NAME: Gary Foresman

05

Practicum Exam – 70 Total Points

Goal: Develop a conceptual water harvesting plan for specified site that includes integrated features for at least 1 earthwork system series (conveyance + infiltration based on 1 catchment area), 1 rain tank, and 1 greywater system. The fourth system is your choice based on site context.

Deliverables:

- ☐ Site Assessment Map, *10pts*
- ☐ Conceptual Plan Map, *10pts*
- ☐ Feature Summary Report detailing 4 water harvesting features, *40pts (10pts/feature)*
- ☐ Issues, Interests, Goals, Project Priorities, and Reasons Summary, 10*pts*

To be completed on-site. 1.5 hours.

1. **Site Assessment.** *30 minutes.*
    a. Use the "*Assessment map*" to draw a comprehensive site assessment. **Include all relevant factors (sun, wind, water, human pathways, + 2 more site factors)**

2. **Conceptual Site Plan, first draft.** *1 hour.*
    a. Create a "*draft Conceptual site plan*" map to rough out a quick first concept.
    b. From your site plan **recommend 4 water harvesting features for the property**. Pick 4 features that you believe are the most important to the site, best fit the property owner's needs, and would be part of an integrated design. Draw the 4 features on the site map and label each feature with a number. **Ensure you have all the information you need prior to leaving the site.**

To be completed in the classroom. 2.5 hours.

1. **Conceptual Site Plan, final.** *0.5 – 1 hour.* Finalize the Conceptual site plan that includes:
    a. Placement and extent of 4 water harvesting features (note: rain gutters alone are not a feature). Include corresponding number ID to summary report.
    b. Arrows indicating routing of water (inflows/overflows)

2. **Feature summary report of 4 water harvesting features.** *1.5 – 2hours.* Complete feature summary detail sheets with corresponding number ID to site plan.

3. **Project Priorities and Reasons.** *15 minutes*. Prioritize list of suggested 4 features and 1 paragraph explaining reasons.

Site Issues Identified (list at least 3 items):

Drip irrigation not wanted either to use at all or at least not groundwate
No greywater currently in use
Neighbor's visual across the alley

Site Interests (mark all that apply):

Water Harvesting Interests:
- ☑ Passive landscape
- ☑ Greywater
  - ☑ Laundry ☐ Bathroom
  - ☐ Kitchen ☐ _____
- ☐ ROW Stormwater
- ☑ Tanks: ☐ Plastic ☐ Culvert
  - ☐ Other:

Restoration Interests:
- ☐ Erosion control
- ☐ Stream Restoration
- ☑ Native Plants
- ☑ Wildlife Habitat
- ☑ Soil Health

Production Interests:
- ☐ Fruit Trees
- ☑ Vegetables
- ☐ Native Edibles
- ☑ Chickens, etc...
- ☑ Grapes

Other Items of Interest:
- ☐ Passive Solar
- ☑ Composting Toilets
- ☐

Site Goals (based on assessment and discussion with site owner):

Utilize greywater and rainwater along the backyard to reduce/remove groundwater use.
Increase screening of neighbors with plants that won't need groundwate
Additional earthworks for existing plantings and contribute towards driveway and patio install

Project Priorities and Reasoning

List the features you recommended by order of importance. Imagine that the homeowner can only afford to implement one feature at a time (or may only implement some of your recommendations). #1 should be the first feature they should implement and #4 the last feature. Note if any of the features must be implemented at the same time.

1. L2L Greywater
2. Earthworks & Planting
3. Raintanks for backyard
4. Additional Raintanks & pump for all irrigation

Explain why you chose the features you did, and the order you propose to implement them in. (1-2 paragraphs)

1. L2L is easy, accessible, pumps, and satisfies several of their goals - greywater, reduce watering in back, grow neighbor screening.
2. Earthworks and planting is affordable and could hele with reducing the need to irrigate, reduce some nuisance pooling, and improve screening as well as attract more birds. This can be tiered for demand and labor intensity.
3. Some Rain tanks can harvest B.Y. water and supplement water-needy plants and veggi
4. Additional tanks and pump can allow for more capacity and access more plants,

Feature Summary Worksheet | Greywater **Name:** _____

Feature ID	Purpose/Benefits of Proposed Greywater Feature:
1 L2L	Easy, accessible, consistent watering for BY plants that need it and that provide screening ✓

Steps to create feature and materials used:

Design, Plume Laundry machine outside (side of shed), and pipe along fenceline. Pipe can be on surface to not disturb roots & plants and make it easier. Outlets for trees/shrubs, grape and trellis. ✓

PVC to poly, 1/2" to ~~3/4~~" pipe, mulch additions

Water Source Calculations	Feature Capacity Calculations
Annual Volume of Greywater Produced by Feature: 4-6 loads/week → 5 loads/week × ~25 gal/load × 52 weeks/year ~6,500 gal/year ✓ (seems high)	Greywater conveyance and outlet configuration size & capacity: PVC to poly to ½" emitters (5-6 total) ✓
Peak Daily Volume Produced by Feature: 2-3 loads → 3 loads × 25 gal/load 75 gal ✓	Distribution surface area (sq.ft) required = 75 gal × 0.7 ft²/gal = 52.5 ft² ✓ Infiltration surface area (sq.ft) planned = ✓ Bed ~40'×2' 80 ft² Basin ~10'×4' 40 ft² = 120 ft²

Associated plant types:
4 mod shrub 1 high shrub
1 mod grape ✓

Plant function in relation to feature:
GW infiltration and soil building
Distribution of GW and prolonged moisture in soil ✓

Estimated annual plant demand (gallons) for GW irrigated landscaping:

Plant Water Use Category: Mod

Planted Area (sq.ft): 5 × ~15 ft² each = 75 ft²
high 2 × 15 ft²

Annual Water demand:
75 ft² × 30 in × 0.623 gal/ft²/in = 1402 + 822 = 2,224 gal ✓
1541 (44) · 0.623

What % of estimated demand will GW supply?
100%+ ✓
* There are other existing plants ~100 ft² × 16 in × 0.623 = ~1000 gal ✓
Can extend beyond low path to other bed on E. side

Explain why you chose this water harvesting feature. How does this feature work together as part of an integrated site design?

There can be plenty of L2L GW to replace irrigation for the side beds and grow screen plants as well as bump the vines & volunteers. Waters high demand vines as well

Feature Summary Worksheet | **Earthworks** **Name:** Gary Foresman

2.1 then 2.2

Feature ID	Purpose/Benefits of Proposed Earthworks System:
Earthworks stormwater plants	Passively utilize roof and patio/path runoff and allow water to gather along planted and newly planted areas. Support screen plants and bird attractors

Steps to create feature and materials used:

Get level of property and modify design for ease of install, focus basins along planted areas root & future root areas, possibly curb cut, gutter smaller roofs, cut BY overflow to alley? Rise laundry head and plumb gutter under Dig basins and overflows, pipe gutter overflow, plant shrubs, mulch, checkdam when needed. Need tools, mulch, plants, rocks

Water Source Calculations	Feature Capacity Calculations
(1) Annual Volume of Harvested Water by Feature: BY: $2350 ft^2 \times 11 in \times 0.623 gal/in/ft^2 \times 0.5 + 1000 ft^2 \times 11 in \times 0.623 gal/in/ft^2 \times .9$ roofs yard = 8050 + 6168 = 14,217 gal/year	Feature dimensions & capacity (gallons): BY = $78 ft^2 \times 7" \times 0.623 \frac{gal}{ft^2 \cdot in}$ = 340 gal
(2) FY = $2500 \times 11 \times 0.623 \times 0.5 + 625 \times 11 \times 0.623 \times .9$ = 8566 + 3855 = 12,420 gal/year (4523)	FY = $110 ft^2 \times 7" \times 0.623 \frac{gal}{ft^2 \cdot in}$ = 450 gal
FSY = $600 \cdot 11 \cdot 0.623 \cdot .5 + 400 \cdot 11 \cdot 0.623 \cdot .9$ = 2056 + 2467 = 4523 gal/year	FSY = $48 ft^2 \times 10" \times 0.623 \frac{gal}{ft^2 \cdot in}$ = 300 gal
Peak Event (2.5") Volume Directed to Feature: factor out 11, $\frac{2.5}{11}$ = 0.22727... BY: 3231 FY: 2,823 gal/peak FSY: 1028	Feature will retain the following rain event: _____ inch BY: 340/1242 gal/in ~ 1/4" rain FY: 450/1129 gal/in ~ 0.4" rain FSY: 300/411 gal/in ~ 0.73" rain
	Feature will handle _____ % of Peak Event BY: 340/3231 ~ 10.5% FY: 450/2823 ~ 16% FSY: 300/1028 ~ 29%

Overflow routed to: Nearby, highest basins for each

Reason why: Maximum distribution and capacity, easiest plumbing reaches plants that can take that watering pattern ok

Associated plant types:	Plant function in relation to earthworks feature:
Existing plantings: Mostly moderate somehigh New plantings: Moderate, native.	Erosion control, infiltration increase, native habitat, mulch accumulation, soil building Reduce tripping hazard

Explain why you chose this water harvesting feature. How does this feature work together as part of an integrated site design?

Basins optimize raintank overflow and greywater harvesting and overflow while reducing irrigation needs overall and growing native screens and habitat.
Earthworks is regenerative and is more affordable than other systems

Feature Summary Worksheet | Rain Tank Name: Gary Foresman

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Feature ID	Purpose/Benefits of Proposed Rain Tank Feature:
Raintank BY	Divert roof water off of patio and into tank where it is accessible and can supplement backyard and veggies ✓

Steps to create feature and materials used:

Gutter large, back roof to the east, set pad on either side of brick wall, bring tanks in from alleyway or front, cut through brick wall to connect tanks near bottom, place and plumb them. Can poly 1" to ½" along walls to vines, under backpath, and fenceline/trellis for ease of watering. First Flush emety to patio vine

Water Source Calculations	Feature Capacity Calculations	
Annual Volume of Rainwater from Collection Area: $600 ft^2 \times 11 in \times 0.623 \frac{gal}{ft^2 in} \cdot 0.9 = 3,700 \frac{gal}{year}$ ✓	Wet or Dry Inflow: Dry Tank Width: 5' ± Tank Height: 7'	Recommended Tank Volume: 2000gal (Multiple tanks?)
Peak Event (2.5") Volume from Collection Area: 2.5in = 841 gal/peak ✓	Tank will fill with the following rainfall depth: 336 gal/in $\frac{2000}{336} = 6"$ rainfall ✓	

Tank w/ 5'dia 7'tall = $\pi 2.5^2 \cdot 7 \cdot 7.48 = \sim 1000$ per tan

Overflow routed to:
Earthwork planted garden with additional overflow to olive thenalley ✓

Reason why:
Good infiltration and beautification and utilizes earthworks ✓

Use of stored water:	Estimated demand (gallons) of intended use for stored tank water?
Watering vines and side garden beds as well as veggie beds. Some side screening.	12ft² veggie .65 in · 0.623 = 486gal New Natives 10×10ft²×16×0.623=997 gal 3 high demand ×10ft²×44in×0.623=822gal ✓ =~2500gal/year **What % of demand will tank supply?** ~100%+ given 2 full uses Water can supplement all hanging & Wall plants as well

Explain why you chose this water harvesting feature. How does this feature work together as part of an integrated site design?

Initial tank install that allows for B.Y. watering without ground water. Overflow, FF, and RW can water establishing shrubs, fenceline plants, and their veggie garden. Overflow uses earthworks and one irrigation line could correspond with greywater irrigation

-0.5

Feature Summary Worksheet | Rain Tank Name: Gary Foresman

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Feature ID	Purpose/Benefits of Proposed Rain Tank Feature:
Raintank FY + Pump(BY)	Capture large, front roof, connect tank storages, and pump to irrigation system. Allow to switch from FY & BY to accomodate watering variation. Watering efficiency is already installed, now use RW

Steps to create feature and materials used:

Gutter front, large roof, make tank pad and place up to 3- 5' dia 7' tall ~1,000 gal tanks and connect together. Plumb connect to back tanks and size to pump in backyard. Connect pump with ~~3-way~~ going to BY irrigation and FY irrigation. Connect those accordingly, label, install backflow. Allow for possible timer/manual options to ease use.

Water Source Calculations	Feature Capacity Calculations	
Annual Volume of Rainwater from Collection Area: $625ft^2 \cdot 11in \cdot 0.623 \frac{gal}{in\,ft^2} \cdot .9 = 3,855 \frac{gal}{year}$ (+3,700 from back)	Wet or Dry Inflow: Dry Available space for Tank: 5' wide 7' high Width: 5' Height: 7'	Recommended Tank Volume: ~1000gal x3 = 3,000gal (+2,000 from back)
Peak Event (2.5") Volume from Collection Area: 2.5in $\times 876 \frac{gal}{peak}$ (+841 from back)	Tank will fill with the following rainfall depth: 8.6" rain 3x! or 5,000 gal from $1225ft^2$ $\frac{686 gal}{in}$ = 7.3" for all from both BY & FY	

Overflow routed to: Nearest, highest basin in FY (for ease and maximum distribution and capacity)

Reason why:

Overflow accesses at least 3 basins before leaving property

Use of stored water:	Estimated demand (gallons) of intended use for stored tank water?
Connection to irrigation line and hand watering option for FY	1-2000 ft^2 planted in FY & BY for very low-mod w/some high 7500 × 16in × 0.623 ~ 15,000gal **What % of demand will tank supply?** 30-60% with 1.5 full uses supplemented with greywater and decreased use w/ earthworks & stormwater

Explain why you chose this water harvesting feature. How does this feature work together as part of an integrated site design?

Irrigation is already installed for current planting and owner wished to use RW instead of groundwater. This system allows to supplement most of that and the overflows contribute to basins and plantings that need watering anyways. The greywater reduces that demand so the RW can benefit the other plantings, and the option for hand watering in the front can help with more specific plant demands. The earthworks mulching will also benefit the water use throughout the property

Gary Foresman Assessment Map

Marlatt Residence | Water Harvesting Assessment :: 3410 E Lester St, Tucson, AZ scale: 1:192

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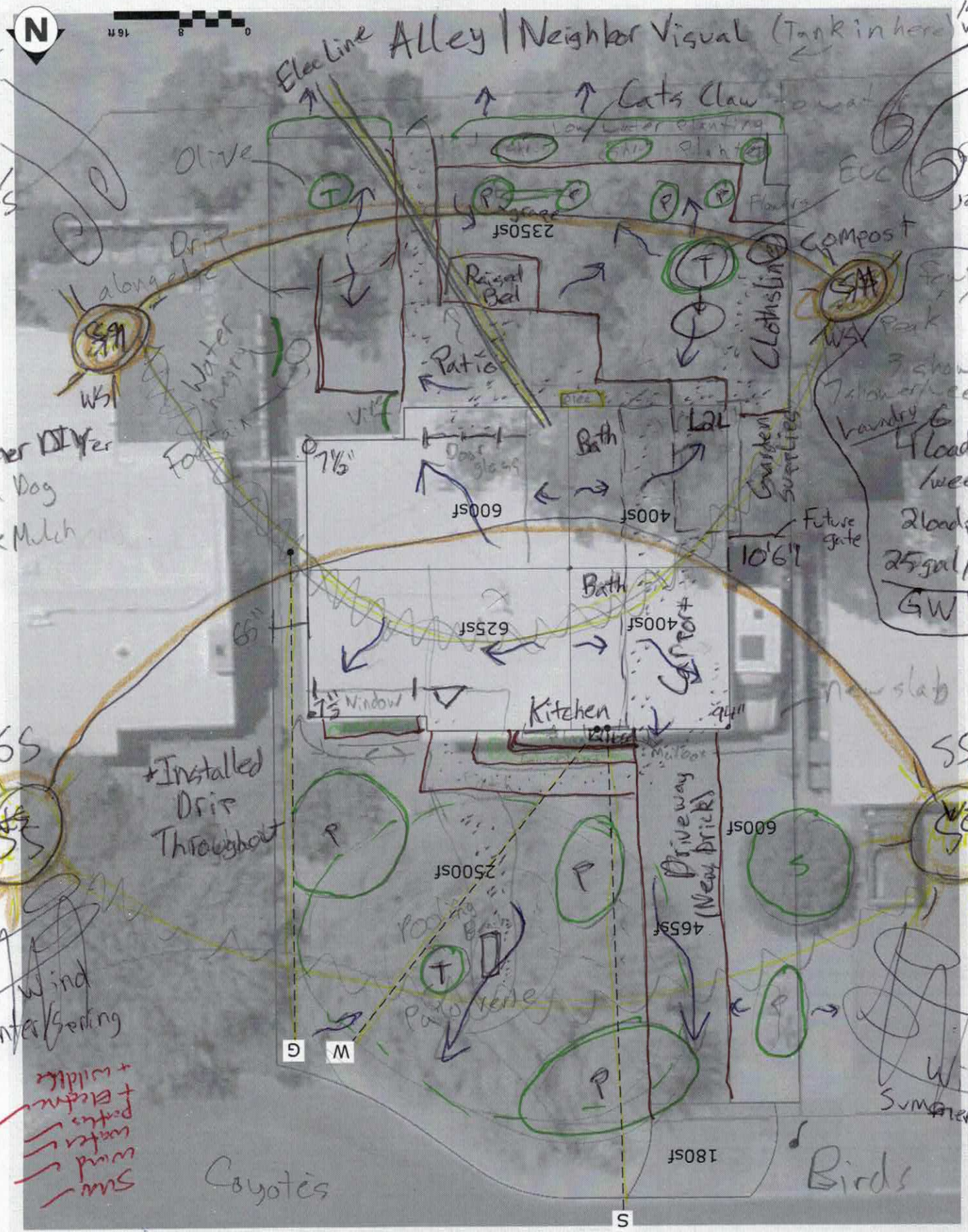
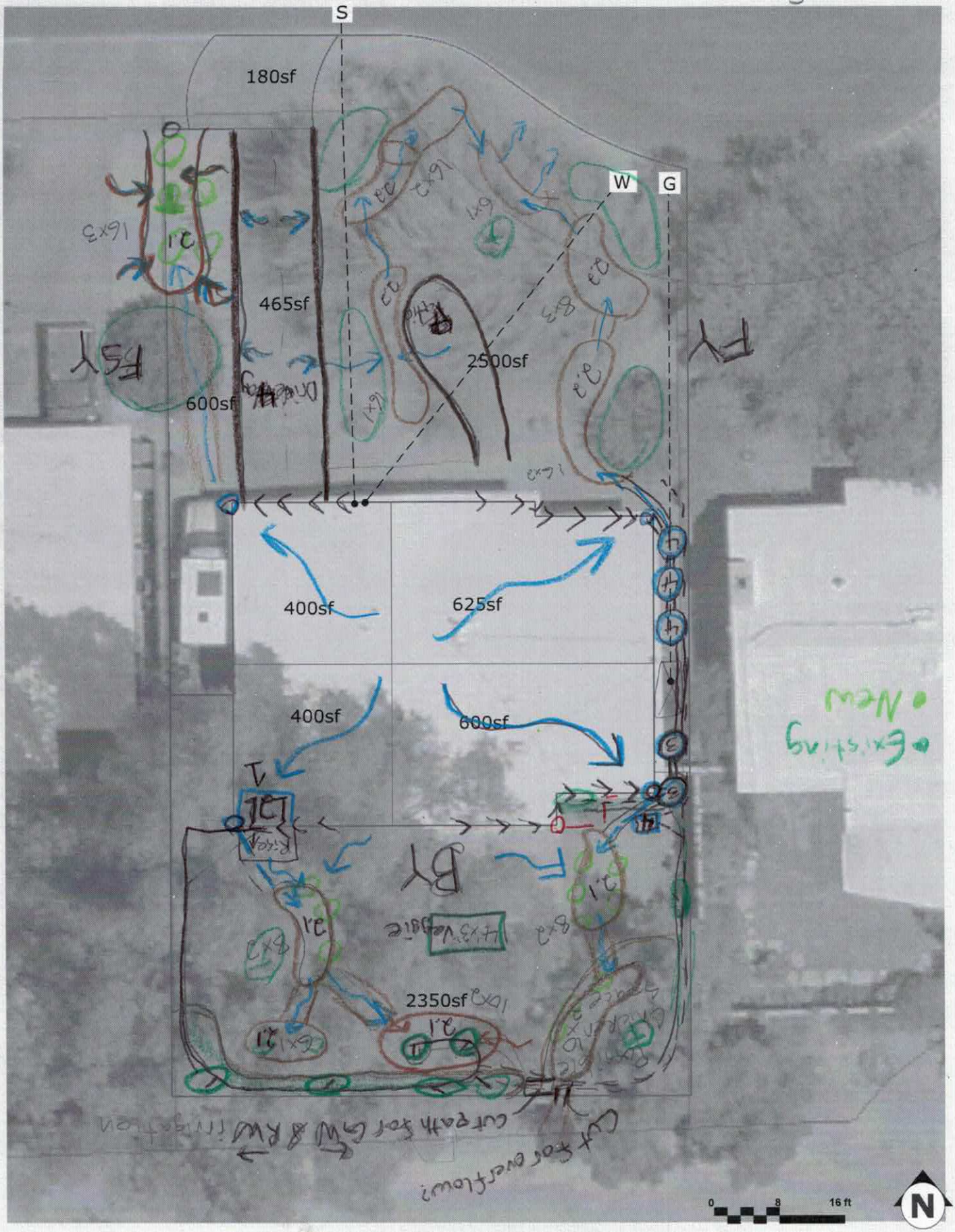


Assessment Gary Foresman

Conceptual Gary Foresman



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Gary Foresman Conceptual Map