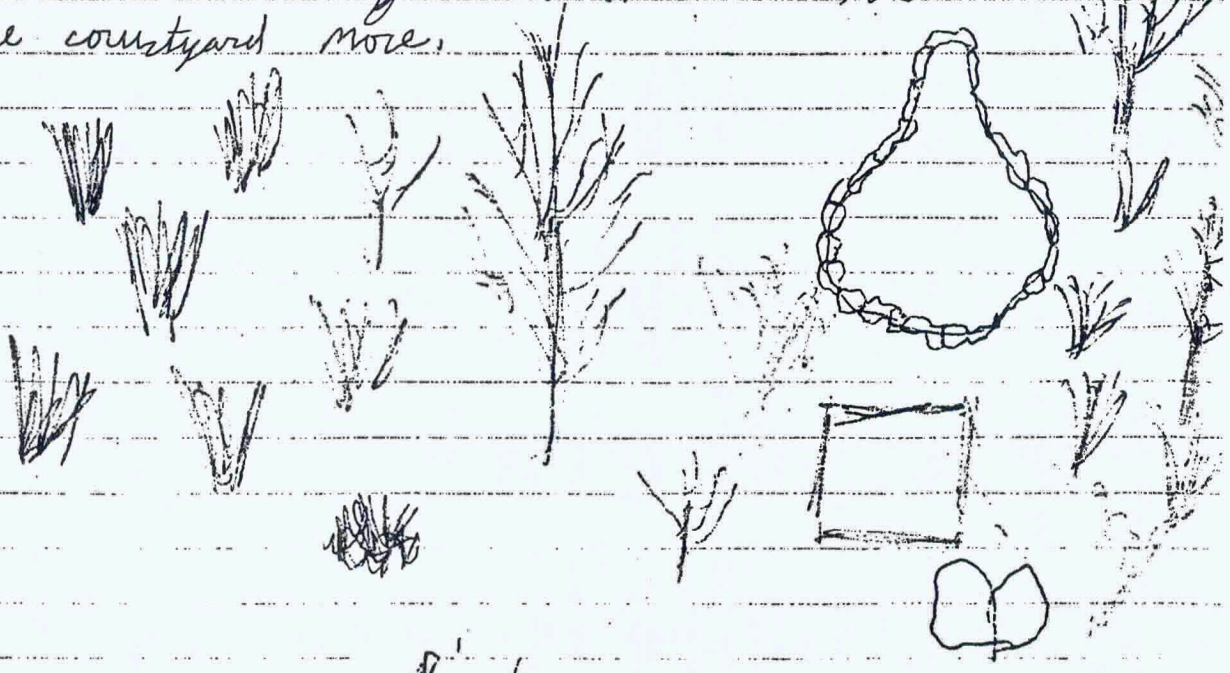
Vanessa Dacascos
Matt Ekman
Ryan McDonald
Sahar Farrokhrodish
Sarah Lindley
Kristin Morton
Glencora Miclea
Jason Eckert.
Michael Johnston
Steve Standage

I think that we could use the courtyard for studying. One way that we could make a schedul is alternate by day. One day it could be one group of teachers and the next day it could be another gro teachers day.

Some things we could do out there are study, work on labs, draw, and do experiments.

There would have to be rules. One way to ma shure everyone know them we could put them in t planner and go over them. Also to make shure the kids obay them we could give the teachers the keys to the courtyard so a teacher would ha to be there to let the kids in.

Some of the ruled could be no banging on the windows, no going in the pond, and no picking plants And that is my ideas on how we could use the courtyard more.



Picture

5/27/99
per. 5

Courtyard: Studying

It would be better if we would use the courtyard for something, because it would let people know it's there. Now kids hardly even notice it. If we used it for something, people would value it more, and maybe they will help take care of it. I mean, why keep and maintain this courtyard if we never even do anything in it, and no one values it?

There are many ideas of things we could do in the courtyard. I personally think it would be better just to sit out there and read than in a gloomy classroom. And we could use the courtyard for projects in all classes. Labs in science, drawing the plants in art, and most especially in 2ASS. At the beginning of the year we do a disscution unit. It'd be fun to do a disscution outside, like the Greeks. And now we're doing a poetry unit. Many people are having trouble finding inspiration, and I'm sure you could find plenty out in the courtyard.

And a great thing about all these ideas is there is no equipment required! People can sit on the

Dear mrs. Burgess and mrs. Richey,
I think that we should be able to go in the courtyard more than we are now. I think if we added some plants, like some trees and more flowers, we could make it really pretty. I think that for maybe a month, or however long it takes, each class should go out there for 30min-1hour. I think if the whole school pitched in, we could clean all the weeds out of the courtyard. I also think that if we put in some flowers, like tulips, or a rose bush, and put a bench and

table or two, we make it more accesible to everyone. I think that if we had study hall out here during the spring time, it might be a nicer working environment.

Thank you.

from,
Stephanie

courtyard proposal

Locke Ashley
Science - 1
May 21, 1999
courtyard proposal

lunch in courtyard - peaceful
anybody who wants to
trac volenteers - supervision
8th grade glass hall closed
no picnic tables
replace some of the ground plants with grass
take gate down
expand to front area
certain people designated to maintain
take an advantage of weather

rules: no running
no destroying plants
respect all living things
people in charge of maintanence, stick to schedule
follow same rules of cafeteria
people who recieve lunch duty still have it only picking up wrapers in courtyard
a cart to pick up trays
no yelling
if not allowed to eat in court yard, go to lunch detention.
food cart parks by the window

We think that we should have classes in the courtyard. Because if we do we could have fun while learning. And certain classes would have certain days of the month to go out in the courtyard. This should be a Priviledge for most classes. And also we should clean the courtyard more often so we can have a clean learning environment. We should also should have someone check the Area to see if it is to wet or have them to check the weather for plans. We could make the Pond deeper and add more fish. We could make a little Island in the middle of the Pond and Putina tree for Shade to help the Fish Survive. We should have about 4 volonteers to feed the fish and Water the Plants etcetect.... All in All We think that having classes in the courtyard would be a good Idea.

Jeff M, Kyle H., Mike D.,

Dear ms. Richey and MS. Burges,

These are my ideas for classes in the courtyard. I think that we should be able to have classes out in the courtyard because it is a great peace full place to learn. I have thought of 7 classes and ideas for the classes to do out there:

Language arts - to write poetry; the courtyard is very inspirational,

Math - figure out the area of the courtyard; depth and width of the pond. try to figure out if there is enough room for more Plants.

Social Studies - Blind fold Someone and have them try to get through the courtyard and name the different plants as country.

Com. Tech - take a survey of how many of the same plants are out there and go back and make pie charts and graphs.

Science - find the Ph of the water; identify Plants; figure out which plants grow better in that environment.

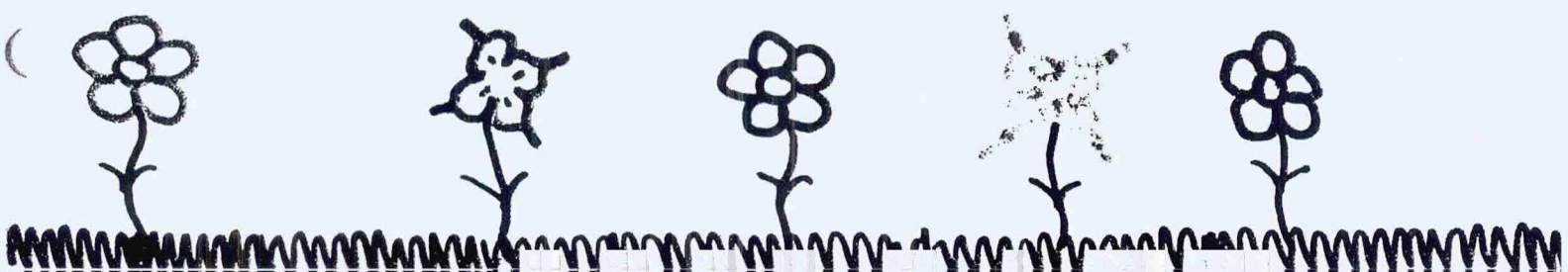
Art - draw plants; draw landscape; design new place for plants

Speech - design a speech on why we should be able to use the courtyard and shoot it in the courtyard. also being out side helps Students speak louder.

These are just a few of my ideas. I feel that the courtyard is just a waste of space right now.

COURTYARD
WE SHOULD . . . ?

* be able to eat lunch or hang out on the grass, willing to take consequences for not cleaning up, etc. We could have series go for half of lunch, and 8th graders the second half, so it wouldn't be too crowded. Since the courtyard is in the middle of the school, it would be easy to monitor.
* go out to the courtyard about 1 class block per month to maintain the cleanliness and to plant new flowers so it will be pretty to look at.
* use the courtyard in our core classes for example- in math we could be given a problem about how many plants are in the entire courtyard area. In art we could find different color schemes of the plants.
* have dances to raise money (charge $5 per person) to buy picnic tables, new plants, and decorations for the courtyard and grass.



Lake Oswego Junior High School

"Science Integrations"
Course 2 and Course 3
Grades 7 and 8

Courtyard Curriculum Projects

•Summer 1998
Byerly
Ebert
Mylet

Table of Contents

WATER QUALITY OF THE POND

Objectives:
Students will:
1. Identify several aquatic organisms.
2. Assess the relative environmental quality of the pond based on indicators of pH, dissolved oxygen (DO), water temperature, and the presence of a diversity of organisms.
3. Become familiar with the use of Computer Based Labs (CBL) while collecting data.

Materials:
CBL with pH, temperature, and DO probes
sampling net
white trays and other containers
magnifying lens
identification guides
microscope (optional)

Procedure:
1. Read the handouts about pH, DO, and water temperature. Be sure to know why they are important in determining water quality and organism probability.
2. Before going outside, be aware that your actions could damage the animal habitats. Be very careful of all organisms and return them when you are done.
3. Using the sampling equipment (nets, trays, etc.), collect as many different animals from the pond as possible.
4. Place them in the white trays for viewing and drawing.
5. Be sure the trays are kept in a cool, shady, spot.
6. Draw at least five animals and attempt to identify them as best as possible (using the guides).
   *You may use the microscopes, if available, to view the animals
7. Return animals to their habitat when finished.
8. Record the number of different animals found.
9. Using the CBL and the probes, determine the pH, temperature, and DO of the pond water. Record.

****BE SURE TO FOLLOW EXACT INSTRUCTIONS FROM YOUR TEACHER ON HOW TO USE THE CBL'S!!!!!!!!!!!!!!**

Data Collection:
1. # of animals found _____
2. pH _____
3. water temperature _____
4. DO _____

5. Animal Drawings:

Conclusion Questions:

1. Were there a lot of different animals living in the pond? Why or why not?

2. What do your CBL measurements tell you about the pond?

3. If we were to put salmon in the pond, would they survive? Why or why not?

4. What types of organisms can live almost anywhere? (see chart)

5. What actions could make the pond a bad place for things to live?

6. What actions could make the pond a better place to live?

7. Predict what would happen if we did these same tests in:
   -the Willamette River
   -Tryon Creek
   -Lake Oswego

pH Ranges That Support Aquatic Life

MOST ACID _____ NEUTRAL _____ MOST ALKALINE

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Bacteria	1.0----------13.0
Plants (algae, rooted, etc.)	6.5----------13.0
carps, suckers, catfish, some insects	6.0----------9.0
Bass, crappie	6.5----------9.0
Snails, clams, mussels	7.0----------9.0
Largest variety of animals (trout, mayfly, stonefly, caddisfly)	6.5---7.5

Temperature Ranges (Approximate) Required for Certain Organisms

Temperature	
Greater than 68 F (20 C) warm water	Much plant life, many fish diseases Most bass, crappie, bluegill, carp, catfish, caddisfly
Middle range: 55-68 F (12.8-20 C)	Some plant life, some fish diseases Salmon, trout, stonefly, may fly, caddisfly, water beetles
Low range: Less than 55 F (12.8 C) - cold	Trout, caddisfly, stonefly, may fly

Dissolved Oxygen Requirements for Native Fish and Other Aquatic Life
D.O. in parts per million

(below 68 F)	(above 68 F)
Cold-water organisms, including salmon and trout	Warm-water organisms including fish such as bass, crappie, catfish and carp
6ppm	5ppm

From "A Lesson Plan for Some Water Investigations." *Investigating Your Environment Series.* U.S. Forest Service, Revised 1977. Printed with permission.

DISSOLVED OXYGEN (D.O.)

Have you ever seen a fish or a small insect swimming in a lake or aquarium? They need oxygen to live just like we do! Unlike humans, the oxygen they breathe is dissolved in water. To breathe underwater, fish and other aquatic organisms use gills instead of lungs. These gills breathe the oxygen dissolved in the water. As you know, a fish out of the water will die because it can no longer breathe.

WHY IS DISSOLVED OXYGEN IMPORTANT TO THE HEALTH OF FISH AND INSECTS IN THE WATER?

Imagine living in a place with polluted air. As the air quality becomes worse, the health of the people who live there becomes worse. The same is true in water. Clean, healthy water has plenty of dissolved oxygen. When water quality decreases, dissolved oxygen levels drop and it becomes impossible for many animals to survive. Some fish such as trout require lots of dissolved oxygen. Others such as carp can live in low oxygen, polluted water.

WHAT ARE THE SOURCES OF DISSOLVED OXYGEN IN WATER?

Much of the dissolved oxygen in water comes from the atmosphere. In areas with waves, or where water tumbles over rocks, falling water traps oxygen and mixes it into the water. Dissolved oxygen also comes from photosynthesis, the process by which plants use sunlight to make food for themselves and give off oxygen.

It is important to know that warmer water holds less oxygen than cold water. Also, the time of year and many other factors affect the amount of dissolved oxygen in water. What do you think happens when trees are removed from the banks of a river?

WHAT CAUSES DISSOLVED OXYGEN LEVELS IN WATER TO DROP?

The main reason is the presence of organic waste. Organic waste comes from something living or that was once living. It comes from raw sewage in cities; runoff from rain and melting snow from farms and animal feed lots; and natural sources like decaying aquatic plants and animals, and fallen leaves in water.

Microscopic organisms, called decomposers, break down the organic waste and use oxygen in the process. Two common types of decomposers are bacteria and protozoa. More waste means more decomposers and more oxygen being used.

TEMPERATURE

HOW IS TEMPERATURE IMPORTANT TO THE HEALTH OF A RIVER?
Water temperature tells many things about the health of a river. Temperature affects:

1) *Dissolved oxygen levels in water* - Cold water holds more oxygen than warm water.

2) *Photosynthesis* - As temperature goes up, the rate of photosynthesis and plant growth also goes up. More plants grow and more plants die. When plants die, decomposers eat them and use oxygen. So when the rate of photosynthesis increases, the need for oxygen by aquatic organisms increases.

3) *Animal Survival* - Many animals need certain temperatures to live. For example, stonefly nymphs and trout need cool temperatures. Dragonfly nymphs and carp can live in warmer water. If water temperatures change too much, many organisms can no longer survive.

4) *Sensitivity to toxic wastes and disease* - Wastes often raise water temperatures. This leads to lower oxygen levels and weakens many fish and insects. Weakened animals get sick and die more easily.

HOW DO HUMANS AFFECT RIVER TEMPERATURES?

In the summer, the sun heats up sidewalks, parking lots and streets. Rain falls on these areas, warms up, and runs into the river. Water is also used by factories and stations that generate electricity to cool their processes. Warm water enters the river, raises the temperature of the downstream area and changes oxygen levels. These are forms of thermal pollution. Thermal pollution is one of the most serious ways humans affect rivers.

Cutting down trees along the river banks also raises water temperature. Trees help shade the river from the sun. When they are cut down, the sun shines directly on the water and warms it up. Cutting down trees also leads to erosion. When soil from the river banks washes into the river the water becomes muddy (turbid). The darker, turbid water captures more heat from the sun than clear water does. Even murky green water with lots of algae will be warmer than clear water.

pH

WHAT DOES pH MEASURE?

pH measures the acidity of water. For example, lemons, oranges, and vinegar are high in acid ("very acidic"). Acids can sting or burn, which is what you feel when you eat some kinds of fruit and there's a sore in your mouth.

pH is measured using a scale from 0 to 14. A pH of 7 is neutral and is used as a reference point. Pure water has a pH of 7 and is considered neutral. From 7 down to 0 the water becomes more acidic. From 7 up to 14 the water becomes less acidic. The numbers used to measure pH are actually ten times greater or less than the preceding number. So a pH of 5 shows an acid ten times stronger than one with a pH of 6.

In the U.S., the pH of natural water is usually between 6.5 and 8.5. pH can vary, however, due to pollution from automobiles and coal-burning power plants. These sources of pollution help form acid rain. Acid forms when chemicals in the air combine with moisture in the atmosphere. It falls to earth as acid rain or snow. As a result, many lakes in eastern Canada, northeastern U.S., and Europe are becoming acidic. This has become an international problem. Air pollution from one country easily crosses borders where it falls in the form of acid rain or snow.

WHY IS pH IMPORTANT?

At extremely high or low pH levels (for example 9.6 or 4.5), the water becomes unsuitable for most organisms. Some fish, like the brook trout, are very sensitive to pH change. If pH changes even slightly, they will die. Very young fish and insects are also very sensitive to changes in pH.

MACROINVERTEBRATE TOLERANCE GROUPS

GROUP 1 INTOLERANT. These organisms are sensitive to pollution. Their dominancy generally suggests good water quality.

GROUP 2 SOMEWHAT TOLERANT. These organisms can tolerate a wider range of water quality conditions.

GROUP 3 TOLERANT. These organisms are generally tolerant of pollution. Their dominance suggests poor water quality.

Courtyard Identification Project

Purpose: The purpose of the courtyard identification project is to practice using a plant identification key by identifying and labeling all the plants in the courtyard area that are not already labeled.

Materials: Plant identification key, paper, and pen or pencil.

Procedure:

1. In groups of 3-4, obtain one of the plant identification keys provided and then proceed to the courtyard area and choose an unidentified plant.

2. As carefully as possible, use the key to identify the plant. Give both the scientific name and the local common name of the plant while you prepare a tag that will be used to label that particular plant.

3. While still in your group, proceed to the Springbrook Park area and identify two more specimens of the same plant in the park, but do not label them there.

4. A sketch of your plant should be made in your journal with the scientific name and common name written beside it. A picture from a camera would be OK to substitute for the drawing if you are not comfortable with your sketching skills.

5. Also in your journal, write a paragraph explaining why you think, or why you do not think the courtyard is an accurate representation of the natural vegetation found in this entire area.

COURTYARD WEATHER STATION

Purpose: The purpose of this activity is to compare the amount of rainfall in the courtyard with the amount of rain at each student's home.

Materials: Clear container with straight sides and a flat bottom, measuring cup, ruler, masking tape, scissors, pencil, a pan about 5 cm. deep and some sand or gravel.

Procedure:

1. Using the procedure from the "Take Home Activities" of the Science Interactions Course 3 book (provided), make a rain gauge that will measure to the nearest 0.1 inch (You will have to modify the procedure that is written for centimeters, but inches is done the same way except you use a regular ruler instead of a metric ruler).

2. Place your rain gauge in an open area outside your home. At the same time each day for one week, measure how much rain fell in the previous 24 hours, record your results, and empty the rain gauge.

3. In your journal, compare your results with those of some of your classmates and with the results obtained from the courtyard each day for the same one week period of time.

4. In another paragraph in your journal, write a hypothesis about what you think is the reason why there might be a difference between the amount of rainfall in different areas that are relatively close geographically (school courtyard, your home, the Portland airport, downtown Portland, etc.).

5. For extra credit, be the person responsible for monitoring and recording the rainfall in the courtyard itself. This should be done at the same time each day, preferably after school so as to be close to the time that others will be making their measurements at home.

RAIN GAUGE

Is the amount of rainfall reported on your local radio or TV station the same amount received at your home? You can find out by making and using a rain gauge.

> ***You need:*** a clear plastic container with straight sides and flat bottom, graduated measuring cup, a straight-sided transparent jar, a metric ruler, masking tape, scissors, a pencil, a pan about 5 cm. deep, sand or gravel.

1. Cut a strip of masking tape, and tape it up the side of the container.

2. To calibrate this container, hold the metric ruler beside it and pour water into it until the water level is 8 cm from the bottom. Put one cup of water in a graduated measuring cup. Pour this water into the container until the ruler indicates the water level is 9 cm. Record the amount of water poured from the measuring cup. This is the amount needed to raise the water level 1 cm in your rain gauge. Empty the container. Put the amount of water needed to raise the water level 1 cm into the empty container. Mark the tape on the side of the container to indicate the depth of the water. This represents 1 cm of rain. Continue adding the measured amount of water and marking the tape to indicate depths of 1-10 cm.

3. You have now made a rain gauge. It should look like figure 1.

4. To prevent your rain gauge from blowing over, set it inside a pan. Surround the base of the gauge with sand or gravel.

5. To more precisely measure fractions of centimeters, you may want to calibrate a smaller container, such as an olive jar. This container must have a diameter smaller than your rain gauge container has.

6. Cut a strip of masking tape the length of the jar, and tape it up the side.

7. Add water to the rain gauge container to the 3-cm mark. Pour this water into the smaller container and mark the height on the tape. Repeat this procedure using 2.5 cm, 2.0 cm, 1.5 cm. 1.0 cm, and 0.5 cm of water.

8. Add four marks equally spaced between each of these marks. With this magnified scale, you can measure rainfall to the nearest 0.1 cm. This accuracy is not possible with the scale on the rain gauge.

9. Place your rain gauge outdoors in an open area. At the same time each day, pour the rain water collected that day into the calibrated jar. Measure the amount collected.

10. Record your measurements each day for a week. Compare your results with those of classmates who live in other parts of the community.

11. Why should a rain gauge be placed in an open space?

COURTYARD ECOSYSTEM PROJECT

Objectives:
Students will:
1. Identify several species of plants and animals living in the courtyard (specifically the pond area).
2. Classify each species as a producer, primary consumer, secondary consumer, decomposer, etc.
3. Make connections between "what eats what" to design a food web to show a complete picture of the ecosystem.
4. Explain how the organisms are interdependent.

Background:
Students should be familiar with basic ecosystem terminology - ecosystem, producer, consumer, decomposer, etc. They should also have some knowledge/experience with using the identification books.

Subjects Involved: Science, Art

Materials:
poster paper
markers/colored pencils
identification books/keys
data collection sheet

Procedure:
1. Make a list of plants and animals that you see (or evidence of) in the courtyard. Use the data collection sheet provided.
2. Use the identification books to identify each organism by name.
3. Draw a simple sketch of each organism found.
4. Classify each organism as a producer, primary consumer, secondary consumer, decomposer, etc.
5. Think about " what eats what" in this ecosystem.
6. On poster paper, draw a picture of each organism found.
7. Use arrows to make connections between organisms according to "what eats what", or other relationships you discover.

Conclusion Questions:
1. What animal is at the top of your food web? Why do you think it is there?
2. What type of organism seems to be most abundant in the courtyard ecosystem?
3. Explain how the organisms in the courtyard are interdependent on each other (depend on each other).
4. What would happen if you took one organism out of the ecosystem? Explain.

COURTYARD

1. List all of the living things you find or see evidence for in the courtyard. List them in two categories: plants and animals.

2. Determine what each is, using the identification books. Be very specific.

3. Draw a sketch of each thing found.

4. Classify each organism as a producer, consumer, decomposer, etc.

PLANTS

Name	Sketch	Classification
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

9.

10.

ANIMALS

Name	Sketch	Classification
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Food Chain Example

Food Web Example

Observation Lab

Purpose: The purpose of this lab activity is to increase or practice the ability to observe and take note of what is, or what is happening around oneself.

Materials: Meter stick, thermometer, paper, pencil or pen.

Procedure:

1. Find a position in the courtyard that is not within 5 meters of anyone else in the class doing this activity.

2. Measure where you are from some fixed reference point, (the corner of the building, a big tree, the corner of the observation deck, next to the water faucet, etc.). Record on your data sheet how far away and in which direction from that reference point you are.

3. Make as many observations as you can in one class period from your point of view. Include things like: date; time of day; season of the year; temperature; size and numbers of plants around you; color of leaves; types of plants or wildlife you observe; evidence of insects, lichen, mosses, soil at your spot; differences between your spot and other areas around you; weather conditions; amount of sunlight or shade; altitude; wind conditions; etc. You may even want to GENTLY lift a rock or big piece of wood to observe any evidence of life underneath the surface, but be sure to carefully return the rock or wood as if it were undisturbed in the first place. After all these animals would like their habitat undisturbed too.

4. Make a quick sketch of what you are looking at from your point of view. Do not include other people in your sketch. This may take the form of a quick plot map of the courtyard area.

5. Record enough information so you can identify any and all changes that take place over the course of the school year. You will be asked to return to the exact same spot at least 3 more times during the school year to observe changes.

6. Write a paragraph statement in your journal about what you observed in terms of what is in the courtyard, the diversity of the area, and what should be done to protect or improve it. After your next three visits you will be asked to write about the changes that took place since your previous visit.

Courtyard Observation

NAME_____

1. Date_____ Time_____ Temp._____
   Exact location of your spot:_____
   _____
   _____

2. Observations about "your spot":
   a) Physical conditions (weather, soil, sunlight, etc.)?:

   b) Living plants (size, number and kind)?:

   c) Living animals (kind and number)?:

   d) Other observations (use the back if necessary)?:

   e) On the back of this paper draw your sketch or map.

COURTYARD MAPPING

Subjects: Science and Math

Objective: Students will use the metric system to measure plant height, radius and location. Students will draw a map of their section of the courtyard to scale.

Materials: Meter sticks (10-15)
Metric tape measures (5 or 6)
Graph paper (1 cm squares)

Procedure:

1. Divide the class into groups of 4 or 5. Each group will be responsible for mapping a section of the courtyard.

2. Each group member needs to be assigned a job. One person needs to do the drawing on the map. Two or three people should measure the distances of each plant's location. One person needs to measure the size of each plant. Getting a completed map requires team work.

3. Once assigned their area, each team needs to measure the location of the plants compared to their area boundary. Each plant's height and radius also needs to be measured and represented on the map. The measurements need to be done in meters and converted to fit on the map. Each group needs to use the same scale so the maps may be put together later.

4. You may want to have groups exchange maps and use the maps to find plant locations.

Evaluation:

1. Have the students calculate the % of ground covered with plant material. This can be done with the formula $A=1/2\ \pi\ r^2$.

2. Estimate the size and height of the courtyard in meters.

3. How would a drawing of the courtyard done in a 3:1 ratio compare to one drawn at 6:1?

4. What might we do with these maps?

SOIL SAMPLING

Subject: Science (Geology)

Objectives: Students will be able to identify different layers (horizons) in a soil sample. Students will be able to use a color chart to determine if a soil sample is hydric (wetland) or upland soil.

Materials: Box of 64 Crayola crayons
Wetlands Soils Color Chart
Shovel
Soil sampler
Scissors

Procedure:

1. Have students color in the color chart using the correct color. Using the exact color is important. It is also important to follow the directions at the top of the color chart about how dark to make the colors. If the directions are not followed exactly the identification will be very difficult.

2. Students should divide into groups of 3 or 4. Each group should take a soil sample using the corer. With this sample they should be able to identify the layers in the soil. Each layer should be measured and compared with the attached example of a soil section.

3. A 2 foot deep hole should be dug to obtain samples for comparing to the color chart.

4. Soil samples the size of ping-pong balls should be removed from several different depths.

5. By holding these samples up to the color chart students will be able to classify the layers of soil as being hydric (wetland) or non hydric (upland).

6. If possible the process described above should be repeated in another area, preferably in a known wetland so there is something to compare.

7. Fill in all the holes.

Evaluation:

1. How do the characteristics of the soil change the deeper you go?

2. If your sample showed evidence of red color what element may be present in the soil? (Hint: Think about a rusty nail). What might cause the red color to appear in the soil?

3. If you went to a second site, what are some differences in the characteristics of the soils from the two sites?

4. Which of the two sites was closest to being a wetland soil?

Procedure:

•Warm Up

Show students a pencil and a pen and have them list qualities that distinguish one from the other. Explain that these qualities are used to *classify* one item as a pen and the other as a pencil. Show students an assortment of pencils. Challenge them to classify the pencils into three groups. Ask students to describe the system (e.g. size, degree of sharpness, number of teeth marks) they used to classify the pencils.

Tell students that wetlands are classified to distinguish them from other land areas. Ask students to list characteristics of wetlands.

•The Activity

Part 1

1. Provide students with the following description of a land area and ask if they would classify it as a wetland. *The land area contains some long-leafed plants that look like grasses. Most of the year the land is dry; however, almost every spring the area is flooded.* Ask students to vote whether or not this is a wetland. Disparity may exist in their opinions, and they may conclude they need more information.

2. Tell students that soils are often used to determine whether or not an area is a wetland. Show students three soil samples. Ask students how they would classify them or distinguish one from the other.

3. Explain that color provides important clues used by scientists when classifying soils. Provide students with background about how moisture content and mineral composition influence the color of soils.

4. Distribute copies of the *Wetlands Soils Color Chart* and review the directions at the top of the page. Explain that this is a simplified version of a chart actually used by wetland managers. Also distribute and discuss the *Soil Sample Data Chart* with students. Have them complete the *Wetland Soils Color Chart* individually or in small groups.

Part II

1. Take a field trip to a nearby wetland, to test the *Wetland Soils Color Chart* against actual soil samples. At the wetland, dig a hole approximately 2 feet (60 cm)deep. Refill the holes before leaving.

2. Remove soil samples about the size of ping-pong balls from several different depths; inspect and compare them against the *Wetland Soils Color Chart.* Tell students to break open the samples to check for the truest color.

WETLANDS SOILS COLOR CHART

Use crayons to color the squares on the chart below. Using the correct colors is very important! Press firmly when coloring, unless the name says "light". Cut out the whole chart and paste it to a piece of poster board or half of a folder. Carefully cut out the black circles through all thicknesses.

Use this color chart when studying soil "in the field". (This is what ecologists and other scientists call going outside to examine a site.) Wetland professionals use similar, but much more complicated, color charts to help them correctly identify wetland soils. Hold the chart in one hand; in the other hand hold a sample of soil behind the chart, so that it is visible through one of the holes. Move the sample around until you find a color that nearly matches the **main** color of the soil.

Numbers 1,5,6,9,10,13,14,15,16, and sometimes 2 are probably wetland soils; the others are probably **not** wetland soil. Numbers 14-16 are *gleyed* wetland soils and are most likely made of clay. You can also use numbers 4,8, and 12 to match *mottles* ("rust spots") that may be found in wetland soil.

O'KEEFE CELLS

Subject: Science and Art

Objective: Students will be able to draw detailed drawings of cells and some of the parts in the cells. Students will find and interpret art in nature. Students will be able to relate cell shape to cell function.

Materials: Watercolor set (one for each pair of students)
Brushes (one per student)
Microscopes (one per each pair of students)
Slides and cover slips
White or beige construction paper (5" x 4")

Procedure:

1. Have students go to the courtyard and collect samples of many different living materials. Examples may include algae, water samples, flower petals, or even dead insects. The thin samples are the ones that will work best. Something thick, like a stick, will not work.

2. Bring the materials in to class and have the students look at all their samples under low (40x) and medium (100x) powers. They should do line drawings of the cells in their journals. Students can share and compare.

3. Once students have looked at several different samples they will choose one sample to use as their "model" for their drawing.

4. With their chosen sample, students will set the scope at medium power (100x) and begin their work of art.

5. The teacher may want to share some examples of Georgia O'Keefe's work. Point out the detail and degree of magnifications of O'Keefe's works.

6. Explain to students that they should try to fill the paper with color and the image. The student may want to enlarge the image they are drawing even larger than it appears in the microscope.

7. Look at some of the examples of cell shape produced by the students. Use these drawings to begin a discussion of cell shape and its relation to cell function.

Evaluation:

1. Describe the possible shape of a nerve cell. Why would it be shaped like that?

2. Why do cells come in so many different shapes?